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Department of Architecture, TOBB University of Economics
and Technology, Ankara, Turkey

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FOREWORD

Materiality/Immateriality of the Symposium & the Book

We are witnessing the rapid transformation of our daily and professional practices done in the way we have been used to for a long time, from material to immaterial, from analog to digital, from face to face to remote, from in-class to online. Early last year, we all were eager to crown our three-year adventure of the Materiart Project with a well-attended symposium, a real atmosphere of a feast with around 200 participants.

We structured the symposium as a three padded event: Keynote presentations, focused symposia sessions, and open entries. Keynote speakers would establish the central underlying theme. The principal objective of focused sessions was to allow multiple presenters who research a common theme to share their perspectives on a unifying question, issue, or topic through brief research talks. At the same time, it would be an excellent way for them to get involved in the conference, give a research talk, and in the process, work and network with fellow researchers who share their interests and discover potential future collaborations. Focused sessions would provide the participants with the opportunity of discussing their work with audience members interested in this broader area of research. Therefore, we asked the Chairs of the focused sessions to organize and facilitate their symposium session. They all have done a great job in doing so.

We grouped the open entries according to their subject similarities and affinities. We assigned one invited inspirational speaker to each group as chair. We were already prepared and impatient to welcome the participants. Then, all of a sudden and unexpectedly, we got stuck in the pandemic barrier. It took away our opportunity to hold a face-to-face symposium.

Since then, we doubt the physical space's existence; if it still matters, and will it matter in the future?

Simultaneously, online/remote/digital characterization and interpretation of the symposia are rapidly gaining ground. The momentum toward dematerialization raises the long-term relevance and sustainability of them as a material fact.

The Symposium

When considered in its historical context symposium is a twofold substance. One is the banquet part; the other one is a book. The banquet has material and immaterial aspects. Material part can be the room where all gathered, all the food and drink served, the music and the songs. All helped create an atmosphere that promoted the participants to share their ideas.

The symposium's immateriality is the impressive atmosphere, unique experience, and instant of authentic life. The symposium space provides an atmosphere of freedom, a space for discharging that often encourages unexpected interactions. Thus, a new experience of exchanging thoughts, setting surprising relations, collecting moments, and forming memories emerge. However that cannot be recorded but narrated from one to the other among colleagues of different ages. Ultimately, we missed the material context's unreplaceable precious moments to create an opportunity for surprising relations because of the pandemic restrictions.

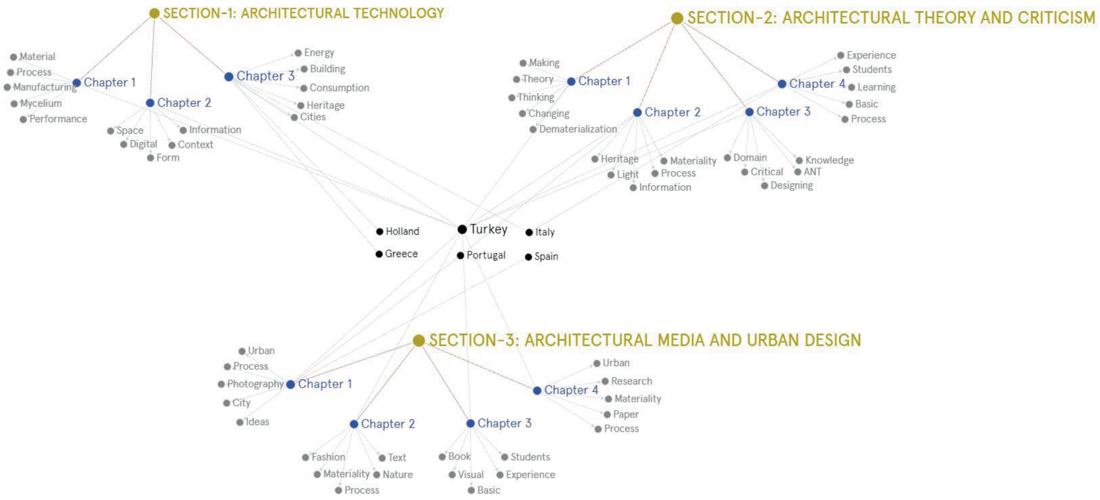
The Book

However, we were able to print the symposium book. The book you hold in your hands is not merely an inert collection of symposium presentations. Still, it has rather a dynamic quality that emerges from the interplay between the book as a physical artifact, its intellectual content, and interpretations of the readers. Shortly the book itself is a material thing. However, it has an immaterial part as a source of knowledge, making it even more valuable.

Therefore, the book finds its ground on a threshold between the material and the immaterial. The readers may explore the philosophy that underlies the papers. They may also recognize and comprehend the contradictions, reconciliations, interdependence, solidarity, and other interrelations. Research papers in the book encourage readers to think deeply about their interests and articulate their ideas.

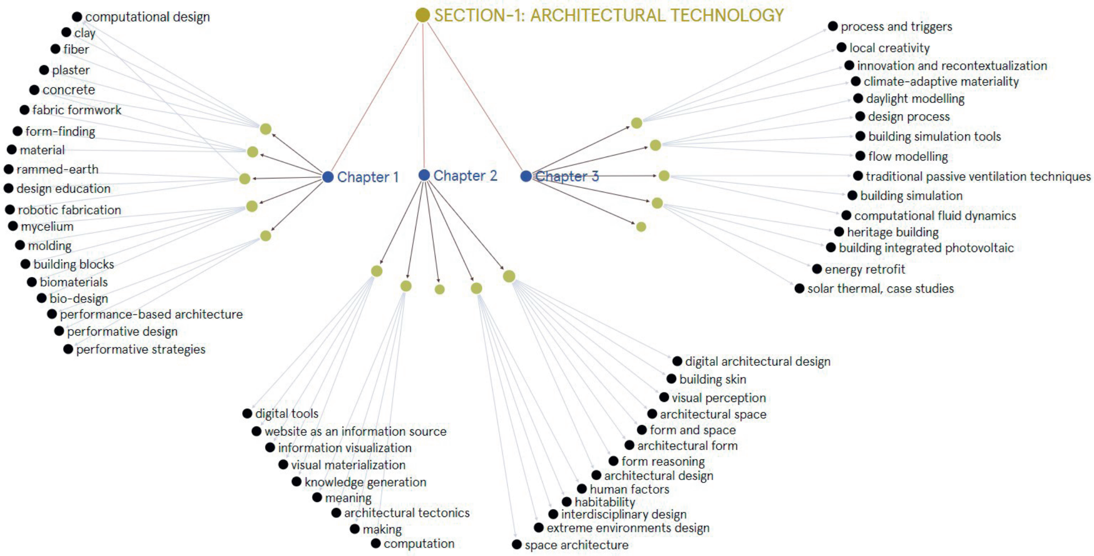
The main theme we defined is "materiality", as an umbrella concept that embraces all the fragments of the whole materialization process starting from architectural imagination, conceptualization, and design to the act of construction. In this respect, we aimed to discuss materiality under three main themes as "architectural design", "research" and "technology". Within this scope, the potential discussions could be around but not limited to architectural practice, architectural design education, heritage and conservation, vernacularity, urban context, theory, R&D in architectural materiality, tectonics, computation, media and immersive visualization, materiality as a process, methods of computational design and materiality. As expected, the collected papers addressed a wide range of disciplinary fields that are somewhat related to architecture, from robotics to theory and criticism, from professional practice to educational practices, from urban scale to the product/ material scale.

The contents of the collected papers are analyzed and based on the analysis results, the book is divided into three main sections regarding their content-wise affinities as (1) architectural technology, (2) architectural theory and criticism, and (3) architectural media and urban design. These sections are also subdivided into eleven chapters.

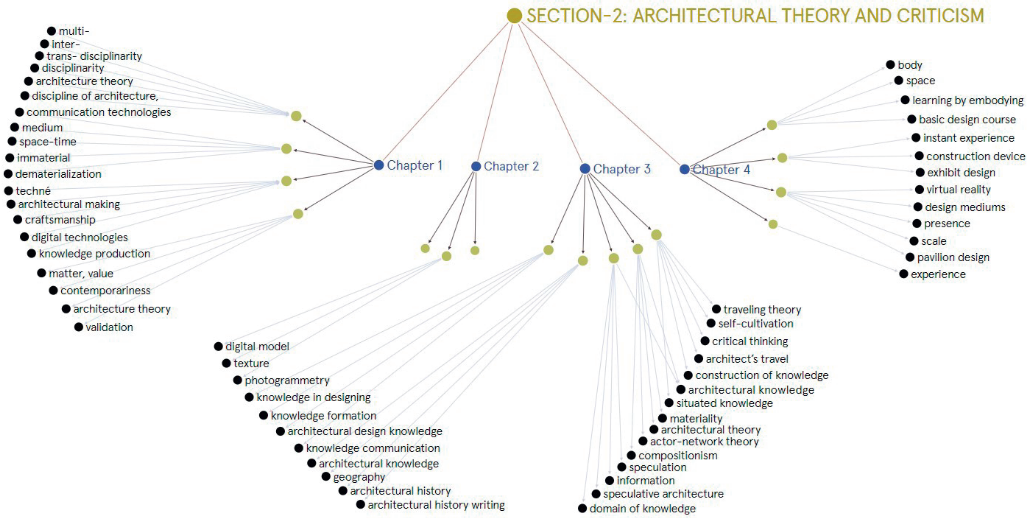


We aimed at analyzing the existing and emerging trends of architectural research based on the contents of the collected papers, which we believe revealed the immateriality of the book. The content analysis is conducted by performing text-mining (https://voyant-tools.org) of the abstracts of the papers for each chapter. Our major aim in performing text-mining is to re-introduce the existing knowledge to readership. To increase the legibility of the content, we mapped the analysis results as a diagram of relations and word clouds shown in the following diagrams.

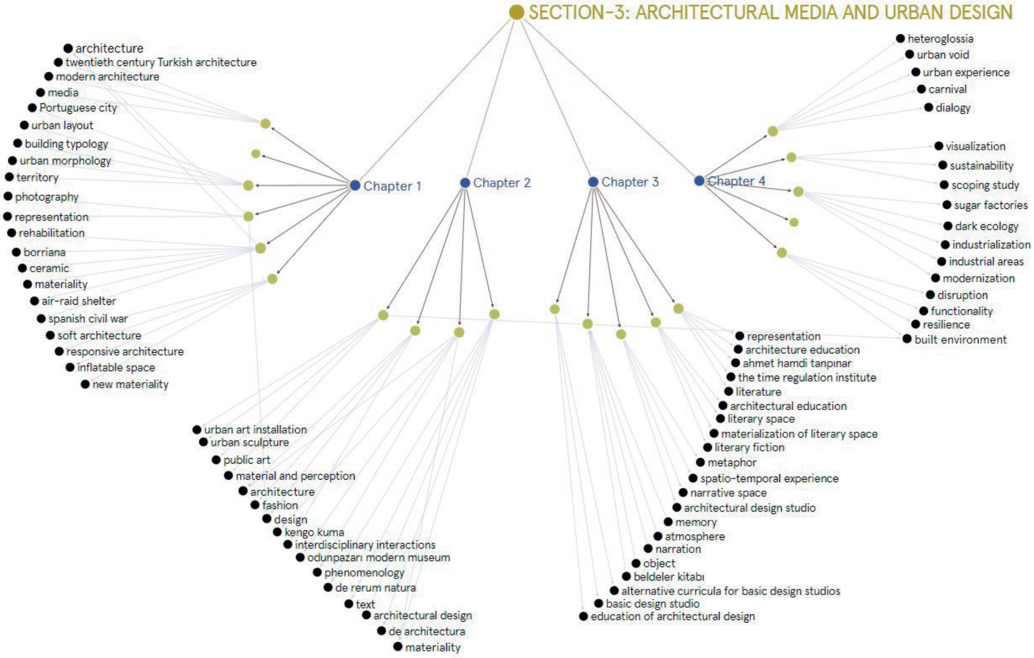
Section-1: Architectural Technology



Section-2: Architectural Theory and Criticism



Section-3: Architectural Media and Urban Design



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We would like to thank our session chairs of focused symposia İpek Gürsel Dino, İnci Basa, Zeynep Uludağ & Esin Boyacıoğlu, Serap Durmuş Öztürk, Zeynep Tuna Ultav, and session chairs of open entries Mine Özkar, Lavinia Chiara Tagliabue, Lucyna Nyka, Aktan Acar, Ivan Cabrera, and Nur Çağlar & Sibel Acar for their generous support and contribution.

Finally, we would like to present our appreciation to our authors, organization committee, and to those who take a part in such a long and arduous process.

Materiart Editorial Team

FOLD & FLOAT: A REUSABLE EMERGENCY LIVING UNIT PROPOSAL FOR POST-DISASTER PERIOD

Sevince Bayrak
Assist. Prof. MEF University
SO? Architecture and Ideas

For architects and urban planners, the 20th century had been a period of discovering how public space is crucial for city life. They were the vigorous advocates of squares, boulevards and plazas where people stroll through the city enjoying modern life. As the century goes on, architects' passion for public space becomes even more clear and the concept of buildings becoming an extension of public space was more popular. The main idea was simple: Bring more people together. Let them meet in your buildings, if not in the extensions of your buildings that are already acting as a public plaza.

However, towards the end of the century, while cities were rapidly becoming global financial hot spots, it became harder to recognize architecture's affection for public space. Though the millennium brought groundbreaking examples like Oslo Opera House or Wyly Theatre, where either rooftops or basements were cuddling up the public plazas, in reality, public space in big cities is being threatened by privatization. Persuading a client to leave the half of the constructible property for a square as in the case of Pompediu or to dig through a bank headquarters to create a public plaza like in HSBC headquarters in the 70s, is now even more arduous.

Then the pandemic happened. Once in a century. Life stopped, the show that has to go on, suddenly ended. It is a global crisis that forces every aspect of life to be questioned, and architecture takes its share. It has to be re-examined. But how? Is it possible for a profession which has been rallied by magnetizing people to suddenly adapt to the "new normal? Reconsidering architecture from a perspective full of socially distanced people requires to rewrite the main contemporary urban theories from scratch. However, looking from a wider perspective pandemic lets us think more about the public space itself, that it is a right, not a privilege to be in reach of free, public open-air areas. In cities where they have enough accessible open-air areas, people can stay outside and still be safe while in denser areas, like in the case of Istanbul, elderly and kids were under lockdown for months.

Pandemic has unveiled the fact that it is essential to have an adequate amount of open-air areas for the whole population, that is homogeneously spread in the city. Pavements that people can walk without touching each other, parks and squares that let the elderly and kids spend time outdoors safely... For us, architects, it is not easy to turn this crisis into an opportunity but pandemic gave us the capability to reclaim public space.

In the case of Istanbul, like many other big cities such as London, NYC, that are under the influence of rapid privatization, pandemic gave us a dreadful reason to reclaim public space, with a louder voice.

However, before the pandemic, there has already been a threat of another disaster in Istanbul, that requires a demand for public space as well. Since the city is on an active fault line, it is expected that an earthquake over 7 magnitudes will likely to happen in the next decade. The last earthquake that was generated by the active fault 20 years ago was in a small city very close to Istanbul. After this big earthquake in 1999, Istanbul took action and announced around 500 public areas, where people can get together after the disaster, put tents etc. But thanks to the rapid transformation of the city, most of these areas have been privatized in the last decade, and there were only 77 of them left in 2017. Our project Hope on Water was initially triggered by this fact. We started with the idea of reclaiming the public gathering areas. The main objective of the almost absurd image of a post-disaster living unit, sailing on the water, was to take attention to one point. Why do we have to build post-disaster housing on water? What happened to the land that was already allocated for this purpose? They are privatized.

So we designed Fold&Float, a foldable floating post-emergency unit, initiated by the idea of reclaiming public space. Meanwhile, in the university, we started an inter-disciplinary design studio on this subject, with architecture students from MEF University, and civil engineering and sociology students from Bogazici University. With our colleagues Ayfer Bartu Candan and Emre Otay, we investigated how would be to live on the water, surviving after an earthquake. Working with students from different disciplines, initially, it was tough to convince each group of students, why we have to to work in collaboration with other disciplines. In general, architects are keen on considering that they are capable of overcoming any type or scale of problematics. However, disasters and crisis require collaboration more than any other topic. Not only because they are complex subjects, but also they include social and physical problems at the same time. Though the process was challenging, at the end of the semester the interdisciplinary design studio was successful and students' work was exhibited in the 4th Istanbul Design Biennale curated by Jan Boelen. Since the topic was about a disaster, it was much easier to collaborate on a vital issue, where each discipline needs others to survive.

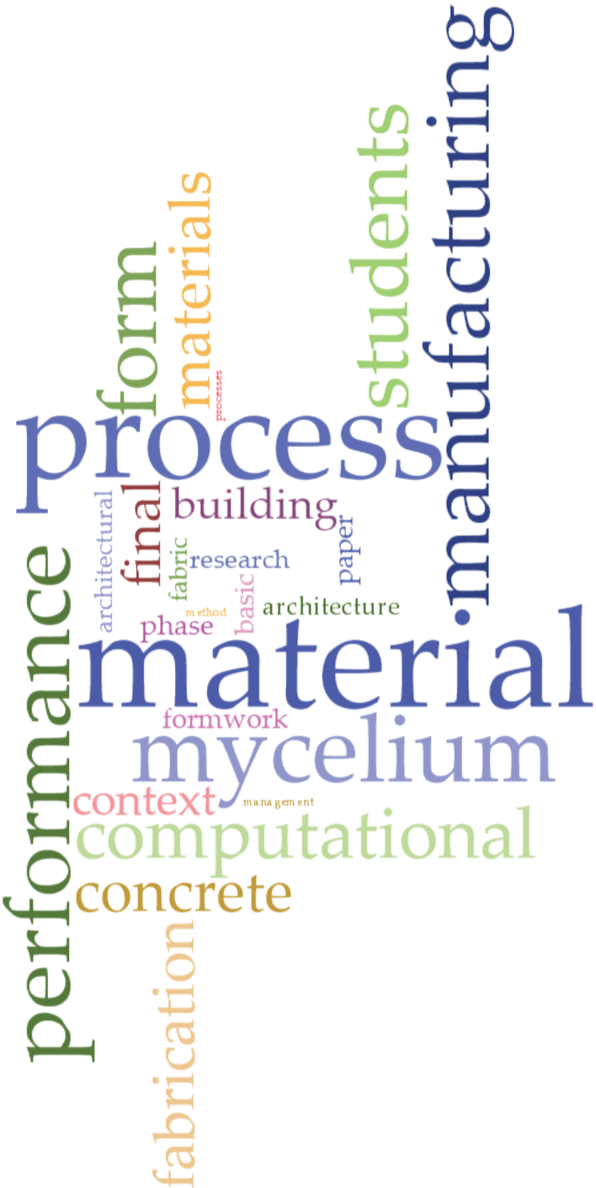
Materiality is one of the main keywords while designing a foldable floating emergency living unit. The final product has to be durable, yet affordable. It should offer a comfortable living area while being able to be reused for several times in different conditions. Though the prototype was mainly made of concrete –the pontoon-, and steel –upper structure-, and plywood – inner structure-; other material options should be considered for upgraded versions of the research. The higher construction budget of steel structure that is preferred instead of plastics , that is mostly used for emergency housing, would be compensated since the units will be transported and reused for several cases, in different locations.

Urgent situations such as earthquakes or pandemics will not all of a sudden change the way architects and designers work. But at least, it will let them think more about a city where each neighbourhood has easy access to open-air green areas, wider pavements for a safe time outdoors. By doing speculative projects on real issues like Hope on Water, we use urgency as a megaphone, to make our voice louder about our demands for a better city.

SECTION I

ARCHITECTURAL TECHNOLOGY

CHAPTER I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students
materials
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building
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architecture
architectural
phase
formwork
paper
basic
fabric
method
management
processes

INTRODUCTION

Mine Özkar
Istanbul Technical University, Istanbul, Turkey

Explorations into materials and the interconnected acts of making and design constitute a significant chunk of research in subject areas of digital and computational design today. The Materiart Project aptly recognizes and highlights an agenda of such research as the vanguards in the discipline of architecture strive for innovative approaches to both the time-enduring morals and the future of designed environments. This section compiles a range of studies that showcase connections between material knowledge, design sensibilities, and computational methods.

The first four chapters share a common trait. They all report on research conducted within a university setting and with the direct involvement of students, whether undergraduate or graduate. Research in the field of architecture comes in many forms. Although limited when compared with other technical fields of knowledge, existing funding structures worldwide support computational architecture research. Expectedly, financial support especially encourages studies that endeavor to develop or apply new technology and have a promise towards a broad impact on multiple stakeholders and communities. Researchers and educators, however, are equally involved in testing design methods that may or may not be generalizable. Coincidentally, there is interest in proposing to reshape the curricular content and means in architecture schools in light of developing design methodologies. That a good portion of research in the field continues in universities produces opportunities to combine it with the training. Especially for research that explores novel ways to apply state-of-the-art material and production technologies in design as well as how these can integrate into the means of educating future practitioners, design learning environments embody a field where ideas are put to test and various parameters are comparatively tried. The authors of the first four chapters have seized this chance to explore alternatives within particularly defined design and production scenarios by engaging students.

The first chapter "Computational Earthcrafts" grows out of a series of work on urban furniture the authors Fulya Akipek and Tuğrul Yazar have conducted collaboratively. They report on methodologically and functionally sustainable designs they develop and produce. They openly share details of the production process which makes a point about the reproducibility of this work and its relevant value for design learning. In a case they present, the exploration is opened up to graduate students. Already, holders of professional degrees, these designers are able to tackle the design problem as research and also create multiple design-answers. The experimentation, with all its layers ranging from the making process to material choices, becomes almost a statement for crafting with digital methods. It offers the chance to see how various forms behave in iterated practices as well as how material parameters effect the production processes and inform form decisions.

In the second chapter titled "Using Fabric Formwork for Freeform Concrete Designs," Begüm Aktaş presents the results of a summer workshop with university students. Simultaneously offering a summary of the use of fabric for flexible formwork in the past, the exploration emphasizes the benefits of flexible formwork for concrete as low material waste and variations in mass customized freeform designs. The results exhibit how types of concrete with different granularity befit free-form casting.

In their chapter titled "Myco-Hills: An Experimental Research on Mycelium-Based Building Blocks," Hülya Oral, Aleyna Karakışla, Berkay Kadakal, Defne Özmen, Elif Korkmaz, İdil Deniz, and Sena Kavaf describe an experimental study with bio-materials undertaken as part of the first-year design studio. The student engagement as part of the research is a statement on how dealing with new knowledge, as opposed to time-tested approaches, can be a part of the design learning process from the very beginning. Moreover, the authors weave together the knowledge and understanding of material properties and the learning of how to design. In first-year design education setups, materiality is commonly deemed significant. This experimentation reinforces this emphasis with a spotlight on questioning the origins, production, and sustainable character of the material itself. The research also extends our knowledge on the cultivation and use of oyster mushroom mycelium, and ready substitutes such as stone powder, as potential building materials.

In "Material Experimentations in the Computational Design Process: Fabricating a Parametric Tower Model with Fibre, Concrete, Plaster and Clay," authors Serbülent Vural and Selin Oktan follow two objectives. One involves training students of design through a computational lens. Authors devise a reversed process in the studio where students are encouraged to think about how the relations between the elements of a finished design might have been established with intent. They are guided to consider a process-oriented systematic manner. The second objective involves production as a crucial part of such an envisioned design process. Students are directed to fabricate the design as well.

These four chapters not only offer useful knowledge of making that informs design but also attest to the importance of allowing new knowledge to seep into ways in which new designers and architects are trained. Their attitudes are instances of instructional methods in design education. They represent experimental setups not as tools of deduction but as abduction, as Charles Sanders Peirce defines it. Their explorations "on the field" frame design problems within limitations and parametrically defined situations. Results offer an open-access insight to multiple takes on a singular problem with conceivably reproducible content.

The exception in this section, to the educational frameworks set up to explore material processes of design, is the last chapter titled "Performance-Based Strategies in Architecture: The Case Studies on Performative Architecture". Its authors, Erhan Karakoç and Gülen Çağdaş shift the focus of their data-driven form exploration to the systematic consideration of anticipated performance. They emphasize structural and environmental performance which closely links to material choices. As computation capacity increases with new technological developments, and as the amount of data to be integrated increases, contemporary computational techniques, such as machine learning, are ever more effective in guiding designers' decision processes in tune with LEED and BREEAM certifications sought after for global standards. Informed methods not only benefit from state-of-the-art computation but are also sensitive to timeless values of sustainable built environments.

COMPUTATIONAL EARTHCRAFTS

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ABSTRACT
This paper covers two instances within a continuing design research process that focus on integrating rammed-earth building techniques with digital fabrication technologies. Common-action Walls is the first architectural prototype designed within this scope and had been built for the 4th International Biennial of Architecture in Antalya. Robotic Earth-Crafts is the second instance that is conducted as a graduate studio at Istanbul Bilgi University Faculty of Architecture and enabled us to find out the pedagogical ways for expanding this research through student prototypes. This paper covers the design and fabrication process of these prototypes with a focus on the feedback relations of materiality and computation; precision and imperfection; industrial and post-industrial production.

KEYWORDS
Rammed-earth, computational design, robotic fabrication, design education

Introduction

The two distinct design research realms of natural building materials and material computation seem to converge within the current discussions of ecological design in architecture. This convergence has the potential to drive the notion of geometry back to its origins as earth-crafts and computation to an agent for developing sensitive relations with the natural assets of the earth. From this point of view, the material computation can be used as a method to explore and reveal the inherent properties of natural materials and digital fabrication can enhance various performances within local building techniques. In this study, we are motivated by the question of how can geometry, mathematics, and related production methods augment the ancient natural building materials and techniques? This paper covers two instances within a continuing design research process that focus on integrating rammed-earth building techniques with digital fabrication.

The first section covers the Common-action Walls project, which had been built for the IV. International Biennial of Architecture in Antalya, 2017. The design process of Common-action Walls was divided into two distinct but associated research domains, one being architectural and the other mathematical. The architectural domain of the project is about the material and construction technique of rammed-earth along with its spatial and functional aspects. On the mathematical domain, the minimal surface of Gyroid was studied to meet the required spatial and material performances. Gyroid made it possible to create a three-dimensional volumetric system, suitable for a single-mold production strategy. The prototypes and the final production of this project helped us to understand the potentials of the material and ask further questions.

Robotic Earth-Crafts is the second instance that is conducted as a summer-studio at Istanbul Bilgi University Department of Architecture in 2018 and enabled us to find out the pedagogical ways for expanding this research through student projects. The second section of this paper covers the design and fabrication process of these prototypes with a focus on the feedback relations of materiality and computation; precision and imperfection; industrial and post-industrial production.

These design-built processes are realized within an interdisciplinary process that integrates the domains of earthen architecture and rammed-earth building techniques; permaculture design principles and landscape design; mathematical models and advanced geometry; performance-based design and simulation; computational design and robotic fabrication. The data flow in these design-built processes is managed by taking consultancy form these various realms which open up the ways to discuss the changing roles of the architect and the educator in architectural design education.

Common-action Walls

Common-action Walls*, selected to take part in the architectural biennial with the theme sustainability and continuity, is a 1:1 scale built prototype wall, for exposing the current potentials of this traditional and local technique and re-interpret the collaboration of low technologies with advanced technologies. This wall is composed of blocks and holes and performs as a vertical garden (Image 1). The holes perform as niches to grow and harvest edible plants which are also integrated with a drip irrigation system. The blocks of this double-sided wall tackle with durability issues and geometric explorations. To accommodate the voids necessary for plants to grow and have access to sunlight along with generating continuous surfaces to direct rainwater to plants, research on minimal surfaces had been done. The final form was an approximation of a triply periodic minimal surface, Gyroid. This special geometry met the physical and functional requirements and was beneficent in the production process as all blocks were cast from a single mold. There were two parallel design-research aims in this project. The first aim was to develop a prototype for a modular and porous building envelope, made from rammed-earth. The other aim was to develop a geometric modeling and production workflow for generating the forms that best fit the design requirements.

The Minimal Surface of Gyroid

A minimal surface is a surface that is local area minimizing, that is, any piece having the smallest possible area for a surface spanning the boundary of that piece (Vamvakidis, 2007). In mathematics, they are defined as surfaces whose principal curvatures at any point have always equal magnitude but are opposite in sign (Casucci and Erioli, 2012). Through their mathematical and physical foundations, the minimal surfaces create a unique spatial quality in the architectural scale. Therefore, they are one of the influential subjects of architectural researches. These interdisciplinary studies approach minimal surfaces from their membrane behavior, and climatic performances (Casucci and Erioli, 2012), self-organizing systems (Barata et.al, 2013), design-build projects (Huang and Lewis, 2014), alternative geometric modeling approaches (Tenu, 2009; Tenu, 2010; Monkova et.al., 2017), crystallographic features (Pineda et.al, 2004), 3d printing (Vamvakidis, 2007), and structural performances (Khaderi et.al, 2014). In addition to architectural researches, these mathematical objects are also subjects of large-scale building practices. One of the most well-known examples is Toyo Ito's Taichung Metropolitan opera in Taiwan. The building's overall form is an approximation of a minimal surface called Gyroid.

Gyroid is one of the most utilized minimal surfaces in design and architecture because of its modular, porous, and infinite labyrinth-like structure. It was discovered by Alan Schoen in 1970 (Schoen, 1970). It is an infinitely-connected and triply periodic minimal surface (TPMS), covering its volume with the least surface area. It divides space into two equal parts, in all directions with a smooth and continuous surface. Gyroid's geometry is suitable for piecewise molding and casting production. Therefore, it is chosen as the subject of geometric research in Common-action Walls project. In her thesis work, Zeynep Keskin (2015) had studied another TPMS called Batwing and produced its approximation by concrete casting. The novelty of this approach will reveal the mentioned qualities such as porosity, modularity, geometric continuity, and spatial qualities of dividing the space into separate volumes.

Geometric Modeling

In general, mathematical objects such as Gyroid can be approximated efficiently by computer tools such as MathMod. These software tools create triangulated mesh outputs. In our study, we developed a basic workflow for creating the Gyroid model with Non-Uniform Rational Basis Spline (NURBS) methods. This enabled us to create fast and accurate approximations of Gyroid, making the mold design and fabrication more effective.

The proposed modeling workflow includes several steps:

- Drawing the fundamental section of Gyroid by a cubic NURBS,
- Lofting the fundamental patch of Gyroid by a NURBS surface,
- Developing the fundamental unit of Gyroid by using several transformations,
- Generating the Gyroid cubic unit by multiplying and transforming the fundamental unit,

The first step is to draw the arc-like curve which defines the edges of the fundamental patch. The implicit approximation of Gyroid is represented by the equation; Cos(x) * Sin(y) + Cos(y) * Sin(z)

Cos(z) * Sin(x) = 0. In order to draw a planar curve where z=0, we converted the equation into an explicit form; y = Arcsin (Sin(x) / Cos(x)). This gives us the points on the section curve of Gyroid lying on the XY plane when we solve y values for $0 \le x \le \pi/4$. A short Python script is developed to generate these points in Rhinoceros CAD software. This curve has a unique form, different from a parabola, catenary curve, or arc. This approximation of the Gyroid curve is used to construct the fundamental patch surface. This is achieved by several transformations. Then, this patch is used to construct the fundamental unit and the unit cube of Gyroid (Image 1). The validity of points on the Gyroid surface was tested with other tools and applications, and proven to be accurate considering the error rate in the chosen material and production technique.

After this modeling process, the initial bricklaying system of the wall is developed by creating a solid unit of Gyroid. The first models suggested modular, piece-wise molds which are in the solid form of the fundamental patch of Gyroid. These mold pieces were produced by 3d printing and prepared for the first casting experiment.

Casting Experiments

We initiated the experiments with the original recipe of "Alker" which is a mixture of clay soil, lime, and gypsum (Kafescioğlu, 2008). The rammed-earth technique is based on the principle of wetting the dry mixture prepared in certain proportions and ramming it in a mold. It does not require external heating to be dried. The mixture and the amount of water to be added vary according to the weather and humidity conditions, and the strength and stability required. Ruhi Kafescioğlu (2008, 2017) developed the Alker mixture, and studied its structural performances, and found out that it is suitable for small and mid-scale masonry structures.

The first mold design is composed of the three copies of the solid fundamental patch, rotated two times (Image 1-left). This geometry is expected to make it possible to separate the mold without damaging the product, creating a zero draft angle. Attempts were made to produce the mold pieces that would form these surfaces. Experiments were carried out to maintain a balance between printing time and the durability of the outcome. As a result of this initial experiment, it was understood that the PLA filament used in the mold could not show sufficient strength against ramming and compression. As a result of the experiments related to the mixing ratios of the soil material, it was seen that the clay soil, water, gypsum, and lime mixture could reach the strength to keep the overall Gyroid form together, but it would cause problems at the sharp corners (Image 2-right). In addition, it was understood that a unit that was made will not be able to carry loads when the units are stacked as a wall. For this reason, it was decided to revise both the mold production technique and the geometric unit.

New studies were carried out on the model so that the units did not form sharp corners as much as possible and sit on large surfaces where loads can spread while overlapping. After the revision on the geometric unit, two Gyroid pieces were combined into one unit and shifted 1/12 ratio which prevents the vertical joints from separating and the formation of weak spots. The blocks are arranged to be locked on each other. It was understood that the wall could survive on its own weight without using any mortar or joinery detail. A prototype model was produced with 3d printing to discuss the scale and orientation of the final design. Instead of maintaining the zero draft angle rule, it was decided to manufacture an industrial mold made from more durable and flexible materials. The second mold was made from a steel case. The form of the Gyroid mold was produced by a fiber-glass structure, covered by a rubber envelope (Image 3-left-middle).

It was observed that the material would not be sufficiently strong to carry its own weight in the predetermined block sizes and creates weak spots quickly (Image 3-right). After these initial experiments, the final mixture recipe was determined, by including glass fiber, perlite, and alpha gypsum for more durability. In the next attempt, the industrial mold was also modified to be composed of three pieces, to be able to safely unmold the product. In addition to these revisions, the geometry of the unit was also modified. It was thickened and the plant reservoirs in it were also modified for additional stability (Image 4). As a final precaution, the consulting engineers advised to add a thin steel frame inside of the blocks for achieving further stability, and reducing the risk of cracks. These frames were added to the system in the ramming process. The third and last attempt was successful in producing the blocks with enough structural stability. Finally, the canals for the drip irrigation system were opened in the blocks. These canals were designed to transfer irrigation water directly to the plants placed inside of the cavities of the blocks.

The Final Installation and Feed-backs

A total of 30 identical blocks were produced by hand, by using 3 separate molds in 5 days at a pre-cast concrete factory (Image 5). The placement of the blocks was completed by two workers and one forklift in one day. The drip irrigation system was connected to the central irrigation system of the park and the planting was made

Common-action Walls had been our first attempt to explore the inherent properties and various performances of the earth as a building material. Since ancient times, earthen architecture had been applied in different parts of the world with various techniques based on different material compositions and construction methods such as adobe, mud bricks, and rammed-earth. This accumulation of different experiences formes a common-knowledge and tradition which also opened up ways for industrial fabrication. We learned about the traditional and contemporary methods of working with "Alker" (Kafescioğlu 2008, 2017) and rammed-earth as a contemporary sustainable production technique (Minke, 2017; Işık, 2019). We found out that this recyclable, sustainable, biophilic, and economic material system could be integrated with digital fabrication to enhance its performances for geometric explorations, durability, and industrialization. Beyond the strengths of this material system towards environmental and ecological issues and social sustainability, the beauty of its natural colors and texture catches attraction from an artistic point of view (Image 6).

Robotic Earth-Crafts

The six-month-long experiment mentioned above was further investigated in a graduate studio in the following year. Robotic Earth Crafts** was a two-week-long experiment, conducted as a graduate studio of architecture at -- in 2018. In this experiment, the molds are produced by a hot-wire cutter which is controlled by a six-axis industrial robot. This enabled us to coordinate the rammed-earth building system with geometry and programming skills necessary in robotic fabrication.

The Studio Setting

The first phase of the Robotic Earth-Crafts studio included seminars and short-term practices on mathematical surfaces, robot technology, and rammed-earth construction techniques (Image 7). At the end of the first phase, the participating student groups designed their block systems and fabricated their molds with the help of the robotic arm. Using these molds, several rammed-earth blocks had been produced and discussed. The second phase of the Robotic Earth-Crafts summer school began with seminars on permaculture design principles. The mold and block systems that were found successful in the first phase were revised and further developed by integrating these principles and functions. The relationships between geometric forms, solar path, irrigation, plants, and the human body are experienced during the design development processes. Groups of students revised and re-produced their structural systems. The results of the studio were modular micro-permaculture systems constructed from rammed-earth blocks with the help of a robotic arm.

Remarks on Student Projects

A total of 15 students created four groups. Below are the brief explanations of two of these projects (Image 8). The first group (A) designed a system of curved tessellation, formed by the molds, cut from 33 cm X 33 cm Styrofoam modules. The design idea included a challenge to create a no-waste design system. Therefore, the mold form is designed according to the curved surfaces created by the hot-wire cutting tool attached to the robot arm, to obtain both the mold and the product through a single cutting operation. In the design process, the initial solid block form is shifted towards curved surfaces via subtractive operations. The rammed-earth units are supported by wooden rods to increase the structural strength for compression loads. This intervention enabled them to generate a structure, which is able to grow in both horizontal and vertical axes. The vertical surfaces facilitated the growth of ivy-like holding plants while the combination of these modules in the horizontal direction creates niches for various plants supporting the bio-diversity principles of permaculture. The structure is positioned considering the solar and wind paths. This structure is designed to be used by the Gastronomy Faculty at the same campus area, as a planting structure to grow edible plants.

One of the student groups designed a conceptual habitat for the birds in the campus area. The rammed-earth blocks provided continuous holes and cavities for sustaining the motions of birds through the structure. The geometric units were designed to create variations, in order to serve for various needs of plants and animals, such as planting holes, sheltering, feeding, and also to enable air channels for birds. These variations of blocks are formed by a flexible mold that has additive and subtractive parts.

Conclusions and Discussion

It is possible to evaluate the results of this research within the framework of the two experiments, as well as to expand beyond this framework to open new questions and discussions. The Common-action Walls project has shown that both the formal properties and the material content of rammed-earth structures can open new research areas. It has been proven that structures built with this technique can be reconsidered to contain inner voids. Although this material is very old, it has shown that it is still possible to develop new and more efficient mixtures. The authors who prepared this study both organize new short-term workshops on rammed-earth structures supported by robotic technology and start new and longer-term research projects in this field. The studies presented in this article provide a reconsideration of a sustainable building technique and material in a way that has not been addressed before. This technique, which is still being tried in large-scale structures, is expected to be more widespread in the future.

Robotic Earth-Crafts studio, on the other hand, highlights an educational model in which design education is supported by one-to-one practice. Today, it is an open discussion topic which new formations the future design instructors should have. Maintaining material-based research in educational environments and integrating into design studios beyond technical education can be facilitated with the help of computational design and production technologies. Therefore, it can be foreseen that digital technologies in design education will evolve from being an abstract and technical field into a more interdisciplinary and applied field. In parallel to this transformation, the future design instructors will be more open to being the catalysts of interdisciplinary educational studies.

IMAGES, CHARTS OR GRAPHIC LEGENDS

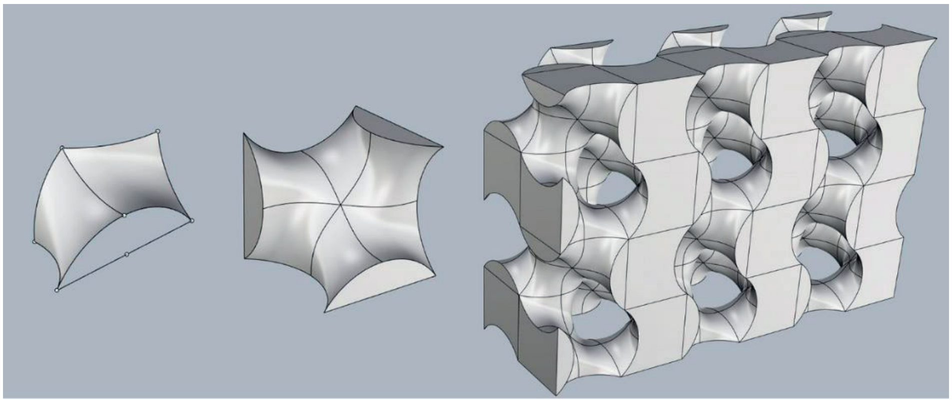

Image 1: The geometric construction of Gyroid and the initial project of Common-action Walls. Left: The fundamental section and patch of Gyroid. Middle: The portion of the cubic unit cell, which is used as the product and the mold of the Gyroid. Right: The initial project of the Common-action Walls, a combination of 24 cubic unit cells.

Image 2:The initial mold system made with 3d printing, and the first casting experiment of the unit cube of Gyroid.

Image 3: Left: The industrial mold. Middle and right:
The second casting experiment made with a revised compound recipe, using the industrial mold.

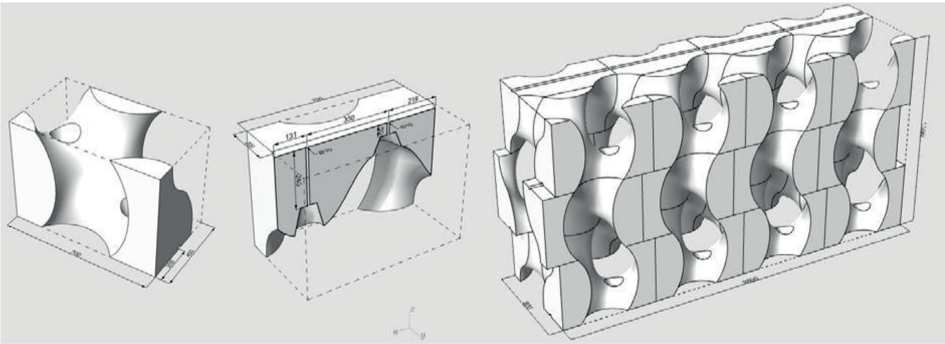

Image 4: The final form of the blocks and the Common-action Walls, developed after the initial production experiments.

Image 5: The block after the final production process.

Image 6: Final installation of Common-action Walls, September 2017.

Image 7: The initial experiments with robotic hot-wire cutting EPS blocks and using them as the molds of rammed-earth modules.

Image 8: Two of the group projects developed at the Robotic Earth-Crafts studio. Left; Workgoup (A). Students: Murat Sökün, Özlem Güven, and Zeynep Tuğba Çakmak. Right: Workgroup (B). Students: Aydan Ataç, Meryem N. Yabanigül, Nihan Kurtoğlu, Selen Turan, and Sinem Kısacık

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** The Robotic EarthCrafts was the 2018-2019 summer school design studio of Architectural Design and History, Theory and Criticism graduate programs of İstanbul Bilgi University, coordinated by Evren Aysev and Bahar Deniz Çalış Kural. Tutors of the studio were Tuğrul Yazar and Fulya Özsel Akipek. The studio assistant was Hülya Oral. Special consultants were; Özgül Öztürk (rammed-earth construction technique), Dilek Yürük (permaculture design specialist). Visual Communication of the studio is supported by hop (graphic design), and Sinem Serap Duran (video artist).

USING FABRIC FORMWORK FOR FREEFORM CONCRETE DESIGNS

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ABSTRACT

The relationship between form, material, and manufacturing has influences on design, manufacturing, and post-manufacturing processes as well as budget, time management, material usage, and material waste. Three-fold relationships between form, material, and manufacturing become prominent as one of the fundamental issues studied in the field of architecture and engineering. Within increasing studies on this topic, the material-based computational design method becomes popular as an interdisciplinary approach. In the material-based computational design methodology, concrete-based studies are more commonly done. Concrete is the most widely used and studied building material in this field and its use has been increased over the years. Concrete enables the manufacturing of almost any form with its fluidity and strength features. In addition to that, concrete is a material that is difficult to recycle. In this sense, many factors as mold technology, budget, time management, material usage, amount of waste material, manufacturing system, and process that has influences on using concrete. In this context, fabric formwork technology gains importance as one of the effective methods that can be used for fluid materials such as concrete, plaster, so on instead of using wood, metal, or plastic-based molds that have long manufacturing time and high cost. The aim of this study, manufacturing process, time management, material usage, amount of waste material for the construction of free-form designs through fabric formwork technology is studied. Through a historical overview of the fabric formwork from the first utilization to up to today, its usage areas, advantages, disadvantages, and possible options are examined. Within the scope of this study, advantages, and disadvantages of fabric formwork on design, manufacturing, and material usage are examined through the case study that was conducted as a ten-day workshop which is based on previous researches and studies.

KEYWORDS

Form-finding, material, fabric formwork, concrete

Introduction

In architecture, before the development and introduction of new building materials and techniques, form-finding studies were conducted as material-based studies, researches, and experiments in accordance with the physics rules. Designers like Gaudi, Otto, Fuller, and Prouve studied material-based studies and their effects on the form-finding process through defining parameters for particularly one to one scale physical models. Antonio Gaudi demonstrated the optimal shape of a structure as an effective way for form-finding through analog calculation under the strength of the gravitational force like the Catenary Arch Models (3D hanging model). Complex curved vaults of the Sagrada Familia Church were designed by the utilization of analog computational methods. Another study is the soap films that are one of the methods studied by many designers, engineers, and mathematicians to find minimal surface as an analog computing approach. By dipping a wireframe into the soap to get the minimal surface was used in the designs of Frei Otto (Image 1). Experimental approaches for form-finding is also seen at Buckminster Fuller Designs and studies. The Geodesic Dome of Buckminster Fuller is a geometrical shape that encloses the greatest volume with the least surfaces (Dimcic, 2011). In that sense, the studies on material and manufacturing technologies come into play on the relationship between form, material, and manufacturing in the historical perspective as well as using concrete in experimental studies in architecture.

On the other hand, as Kloft, H. (2005) stated that the formal, geometric shifts often coincided with the development of new techniques and materials. ...developments in concrete and later plastics, textile-inspired architects and engineers to move away from the Pythagorean geometries and to treat form in a less restrained geometric manner (Kloft, 2005). Filmy shell structure by Felix Candela, Palazetto dello Sport by Pier Luigi Nervi, TWA Terminal by Eero Saarinen, Lightweight tent and cable- net structures of Munich Stadium by Frei Otto are the results of the developments. In this context, it was seen that the relationship between the methods of making (manufacturing) and representation, the transition from physical to digital, and material-based form-finding studies influence the architectural design and construction process. Studies on the form-finding methodologies and techniques in relation to studies on textile and concrete have been the threshold for the development of new studies, researches as well as manufacturing techniques from the Euclidean geometries to free-forms (Image 2).

Methodology

Concrete, which is a widely used material in the construction industry, is a heterogeneous building material consisting of composite, randomly distributed aggregates. Nowadays, concrete has been used in varied forms and areas through diverse manufacturing methods than traditional, conventional use due to developments as the production of durable concrete and the utilization of fiber materials in concrete. The fluidity feature of concrete makes it possible to design and manufacture single, double curved, and free-form designs. Within the developments on molding technologies, architects and engineers started to build designs and structures that are previously both structurally and geometrically difficult to construct by traditional manufacturing, constructing methods in a shorter time. The utilization of the flexible molding technology in construction industries for fluid materials as concrete, plaster, so on, enable the rapidly increasing studies for the development of flexible molding technologies and methodologies to construct structurally, geometrically difficult forms and designs. On the other hand, flexible molding technologies are still not widely used in the architecture and construction industry. In order to increase the usage of these technologies, more researches are needed in this area.

Concrete has been used in a variety of ways since its first discovery. Flexible molding technologies started to be used in the late 1800s and continued to be used although it is not commonly used up to today. Particularly, development in the textile industry such as the production of flexible textiles that are more resistant to environmental factors, pressure and tensile resulted successfully and enable wide usage for the inclined road, dam, irrigation channel construction by engineers (Image 3). Despite the fact that fabric formwork technology is relatively new in architecture. New utilization possibilities of fabric formwork technology emerged with the rapid and efficient digital modeling in CAD/CAM environments, that shorten design and manufacturing processes of different variations, draw attention to fabric formwork researches. This increased the work on the possibility to quickly manufacture and construct physical designs of digitally produced ones. Thus, new alternatives and possibilities emerged by fabric formwork methods in architectural design and construction. Formwork free from geometric limitations can open up the possibility of mass customization of concrete components for their specific context, boundary conditions, and load cases (Jipa et al., 2017).

In textiles, a one-dimensional medium -filament material as fiber, yarn, rope, etc. - is transformed into two or three-dimensional medium as textiles by recursively operating loops. This simple recursive looping operation can generate not only Euclidean but also non-Euclidean meshed surfaces such as hyperbolic surfaces, which are difficult to create with traditional construction materials and methods (Henderson & Taimina, 2001). The knitting techniques run as an algorithm in the background for pattern schemes like weaving to generate various geometries through different patterns, channels, openings, and multi-layered formations. As Garcia states, one is always pervading the other: textile techniques become computing techniques, the surface becomes structure, and structure becomes geometry. It goes beyond a pure transmutation of textile techniques into design techniques; it is, as Lars Spuybroek would say, a completely 'textile way of thinking' in architecture (Garcia, 2006). The aim is to integrate the "textile way of techniques" based on computational techniques to generate a lightweight, robust hybrid textile system (Garcia, 2006). In this context, "textile" based calculation techniques are applied to manufacture lightweight, robust hybrid textiles. These techniques provide both tensile and pressure active components and various data-driven design processes to manufacture seamless textile composites. In this context, the combination of pressure-driven rigid, static material as concrete and tensile-driven flexible, dynamic material as a textile is a research area through a tension between them in terms of creative potential (Elmas & Alaçam, 2019) Therefore, increasing and extensive studies in fabric formwork are increasingly conducted over time.

Developments in CAD/CAM technologies in design and construction, material studies, and manufacturing methods lead designers, architects, engineers, and researchers to study the relationship between form, material, and manufacturing by utilizing new tools, materials, and approaches. As Cerovic stated that today, textile materials in combination with software, robotics, and sensorial devices provide for the renewed inters in adaptable form of architecture and the ability of the built environment to react according to contextual changes (Cerović, 2012). Thus, textile materials in architecture become popular and widespread among designers while opening up new ways to communicate with others through firstly remanufacturing existing and available forms. As Vazques and Jabi stated that this created processes where the architects set the various parameters based on fabrication techniques and material properties and adjust them iteratively in the physical and digital models until a balance between material properties, technical requirements, and aesthetics is reached (Vazquez & Jabi, 2015). Through changing the application of the textile composites, these data-driven designs will provide solutions to desired performance criteria for the concrete based studies.

In architecture, one of the first applications of fabric formwork is done by Spanish architect Miguel Fasic. In the 1970s, for the Juan Zurita residence design, the architect used rope and plastic-based material to create precast façade panels (Image 4). In the 1990s, Japanese architect Kenzo Unno used fabric formwork to design and construct wall panels. These works were followed by American Architect Mark

West and South Korean Architect Byoung Soo Cho. In parallel to these works, designs, and researches industry-based researches were started to be done. Fab-Form Industries, Monolithic, Concrete Canvas are a few of various research companies, laboratories, and university-based research groups in this field. The most prolific research currently being conducted is under the direction of Professor Mark West, Director of the Centre for Architectural Structures and Technology (C.A.S.T.) at the University of Manitoba, Canada (Schmitz, 2015).

Since the early 1990s, the fabric formwork method has been applied by pouring concrete into a flexible textile material to achieve complex non-orthogonal forms while being minimal material waste and low cost. Nowadays, pouring concrete into a flexible textile has become a widely used method through computational design methodologies, discovering the advantages of the fluidity of the material allowed architects, engineers, and researchers to study complex form designs. Two categories of fabric formwork emerge as are filled molds and surface molds depend on the master thesis of Veenendaal (Hawkins et al., 2016) (Image 5). These two main categories are divided into many different sub-categories according to the type of the application, a feature of the building component, and load-bearing properties.

Depending on the developments in CAD/CAM technologies and the introduction of new building materials in architecture and manufacturing provide more free-form designs. Especially the studies on the digital-based manufactured physical models have increased and enabled rapidly mass production of free-form designs. Within the help of the fabric formwork, progress from mass production to mass customization for diverse forms in architecture, design, and construction is accelerated initially starting from form-finding studies. In addition, modular mold units allow for shortening both manufacturing of fabric formwork than the existing molding techniques and constructing free-form concrete designs (Image 6). Through this technique, that accelerates the manufacturing process of concrete structures, designs particularly free-form designs, concrete pours on and into the fabric formwork that takes shape according to environmental forces as are pressure and tensile forces. Due to this technique form can be seen outside of fabric formwork while liquid inside the concrete is percolated. As a result of this more durable concrete designs and structures are achieved. In this way, this allows for less material waste as are molding material and concrete while accelerating the process from the design phase to the end-product. On the other hand, during the process, excessive forces in and on the formwork and also the chemical process of the concrete as curing affect the properties of the textile material as a shape deformation of fabric that is caused to change it for each process. Even for changing the textile material, fabric for each process, using fabric formwork is shorten and accelerated the process compared to the existing molding techniques.

Free-form Concrete Design

Within the scope of this study, it is aimed to design free-form concrete designs and structures by using the fabric formwork method. A ten-day architectural summer school workshop was organized at Abdullah Gül University to design and construct a 1:1 scale model. During the preparation of the summer school, preliminary studies, and researches were made at the office of Melike Altınışık Architects. In the preparation process, fabric formwork technology was examined and observed to learn and get principles of materials like concrete and fabric formwork techniques. Entire preliminary studies were done as a small-scale mock-up. Through plastic-based materials, hemp threads, water-filled balloons, frost pins, various cardboards, and recyclable materials as cola and water bottles were used (Image 7). From each study, the ratio of sand and cement was noted to observe and learn the effects of them on the form-finding process. Therefore, as a result of these preliminary studies, the estimated properties of the concrete like the fluidity of concrete to be used at the workshop were almost determined and provide effective communication between the R&D team and participants of the workshop. In addition to that, the dimensions of the molds and features of the textile were also defined.

The project was built to a scale of 1: 1 at gardens of the Abdullah Gül University Student Guest Houses that is registered under an Industrial Heritage (Image 8). Fabric formwork-based design and manufacturing process was defined through dynamic and variability molding methods. For this design, fabric formworks were utilized as a modular molding technique that the dimensions of the modules are 50x50x25, and also inside of the molds were designed, planned by using pins. This project was conducted through the taking negative of the cast concreted 158 modules. For each and every casting concrete maximum of 36 molds were used and this process was repeated five times for the entire design. Each manufacturing process for each module was planned in three main steps as preparing molds for casting, casting concrete into molds, removing the concrete forms from molds. Hereby, in addition to small scale mock-up studies, before the main casting process, a few preliminary 1:1 scale concrete casting for some modules were carried out by workshop participants to learn and observe the material behavior and each step of the process (Image 9). Therefore, the inside design of the formworks, the base thickness of the concrete forms, and material choice for dowels that were used form-finding were defined as the main design and construction principles by the participants of the workshop.

Manufacturing Processes of Free-form Concrete Design

Modular System and Mould Design

Design decisions are taken based on the observations and knowledge obtained from the concrete casting studies that are to divide the 50x50cm base of the mold into 5x5 squares as a grid system. Entire design decisions were taken analogously as annotations and sketches. According to design decisions, the plastic-based styrofoam dowels were placed onto the grid inside of the molds (Image 10). Thus, the preparation and application of each formworks process are planned and gotten easy compared to existing molding technologies. In this approach, the process was started as placing the styrofoam dowels inside of the formworks according to the 5x5 grid system, then continued as anchoring the textile material at the open surface of the formworks for simultaneously enabling to sag, expand, and wrinkle of textile during the casting concrete. In addition to that, the casting concrete phase was also another crucial phase. While casting concrete into the formworks, entire participants of the workshop had to be careful to prevent styrofoam dowels and plastic-based re-used material from falling down inside the formwork. Otherwise, while casting concrete dowels could be move, fallen down, or broke down which affects the form of the concrete design. Thus, casting concrete into the formworks was started from the corners of the formwork and then continued as interior edges of the formwork were then finalized through casting concrete to the center of it. In some failure cases, workshop participants had to hold styrofoam dowels by their hands until the pouring concrete into that formwork is finished. Therefore, within the fluidity of the concrete and flexibility of the formwork, more form-finding studies were done in a short time while getting less material waste and decreasing the time of the manufacturing process.

Material Choices and Recycling

The relationship between the systematic approach to casting concrete and material choice that was used for both mold material and materials for the inner design of mold had influenced the form-finding process. Wooden dowels, plastic water pipes, paper rolls, styrofoam, water bottle, cans, paper cups, and plastic buckets were used as re-usable material. According to preliminary 1:1 scale concrete casting, styrofoam, plastic water pipes, and plastic buckets were chosen for the inner design of the formworks. Styrofoam is used as dowel (pillars) inside the formwork while plastic water pipes and buckets are used for holes (openings) in the formworks. Hereby, styrofoams were pre-produced by cutting to similar sizes according to defined dimensions. As a result of the preliminary 1:1 scale concrete casting, it was observed that styrofoam was deformed by increased heat of the concrete as a result of the chemical reaction between the cement and the water. In order to prevent this deformation, each styrofoam was covered by paper tapes. Furthermore, three different size aggregate materials as with coarse, medium-grained, and fine particle aggregates were used for this study (Image 11). In that sense, coarse and medium-grained aggregated concrete enable water-permeable designs. One of the design decisions is to design water-permeable modules for gardening. Thus, water filters directly into the soil without accumulating in the pits of the design that is enabled for new plants.

Manufacturing and Coding Systems

In the concept design phase of the project, it was decided that the white concrete to be used will be produced with three different aggregates. In this context, while the outer modules forming the boundary with the soil were produced with coarse aggregate concrete, the intermediate, transition modules were produced with medium-grained aggregates and the highest elevations were produced as gross concrete. At this stage, the coding of the modules according to the properties of the material to be used for each module, the hole sizes, and types were noted on the site plan as an analog process. Coding was made as A1.1 / A15.3, consisting of the line and row where each module is located. The colored dots at the upper left corner indicate the material of the module and 0 or 8 at the upper right corner indicate the holes, opening of the modules. Also, modules were coded from 1 to 5 from right to left, as well as modules were coded as A1 to A35 from top to bottom (Image 12). These documents were used at all stages.

The properties of the white concrete as are rapid curing duration, effects of self-organization of concrete under force during the casting, and the difficulty of casting concrete by using wheelbarrows and small shovels became effective for revising the workflow. Additionally, one of the design decisions is to design it as a part of the existing ecosystem of the garden. Therefore, it was decided to design modules within one or two holes for planting in them. While calculating the amount of concrete for casting, three different aggregates types were considered as well as the volume of the holes. The layout of the coding system of manufacturing stages was digitalized according to the types (properties) of concrete, types of holes, and location of the plants (Image 13).

Concrete Casting Process

Within the scope of this workshop, considering the historical importance of the project site where is registered under an Industrial Heritage was covered with plastic poly sheeting for each casting to protect the area. Then, formworks are placed on these plastic sheeting. The process is repeated for each casting concrete. The inner of the formworks that frost pins were used for stabilizing. Fabrics were stretched to the molds (formworks) with the help of pneumatic staples while envisioning the thickness of concrete designs as five cm. Thus, these five cm thickness is enabled to prevent the concrete to be broken due to getting too thin layer because of the design of the formwork and losing its strength. At the final stage of the workflow, the fabric of the formwork was lubricated to the easy removal of concrete from the mold (Image 14). The prepared formworks were placed as two or three rows to allow the wheelbarrow to move easily between them in the casting stage.

The concrete casting was another critical point of this workshop. Therefore, it was decided to cast five times instead of casting three times considering the curing process of the concrete. Although for the first casting phase, the casting concrete process was carried out slowly. But the further phases were systematically planned and carried out. The concrete was filled to wheelbarrow from a concrete mixer truck to cast concrete into formworks while taking into account the elasticity, fluidity, and volume of the fabric formworks for every module. Moreover, by taking into consideration of weather of the project site in summer for both the curing process of the concrete and the workshop participants, casting concrete was carried out in the evenings. After 12 hours of curing time, the removal of concrete from the formwork was done in the morning between 9-10 am when the weather is not still hot. During casting concrete, firstly concrete was slowly and carefully placed at the corners of the fabric formwork while considering the possibility of tilting and damaging of the styrofoam dowels in the formworks. And then, the concrete casting was carried out along the edges, boundaries of the fabric formwork (Image 15). After pouring concrete along the edges of the formwork, the rest of the concrete was directly poured into the formwork from a wheelbarrow. After 12 hours of curing time, concrete removal was done. While fabric formworks were prepared for further concrete casting, removed concrete designs were frequently watered due to the hot weather of the project site. For the curved bottom surfaces of the 14 modules, the concrete casting was made separately from others. In that sense, the bottom surfaces of the modules that these most inclined ones were shaped in the first 1-2 hours of the curing by hand to correspond to the slope of the ground.

Environmental Impacts of Existing Landscape on Design

The grass-covered project area is located next to the vegetable garden of Abdullah Gül University, it was decided to have holes in some of the modules and planting them to comply with the existing landscape. In the site preparation, the boundaries of the project, symmetry axes, and reference points were marked, and the curve form of the artificial hill was made. For the form of the hill, the iron bars were nailed on at intervals of 50 cm on the symmetry axis. The sandbags were placed in a staggered manner, while the sandbags were placed on top of each other for the purpose of preparation of the artificial hill. At the last stage, the hill was packed with burlap, and the flow of sand and soil that formed the hill was taken under control (Image 16).

Plant selection for the project that is compatible with the climate of the project site and easy to maintain plants were examined and decided to plant the Festuca Glauca (blue grass). The number and size of the holes for each module that is for the plants were recorded in the layout plan. At the last stage of the study, Blue Grasses were planted by a large group of people. (Image 17). This plant, which is very easy to care for, was first irrigated to quickly hold onto the soil after planting and in the following days.

Conclusion

Within the scope of this study, A ten-day workshop organized as a part of the architectural summer school at Abdullah Gül University was applied to the fabric formwork technique to design and build free- from concrete designs. Within the recent studies on fabric formworks, fabric formwork methodology was utilized for the workshop as a result of low material waste, rapid manufacturing process, building and designing free-form designs easily, flexible molding techniques both for form-finding studies and mass customization in the industry. In the current molding technologies, in consideration of the fabric formwork technologies wood, plastic, and metal-based molding have a long manufacturing time. In that sense, utilizing fabric formworks was enabled to change formwork in parallel to the design process from the early design phase to construction simultaneously. Beyond that, fabric provided smooth surfaces through the slightest effort even for the different sizes of the aggregates as coarse and medium-grained aggregates. As a result of the chemical reaction between the cement and the water in the process of self-organization of concrete under force during the concrete casting in the formwork, the liquid inside the concrete was percolated and the heat of the concrete was increased. That affected the mechanical properties of the textile fibers as fabric and melted the plastic-based styrofoam dowels. Therefore, after each concrete casting, whole styrofoams and fabrics needed to be controlled and if necessary, to be changed for other casting concrete. Although almost all of the fabric had to be changed after each concrete casting, fabric formwork shortened and accelerated the entire process both for the molding production process and construction of the free-form concrete designs by less man labor. Through the possibility of modular design and construction approach, waste materials were the fabric that was deformed by the chemical reaction of the curing of the concrete and styrofoams. The wooden part of the formwork could be used again and again for the other designs and construction. Apart from the textile material of the fabric formwork, these flexible molds provide multiple usages in comparison to existing molding technologies. In addition to that, the systematic approach for the manufacturing process of the free-form concrete through analog coding on the site plan shortened both preparations of inner of formworks and casting concrete process. Thus, in a short time, a variety of different form-finding studies were done as a part of the learning by doing approach.

IMAGES, CHARTS OR GRAPHIC LEGENDS

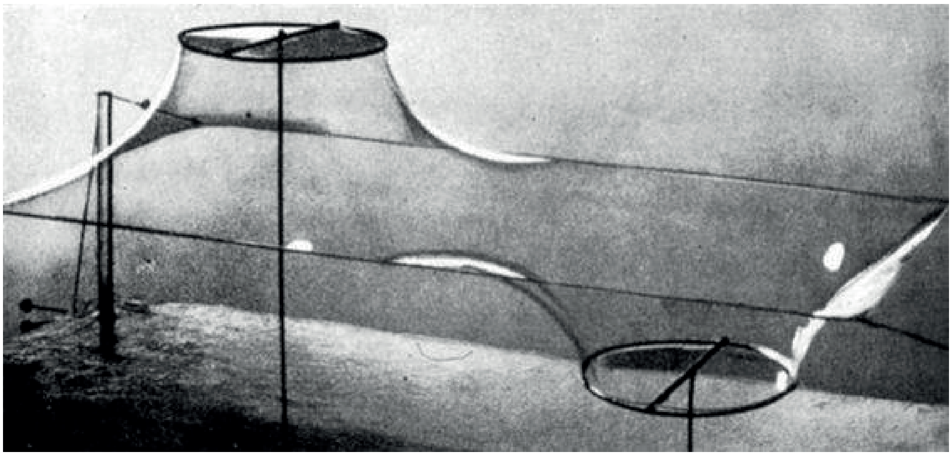

Image 1: Frei Otto Experimenting with Soap Bubbles (Zexin & Mei, 2017).

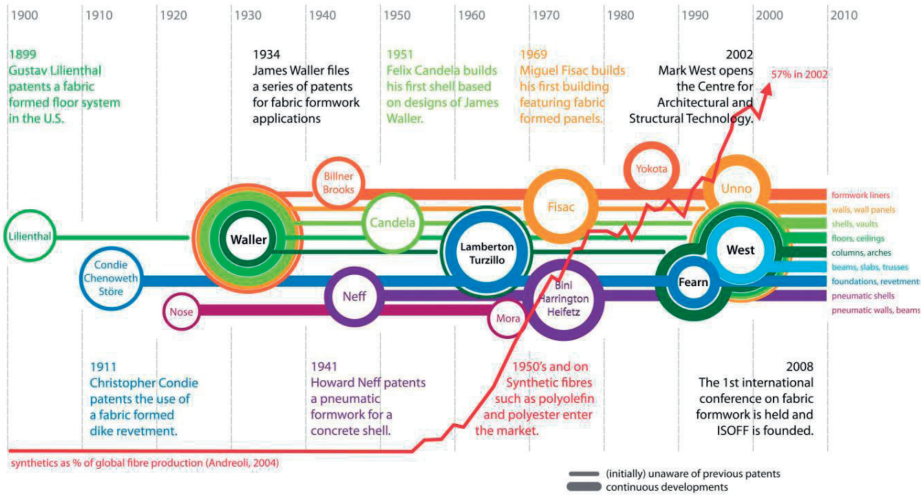

Image 2: Timeline of flexible molding Technologies (Veenendaal, West, & Block, 2011).

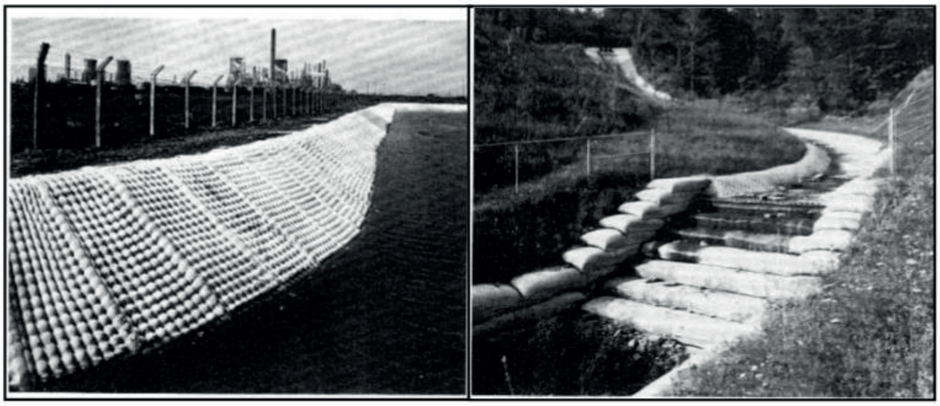

Image 3: Utilization of fabric formwork (Schmitz, 2015)

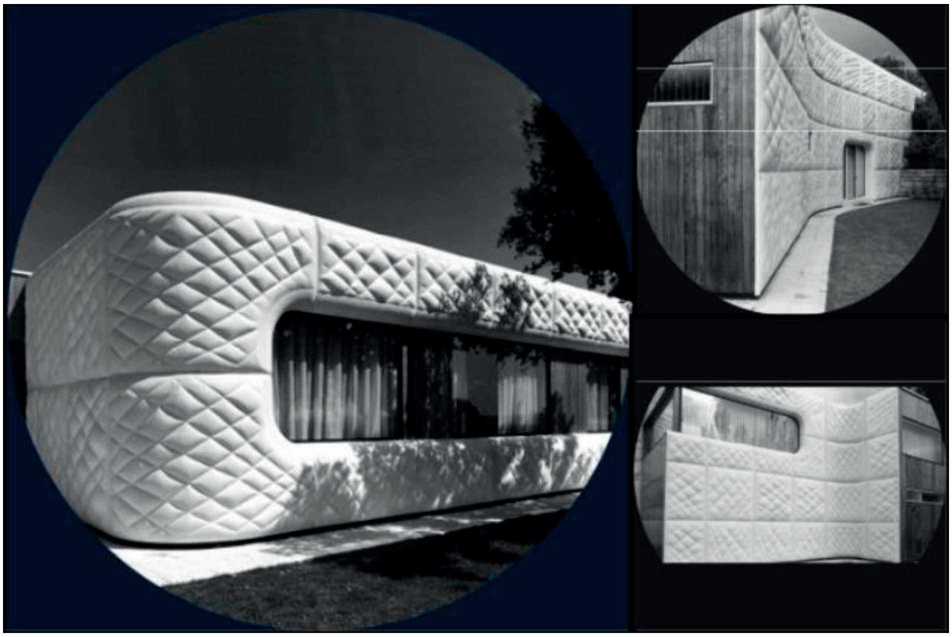

Image 4: Residence design by Juan Zurati (Schmitz, 2015).

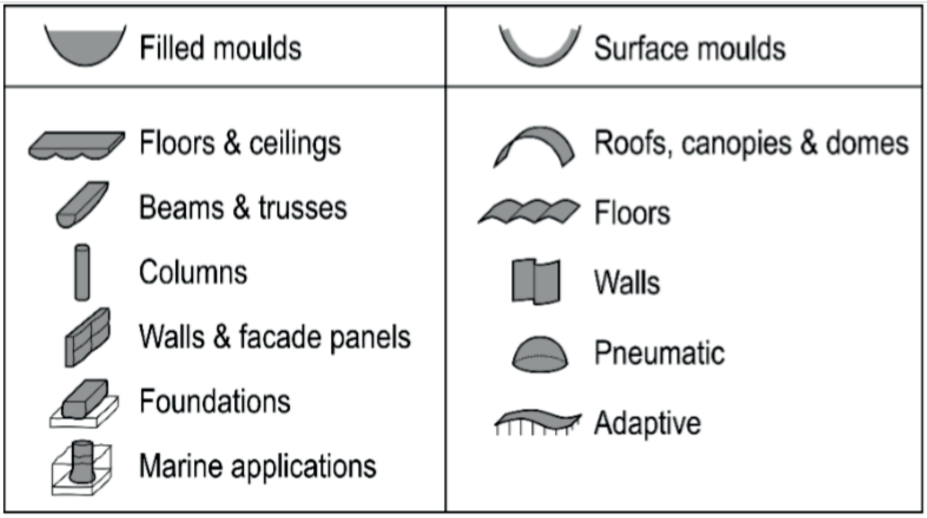

Image 5: Fabric formwork classification (Hawkins et al., 2016).

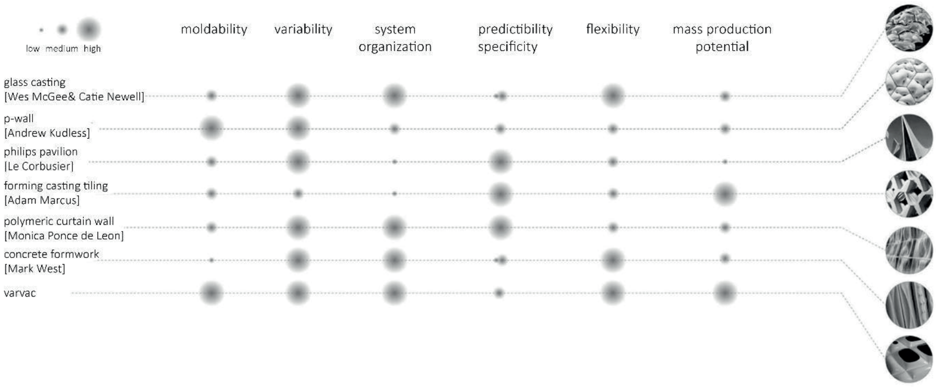

Image 6: Properties and potentials of fabric formwork (Swackhamer & Satterfield, 2013).

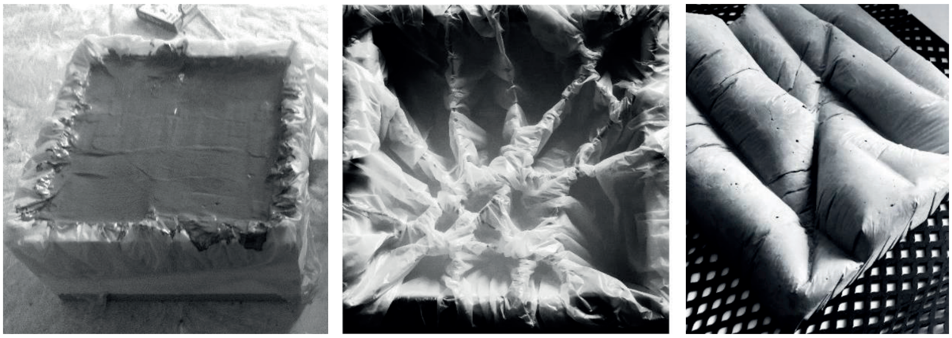

Image 7: Preliminary studies on material choice, features, and molding methods.

Image 8: ACHROME[scape] project.

Image 9: Preliminary casting of concrete studies.

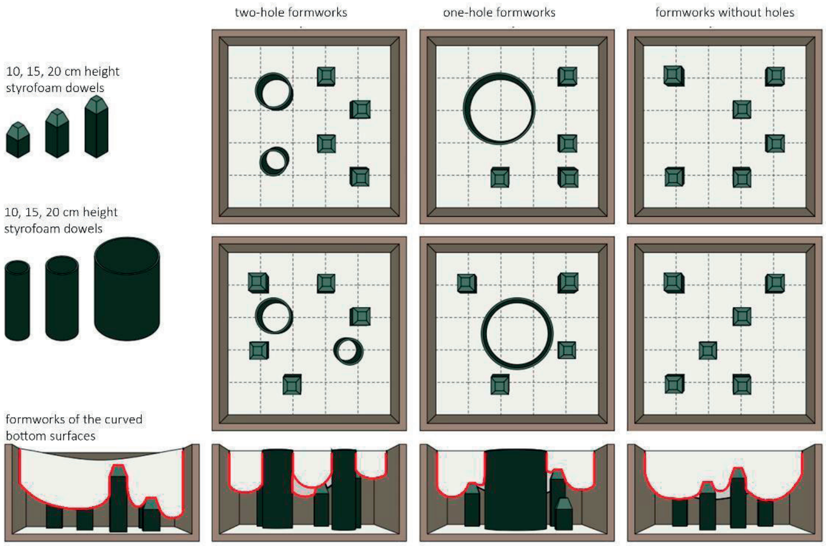

Image 10: Design of the inside of the formworks and manufacturing process.

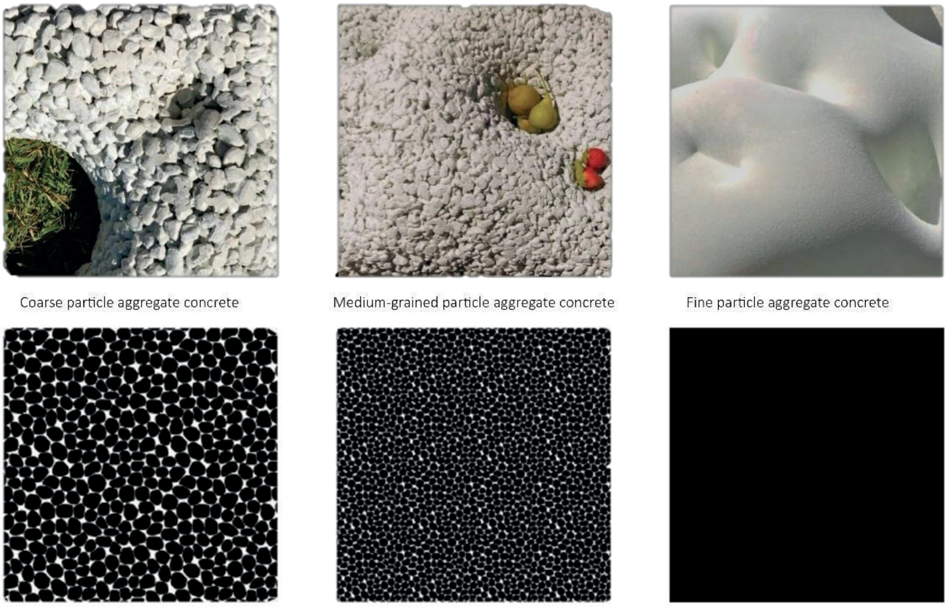

Image 11: Coarse, medium-grained, and fine particle aggregate concrete designs.

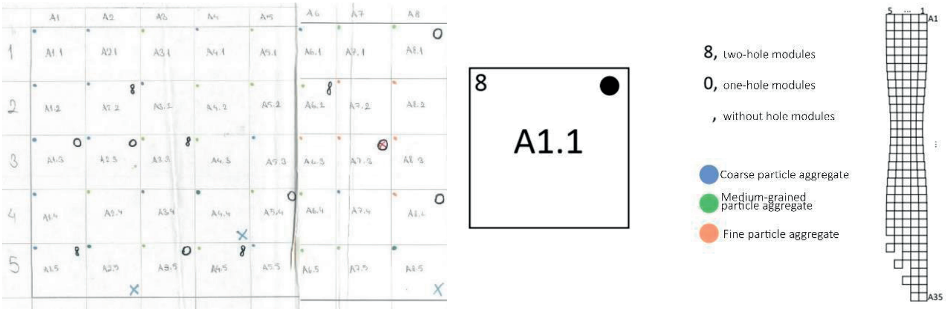

Image 12: Coding system of the modules.

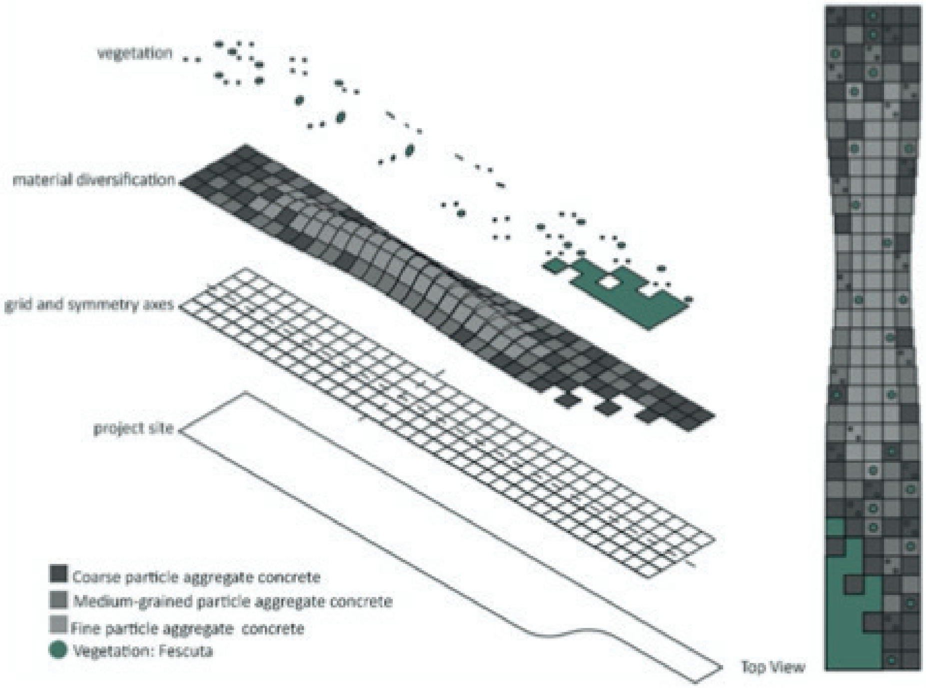

Image 13: Settlement plan

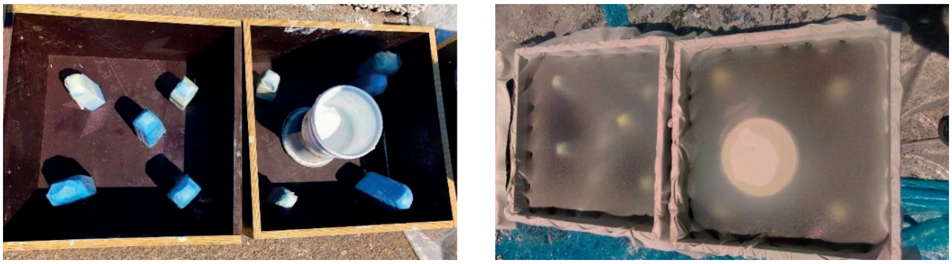

Image 14: Preparation stages of the formworks for casting concrete.

Image 15: Concrete casting process of the fabric formwork-based design.

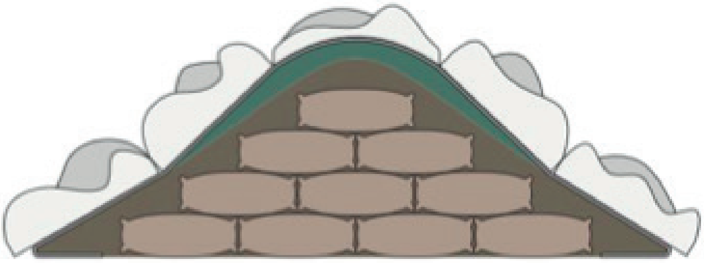

Image 16: Design of the artificial hill.

Image 17: Planting at the project site.

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MYCO-HILLS: AN EXPERIMENTAL RESEARCH ON MYCELIUM BASED BUILDING BLOCKS

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ABSTRACT

In a rapidly developing world, pollution caused by the overconsumption of non-recyclable materials in design and architecture has led designers to find sustainable solutions like biodegradable materials. Mycelium is a significant example of it. In this paper, the research conducted as a part of Basic Design Studio Istanbul Bilgi University on the producing mycelium-based building blocks through the process of cultivating mycelium in different materials and ratios to assess the possible mixture to use in self-standing interlocking wall assemblies. In this research. After analyzing the possible factors which affect this process by comparing the mycelium mixtures, the design and production of molds for interlocking building blocks are explained. Due to the lack of time for growing mycelium for every mold, the properties of other materials are analyzed as an alternative to the mycelium-based biocomposites. As a result, the final design which functions as a sitting unit and flowerpot is realized in the 1:1 scale by using stone powder to test the physical application of the proposed design as a self-standing structure. The paper presents actual applications of mycelium-based biocomposites from the perspective of various design principles. Then, the process steps for mycelium mixture is explained as the inoculation, cultivation, and drying heating. The packages that are prepared as different mixtures are explained and compared to select the working one. The potentials of mycelium in the future are discussed as final remarks.

KEYWORDS

Mycelium, bio-design, biomaterials, molding, building blocks

Introduction

Regarding the improvement of building materials research, biodegradable materials have covered a large part of them. These supplies can be decomposed by microorganisms such as bacteria, enzymes, and fungi. One of them is mycelium, which is a vegetative fibrous root system of mushroom, so by giving it a form, the low-cost organic wastes transformed into nutrition-based building material. It is not only eco-friendly also it can quickly be produced in different forms. Mycelium can be a solution for plastic usage. The latest innovation of Ecovative partnered with BioMASON MycoBoard allows people to use mycelium as a packaging material (URL-1). Myco-Board is a different form of mycelium. It can substitute with polystyrene in terms of thermal and acoustic performance. Myco-Board has thermal and acoustic insulation properties. It is a light-weight material that is easily floating and at the same time, it is strong. The Strength of the material is considered in the video of Nathan Finkel 'Mycelium-bricks' (URL-2). For instance, the comparison between mycelium and concrete shows us the importance of mycelium. Moreover, mycelium has a high resistance to heat. As an outcome of all these qualifications, it actively uses as a masonry building element. For instance, one of the most impressive examples of mycelium brick-based structure is the Hy-fi tower in New York City. 10.000 mycelium bricks are used for constructing the pavilion. It is a 13-meter-tall tower, so it shows that mycelium has already started to be used for structures on the architectural scale (URL-3).

To use the potentials of mycelium, the research is done as a part of Computational-based Basic Design Studio conducted at Istanbul Bilgi University in the 2019 Spring Term. The second term of the studio focuses on the solid-void relationship through hands-on making in terms of materiality and its performance (Gündüz et al., 2018). By scaling-up both the given boundaries and complexity of the exercises, the final assignment reaches a 1:1 scale. It is asked to design a material system as a self-standing structure. Rather than concentrating on the developing mechanic joinery system, the experimental study as material research is conducted as a part of the final assignment. Nearly ten weeks of research with mycelium material is examined in terms of developing a material system consisting of interlocking blocks called MYCO-HILLS. The concept of the project is to design a self-standing structure functioning as the sitting unit and the flowerpot. Thus, two different components are designed and produced for both purposes.

The research is two-fold. Firstly, it is aimed to investigate which substrate mixture affects the oyster mushroom mycelium the most in terms of growth. Secondly, a mold system for interlocking elements is designed. Within the scope of this paper, 7 mixtures will be compared in terms of the activation performance of each substrate.

Also, the methods which protect mycelium for contamination will be examined. The potential of mycelium as a building material will be discussed as final remarks.

Background

Discovery of mycelium as biomaterial dates to the 1990s by Japanese scientist Shigeru Yamanaka. This research is about producing a paper and specific building material out of mycelium (Yamanaka & Kikuchi, 1991). Later, the environmental treatment potential of mycelium is displayed by Stamets (2005). Mycelium based composites contribute to soil enrichment in its life cycle (Figure 1). Thus, this sustainable property of mycelium has attracted designers' attention.

Mycelium has already started to be used in design practice. For instance, MycoWorks, which was established by Phil Ross (Boyer, 2014) proved that mycelium-based composite has various mechanical properties such as fire resistance, it has a better compression strength performance than cement-based bricks and it is able to float on the water (Figure 2-a). It means despite its lightweight structure; mycelium has the capacity of using it as a loadbearing structural element due to its durability. In that sense, mycelium is eligible material to use in furniture design. MycoWorks also manufactured chairs out of mycelium (Figure 2-b) and leather-like material is produced (Figure 2-c). In fact, it is transformed into another material like leather by changing the conditions which affect its growth (URL- 5). From the perspective of industrial design, Ecovative has developed a mycelium-based package that could exploit a substitute for plastic-based packaging (URL-6). Ikea is one of the pioneer companies which has changed its packaging to mycelium-based foams (Figure 2-d).

More recently, mycelium-based bio composites show considerable value in terms of thermal, acoustic, and fire performances. These composites can even be compared with the popular insulation and construction materials (Girometta et al.,2019). Thus, mycelium-based floor ceiling and acoustic wall panels (Figure 3-a) are developed by MOGU as an ecofriendly and low-cost alternative to petroleum-based insulation (URL-4). Along with the development of mycelium as an insulation product, it is used in some small structures being a masonry unit such as Hy-fi Tower (Figure 3-b), Mycotecture Alpha (Figure 3-c), MycoTree (Figure 3-d). Hy-Fi Tower is a 13 meters tall temporary structure constructed with 10.000 mycelium blocks which are the products of Ecovative in MoMA'S PS1 Courtyard. The macro form of the project is branching circular chimneys with a visible wood skeleton inside (Slavin, 2016). Mycotecture Alpha is a small structure that was designed by Philip Ross, co-founder of MycoWorks. It was displayed in the ‘’Eat Art” exhibition in Germany for the 25th anniversary. 500 bricks which are obtained from a mixture of Ganoderma Lucidum and sawdust, are used (Jones et al., 2017). MycoTree is designed for the 2017 Seoul Biennale of Architecture and Urbanism. It has a spatial branching structure out of bamboo and mycelium blocks. Different from other projects, its structure is designed benefiting from structural analysis software (Heisel et al.,2018). The examples are shown that mycelium has the potential to be used in either product or an architectural scale (Figure 3).

Experimental Setup

As a part of Basic Design Studio, the design process is started with defining the experimental setup for growing and observing the behavior of mycelium in variable mixtures. The experimental setup consists of three steps: inoculation, cultivation, and drying heating. The inoculation step, spawn, is a starter of mycelium. In the inoculation process, the seed must mix with water, shaving, and flour. All the materials must be sterilized. The sterilization process is discussed under the title of the preparation process later in this section. Besides sterilization, this process also must complete in a clean environment constantly ventilated with filtered air; after that, the bags are resealed. In the cultivation step, the mycelium grows. If all processes so far went right, the mycelium should start colonizing the grains. When the contents of the bag are completely white, the material is ready to be transferred into the mold which also must be sterilized beforehand. After, the mycelium is broken up again to be transferred to the desired shape. Once transferred, the mycelium needs time for a second growth. The mycelium grows again and starts hardening and has white outer skin. In the drying-heating step, after the growing step, the mycelium must be heated in order to turn the living organism into a biomaterial for stopping any further growth. For this step, both the hardened and whitened micelle blocks are placed in the oven for 90 minutes at 90 Celsius, so the water inside of the mycelium block can evaporate and by losing ⅓ of its own weights (Ghaznivan et al.,2019).

Preparing Process

For the material research of the inoculation, prepared 7 bags with different ingredients to analyze which mixture will be the optimum substrate (Figure 4). For the preparation, three materials are found that activated the mycelium to grow. These are flour, coffee grounds, shavings, and water (Corbley et al., 2019). Every substrate is sterilized to prevent the mycelium from being bacterized. All packages are prepared in a sterile way by using isopropyl alcohol, and shavings are boiled in 100 Celsius degree heated water. Then, the mixture is blended until all the materials got wet. The blend is preserved at a temperature of 25 to 32 degrees Celsius with no direct contact with the sun. When the packing is finished, both bags are drilled with a needle with the same number of holes. The expected result at the end of this process is the observation of white-colored micelles. After the preparation day, mycelium waits 5 days until it is ready to be opened, then it is taken out and started to fill up to the rectangular molds. Before it started to fill up gloves have been worn to disinfect the components with isopropyl alcohol. Then mycelium is being torn apart and put into the molds. 7 different mixes are prepared to get the most accurate mix.

Different outcomes are obtained as a result of mixtures (Table 1, Table 2). If results are considered in order, at the first package %8 mycelium, %15 water, and %77 shavings are mixed. However, the mold is observed due to excess water. Then, emerging white spots are observed at an early stage but then it started to get moldy. In the second package which ingredients are %8 mycelium, %8 water, %80 shavings, %4 flour, and the third package in which ingredients are %15 mycelium, %7 water,%74 shavings, %4 flour. After that, no further changes were observed at the fourth package which ingredients are %14 mycelium,%7 water,%71 shavings, %7 flour, fifth %14 mycelium, %7 water,%71 shavings %7 coffee, and the sixth package which ingredients are %14 mycelium,%7 water,%71 shavings,%4 flour, %4 coffee. Lastly, a little growth was observed in the seven packages whose ingredients are %45 mycelium, %5 water, %45 shavings, and %5 flour. Following this study continued with the seventh package (Table 3, Figure 5).

Mold Production

To produce the interlocking elements, the mycelium mixtures in which the growth observed are put inside the designed molds. Another research is done for deciding the material of the mold. These molds are made of polypropylene, corrugated cardboard, and MDF. Each mold is sterilized with isopropyl alcohol to prevent air transfer. Covered each mold with stretch film, and they are placed in where they do not expose the sunlight directly. Unfortunately, the molds made by corrugated cardboard and MDF started to be moldy, but the distribution of the mycelium was observed in the mold made by polypropylene. The sterilization is very important, and the first molds are made by MDF, so it's hard to keep it clean. Moreover, we use tape for holding component pieces, and it's also difficult to control. Therefore, we used the PP sheet and used the stapler to hold together the pieces. It can be easily cleanout. If the mold is not sterilized enough, the mycelium progress is affected and cannot grow. After the material is selected for the mold, the form of interlocking blocks is determined according to the mycelium, which can't get the shape of the complex geometric molds. So, more orthogonal shapes are made to get the best results. The second versions of our molds were straighter than the previous ones, so it gives enough space to mycelium for growing. The last process is the heat treatment in order to get the growth of mycelium under control. Finally, mycelium is baked at 90 degrees for thirty minutes.

For the design process, Rhinoceros was used for designing various molds to produce modules by using these molds. The interlocking modular system was proposed for the final design (Figure 6). Mycelium can grow in various shapes with the help of molds. Molds are important for the shape of mycelium design so. First, we need to be aware of our design needs. First molds have more sharp corners, so it affects negatively to spread mycelium equally in the mold. Then we made a new mold design in which one has more surface and wide corners and it works more clearly but this time because of the mycelium amount. It didn't grow enough connected to the time. As we can see at the end of many trials, the best working molds are commonly the ones that have more likely to conventional brick modules. Our design has sitting areas and blank spaces for plants. There are two different components that came from one module. We connect different amounts of one module in different ways and create our two main components and they have an interlocking system. For the final pavilion design, because of the time, we used stone powder instead of mycelium. This way we can show the physical design in the right dimensions in a short time. Especially we choose the stone powder instead of plaster because we did our final project outside so it can be more durable.

Results and Discussion

Experimenting with packages in-home standards can affect the results because humidity has an important role in the growing process of mycelium. However, the growth of mycelium was observed only in the seventh package (%45 mycelium, %5 water, %45 shavings, and %5 flour mixture). In the final analysis, mycelium has beneficial properties in terms of using different design principles. In addition to its fully biodegradable self-standing structure, it is undoubtedly easy to produce composites with different mechanical properties such as leather, thermal insulation, sound insulation, structural elements, etc. Therefore, it would be even possible to see prefabricated houses that are entirely made of mycelium-based composites in the future. The main limitation of mycelium building blocks is the long cultivating process of it which takes almost 2 weeks. It means that growing mycelium took too much time for the small-scale project in the scope of the basic design studio. Thus, the project ended with exploring the alternative material. These are adobe, plaster, stone powder. Adobe is the most similar one amongst them because it is reinforced clay with straw. However, the adobe must beat with a mallet in the molding process and the multi-faceted components are not suitable for that material. Plaster application is pouring the mixture of plaster and water into the molds which can easily work with our components, but plaster is not waterproof. Unlike plaster, the stone powder is waterproof and has the same application method. Therefore, a prototype version of the form intended to be made of micelle was made of stone powder in order to test the intended interlocking blocks at least (Figure 7).

Conclusion

The project is designed and produced within the scope of the Computational-based Basic Design course at Istanbul Bilgi University. A series of experiments for producing a self-standing structure for sitting and growing plants is conducted as a part of the final assignment of the studio. Mycelium is made up of the growing "root" cells of the fungus. Moreover, it was seen that mycelium, which does not harm the ecosystem and can be degraded in nature when the time comes. Mycelium can be a building material under appropriate conditions and with certain methods. For instance, the Hy-Fi Tower, built by architect David Benjamin in New York, is a cluster of 12-foot-high circular towers using 10,000 bricks naturally grown from naturally shredded corn stalks and fungal mycelium. Considering this pavilion, it makes you wonder if you can build houses out of mycelium in the future. Natural, economic, and carbon-releasing buildings from this material will ensure that no damage is done to nature. The less synthetic substance use occurs, the healthier the future awaits us. As a result, mycelium is a renewable and economical material that does not damage the ecosystem that can be used in architecture, product, and interior design. Additionally, it seems likely that in the future concrete buildings and synthetic clothing could be made with mycelium material.

IMAGES, CHARTS OR GRAPHIC LEGENDS

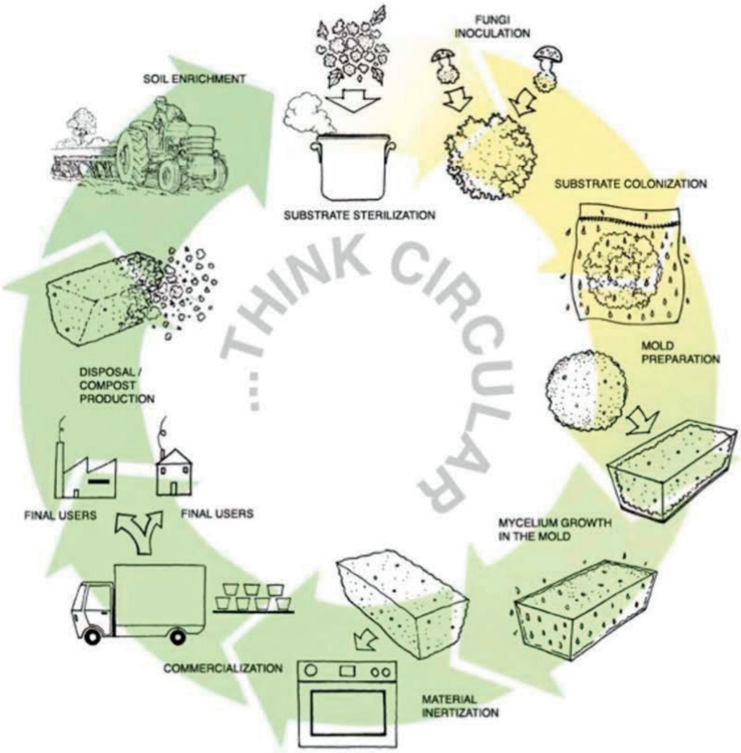


Figure 1: A diagrammatic explanation of the life-cycle of Mycelium (URL-4).

Figure 2: Applications of different design principles.

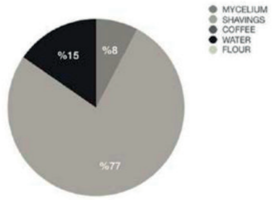
Figure 3: Examples of Mycelium in architectural design.

Figure 4: The sterilization and cultivation process.

Package 1
Table Chart: Mycelium and mixture ratio

Materials	Unit Weight : gr
MYCELIUM	10
SHAVINGS	100
COFFEE	0
WATER	20
FLOUR	0

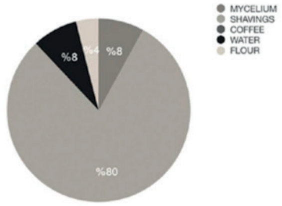
Package 1
Pie Chart: Mycelium and mixture



Package 2
Table Chart: Mycelium and mixture ratio

Materials	Unit Weight : gr
MYCELIUM	10
SHAVINGS	100
COFFEE	0
WATER	10
FLOUR	5

Package 2
Pie Chart: Mycelium and mixture



Package 3
Table Chart: Mycelium and mixture ratio

Materials	Unit Weight : gr
MYCELIUM	20
SHAVINGS	100
COFFEE	0
WATER	10
FLOUR	5

Package 3
Pie Chart: Mycelium and mixture

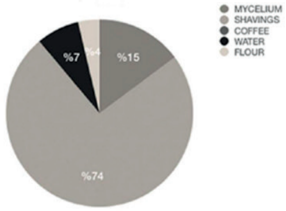
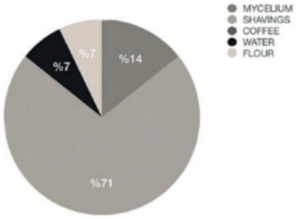


Table 1: The first, second, and third package in the inoculation process.

Package 4
Table Chart: Mycelium and mixture ratio

Materials	Unit Weight : gr
MYCELIUM	20
SHAVINGS	100
COFFEE	0
WATER	10
FLOUR	10

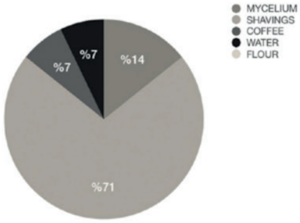
Package 4
Pie Chart: Mycelium and mixture



Package 5
Table Chart: Mycelium and mixture ratio

Materials	Unit Weight : gr
MYCELIUM	20
SHAVINGS	100
COFFEE	10
WATER	10
FLOUR	0

Package 5
Pie Chart: Mycelium and mixture



Package 6
Table Chart: Mycelium and mixture ratio

Materials	Unit Weight : gr
MYCELIUM	20
SHAVINGS	100
COFFEE	5
WATER	10
FLOUR	5

Package 6
Pie Chart: Mycelium and mixture

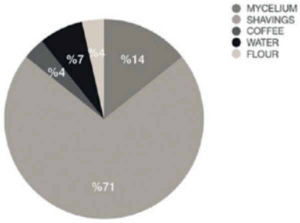
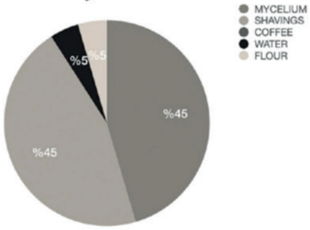


Table 2: The fourth, fifth and sixth package in the inoculation process.

Package 7
Table Chart: Mycelium and mixture ratio

Materials	Unit Weight : gr
MYCELIUM	100
SHAVINGS	100
COFFEE	0
WATER	10
FLOUR	10

Package 7
Pie Chart: Mycelium and mixture



FIRST DAY

FIFTH DAY

Table 3: The seventh package in the inoculation process.

Figure 5: The seventh package that mycelium grew.

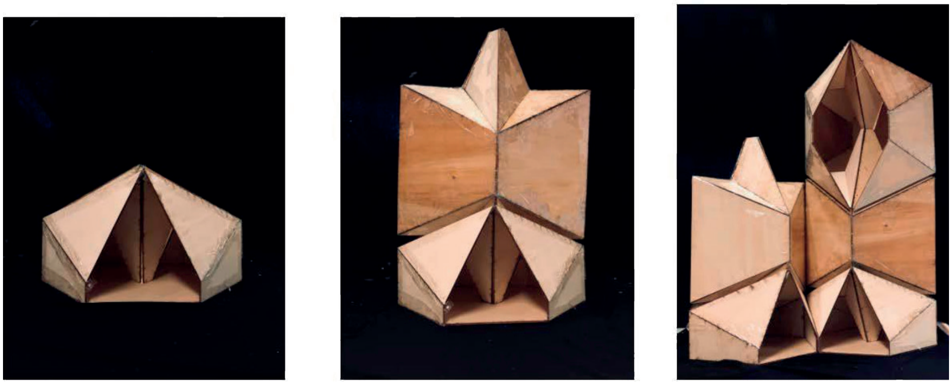


Figure 6: The mold design and cultivation trials.

Figure 7. The Final Design.

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MATERIAL EXPERIMENTATIONS IN THE COMPUTATIONAL DESIGN PROCESS

Fabricating a Parametric Tower Model with Fibre, Concrete, Plaster, and Clay

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ABSTRACT
The study focuses on material experimentation within the context of the computational design process. It was carried out in two phases. The first phase aims to teach designing the design process, the second phase aims to discuss the fabrication process. In the first phase, the final designs and the design steps were given to the students. The students tried to remodel the final products, parametrically. This phase aimed to discuss computational design processes and to think about how the fabrication process be set up within the context of the material.
With this study, the students have learned how to define an architectural form in a computational manner. The final complex form was created with basic Euclidean shapes, and the students tried to figure out how and with which parameters these basic shapes come together. In computational design processes seeing the purity in the complexity is an important skill and it must be improved. One of the aims of this exercise is to improve the students' seeing ability. In the design process, basic Euclidean transformations were used to transform the initial shapes. The students tried to define these transformations with the parameters. Predicting the form after the transformation process is also an important skill. The student groups have a chance to experience the relation of material and fabrication techniques. In the case of failure, they tried to build their structures one more time with an improved method. As a result of this study, it is concluded that fabricating the final products makes the students learn deeper. Because experiment and learning by doing are the key points of deep learning. It is also seen that relating the fabrication method with a different problem, in this study that problem is the material itself, leads the students to gain the ability to develop a solution.

KEYWORDS
Computational design, fiber, concrete, plaster, clay

Introduction

Material experimentations in architecture lead to new research areas and new fabrication techniques. The material and design relation have always been considered and questioned by the designers. Every invention of material utilization effects architecture within the context of the social era. For example, plastic's becoming a part of architecture which was associated with 70's social intellection, which space studies effected a lot, led to the concepts of "placelessness" and "acontextual spaces". Materials have their own languages about their origins, and they add value to the architecture (Pallasmaa, 2000). The relation between architecture and material redefines itself as technology develops. The occurrences such as wars or military or aerospace studies caused new materials like polymers, superalloys, etc. to be born in the 20th century (Schröpfer, 2011). Developing tools and new fabrication techniques uncover the potentials of materials.

In consideration of the studies focuses on digital technologies, various fabrication technologies are tried to be integrated with material to uncover the hidden potentials of materials. Today, the materials and fabrication techniques that are not ordinary for building technology are tried to be developed to become a part of the architecture. For example, carbon fiber materials with weaving technology are studied to search the potentials for use in architecture. Another material which is very popular recently is fluid materials like clay. Within this context, to use the material in the fabrication process unique tools pertained to the material have to be developed. In these kinds of studies, a robot manipulator is used frequently. A robotic manipulator is defined as an incomplete machine. Because the robot's functions change with the tool that is used as the end effector. For example, robotic clay studies are mostly done with a kind of 3D print end effector.

The understanding of craftsmanship must change within the context of alternative communication, learning, and apprenticeship methods (Beorkrem, 2013). The maker's definition is changing with the new technology. It can be said that there is a transformation from craftsmanship to the digital maker (Sharif & Gentry, 2015). In the manufacturing process, the craftsmanship's talent directly effects the quality of the final artefact. On the other hand, the digital maker defines and organizes the manufacturing process in the digital environment. The artefact is produced by a digital tool and the craftsman's effect on the artefact is minimized.

Within the context of today's architecture, accomplishing the whole process of fabrication with digital tools is still not possible. Because the process of integrating this new technology with architecture has not been completed, yet. In this transition process, humans and machines work together with different roles. The craftsman builds the structure with the digitally fabricated construction elements.

Because human is still a part of the fabrication process, the problems based on human have not been able to minimize, yet. From this point of view, this study represents the transition process from conventional to digital fabrication. Therefore, within this study, the students have a role in the fabrication process.

The aim of this study is to think on the relation between material and fabrication techniques. The study was carried out in two main phases. The first phase focuses on teaching designing the design process. Within this context, the initial shapes, design steps, and the final products' perspective views are given to the students. The students try to model the final product with these data. Thinking on material remained in the background during this phase. The second phase aims to fabricate the design products.

The study was carried out with four groups of five students who are fifth term undergraduate students. Each student group experienced a different material in this phase. Between the design process and fabrication process, the groups thought on the material behavior and they tried to find a proper way to fabricate. For this reason, every group tried different techniques of making which is appropriate for their material. This study finds a place itself between digital fabrication and craftsmanship about the material and the intersection of craftsman and digital maker.

Teaching Designing the Design Process

In computational design processes seeing the purity in the complexity is an important skill and it must be improved. This phase of the study focuses on improving the students' seeing ability. In the design process, basic Euclidean transformations were used to transform the initial shapes. The students tried to define these transformations with the parameters. Predicting the form after the transformation process is also an important skill.

The computational design process makes the designer to think about the design phases and to decipher the design steps. To model in a computational way, the design steps have to be defined clearly. It is important for creating various design alternatives by changing the parameters.

The computational design's one of the most important outputs is to create a design space. Defining a computational model generally takes more time than a conventional one. But in the end, the designer can create lots of design alternatives by changing the parameters. That is why designing the design process is a very important issue in computational modeling. Being able to create meaningful alternative designs means that the 3D model is defined successfully.

Within this study, the design process is regarded as a reverse process. The final products are predetermined by the lecturer, so the students have the chance to focus on the design steps and modeling process. In the computational design and modeling process, the way the designer defines the form is very important. Deciphering the design process means describing all the shapes used in the design process, to define the relations between these shapes, and to reveal the geometric deformations. The design composition must be defined systematically and in a computational manner. Within the context of this study, to show the students how to set a computational model and how to define these relations a parametric tower design process was carried out.

The modeling process of the design product consists of three steps: Deciphering the initial shape, deciphering the design steps, compare, and learn.

The first step: Deciphering the initial shape

In computational design methods, complex shapes are created at the end of the process, mostly. But these complex shapes consist of ruled geometries. This part of the exercise focuses on thinking on the rules of the design process and seeing the simplicity behind complex geometries. Deciphering the design steps makes the students understand the form generation process, clearly. Because in this process the students ask questions to clarify the process and try to find answers. This leads to a deeper search.

Various final products were given to student groups. Totally four design products were produced by four groups. The designs were complex forms that were derived from simple geometries and geometric relations. In the 'deciphering the form' step, the students were expected to find the simple relations that describe the initial shape.

In deciphering the initial shape step the students draw sketches and thought about mathematical relations. With these sketches, the students tried to figure out which basic Euclidean shapes were used and how this shape was transformed for creating the parametric tower's form.

This part of the study also includes a basic shape grammar exercise. In shape grammar exercises initial shapes and rules are defined. Starting from this data more complex shapes are created. From this point of view, this exercise can be defined as a kind of shape grammar exercises whose rules and initial shapes are predefined. But differently from shape grammar, the students are supposed to define all the parameters to create the computational model. This is the challenge of this study.

The second step: Deciphering the design steps

Once the groups found out how to create their initial shapes, they moved on to the second step. It is called "deciphering the design steps". In this step, the students tried to model their final products. In the modeling process, they used the instructions which were prepared by the lecturers. The instructions give some clues about the modeling process (Image 5), and they are the summary of the parametric model definition. In the modeling process, if the groups use the commands in the given order, and define the parameters properly, the final model will be created completely.

Computational modeling processes are defined as a kind of algorithm. For this reason, the design process can be monitored step by step like a series of instructions. From this point of view, the computational design process can be considered as a glass box process. All the parameters of the design are clear, and all the relations are explicit. Thus, every new parameter and the variety of relations ends up with a design alternative.

The third step: Compare and learn

The groups created their own parametric models at the end of the second step. In the third step, the parametric model definitions generated by the lecturer was given to the students. The students were asked to compare their models with the lecturer's model. With this comparison, a self-assessment was aimed. The students were able to easily realize which parts of the parametric model they had done wrong.

As a result of the comparison, it is seen that some groups had difficulty to create the initial shape and to see the simple relations behind the initial shape. Another problem detected in the modeling process is about defining the parameters incorrectly. Especially the parameters about the transformation of the form were problematic. This caused the students to not be able to create the model accurately. These mistakes must not be considered as negativity, because these kinds of failures make the students learn deeply.

Although the students did not design the final products themselves, they learned how to manage a parametric model. Because they tried to develop the parametric model by themselves and at the end, they had the chance to see the exact parameters and definition of the model. By not focusing on design, they were able to concentrate on the parametric model itself. At the end of the parametric model process, the groups began to think about how they were going to fabricate the design product and which material they were going to use.

Discussing Fabrication Process within the Context of Material Behaviour

In the second part of this study, the design products were fabricated by using various materials such as fiber, concrete, plaster, and clay (Image 6). In this stage, the relation between the fabrication technique and the material was discussed. Each student group experienced a different material, and every student learned from each other. In the case of failure, they tried to build their structures one more time with an improved method.

Various material studies bring along various fabrication techniques. Within this study, the fiber material was applied with the weaving technique, concrete with molding technique, and clay and plaster with plastering technique. Carrying out the process in a computational manner was a must for the fabrication process. Once the groups decided which material they were going to use, they began to think about how they would manage to fabricate their forms with that material. CNC laser cutting machine was the digital fabrication tool for the fabrication processes. For this reason, groups tried to optimize their fabrication processes for the CNC laser cutting machine.

The group who use the fiber material (Image 7), first design the fabrication process on the parametric model. The fiber was modeled, and sections were arranged to build a structure. The structure was formed with plexiglass material. The intersection between the fiber and plexiglass material was computed on the parametric model and the cut points were defined. Thus, the whole system got ready to fabricate with the CNC laser cutting machine.

With the fabrication process of the fiber material and weaving technique, almost the most accurate final product was obtained. Because about %90 of the fabrication process was managed with digital fabrication tools, which minimize the human error in the building process. Also, the compatibility between materials and techniques increased the success rate.

The group who used the concrete material prepared a mold of their form (Image 8). The group tried twice because in the first attempt their mold collapsed. In the first attempt, the group used a mixture of 5 kg. aggregate, 1 kg. black cement, 3 kg. white cement and 3-5 liter water. The reasons for collapsing were the cement mixture was too fluid and the cardboard mold was not strong enough. In the second attempt, which was the successful one, the mixture was changed to 3 kg. white cement, 5 kg. aggregate and 2-liter water. In this way, they got a more intense mixture of cement. In this fabrication process, the mold geometry was flattened in the model and cut with the CNC laser cutter. The other parts of the fabrication process were performed manually. As a result of this process, not the same but a similar form was achieved.

The other two groups used the plastering technique with different materials. The group, who used plaster material, prepared mold with the sectioning technique. In this way, the surface of the design was formed. The surface was used for plastering the plaster material. The plastering process was carried out by hand, wherefore the quality of the product was depended on the ability.

The group, who used clay material, first unroll the surfaces of their form. The unrolled surfaces were cut by the CNC laser machine and a mold was made. This fabrication process was the least computational one because of the clay material. Because of the lack of kiln-dry process tools, the clay cracked in time and the form was destroyed.

Discussions

This study focuses on two main phases of a design process: Modelling and fabrication processes. With this study, the students found the chance to experience the whole process from file to factory and fabricating. Learning by doing was at the core of both phases. Thus, the students were able to internalize knowledge. In the whole process, they confronted lots of problems and tried to solve them. With this study, the students learned how to define an architectural form in a computational manner. The final complex form was created with basic Euclidean shapes, and the students tried to figure out how and with which parameters these basic shapes come together

The study finds a place itself between craftsmanship and making digitally. Because of the lack of knowledge of the students about digital fabrication, simpler methods, and simpler digital tools were used in the fabrication process. This obliged the students to use both conventional and computational methods in the fabrication process. The final products can be put in order from more computational to less computational: the fiber tower, the plaster tower, the concrete tower, and the clay tower.

The fiber material process was the most computational one because the human effect on the fabrication process was less than the others. All the material relations were defined on the parametric model and all the parts of the physical model were cut by the CNC laser cutting machine. The structural elements were fabricated with a CNC laser machine. The fiber material was applied on the edge of the structure. This reduced human error in the fabrication process. On the other hand, the clay material process was the least computational one. Because in that process only the surfaces were cut by the CNC laser machine, and the other steps were carried out by the students. So, the final product's quality was very related to the students' talent.

The concrete material process was also a computation-driven process. The surfaces of the design product were defined and unrolled, and the mold was created in this way. On the first try, the mold was deformed and the application was repeated. In the second try, the mold was supported with the wooden bars to strengthen. The plaster material process was carried out in two different ways. In the first one, a mold was created with unrolled surfaces, but this method was failed. In the second method, the form was created with the cardboard material layer by layer. And plaster material was applied on the surface of the cardboard structure.

As a result of this study, it is concluded that fabricating the final products makes the students learn deeper. Because experiment and learning by doing are the key points of deep learning. It is also seen that relating the fabrication method with a different problem, in this study that problem is the material itself, the students gain the ability to develop a solution. The relation between material and fabrication technique is the key point of the study. Just as Louis Kahn asked the brick what it wanted to be, the students asked themselves how the material will be formed and what kind of fabrication technique should be used. The students asked questions about the material and making process. Thus, they had the chance to experience a material-oriented fabrication process, and they learned how to manage the process.

IMAGES, CHARTS OR GRAPHIC LEGENDS

Image 1: Material – tool relations | Robotic fabrication (URL-1, URL-2).

Image 2: Various alternatives of a computational model.

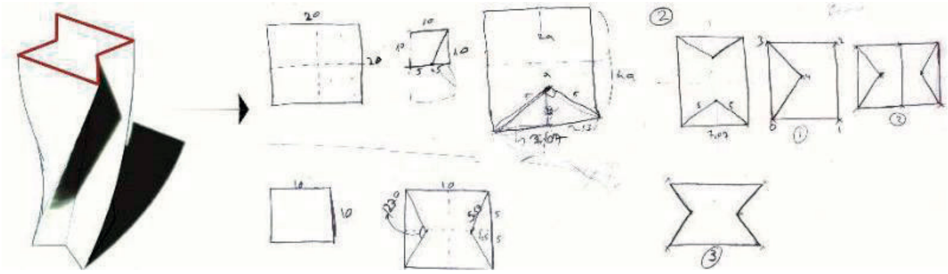


Image 3: Deciphering the initial shape – A study of a student group.

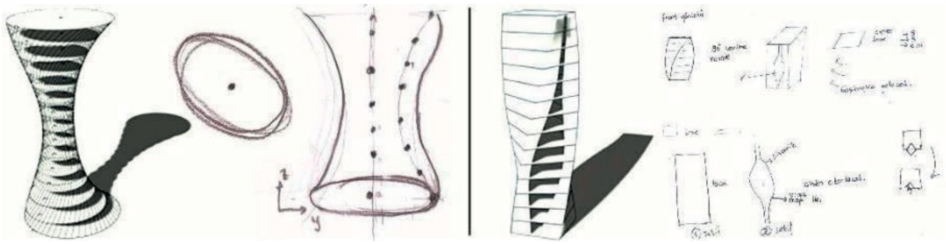


Image 4: Searching for the form developing steps.

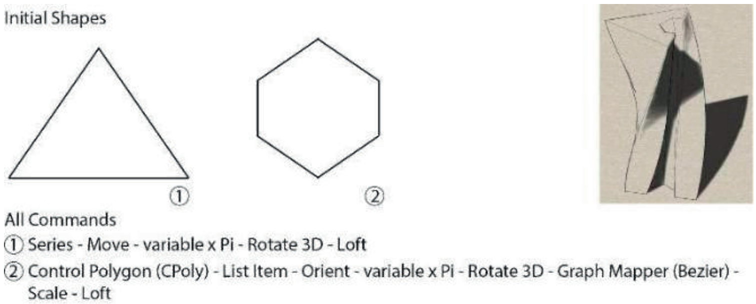


Image 5: The instructions for creating the final form.

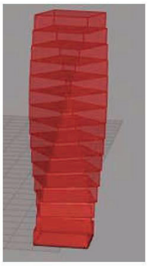
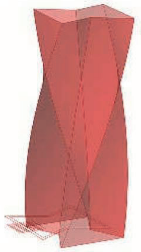
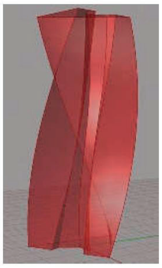
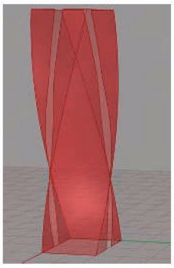
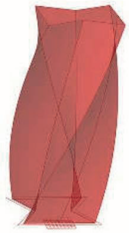
	Group 1	Group 2	Group 3	Group 4
What they did				
What was expected				

Table 1: The comparison of the models 'what they did' and 'what was expected.

Image 6: The final products: Fibre, concrete, plaster, and clay materials.

Image 7: Fibre material with the weaving technique.

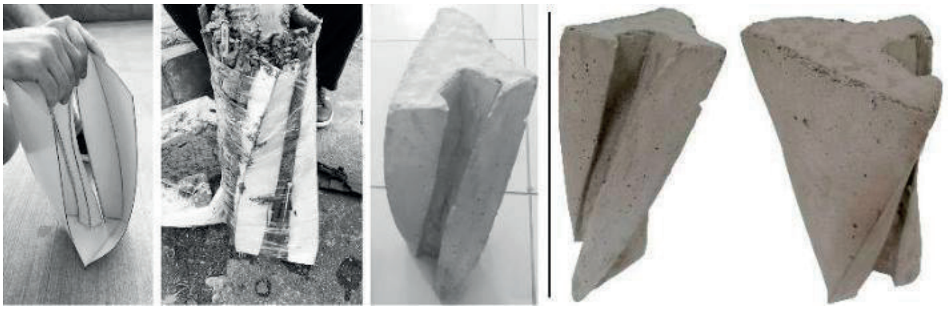


Image 8: Concrete material with molding technique.

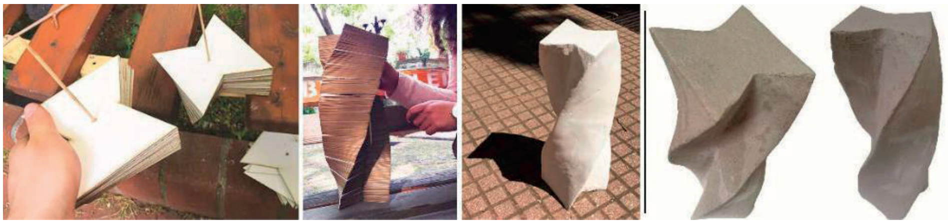


Image 9: Plaster material with plastering technique.

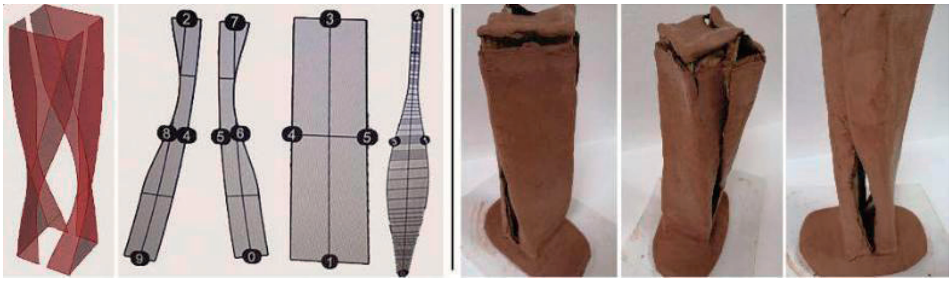


Image 10: Clay material with plastering technique.

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Schröpfer, T. (2011). Material Design: Informing Architecture by Materiality. *T. Schröpfer (Ed.), The alternative approach: Observation, Speculation, Experimentation (pp.10-33).* Basel: Birkhauser.

Sharif, A., & Gentry, R. (2015). Design Cognition Shift from Craftsmanship to Digital Maker. *Emerging Experience in Past, Present and Future of Digital Architecture, Proceedings of the 20th International Conference of the Association for Computer-Aided Architectural Design Research in Asia CAADRIA, Hong Kong,* 683-692.

URL-1, http://www.achimmenges.net/index.php/nggallery/page/2?p=5561

URL-2, https://iaac.net/project/terraperforma/

PERFORMANCE-BASED STRATEGIES IN ARCHITECTURE

The Case Studies on Performative Architecture

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ABSTRACT

Since the concept of performance varies depending on the context and where it is applied, there is no general definition of performance-based design. Although it has no exact definition, when viewed from a broad perspective, performance-based design relates to all of the computational design areas. The performance-based design makes suggestions about the effect on the design object and the resulting response and allows the process to be actively evaluated and developed in this context. The performance-based design approach is widely used in the solution of many architectural design problems, from the determination of the building form to the selection of materials, from structural systems to environmental organizations. In this article, it is aimed to discuss the role of information technologies in performance-based design, performance concept in architectural design, and performative strategies. At the same time, it is aimed to increase the awareness of the examples and innovative approaches used in today's literature in this field. Within the scope of this article, performance-based design strategies and performance types are explained over selected cases.

KEYWORDS

Performative design, performance-based architecture, performative strategies

Introduction

Rapid technological developments in recent years have affected the functioning and perception of almost all professional practices. With these changes, the practice of architecture and the role of the architect has also radically evolved. With the rapid technological developments and the widespread use of information technologies, digital tools and techniques have become the determining factors of the designer's role. Information tools have caused the architect's design process and perspective to design to change profoundly.

In his book, Vitruvius De Architectura Libri Decem described three basic qualities of architecture as firmitas (robustness), utilitas (usefulness), venustas (aesthetics) (Rowland and Howe, 1999). Although later architectural theorists have introduced different methods for analyzing, evaluating, discussing, and criticizing architecture, the definition of Vitruvius still provides a valid basis for criticism and analysis of the architectural product today. However, in the architectural design practice to date, the role of architects and engineers has been sharply separated. While the architect became responsible for the features of the building, such as form and function ("utilitas," "venustas"), the engineer took the responsibility of mathematical "firmitas". This will change with today's architecture and engineering approaches, where interdisciplinary convergence increases.

The approach discussed in the historical process and changing depending on these discussions is how to design the buildings, as well as to determine which disciplines and principles of design will be concluded. For example, ‘’ form follows function ‘’ Although there is an approach that was valid in the field of architecture in the 20th century, ‘’ form follows performance ‘’ approaches today are in principle stands out (Hensel and Menges, 2008). The principle of "form following the performance" can be evaluated as the most important approach in making more performative structures when the information technologies are not developed so much and there is no interdisciplinary convergence by taking inspiration from the systems in nature and making use of today's technological opportunities. Even though information technologies play an essential role in design in today's architectural practice and the advantages they provide at every stage of design, it is not yet common enough to consider performance data in the design process. The relationship between performance and design is mostly in the form of evaluating the performance of a finished design product with information tools according to specific criteria.

In performance-based design, it is essential to which performance elements the design will depend on. These factors can be an artistic performance as well as an environmental or structural performance. In today's architectural approaches, there have been significant developments in building designs based on environmental performance with new approaches such as computational design. It is a product of the development of a performance-based architecture approach, as the building is more mobile and reactive than being a stationary object and can be changed as a result of itself. Also, buildings can be harmonized with the environment, or any performance and optimization can be achieved according to the performance data.

Performance Concept in Architectural Design

Performance-based design is also called performative design in the literature. Performative architecture is an area that covers performance-based architecture and performance-driven architecture. Performance-driven architecture is an approach in which performance data are used as the primary input in architectural design (Shi, 2010). In the literature, the usage differences arising from the fact that the concepts are new in this subject are frequently encountered.

According to Rivka Oxman, Performative architecture is used in the design of topological models, the parametric relational design and interactive design, form or building optimization, and form generation and design (2008). According to Burry and Murray, parametric designs are represented in spaces created with a computational design approach and change the geometric structure using various parameters. With this aspect, they have an important place in performative architecture. In parametric design, topological relationships and performance inputs can form parameters together (1997).

In interactive design, designs can be made based on human interaction with architectural elements. Interactive designs can be stationary or dynamic depending on location. Designs that are based on open-ended space designs with the use of new technologies and made without adhering to a specific form are shaped by using various performance inputs and topological relationships (Oxman, 2008).

Dynamically designed structures allow for different constructions such as the interaction of body and space, as it allows for various structure constructions (Fox & Kemp, 2009). Today, performative approaches and developing information technologies in architecture are of great importance in the integration of architecture with various artistic performance fields and working with different design disciplines.

At the same time, performative architecture is vital in that environmental impacts (wind, temperature, humidity, etc.) are involved in the design process with the help of simulations. Both productive and evolutionary design possibilities are used in building design realized with performative architectural approaches

(Kolarevic and Malkavi, 2005). A new building can be designed according to performance inputs only when desired, or a building designed when desired can be reshaped according to performance data and simulated according to various inputs. (Oxman, 2008).

Form generation and design is a design method followed based on the data created as a result of examining various performances. This design method is called "performance-based generation" (Oxman, 2008). In productive systems, performances can participate in an algorithm or agent-based design and play various roles there. Productive system approaches are frequently used in defining the relationships in the studies within the scope of form production. In performance-based design, there are design outputs that have been re-designed or optimized as a result of analysis or simulation of any phenomenon or performance (Oxman, 2007).

At the same time, interactive architecture, responsive architecture, and adaptive architecture can be evaluated within the performance-based design. In this article, performative design strategies are limited to structural, environmental, and material-based performance. In addition, it is aimed to explain all of these strategies in integrated design strategies.

Performance-Based Strategies in Architectural Design

Two important concepts are emphasized in the context of performative architecture. The concepts of form generation (form) and form modification are essential for the building to adapt to the performance data. Designs, where performance is used as data for the production of a form or fiction, are produced based on these inputs. It can be seen that the final product is produced based on performance with the whole.

Performative designs are important strategies for redefining the relationship between architecture and users. Architectural products that require performance-based constructions are within the potential application areas of performance-based strategies. In this article, the strategies commonly used in architectural design are classified under four main topics, such as structural, environmental, material, and integrated design strategies.

Consequently, depending on the lack of a full definition of performative architecture, it is envisaged that the main topics mentioned as performative design strategies can be reproduced. Performative architecture is an important concept that requires many different strategies and methods depending on the ambiguity in the design process and enriches the architecture in this respect. Performance-based designs in which the strategies mentioned in architectural design are applied will be examined with examples under four main titles.

Structural Performance-Based Design

Structural performance is one of the areas that define the functionality of the structural system of the building, and the information technologies are widely used. The structure is robust and it is designed to allocate the most space to the architectural project (habitable areas) in the most economical ways and it is one of the main application areas of structural performance analysis tools. The analysis methods of amorphous structures differ by analyzing the structural systems where basic geometries are created. According to Dimcic, the solution of complex surfaces that are not Euclidean is solved by working with multiple optimization systems and multiple algorithms for a solution (2011).

EVe Voronax is designed by Dimcic as part of his doctoral thesis; It is a software-based on the Voronoi diagram of the structural systems of complex surfaces, performing genetic algorithms and performance-based analysis and optimization. This software, which was designed initially with

Rhinoceros software and plug-in Grasshopper (Figure 1), was later turned into an interface that can be used with Rhino using C ++, finite element method (FEM: Finite element method), and computer-aided design software (CAD) (Figure 1 and 3).

EXPO Axis made by Dimcic in China using eVe Voronax software during the thesis process Informatics in the inclusion of the Shanghai Building structural performance in the design process. It proves the efficiency of its technologies (Figure 2).

TENSYL has been used in the Stuttgart 21 project to solve structural problems of computational models. It shows how important performance-based design is at this early design stage (Figure 4).

This structure, which was created using the finite element method (FEM) and designed according to structural system performance, was analyzed with an engineering and design software called TENSYL. According to the performance values, the building form was revised and took its shape in Figure 5. In addition to the finite element method, various genetic or evolutionary algorithms, Catmull-Clark and Weaverbird surface algorithms and much other similar software are used in optimizing the structural system and analyzing complex design problems according to performance.

The algorithmic model (Figure 6) developed for BMW's Dynaform project was designed as a script that predicts the performance of the structure by examining the operation of the structural system at a performative level.

Environmental Performance-Based Design

Buildings exposed to environmental impacts are faced with problems such as heating, lighting, noise, and ventilation problems (Bennetts, 2003). Performance-based architectural approaches have an important place in solving such comfort problems. Problems aimed at solving performance-based architecture can be summarized as thermal, visual, auditory comfort problems, and problems related to ventilation quality (HVAC).

Performance-based and dynamic facades are important in the context of the optimization systems they use in solving comfort problems in buildings. Building information modeling, computer-aided design, and computer-aided manufacturing (BIM-CAD-CAM) systems are used. Because the dynamics of such building shells and facades do not seem possible with conventional design methods (Wigginton, 2002). The most important reason for that situation is the buildings and their shells or facades that are managed with certain decision support algorithms. These algorithms evaluate the data brought by the sensors with an artificial intelligence algorithm and provide the operation of the building systems. These algorithms, called decision support algorithms, help to provide optimum comfort by making optimum decisions with the help of computers and programs.

Performative buildings ensure that all environmental systems (building envelope, ventilation, solar control, etc.) work together to ensure that the required facade movements are made to be comfortable in all aspects of the building. If systems on performance-based facades are analyzed, it can be seen that they are controlled by an individual manager (computational decision support system) parametric algorithm. These systems operate in conjunction with other mechanical and electronic systems, and decision support mechanisms close the gaps of the decisions made during the design process.

One of the examples using the GECO program shows graphs of the analysis of performance-based data. A design process has been designed that will examine the existing physical conditions and restructure them according to the existing environmental inputs.

In the project carried out with the GECO program, the comfort conditions analysis shown in Figure 7 were made according to January 29. When using the program, first of all, solar radiation was analyzed; As a result of this analysis, optimization was tried to be provided on the wall formats. By analyzing all aspects and directions of the defined area, it was tried to find the most suitable wall type. The data received while visualizing the color analysis are written in detail at the bottom. The obtained illumination is analyzed in two parts, 300-600 lux, and 600-1800 lux. The colors are listed from cold to warm, with reference to solar radiation (Figure 7).

In another example using Diva software, glass coating surfaces (glazing) were calculated with daily illumination times (Figure 8). In Diva software, this program can be used for an efficient analysis in architectural solutions where visual comfort comes to the fore through the daily available daylight optimization. In the example, the diagrams on the views have an important place in the design process and building optimization.

The number of examples where performance-driven approaches are applied increases in parallel with the development of information technologies and the increasing use of architectural and engineering problems. A simulation that analyzes the building envelope and is prepared with the interfaces developed using the "Building Design Advisor (BDA) and SEMPER Environment" software of the fluid dynamics and is shown in Figure 9. In this simulation, the façade, which is the fastest exposed to the airflow, and the façade with the lowest flow rate is indicated in blue and green.

Software-based on simulation of fluid mechanics and dynamics, which is one of the main problems of engineering calculations, with "Rhino software plug-in" to Grasshopper with scripts and code snippets in the "Python" language, is used in the analysis of ventilation systems (Figure 9-10). These codes were used as an analysis of the interior space after design (Figure 10) and design-oriented approach (performance-driven) in the early design phase (Figure 9).

The Media – TIC building in Barcelona is an important reference point where research and development of computing and technology projects are made, produced, and displayed. The building was designed by making simulations according to the performance inputs of its location, and there is a dynamic system based on performance on its facade.

Various measuring sensors were used in the design of the building. These sensors made measurements of many other parameters, including heating, lighting, and humidity, and changed the form of the building based on performance by communicating with the mechanism that allowed the shape of the building's outer shell.

The building is also controlled by software and the necessary comfort can be provided more easily with the help of software. It pays due attention to sustainability and passive systems as it takes into account the life-cycle. In this way, the building envelope reacts to the effect by making the necessary movements and provides balance.

Material Performance-Based Design

Owing to the development of material technology and the use of nano-technology in material development, improvements have been made in the science of materials. While evaluating the relationship between the building and the performance in the context of the printer, the printer states that all the properties of the material directly affect the performance and the building (2013).

Combining different materials with a Hylozoic floor project (Figure 12) to build a performance-based installation, Philip Beesley has created a chemically active (near-living) material set (with metabolism due to organic fluids) using sensors that react through to sensors. (2013).

This material pattern, which was made as a result of analyzing the mineralization process of rocks, was created by combining hard and soft materials into a performative composite. This structure was designed in the "MIT Mediated Matters" unit under the direction of Neri Oxman, inspired by nature in a way that can react to different weights and environmental conditions (Figure 13).

Integrated Approaches to Performance-Based Design

Evaluating the non-geometric aspects of the performance (environmental, structural, etc.) while the final decisions about the design have not yet been made may affect the design alternatives and the resulting product and change the design process. In addition, design processes in which information from different disciplines are integrated can make solutions to complex problems more satisfactory. Using information technologies to bring together knowledge from different disciplines can make the process more productive by increasing creativity and innovation in the design process. Performing the evaluations on performance with a basic level of command by the designer simultaneously and with small iterations will support the integrated processes by enabling the design decisions to be handled as a guiding dimension rather than the evaluation of a product that has finished performance.

Building Information Modeling (BIM) provides a workflow that can be expressed in an integrated manner in performative design using the IFC (Industry Foundation Classes) common file system created by the IAI (Industry Alliance of Interoperability) for interoperability. According to SOM's (Skidmore, Owings & Merrill) expressions, the appropriateness of the graphic (form, geometric) and alphanumeric (material, cost, physical environmental control data, etc.) data of the building is checked during the building performance simulation phase (Garber, 2014). While building the structure development BIM model, it is provided to transfer the structure performance simulation and analysis data to the design by filtering through a transition layer and making the simulation again.

BIM is a suitable integrated system to make the design based on all dimensions (4th dimension planning, 5th dimension cost calculations, 6th dimension performance (sustainability), 7th dimension operation, and repair). The transformation of the design from two-dimensional plan schemes into a three-dimensional parametric model designed in line with performance analysis and an applied structure can be achieved through the integrated design setup of BIM.

The contribution of BIM models to the integrated design approach is important. However, using performance elements together in the evaluation and evolution of inputs plays an important role in building more efficient buildings. In architectural design, changes can be made in the mechanism that evaluates them, provided that the inputs remain constant. Owing to the integrated use of structural, climatic, material based performance strategies, it is possible to obtain more effective and performative buildings. At the same time, it is possible to develop these buildings in a different dimension by various algorithms to increase aesthetic and artistic performance. At the same time, it is thought that the contribution of this process will be great in ensuring sustainability and energy-efficient buildings. It is envisaged that performative approaches can play a key role in the architectural design phase, owing to the integrated implementation of performative design strategies.

Conclusion and Future Insights

The prediction of an era in which information technologies are preferred over conventional methods is becoming widespread in architectural design. This is even more pronounced when it comes to performance-based design. Such progress in performance provides significant advantages in many areas such as cost, comfort, construction time, and so on. It is anticipated that performance-based design will further increase the momentum gained by computer-aided design with the integrated use of BIM systems.

The process started with the certification of LEED and BREEAM certifications, which enable building performances to be improved and sustained, to persuade designers to analyze with various incentives. Thanks to the performance-based design approach and information infrastructure that developed in the continuation of the process, the zero-energy building was started to be designed and implemented. Some buildings designed as a performance drive today produce energy or water and meet the needs of their users, while also providing increased energy and water to city networks for a fee.

With the use of expert system applications (decision-support) and cloud technologies (cloud computing) that are started to be developed by BIM software companies, software are actively expected to make suggestions to the designer and the people who manage or use the building to improve the building performance. Nowadays with the integrated new approaches in which evolutionary algorithms and performance-based design are used together, BIM systems will be able to offer alternatives to the designer by producing form and plan charts according to the suitability of performance analyzes.

With artificial intelligence and machine learning, the buildings transform into electromechanical systems, robotic starting from their facades, and consequently building performance-based dynamic buildings. It is aimed to make the performance improvements of the buildings deemed appropriate and to be sustainable through government incentives.

As a result, designers are pushing the boundaries of great development in terms of both performance-based designs made with today's information, communication, and knowledge technologies (ICKT) and those planned in the future. In line with these examples and developments, information technologies are an integral part of the development of performance-based design and performance-driven design, as well as making significant contributions to the creative, productive, and efficient development of designs.

IMAGES, CHARTS OR GRAPHIC LEGENDS

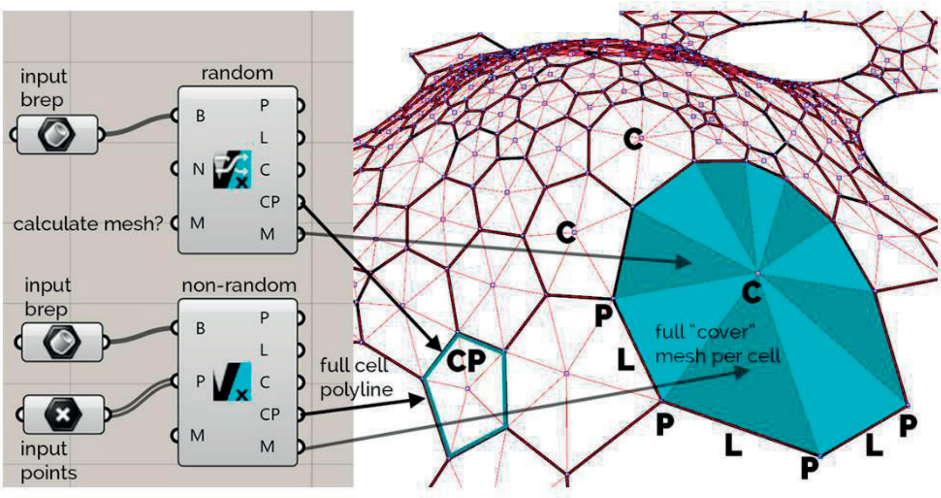

Figure 1: Visual code (Grasshopper) made by Dimcic (Url- 1).

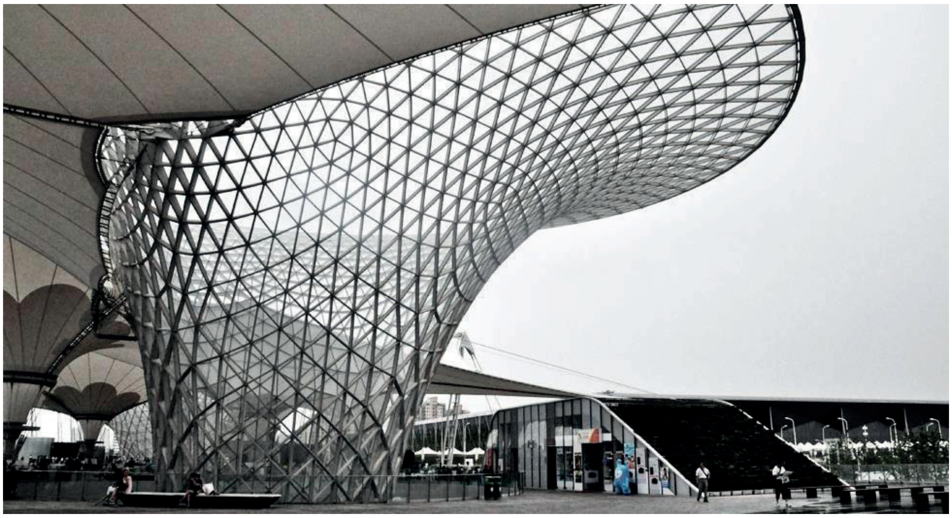

Figure 2: EXPO Axis Shanghai, 2010 (URL-2).

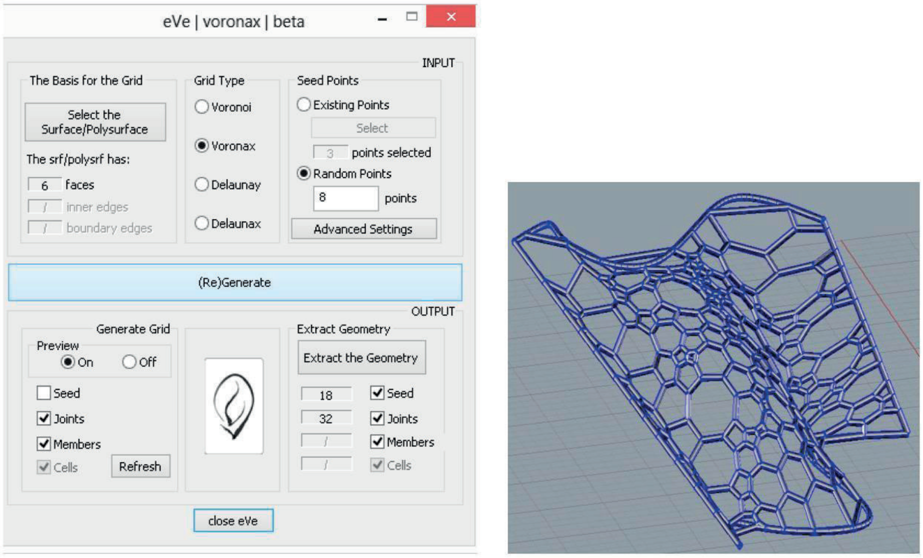

Figure 3: eVe Voronax interface (left), a performative structure made with Eve voronax (right) (Produced within the scope of XXX University, The Department of YYY, ZZZ Program, QQQ course).

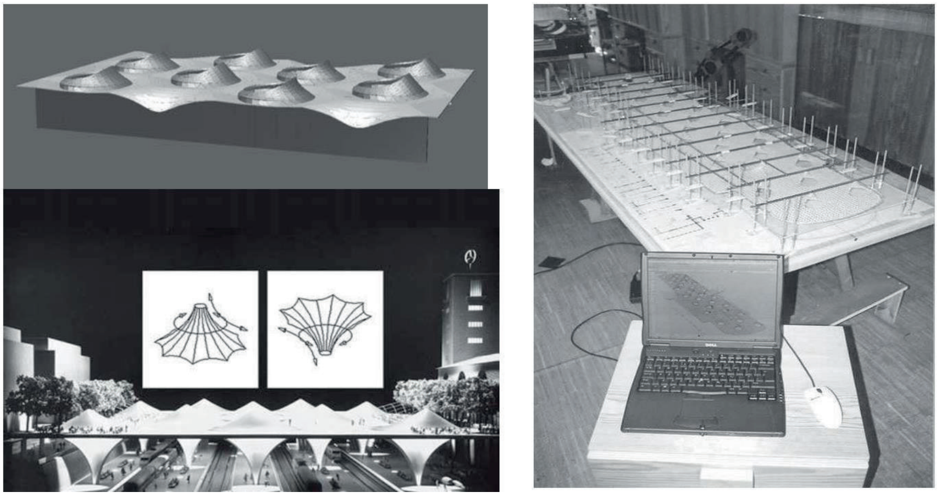

Figure 4: Stuttgart 21 project, digital model (top left), model (bottom left), physical material simulated structural system model (right), Christoph Ingenhoven Overdiek Architecture, Germany, 2001.
(Kolarevic, Malkavi, 2005)

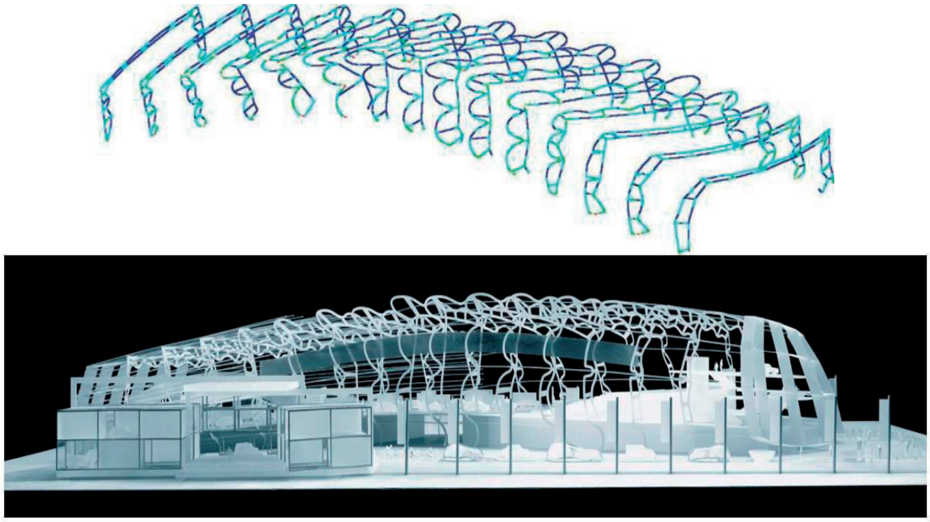

Figure 5: Simulation of loads and performance of a steel structure (above), project model (below), (BMW Dynaform, Franken Architecture) (Kolarevic, Malkavi, 2005)

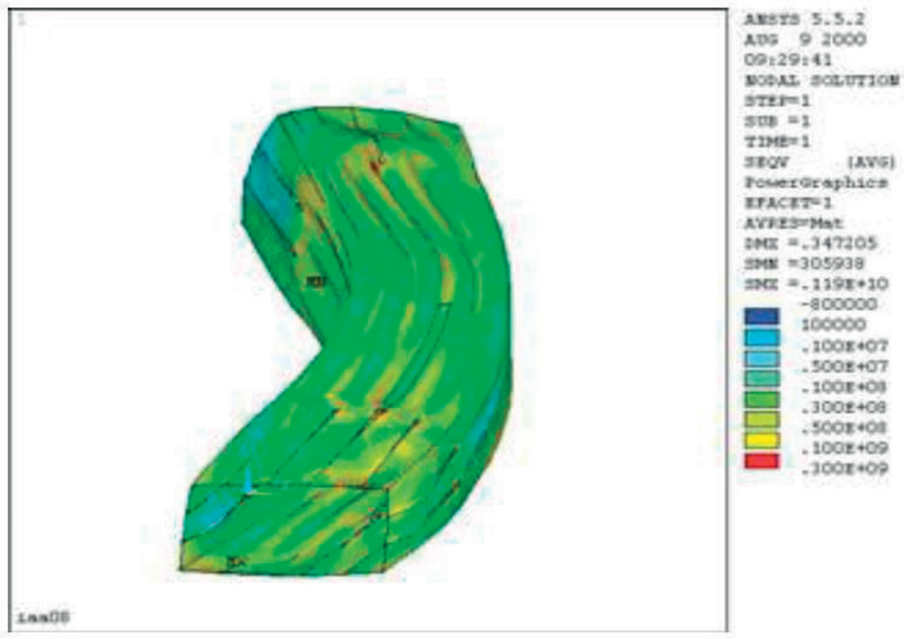

Figure 6: Simulating the load transfers of a metal building shell (BMW Dynaform, Franken Architecture) (Kolarevic, Malkavi, 2005)

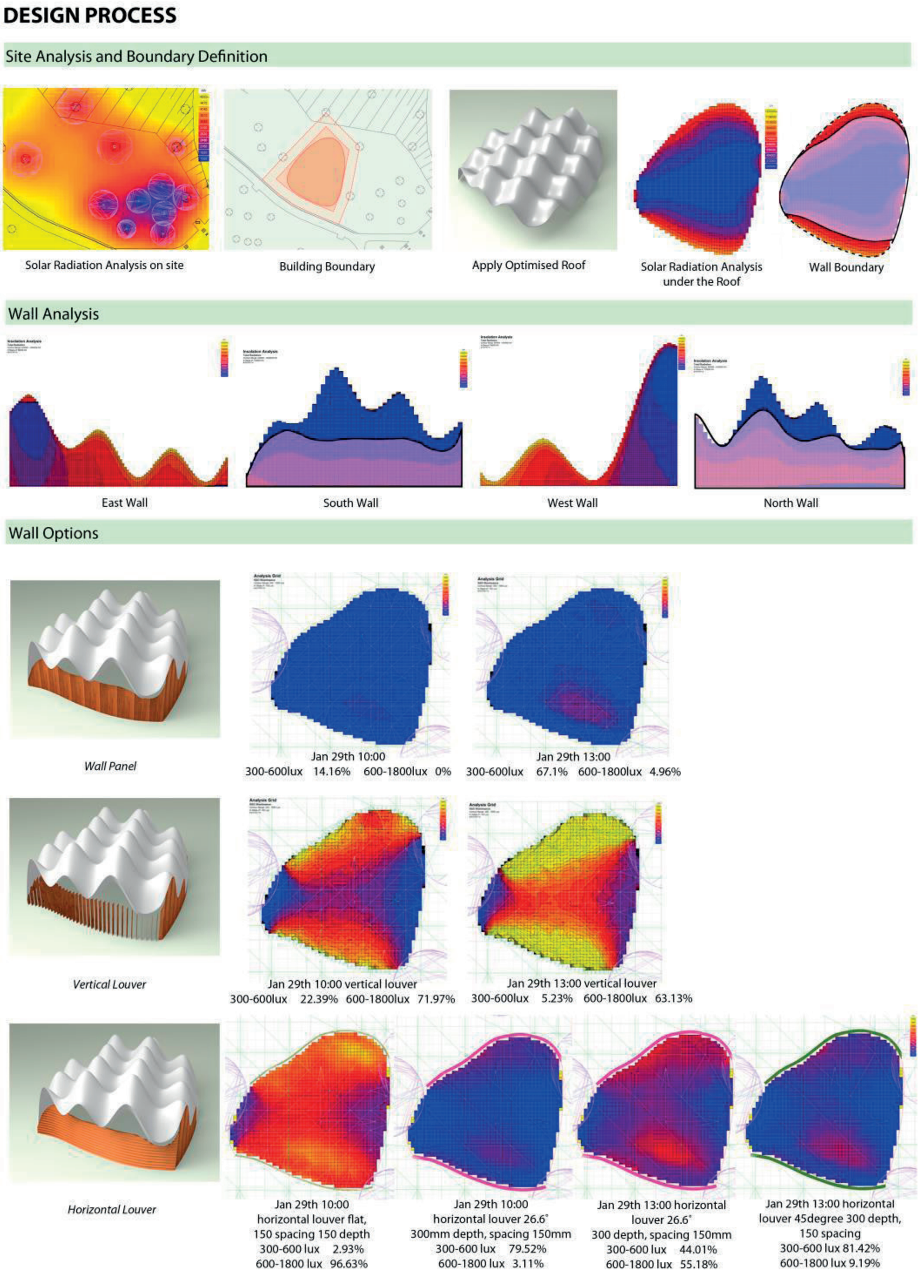

Figure 7: A performance analysis work with GECO (URL- 3).

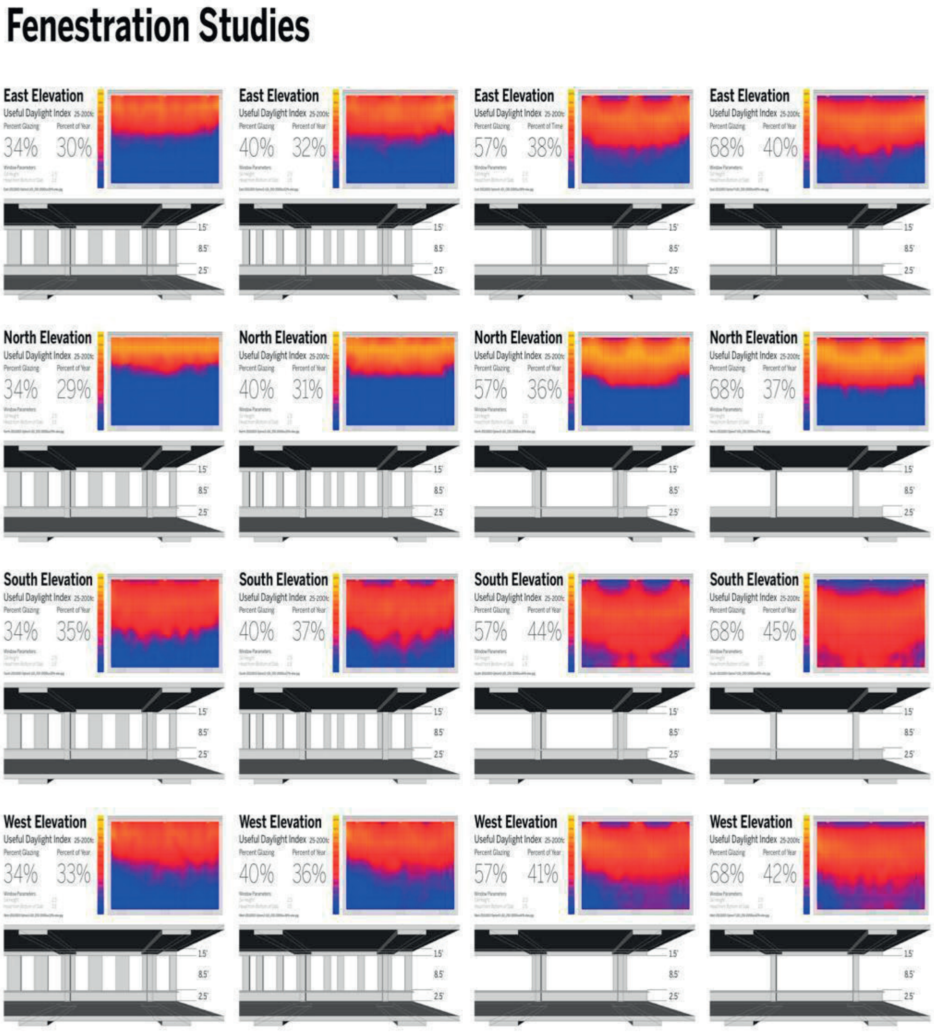

Figure 8: A performance analysis work with Diva (URL-4).

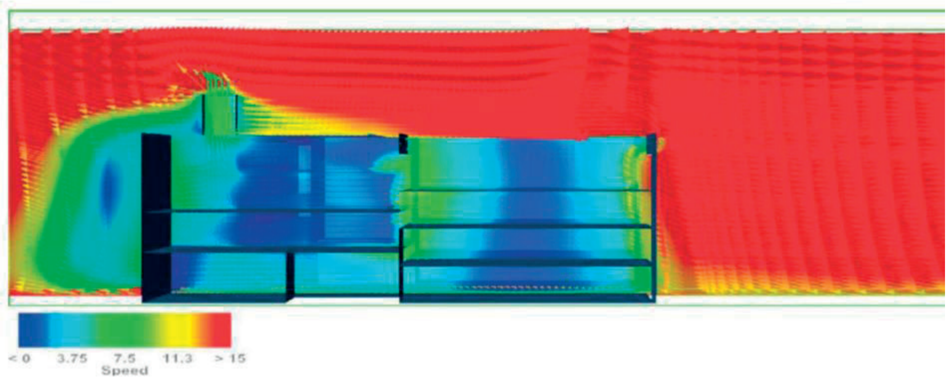

Figure 9: Penndesign Design Center with CFD (Computational fluid dynamics) simulation early design stage analysis of ventilation values and air movement speeds measurement (with Building Design Advisor (BDA) and SEMPER environment interfaces)(URL-5).

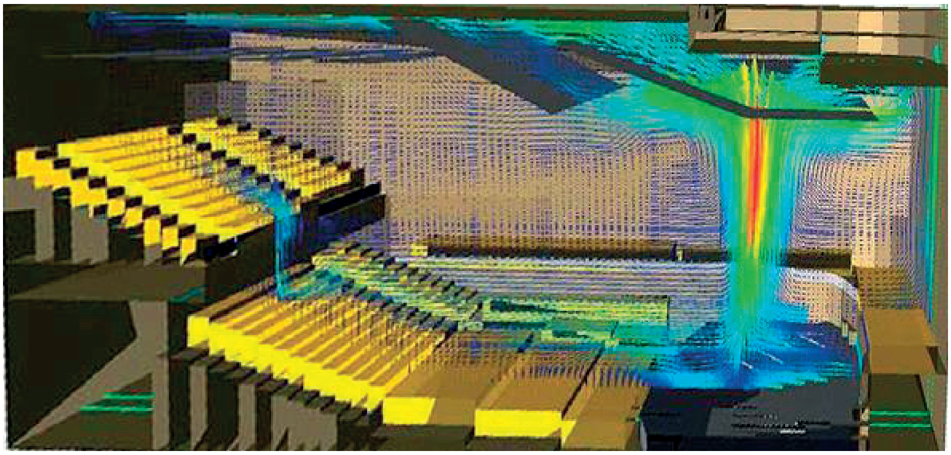

Figure 10: Rensselaer Polytechnic Institute Performing Arts Center (USA, 2003- 2007), CFD (Computational fluid dynamics) simulation and analysis of ventilation values (Nicholas Grimshaw and Partners Architecture Office) (Kolarevic and Malkavi, 2005).

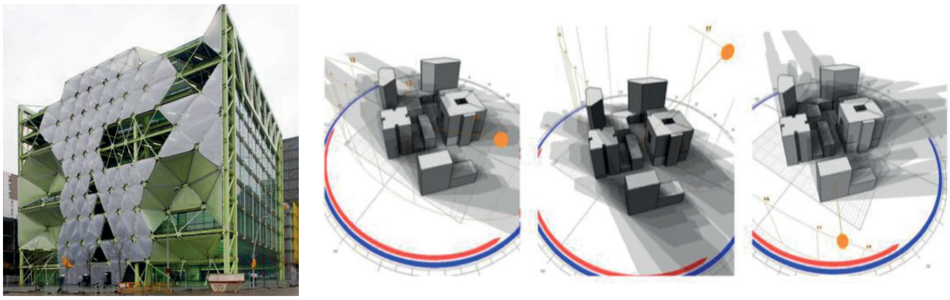

Figure 11: Simulation of the Media – TIC front with the sun-shade diagram (right) with the Media – TIC front partially open (left) (URL-6).

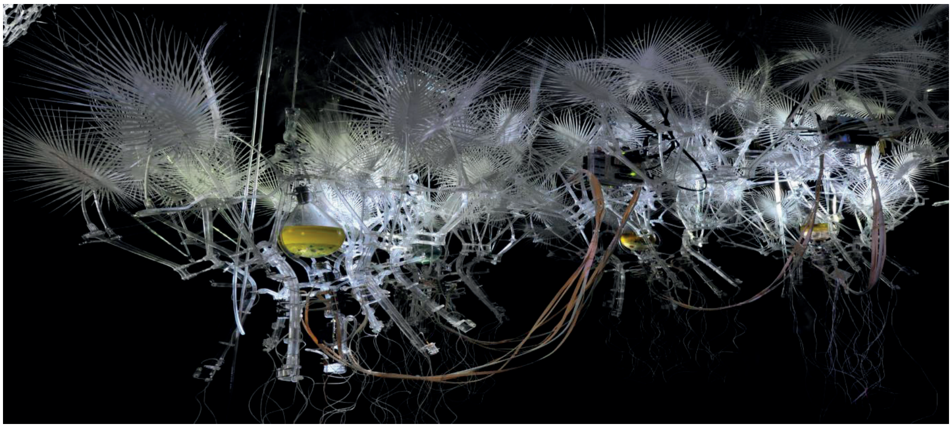

Figure 12: Hylozoic ground project, Venice biennale, 2010 (URL-7).

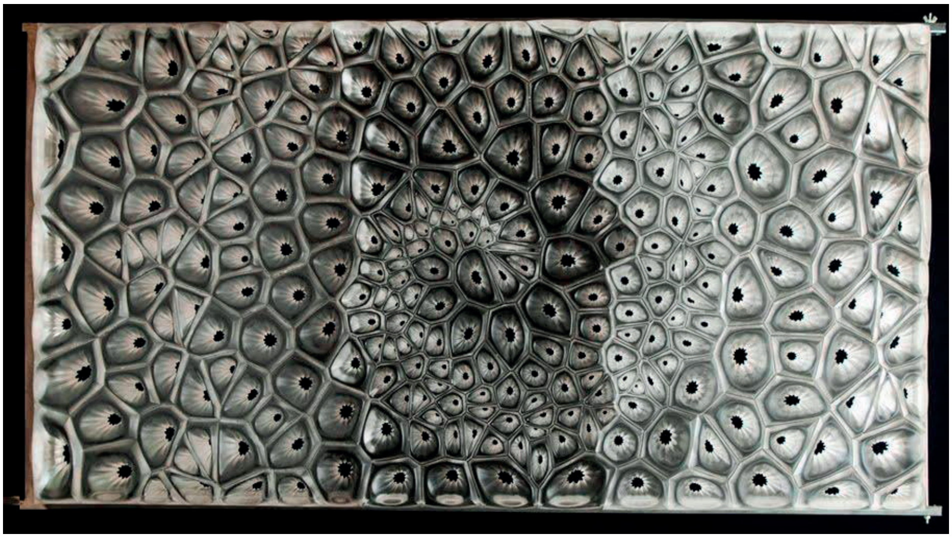

Figure 13: Stalasso experimental material, CNC and acrylic urethane-based plastic, a special production (Acrylic, Urethane Rubber, and Polyurethane Casting Resin Composites) 2009 (URL-8).

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URL 1: http://www.programmingarchitecture.com/

URL 2: http://www.programmingarchitecture.org/projects_expo.html

URL 3: https://dfabnus.wordpress.com/category/studio/ay-20112012-sem-2/page/2

URL 4: http://lmnarchitects.com/tech-studio/featured/diva-review

URL 5: http://www.mebd-penndesign.info

URL 6: http://ad009cdnb.archdaily.net/wpcontent/2010/02/1265

URL 7: http://www.philipbeesleyarchitect.com/sculptures/0929_Hylozoic_Ground_Venice

URL 8: https://web.media.mit.edu/~neri/site/projects/stalasso/stalasso.html

CHAPTER II


formal
practices
knowledge
website
methods
digital
programs
study
award
human
form
free
characteristics
materialization
space
discourse
contemporary
material
habitat
making
process
expression
information
context
textual

INTRODUCTION

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The complex relationship between architecture and technology is intensifying in the 21st century and giving rise to developments in a pace and intensity that was never experienced before. Departing from a fundamental but critical need to satisfy basic human needs, the tools and methods of new technologies have paved the way towards the acquisition and development of new experiences, knowledge and skills that are now inseparable from rather intricate correspondences between the built environment and many of its associated fields. The revolutionary transformation that architecture has been going through is also a product of a new momentum initiated by the changing role of the architect in the design and realization of artifacts of architecture, from purely imaginary spaces that refuse any sort of association with the physicalities of architecture, to purely material forms of production. This new expanded field also addresses various sensitivities, including aesthetical concerns and experimentations of the form and visualities of built forms to the pressing needs of realities regarding the adaptation of the built environment and urban spaces to the negative effects of climate change, environmental degradation or pandemics. The capacity of the existing technologies, both physical and virtual, in tackling these problems has been discussed widely. Technophilic views that enthusiastically support that advances in recent technologies can lead to the coevolution of design, techne, and underlying sciences towards the progress of many fields simultaneously. Technophobes, on the other hand, point to the threats that extreme and uncritical reliance on technologies and the irreversible disruption that entails on the social, physical and spatial structures in relation to architecture. A realistic, balanced approach which can be found in constructive but yet critical attempts that realistically understand the existing possibilities that can be triggered by the use of developing technologies and the architectural repercussions that might unfold afterwards. To this end, this section provides a multifaceted outlook into the recent research work in diverse fields, presenting approaches and methods that can pave the way for new, constructive ways of thinking about, practicing and teaching architecture.

Günsu Merin Abbas discussed issues in the main framework of "Architectural Tectonics" and the distinction between meaning and making. Her paper aims to map and re-frame the meaning and making through changing tectonic paradigms and to question the meaning and making in the context of advancing technology. Her work questions the shifting architectural materiality with the information-intense design processes, which transforms making and meaning into the material and data. Baran Ekinci, departing from a data-statistical stance point, aims to operationalize textual data sources in the exploration of the recent topics and issues pursued in the academia. The paper provides insight into the architectural research agenda of Turkey from the Master of Architecture theses published 2003 to 2018. With the use of statistical and computational techniques, knowledge is extracted by revealing the architectural research agendas, understanding novelty and emergence of architectural agendas over time, and comparing the research agendas of various institutions. By doing so, he shows novel ways of using statistical techniques as a rich medium to explore and interpret data, and at the same time introduces a reproducible and scalable method of qualitative research to be used in the architectural domain. Sezi Yilmaz focuses on a subject topic that has gained much attention in architectural design, Free-form architecture, and offers an exploratory insight into different spatial forms triggered by the used of complex, double-curved architectural forms. Her work offers a new interpretation of free-form architectural forms, which traditionally hitherto focused on the physical (i.e. form, material, structure, construction) rather that the immaterial and the spatial. Her critical analytical approach in reading the recent built forms aims to show the impact of formal expression of the building skin on interior spaces. Ece Yeğen, in the paper, focuses on "Space architecture" which has been receiving increased attention recently by the field of architecture, similarly to other disciplines of engineering, natural and social sciences. The discusses the role of the architect not as the designer but also the central leader in a design team for space habitation, and discusses the potentials of the traditional role of architecture in traditional design teams, as well as some challenges of disciplinary fragmentation, the use of high-end engineering knowledge and methods in the architectural making and establishing bottom-up design collectives for hitherto unexplored architectural typologies and environments. The relevance of "designerly ways of knowing" in the designing of Space habitation can be extended towards architectural production in extreme environmental conditions, which is increasing in relevance due to the changing climate and the expansion to previously uninhabited part of the globe. Finally, Didem Savas explores the different modes of materialization in architecture by developing a research method based on the discourse analysis of the texts, specifically the website of the Pritzker Architecture Prize as a digital information source. Savaş's purpose is to make the invisible information visible by producing visual materials named "infographics" that represent the visualized form of knowledge created from the verbalized textual materials.

We need unprecedented and comprehensive solutions to reconsider and reconstruct the relationship between new technologies and architecture, to transform architectural practices in the light of innovations and to find solutions to the negative effects of technologies. Rethinking the society's production systems and cultural structure is one of the fundamental tasks of architecture, among other fields. While creative and critical thinking triggers the forward momentum needed to revitalize new relationships, architecture has the power to form a meaningful yet fruitful partnership with technologies to make the environment and cities more livable and healthy. Although architects and designers cannot alone solve complex global problems, they are one of the key players in this critical challenge. Based on this, this section presents developing technologies that are discussed from many different aspects with the focus of changing-transforming architectural practice and theory.

REVIEW ON ARCHITECTURAL TECTONICS THROUGH *MEANING* AND *MAKING*

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ABSTRACT
The architectural tectonics is built upon a strong distinction between meaning and making. Since Vitruvius, the makers and thinkers seek for the formulation of what good architecture is based upon such distinction. Each time, good architecture has re-formulated and re-defined regarding the changes and the developments in the course of history. At this stage, this paper aims to map and re-frame the meaning and making through changing tectonic paradigms and aims to question the meaning and making in the context of advancing technology.

KEYWORDS
Architectural tectonics, meaning, making, computation

Introduction

Makers and thinkers, since Vitruvius, seek for the formulations of what "good architecture" is. All definitions of "good architecture" place into focus architectural tectonics, which is highly dependent on the dominant epistemology and the construction technologies of their time. Nevertheless, the dispute between meaning and making as an ageless problematic of architectural tectonics has never changed due to the narrative, visual, cultural, institutional, and performative roles of architecture.[1, 2, 3]

Over the past two decades, rapid advances in computational technologies have shifted the architectural tectonics from the Classical paradigm to *digital tectonics,*[4] aiming at overcoming the dispute between *meaning* and *making*. *Digital tectonics* employ digital tools and methods for design and fabrication[5]. Such advancements provide; (1) communication with computer-aided drafting/modeling, and (2) synthesis for form generation, and (3) evaluation as feedback for the performance of the design[6]. In this respect, a new tectonic paradigm emerges extending the capabilities of the designer by aiding the generation of complex forms, increasing the expressiveness for visual representation, enhancing the level of precision for fabrication, and providing means for testability for improved building performance[7, 8]. In pursuit of such a shift, the developments in information, fabrication, and material technologies have led the architectural tectonics to the new frontiers (such as *material ecology, composite paradigm* and *informed tectonics*) that involve a high level of inter, para and transdisciplinary collaboration, which have the potential to overcome the gap between *meaning* and *making*. At this stage, this paper aims to map and re-frame the *meaning* and *making* through changing tectonic paradigms and aims to question the *meaning* and *making* in the context of advancing technology.

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Defining Architectural Tectonics: Meaning and Making

The classical notion of tectonics is built upon a sharp distinction between making and meaning, which is evident in multiple sources.

The first architectural use of the word *tectonic* is by Karl Otfried Müller in the context of material and making processes of ancient Greek art and architecture[9]. As evident in Müller's *Handbuch der Archaologie der Kunst* (1830), architectural tectonics is beyond the methods of *making* (application) by also referring to *meaning* (expression, narrative, sentiment, and arts)[10]. Similarly, Bötticher made a distinction between the *kernform (core-form)* and *kunstform (art-form),* which are the mechanically functioning pieces of a building and the expression (style, institutional role, etc.) that is formed by these functioning pieces, respectively[11, 12]. A similar distinction is evident in Semper's *structural-technical* and *structural-symbolic,* which is between the structural and symbolic parts of construction; while earthwork, or heavy construction associates with the *structural-technical*, the enclosing membrane and its light structure associated with the *structural-symbolic*[13]. In parallel, Frampton structured such distinction with the *ontological* and *representational object*[14]. In all cases, the building becomes a canvas for expression by being identified with the representational object, art-form, and structural-symbolic characteristic.

Each way of distinction brings a different approach to *making* and *meaning*. While Bötticher sought the balance between the *meaning* and *making* (*core-form* and *art-form*), Semper prioritized the *meaning* (*structural-symbolic parts*) over *making*[15]. However, Frampton aimed to bridge this distinction via *poetics of construction*, by supporting the tectonic object via topography, construction, structure, culture, and expression without favoring any style or formal approach[16].

9. Müller, K. O. (1850). *Ancient Art and Its Remains: or, A Manual of the Archaeology of Art.* (J. Leitch, Trans.) London: A. Fullerton and Co.
10. Frampton, K. (1995). *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth-and Twentieth-Century Architecture.* Cambridge, Massachusetts: MIT Press.
11. *Ibid*., p. 82.
12. Bötticher, C. ((1844-1852) 1992). The Principles of the Hellenic and Germanic Ways of Building with Regard to Their Application to our Present Way of Building. In H. Hübsch, R. Wiegmann, C. A. Rosenthal, C. Bötticher, & J. H. Wolff, *In What Style Should We Build?: The German Debate on Architectural Style* (pp. 147-168). Santa Monica, CA: Getty Publications.
13. *Op.Cit.*, (Frampton, 1995), pp.5-16.
14. *Ibid.*
15. *Ibid.*
16. Leatherbarrow, D. (1997, March Vol. 56 No. 1). Review: Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture by Kenneth Frampton. *Journal of the Society of Architectural Historians*, pp. 98-100.

Shifting Grounds: The Historical Timeline of the Change in Architectural Tectonics

There have been social, economic, and scientific shifts in history that changed the trajectory of architecture. A shift, typically, is preceded by a crisis, a rejection or a negation of the existing dominant paradigm and followed by the emergence of a new paradigm that severs all links with the previously accumulated knowledge[17].

The Incomplete Attempt: Claude Perrault

According to Alberto Perez-Gomez (1993), the theory of architecture had its first shift with Claude Perrault in the 17th century[18]. This shift is accepted as "*a search for new means to acquire knowledge*" and as the first attempt to rationalize architecture to free architectural expression from external references[19]. Up until Perrault, architecture sought for external and transcendental references in its dominant imagery. These references varied throughout time; it refers to the cosmos in antiquity while Christianity in medieval ages[20, 21], and to the cosmos again in Renaissance with the renewed interest in the antiquity[22]. Perrault was the first to challenge this epistemological tradition by aiming to sever all links with cosmology and to re-position architecture within the 17th-century scientific understanding[23]. Such an attempt also meant a challenge for the Vitruvian tradition. In *De Architectura Libri Decem*, Vitruvius attempted to formulate comprehensive ground for *good architecture* as a reflection of cosmos[24, 25]. As stated in the tenth book "… [our ancestors] took their models from nature, and imitating them were led on by divine facts.[26]" Architecture should, according to Vitruvius, fulfill the most of the parameters (order, arrangement, eurhythmy, symmetry, propriety, and economy) referring to the completeness of the cosmos to be accepted as *good architecture*[27].

To challenge the Vitruvian tradition, Perrault (1683) reviewed the proportion systems of the antiquity and Renaissance via investigating *De Architectura Libri*

17. Kuhn, T. (1962). *The Structure of Scientific Revolutions*. Chicago: Chicago University Press.
18. *Op.Cit.,* (Gomez, 1993, p. 37).
19. *Ibid.*
20. Mallgrave, H. F. (2006). *Architectural Theory: Volume I - An Anthology from Vitruvius to 1870*. Blackwell Publishing.
21. Kruft, H. W. (1994). *History of Architectural Theory.* Princeton Architectural Press. pp. 31,34,40.
22. *Ibid.*, p.47.
23. *Op.Cit.*, (Gomez, 1993, p. 37).
24. Vitruvius, P., & Morgan, M. H. (1960). *Vitruvius: The Ten Books on Architecture.* New York: Dover Publications.
25. Kruft (1994, p.29) asserts that Vitruvius did not propose a systematic architectural theory, and well-structured knowledge. However, due to the various parameters that are discussed in *De Architectura Libri Decem,* it is possible to assert that his theory aimed to be comprehensive as possible referring to the completeness of the cosmos without making any demarcation between the visible or invisible, or meaning and making.
26. *Op.Cit.,* (Vitruvius & Morgan, 1960, pp. 16, 17).
27. *Ibid.*

Decem and the existing buildings of antiquity[28]. He spotted the discrepancies in measurements and proportional systems in existing buildings and highlighted their arbitrary implementation[29]. As a response, Perrault proposed a modulation system based on standardized proportions that are easily subdivided and remembered. His modulation system is mathematical and rational and aimed at making architecture commensurable and repeatable in practice[30]. Hence, the source of architecture became a universal practice through observation, experience, and progress[31].In this respect, Perrault conceptualized *positive beauty* by norms that result in standardization and precision, and *arbitrary beauty* that assumes an expressive function[32]. With *arbitrary beauty*, Perrault qualified the building skin and ornamentation as narrative elements[33].

The Complete Attempt: Jean-Nicolas-Louis Durand

Perrault did not radically object to antiquity's ways of building, composition, material, or meaning despite his attempt that challenges Vitruvian tradition[34, 35]. Perrault's challenge may be regarded as an incomplete attempt to fulfill the Kuhnian paradigm shift; however, paved the way for Durand's rejection of the dominant design methodology of the antiquity[36].

Durand's approach could be considered as the next but complete rejection of the Vitruvian tradition and the attempt for rationalization in the late 18th and early 19th centuries[37, 38]. The analytical approaches become prominent in architecture in line with other disciplines regarding the Industrial Revolution, the French Revolution and the academies that prioritize rationalization and systematization. Like Perrault, Durand started his manuscript *Precis* by questioning the proportional

28. Perrault, C. (1993 (1683)). *Ordonnance for the Five Kinds of Columns After the Method of the Ancients.* Santa Monica, CA: Getty Center Publications.
29. *Ibid*., p. 52,53.
30. *Ibid*., p. 60.
31. *Op.Cit.,* (Gomez, 1993, p. 9).
32. *Op.Cit.,* (Frampton, 2007 (1980), p.14)
33. *Op,Cit.,* (Gomez, 1993, p. 29).
34. *Ibid*., p.27.
35. Perrault's only focus was the visible aspects of antiquity. According to Perez-Gomez (1993), this attitude brought the *'crisis of representation'* for the first time to architecture. It is possible to evaluate it as a root of the dispute between the form and function, meaning, and making.
36. Between Perrault and Durand, there are several prominent figures like Fremin, Cordemoy, Laugier, Boulle, and Ledoux that were in search of purity and simplicity. While Fremin and Cordemoy sought purity in geometry and structure via discouraging the use of ornamentation, Boulle and Ledoux searched for the expression via pure geometries. Also, Laugier attributed utility as the very nature of architecture with his primitive hut. By any means, architecture distanced itself from the surface articulations, but not from the narrative yet. (Frampton, 1995), (Frampton, 2007 (1980)).
37. Picon, A. (2000). From "Poetry of Art" to Method: The Theory of Jean-Nicolas-Louis Durand. In J.-N.-L. Durand, *Précis of the Lectures on Architecture: With Graphic Portion of the Lectures on Architecture* (pp. 1-68). Los Angeles, CA: The Getty Research Institute.
38. *Op.Cit.,* (Gomez, 1993, p. 29).

systems of the antiquity and challenging the concept of beauty[39]. Supported by the ideas of his predecessors Claude Nicolas Ledoux and Étienne-Louis Boullée, Durand aimed to establish a modern architectural practice based on an analytical model[40]. With this model, architecture was to be an autonomous discipline having its methods and sources[41]. Accordingly, to systematize architectural design Durand proposed a selective modular typology as a bottom-up approach for design based on the composition of the elements of Classical architecture[42]. His design method offers a new way of making architecture, similar to a language that has a coherent grammar. Hence, Durand prioritized utility, economy, and reasoning as the sources of beauty, which were scientifically verifiable and non-speculative, and declared beauty as futile, and ornamentation as expensive[43]. In this respect, Durand gives reference to Marc-Antoine Laugier's primitive hut and acknowledges that the origins of art and architecture are due to necessity[44].

John Ruskin and Eugène Viollet-le-Duc

Durand and Perrault did not criticize the forms or materials of antiquity[45, 46], but their vision paved the way to Modern architecture. The transitory period between Durand and the rise of Modern architecture could be summarised via John Ruskin and Eugène Viollet-le-Duc as their opponent approaches could be regarded as another example of the debate between *meaning* and *making*. As two prominent figures of the 19th century, they influenced the Gothic Revival in different ways. Viollet-le-Duc valued the Gothic for its logic and rationalism in its tectonic qualities, while Ruskin valued for its beauty and craftsmanship[47]. For Viollet-le-Duc, structurally or programmatically being *true*[48] must be the primary aim of architecture[49]. In contrast, for Ruskin, the aim of architecture must be the beauty that is materialized through the use of ornamentation[50]. In that sense, while Ruskin focused on *meaning*, Viollet-le-Duc focused on *making*. Despite the ornamental

39. Durand, J.-N.-L. (2000 (1802-1805)). *Précis of the Lectures on Architecture: With Graphic Portion of the Lectures on Architecture.* Los Angeles, CA: The Getty Research Institute.
40. *Op.Cit.,* (Picon, 2000).
41. Picon (2000) asserts that Durand's ambition of autonomy is far more than his positivist/analytical overtake. In this respect, Picon interprets Durand's attempts as utopian that aims to make architecture to be free from any restrictions.
42. *Op.Cit.,* (Durand, 2000 (1802-1805), p. 83).
43. *Ibid.*, p.79, 86.
44. *Ibid.*, p.83.
45. *Op.Cit.,* (Frampton, 2007 (1980), p.30).
46. *Op.Cit.,* (Durand, 2000 (1802-1805)) .
47. Pevsner, N. (1969). *Ruskin and Viollet-le-Duc: Englishness and Frenchness in the appreciation of Gothic architecture.* Thames and Hudson.
48. The terms *truth* and *honesty* are widely used by Ruskin and Viollet-le-Duc. The terms signify the appearance of a building that is in accordance with its actual materiality and structure. (Spurr, D. (2012). *Architecture and Modern Literature.* University of Michigan Press.
49. *Op.Cit.,* (Pevsner, 1969).
50. *Ibid.*

nature of the Arts and Crafts movement at that time, there was a general tendency to reject the stylistic considerations that prioritized the taste of the designer/craftsman (represented by Ruskin and his views on ornamentation). Stylistic considerations are thought to be subjective, non-scientific, and non-functional in line with the ideas of Viollet-le-Duc[51].

Ornamentation is Crime

In the late 19th and early 20th century, the prevailing tendency in architecture was still Durand's and Viollet-le-Duc's analytical ideas. In this period, particularly ornamentation was disdained and considered as excess, regarding the manifests of Sullivan and Loos[52, 53]. In his *Ornamentation and Crime* (1892), Loos rejected all the links with history and the use of ornamentation[54]. However, the *meaning* was still there, and there was a search for alternative tools for narrative. Accordingly, form, geometry, and proportion served as a tool for expression[55, 56].

In the 1920s the shift in architecture that started with Durand found its ultimate peak as International Style of Modern architecture[57, 58]. In this period, the way of *making* provided the *meaning* to architecture. With the First World War (1914-1918), the developments in machinery (standardization and mass-production) and construction technology (reinforced concrete) re-shaped society and architecture[59]. Such developments placed machinery, utility, practicality, rationality, and objectivity into focus, and rejected the use of the architectural elements such as ornamentations due to their *non-instrumental* character[60]. In this respect, clear-cut and machine-made forms, homogenous, plain, and white-washed surfaces were used universally, regardless of their context and geographical conditions. These forms became the tools for expressing the idea of standardization and machinery in architecture[61], despite the rejection of the dominant formal approach of Classical architecture. Such understanding is accepted as a significant shift in the history of architecture that continued until the 1960s.

51. Banham, R. (1960). *Theory and design in the first machine age.* New York: Praeger Publishers.
52. *Op.Cit.,* (Frampton, 2007 (1980), p.30).
53. *Op.Cit.,* (Banham, 1960).
54. Loos stated "[s]ince ornamentation is no longer organically linked with our civilization, it is no longer an expression of our civilization. The ornamentation being created today is not connected with us, is not connected with anybody, not connected with the order of the world." (Loos, A. ((1908)1998). Ornament and Crime. In A. e. Opel*, Ornament, and crime: Selected essays.* California: Ariadne Press.
55. Sullivan, L. (1892). The Ornament in Architecture. *The Engineering Magazine*, 187-190.
56. *Op.Cit.,* (Frampton, 2007 (1980), p.56).
57. As highlighted in the text, Modern architecture took a long period to emerge, starting slightly with Perrault, and then Durand, that had its peak in the 1920s.
58. Curtis, W. J. (1996). *Modern architecture since 1900.* London: Phaidon.
59. *Ibid*., p.105.
60. *Ibid*., p.248.
61. *Ibid*., p.248.

Heightened Communication: Postmodern Architecture

In the 1960s Postmodern architecture emerged as a critique of Modern architecture. Instead of the pure, straightforward, and homogenous nature of Modern architecture, Postmodern architecture supported plurality, hybridity, and ambiguity[62, 63]. Robert Venturi is one of the prominent figures to criticize Modern architecture's *oversimplification* that negates the complexities and contradictions in society and runs the risk of "separating architecture from the experience of life and the needs of society.[64]" Similarly, the rigid formalism of Modern architecture is criticized for diminishing the poetic/expressive/communicative nature of the architecture[65, 66, 67].In this respect, Postmodern is valued prominently for its aim to achieve *"heightened communication"* to convey *"heightened consciousness"* of the plurality[68]. Accordingly, ornamentation[69], exaggerated materials, and forms from different styles and periods of history are employed as tools to *enhance the communicative value of architecture*[70]. In the 1980s, Deconstructivist architecture emerged within the scope of Postmodern architecture, yet with a notably different formal approach[71]. The "…twisted volumes, warped planes, and clashed lines" are used to "violate the cubes and right angles" of Modern architecture as an emphasis on instability and plurality[72]. Also, Deconstructivist architecture interpreted the Modern building as *giant ornamentation*, due to the formal purity as an expression of the function, which limited the efficiency of the structure and spatial planning[73].

The Shift: The Aggregation of the *Meaning* and *Making*

A decade after, digital technologies emerged and aimed to resolve the above mentioned discussions by offering new methods and tools for architectural

62. Venturi, R. (1966). *Complexity and Contradiction in Architecture*. New York: The Museum of Modern Art. p.16.
63. Jencks, C. (2011). *The Story of Post-Modernism: Five Decades of the Ironic, Iconic, and Critical in Architecture.* West Sussex: Wiley.
64. *Op.Cit.,* (Venturi, 1966).
65. Graves, M. ((1982) 1996). A Case for Figurative Architecture. In K. Nesbitt, *Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory 1965-1995* (pp. 86-92). New York: Princeton Architectural Press.
66. *Op.Cit.,* (Jencks, 2011, p.3).
67. Besides the visual and cultural aspects of Modern architecture, the technical aspects were also criticized. Due to the negation of the physical context like site and climate, Modern buildings do not perform adequately with respect to their environmental requirements. (Mumford, L. (1964). *The Highway and the City.* London: Secker & Warburg).
68. Op.Cit., (Jencks, 2011).
69. Venturi et.al. (1972) provided a distinction within the scope of form and ornamentation by proposing *the Duck and the Decorated Shed*. The *duck* represents the buildings with a symbolic form that its structure, spaces, and program are dominated by this symbolic form; and the *decorated shed* is the buildings which are designed according to its purpose by means of its program, spatial configuration, and structure, with ornamentation, applied independently. At this point, Jencks interpreted the buildings of Modern architecture as individual giant ornamentations due to Modern architecture's rigid and symbolic formalism referring to the emphasis on the machine and industry, as *the ducks.* (Jencks, Language of Post Modern Architecture, 1977).
70. *Ibid.*
71. Johnson, P., & Wigley, M. (1988). *Deconstructivist Architecture.* New York: The Museum of Modern Art.
72. *Ibid.*
73. *Ibid.*

tectonics. At the beginning of the 1990s, there appeared a broad interest in digital design tools and methods due to the advancements in technologies, and Gilles Deleuze's *The Fold: Leibniz and the Baroque* (1988) which provided a philosophical basis to use of such technologies in architecture[74, 75, 76]. Such developments paved the way for the digital design practice in architecture, which is the exploitation of computers as tools for communication, synthesis, and evaluation[77, 78].

With computer-aided drafting and modeling, particularly with Non-Uniform Rational B-Splines (NURBS)[79] the visualization of complex geometries became possible[80]. With computational design methods and tools, the design generation process was guided by algorithms, which is the articulation of a generative logic rather than the articulation of the form[81]. These technologies facilitate to visualize, manipulate and test complex geometries, and generate multiple designs at a single time. Accordingly, the understanding of form as static and autonomous has shifted to the process of formation, which is dynamic and interactive[82]. Referring to D'arcy Thompson's "[t]he form of an object is a diagram of forces"[83], formation is the result of the process of the changing forces, which is prioritized over form[84]. Similarly, Greg Lynn defined form as a morphological continuity directed by the forces that result in curvilinear morphologies[85]. Such understanding is evident in Bernard Cache's *Objectile* that proposed mass-customized manufacturing via the continuous process of transformation of the object. In *Objectile* each instant of the process generates the variation of the form out of the ever-changing forces[86, 87].

In 2003, the international architectural exhibition "*Non Standard Architectures*" curated by Frederic Migayrou and Zeynep Mennan manifested the consequences of such tools and methods on architectural form and generation[88]. Mennan (2008) associates this shift with the revival of the organic paradigm but with an opposite

74. Deleuze, G. (1993). *The Fold: Leibniz and the Baroque*. The Athlone Press.
75. Carpo, M. (2014). The Digital: From Complexity to Simplicity-and Back. *Serbian Architecture Journal*, Vol. 6(Issue 3), 256-265.
76. Kolarevic, B. (2003). *Architecture in the Digital Age: Design and Manufacturing.* New York: Spon Press: Taylor & Francis.
77. Carpo (2014) interpreted the prevalence of such practice as a shift and termed as the *first digital turn*. However, such practices have existed since the 1960s. (i.e. In 1963, Ivan Sutherland introduced the 'Sketchpad' system which enabled 2D drafting and 3D modeling facilities.).
78. *Op.Cit.,* (Kalay, 2004).
79. NURBS (Non-Uniform Rational B-Splines) is a mathematical model used in drafting and modeling software, which enabled the manipulation of the Euclidean geometry with knots, weights, and control points. This made possible the precise representation and generation of complex geometries.
80. *Op.Cit.,* (Kolarevic, B. (2003). pp.2-3)
81. Menges, A., & Ahlquist, S. (2011). *Computational Design Thinking.* Wiley & Sons.
82. Kolarevic, B. (2004). *Architecture in the digital age: design and manufacturing.* Taylor & Francis.
83. Thompson, D. W. ((1917)1992). *On growth and form.* New York: Dover Publications.
84. Picon, A. (2014). The Seduction of Innovative Geometries. In R. Oxman, & R. Oxman, *Theories of the Digital in Architecture* (pp. 47-55). Oxon: Routledge.
85. Lynn, G., & Therese, K. (1999). *Animate Form.* New York: Princeton Architectural Press.
86. *Op.Cit.,* (Deleuze, 1993)
87. Marcos Novak and Mark Burry have various studies like *Paramorph*, concerning the transformation processes instead of the transformed geometry.
88. Mennan, Z. (2008). The Question of Non-Standard Form. *METU JFA,* 171-183.

epistemological background[89]. The formal processes of the organic paradigm are accepted as "…individualistic, subjectivist, intuitionist", due to their unanalysable and non-standard nature[90]. However, with computational tools, such processes become transparent and controllable, and such geometries become computable, rationalized, therefore become producible[91]. Due to the transparency and feasibility of the design process, an interest in organic/complex/curvilinear forms appeared[92, 93, 94].

Digital tools and methods also changed the materiality in architecture. Representation by digital means provided graphics settings without any *real* architectonic quality of the actual construction[95]. Such immaterial ground is termed as *digital tectonics*[96]. Here, there are two contradictory approaches to the consequences of *digital tectonics*. On the one hand, the *digital tectonics* provided architects with an environment without any references like gravity, load, culture, structure, topography, dimension; but the will of the designer[97]. On the other hand, it provided a reconciliation between the digital and the material. This reconciliation is the result of the generation and rationalization of architecture as a hybrid practice of architecture and engineering sciences[98]. Accordingly, digital tectonics is widely assumed to have the potential to mediate the *making* and *meaning* with such a hybrid process by suggesting structural integrity, and material composition with graphic properties of a building[99].

In pursuit of digital tectonics, the contemporary advancements in information technologies brought architecture to new frontiers that are led by hybridity, integration, data, and material articulation to merge *meaning* and *making*, which is far beyond the conventional practice of architectural design, production, and assembly.

89. The organic paradigm is based on the historical debate between nature and man-made (organic and mechanic). While the mechanic is used for unity, standardization, and normativity; organic is used for dynamic, intuitive, and non-standard. (Mennan, 2008).
90. *Ibid.*
91. *Ibid.*
92. Carpo, M. (2014). Ten Years of Folding. In R. Oxman, & R. Oxman, *Theories of the Digital in Architecture* (pp. 35-47). Oxon: Routledge.
93. Prior to the design generation, architecture is influenced by the applicability of smooth morphologies based on complex curvilinear geometries with the introduction of digital modeling software. This paved the way for a great interest in smooth morphologies in architecture. However, such formal interest ran the risk of being evaluated often as a style. The smooth morphologies can be considered as merely the most visual result of the process and this shift.
94. Lynn, G. (1998). Folds, *Bodies & Blobs: Collected Essays.* Brussels: La lettre volée.
95. Mitchell, W. (1998). Antitectonics: The Poetics of Virtuality. In J. Beckman, *The Virtual Dimension* (pp. 204-217). New York: Princeton Architectural Press.
96. *Ibid.*
97. *Ibid.*
98. *Op.Cit.,* (Leach, Turnbull, & Williams, 2004).
99. *Ibid.*

Information as a New Materiality

Information plays a crucial role in changing the architectural tectonics paradigm since an empirical dimension is one of the opportunities that digital technologies brought to architecture, that enables the tests and evaluation of design options before their realization. The developments in material, fabrication, and information technologies also changed the way of *making* architecture and shifted the focus from mechanical assembly to material articulation. With the involvement of multiple design criteria and therefore, the increase in the complexity of architectural design processes, the knowledge, information, and the collaboration of different disciplines are required. In this respect, the idea of *integrated design* emerged to improve and manage the complexity of the design process, which aimed to mediate different design criteria of different disciplines that are involved in the process[100].

The contemporary tendency in architectural research and practice is the enhancement of this approach with the material technologies and the information, and material's response to the environmental forces. For instance, *"morpho-ecologies"*, as a context-sensitive framework based on the performative capacities of material systems in relation to their specific environments, which integrates digital fabrication methods to reveal the performative capacity and behavior of the materials[101]. Such a performative approach enables designers to perceive the design process as a system with its interactions and behaviors regarding the forces sustained through the *file to the factory*[102]. Also, the *composite paradigm* and *material computation* are two prominent approaches in this respect. They primarily question the assembly methods of the dominating tectonic paradigm, which is supported by the mechanical assembly. As an alternative to mechanical assembly, *fusion* as chemistry and heating processes is proposed by the *composite paradigm*[103]. For instance, building skins are manufactured similarly to sail cloths, as a single entity with many layers adhered to each other by means of chemicals and heating[104].Differently, *material computation* employed additive manufacturing methods for jointless architectural production, without any layers or secondary materials[105].*Material computation* is based on the form generation process guided by the analysis and simulation of material properties and material's response to environmental conditions and constraints[106]. "In this approach, material precedes shape, and it is the structuring of material properties as a function of structural and environmental

100. Fasoulaki, E. E. (2009). Towards Integrated Design. Proceedings of the 14th International Conference on Computer-Aided Architectural Design Research in Asia (pp. 13-22). Yunlin: CAADRIA.
101. *Ibid.*
102. *Ibid.*
103. Lynn, G., Gage, M., & Nielson, S. (2011). *Composites, Surfaces, and Software: High-Performance Architecture.* WW Norton.
104. *Ibid.*
105. Oxman, N. (2012). Material Computation. In B. S. (ed.*), Manufacturing the Bespoke: Making and Prototyping Architecture* (pp. 256-265). John Wiley & Sons.
106. *Ibid.*

performance that generates design form.[107]"With such processes, a single material that is processed continuously has the potential to act as both structure and skin while responding to environmental forces[108]. To this end, the concept of form, assembly, homogeneity in material behavior, the construction methods of building industry, and the split between the building skin and structure, meaning and making are challenged radically. This has resulted in *informed tectonics,* a wider perspective for architectural tectonics, referring to all levels of design and materialization processes that are directed and sustained by data, material, and collaboration of different parties[109].

Conclusion: Aggregating *Meaning* and *Making*

The hybrid and integrated approaches could not be limited to the ones that are discussed within the scope of this paper due to the strong tendency in the field towards the material articulation that is encapsulated by information/forces that enables the jointless assembly. The idea of jointless assembly blurs the margins of skin, structure, and form. Since nothing is separable or demountable in *informed tectonics* and *material ecology*, all discussions about the dispute between the *meaning* and *making* which is at the core of the classical and digital tectonics are standing irrelevant and outdated and accommodates both in the course of architecture. To this end, the classical repertory would be inadequate to discuss the novel understanding in tectonics, *informed tectonics.* Despite their scales, contemporary experimental studies with holistic understanding may potentially be the hints of the next architectonic paradigm shift.

As a concluding remark, architectural tectonics has changed over the centuries. Up until the widespread use of digital technologies in architecture, the focus of tectonics was culture, material, structure, detail, construction, building skin, surface articulation, and form. With the use of such technologies, architectural tectonics started to discuss concepts of continuity, information, form-finding, fabrication, and *informed material*. With the use of information and material technologies, the focus has been shifted to material and information (Fig.1). Particularly, over the past three decades, the architecture and building as its one of the concrete results that sustain the discussion of the *meaning* and *making* left their place to material and data. The materiality of architecture shifted from physical to virtual

107. *Ibid.*
108. *Ibid.*
109. Oxman, R., & Oxman, R. (2014). *Theories of the Digital in Architecture*. Oxon: Routledge. p. xxi.

and re-shifted from virtual to re-materialization[110].The re-materialization of architecture, which is directed and sustained by information technologies, have already started to bring a radically new understanding of architectural tectonics. With this new understanding and advances in fabrication technologies, all discussions of architectural tectonics based on *meaning* and *making* have started to resolve.

110. *Ibid.*

IMAGES, CHARTS OR GRAPHIC LEGENDS

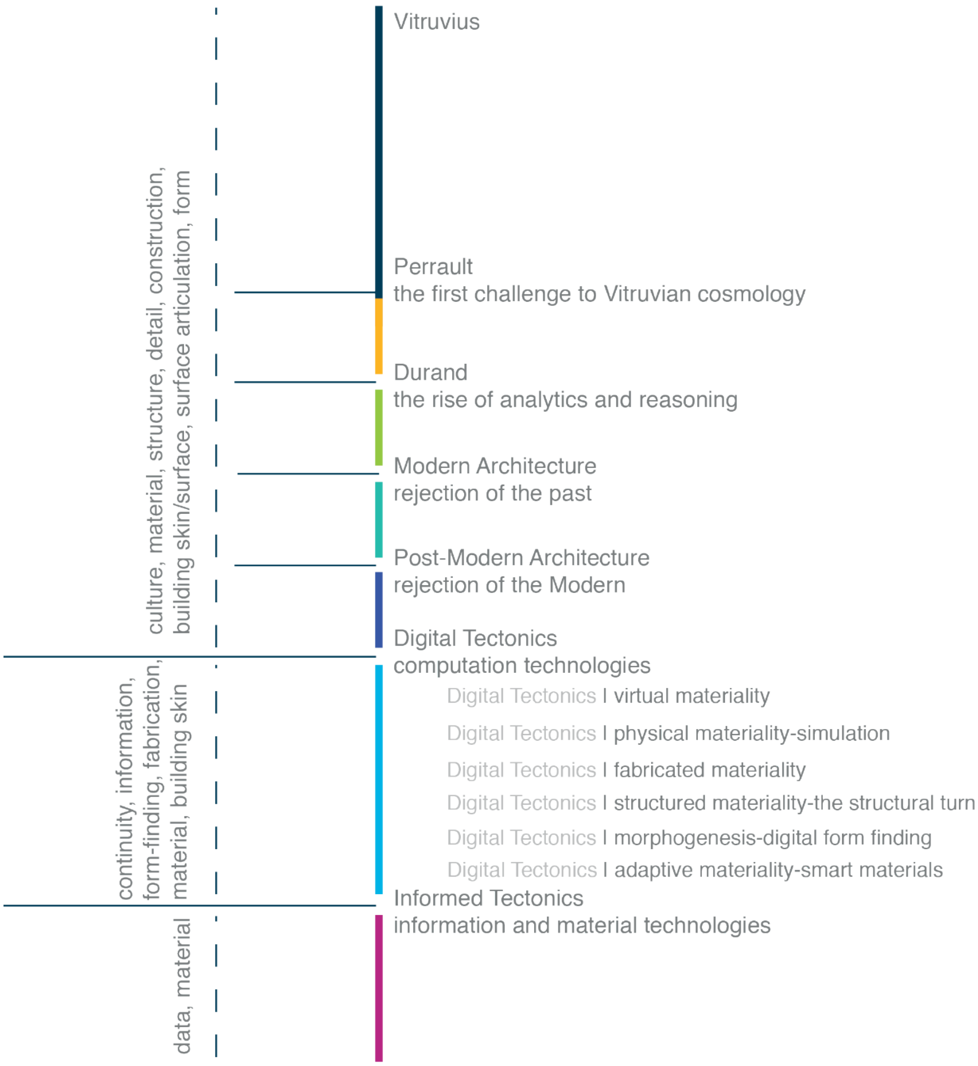

Image 1: The Timeline of Change in Architectural Tectonics (by the author).

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AN EXPLORATORY DATA ANALYSIS ON ARCHITECTURAL RESEARCH AGENDA OF TURKEY

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Introduction

Architectural graduate programs and schools in Turkey have increased drastically over the since the early 2000s, from less than a dozen to almost 50 universities are now offering programs related to architecture, building science, architectural design, cultural heritage and conservation, and project management. As partial fulfillment of graduation, most of these programs require their graduate students to submit and defend a thesis. Each year hundreds of students conduct research based on different research motives, socio-political context, or funded projects. The number of contributing students and hence the number of theses submitted are exponentially increasing.

Within this context, the problem of tracking and exploring the architectural agenda emerges. While conventional, manually compiled, methods deem to fail in terms of scale, reproducibility, and time consumption; novel approaches can provide a feasible ground for exploration and evaluation.

In this study, the aim is to gain insight into the architectural research agenda of Turkey from the Master of Architecture theses published 2003 to 2018. These theses are to be treated as textual data that in terms of research represents the architectural theory, discourse, and above all the agenda of post-2003's Turkey. Henceforward, the textual data will be evaluated by statistical and computational techniques, and through critical reading, the aim is to extract knowledge by:

1. Revealing the architectural research agendas
2. Detecting novelty and emergence of agendas over time
3. Comparing the research agendas of institutions.

The statistical techniques are presented as a novel medium to explore and interpret with the vastly increasing architectural textual documents. Therefore, another outcome of this study is to introduce a reproducible and scalable method of qualitative research to the architectural domain.

Methodology

Data Collection and Pre-Processing

The corpus contains 4370 documents, submitted from 39 universities and spanning from 2003 to 2018. The main attributes collected for each document are the submission year, the university that it was submitted, title, and the abstract in English.[1] The main assumption regarding the documents selected for this study is that the abstract of each thesis clearly expresses the content with the most significant words, this is an expected quality. Although ideally, an abstract of a study represents these attributes at a higher quality, it is debatable that this is applicable for every case.[2] Some abstracts might be written poorly in terms of quality and might even be misleading regarding knowledge discovery.

Regarding the distribution of the documents over the years; the drastic increase of the thesis submittal, thus the increase of textual data is evident (Figure 1). The rapid increases in 2004 and 2010 are caused by the student amnesty offered by the Council of Higher Education (Y.Ö.K.) to students. Additionally, there is also a steady growth of the corpus from 2013 due to the increasing amount of private funded universities and the newly established departments of architecture and research programs.

This initial overview of the data set indicates the two aspects of the corpus: a group of universities in terms of consistency and proportion; and a breaking point on the timeline regarding the corpus size expansion. Initially, 65% of the corpus is generated by five universities: GAZI, ITU, METU, MSGSU, and YTU. These universities have a long history of the architectural research program (30-50 years) and are the pioneers in the architectural domain of Turkey, hence require an in-depth analysis. Other universities are also categorized based on their common properties such as funding source, program history, and location (Table 1). Each university is gathered under a group and therefore each document has a new attribute of

1. Collected from the open-source database of The Council of Higher Education. (https://tez.yok.gov.tr/UlusalTezMerkezi/IstatistikiBilgiler?islem=1)
2. Westergaard et al., "A Comprehensive and Quantitative Comparison of Text-Mining in 15 Million Full-Text Articles versus Their Corresponding Abstracts."

the group. With this new attribute, the metadata contains a continuous variable of year, the discrete variables of university and group.

Group	Universities	Properties
A	gazi, itu, metu, msgsu, ytu	Public funded, historic, located in Ankara and Istanbul
B	cukurova, deu, dicle, ktu, selcuk, trakya	Public funded, located at other major cities
C	anadolu, balikesir, erciyes, gtu, iyte, karabuk, kocaeli, mau, nbu, ogu, sdu, uludag	Public funded, new, located at less populated cities
D	arel, bau, beykent, halic, iau, ieu, iku, kadir, kalyoncu, kto, maltepe, tobb, toros, yasar, yeditepe, zaim	Private funded, new, mostly located at Istanbul

Table 1 Universities gathered under groups by defining properties.

There are three crucial steps at the pre-processing of the texts that lead to building the model vocabulary:

1. Removal of universal[3] and custom stopwords.
2. Filtering words that appear less than 1% and more than 90% of the documents.
3. Stemming of the words.[4]

These steps determine the content quality[5] of the corpus by eliminating insignificant words from the corpus and hence a vocabulary set of 2014 unique words is generated. Therefore, each document is now enumerated by the frequency of the word usage in its abstract and prepared for topic modeling.

Topic Modeling

This study utilizes topic modeling algorithms and techniques to classify the architectural research collection: these techniques are commonly used for discovering information from a collection of documents by classifying them in abstract topics.[6] This is achieved by enumerating words that constitute the documents, and

3. http://snowball.tartarus.org/credits.html
4. Porter, "An Algorithm for Suffix Stripping."
5. Schofield et al., "Understanding Text Pre-Processing for Latent Dirichlet Allocation."
6. Hofmann, "Probabilistic Latent Semantic Indexing."

then by clustering these words under a predetermined number of topics. Afterward, the documents are clustered under a mixture of topics. The clustering process is a probabilistic process in which the words are clustered in topics according to their probability of co-occurrence and frequency, hence words are gathered in every topic with different probabilities. Likewise, documents are affiliated to topics with different probabilities; the degree of affiliation (probability) enables interpreting a topic regarding the information it contains through clustered documents and keywords.[7]

Although topic modeling does not attain an absolute certainty over the knowledge contained within the document collection due to its statistical mechanics, it provides a certain level of flexibility to interpret the results depending on the researchers' aim and intention. Moreover, this study highly emphasizes the framework of Structural Topic Modelling[8] -introduced by its authors and contributors- to interact and interpret the results.

The core concept of STM is to distribute the vocabulary over the user-chosen number of topics, while also keeping each documents' relation with the metadata to estimate the effects of the user defined attributes.[9] Based on the STM framework a model of 38 topics is generated after numerous iterations. This model had the most optimized topic quality of exclusivity and semantic coherence.[10]

RESULTS and FINDINGS

Topic Prevalence

Initially, the result regarding the topic proportions (Figure 2) indicates the proportional dominance is decreasing from the general architectural research focus; such as common subjects of different disciplines cultural heritage and preservation, architectural design and theory, urban theory, project management, building science, towards more specialized subjects such as building and public space inquires, acoustics, building materials, and systems. In a general sense, the layout of these results is expected in the overall architectural research environment.

However, one of the relatively unexpected outputs of the model is the significantly high proportion of the Topic-34, which represents theses with research focus towards architectural preservation and conservation. Although, there is a

7. Blei et al., "Latent Dirichlet Allocation."
8. Roberts et al., "Structural Topic Models for Open-Ended Survey Responses."
9. Margaret E. Roberts et al., "The Structural Topic Model and Applied Social Science,"
10. Mimno et al., "Optimizing Semantic Coherence in Topic Models."

drastic proportional difference between Topic-34 and the following topic (Topic-2); a first-hand implication that this topic is the most prevailing research subject among Turkeys' architectural research agenda can be misleading. This can be interpreted as that the topic represents documents that are so similar to each other and at the same time differ from most of the other topics and thus it has a concrete structure of information. Additionally, when the highly affiliated documents are checked, the topic contains research regarding the preservation of selected case studies. Although these theses have different case studies, the descriptions of the preservation and conservation principles (the abstracts of the theses) are mostly alike in terms of word usage and expression. Therefore, the related documents are not proportionally dispersed among other topics. Even though the proportional prevalence of the Topic-34 is investigated it can still be accepted as the most prominent research subject.

Topics related to architectural theory and design are composed of four of the top five topics. Although these topics are commonly and broadly discussed subjects within the architectural domain; an out of common result is that studies regarding the representation of architecture on fiction and art (Topic-2), such as cinema, literature, and so on, is prevailing among these topics. This topic is yet to be followed by most expected research agendas on architectural design process and tools (Topic-4), then by architectural theory and criticism (Topic-31) and formerly by conceptual design and form agenda (Topic-37).

Building science is highly represented by the studies on high-rise buildings (Topic-6), especially on office buildings and their systems; followed by other attractive subjects of energy efficiency (Topic-28) and sustainability (Topic-35). With the remaining related topics, the general layout of the subjects of this discipline has quite less unexpected outcomes, while the topics are strongly representing the research focus and agenda of the discipline.

Topic Trends

The initial observation of the proportional distributions of topics overlap their overall excepted proportions presented in Figure 3; however, some topics display increasing and decreasing trends over the timeline. Topics regarding the architectural design and theory, the highest emergence rate is with the topic associated with experience and perception of real and virtual spaces (Topic-22). The drastic proportional increase of this topic is a standalone situation where this trend even differs from the trends of the highly correlated topics (Topic-2, Topic-31, and Topic-37). While there are no valid signs to explain this phenomenon, the sudden increase and then the decrease around between the years 2012 and 2016 could be interpreted as a temporary research focus.

Energy efficiency (Topic-28) and sustainability (Topic-35) display a simultaneous increase until 2011 and afterward a slight decrease. For the case of Topic-35, it is highly affiliated with theses focused on building energy certification and sustainable design. While these agendas have an increased interest worldwide, energy certification became a subject of interest in Turkey at the same time frame with the escalation of the construction industry and high-end projects with energy efficiency considerations.

A comparable discussion can be carried out for Topic-20 as well, where the topic gathers documents regarding urban transformation and renewal. Although this topic has a mild increase over time; within the context of Turkeys' urban development policies, the trend of the topic indicates a level of research interest to the contextual political effects and results

As one of the most industry-related disciplines, project management and its associated topics represent a different tendency. While Topic-5, Topic-9, and Topic-18 show a correlated decline of interest after 2010; especially Topic-18 is gradually decreasing ever since. This topic, representing the agenda of project and construction management, is the prominent agenda of its related discipline. This decrease could be interpreted under two circumstances: firstly, considering the nature of this discipline, it intersects with administration, law, and management rather than the architectural domain. Secondly, since this discipline is heavily affiliated with the construction industry, the focus of the institutes might be shifted from a research program to a graduate program without a thesis, where the main aim is to train a qualified workforce for the industry.

Institutional Factors in Research Tendency

Universities, under four groups, were introduced as covariates to the STM and the effects of these groups over the years are represented in Figure 4. Initially, the significant effect of GROUP-D can be observed on topics regarding sustainability (Topic-35), the urban culture discussions related to Istanbul (Topic-16), waste management (Topic-23), and high-rise buildings (Topic-6). According to their effects on these topics, the research focus shifts from one to another without any reliable correlation or clarifying data. A noteworthy assessment of these effects can be the nature of the universities that form this group: most of these universities are located in Istanbul and they are all private-funded. Since Istanbul is the most densely populated and the economically leading city of Turkey, being located there boosts the research tendency towards the agenda of the city. Apart from that, this group does not have any determined agenda but leans towards mainstream discussions.

The GROUP-C, which is constituted by public-funded universities and relatively newly established architectural research programs, displays dominance mostly over urban studies. The effects of this group on Topic-20, urban transformation, and Topic-30, public spaces, can be interpreted to the lack of city and regional planning research degrees, and therefore the master of architecture program initiated these studies. An unanticipated result, is the proportional effect of this group on topics with high relation on urban identity and cultural discussions related to Istanbul (Topic-11 and Topic-16), while none of the constitutive universities of this group is located there; this situation can be interpreted as an attempt to align with the mainstream case studies.

Regarding the effects of the GROUP-B universities, there is a distinct tendency towards architectural preservation and conservation that can be observed in their proportions over Topic-3 and Topic-34. This group can be attributed as the most dedicated universities towards this discipline as per their proportional dominance. Additionally, the discipline of building science is also greatly contributed by this group according to their prevalence on Topic-10 and Topic-36; where the former contains the studies on construction materials and applications, and the latter is associated with research-based on construction systems. Although the group demonstrates interest in other disciplines as well, their research characteristics can be identified in these two disciplines.

As the major document contributor and with a long history of architectural research programs, GROUP-A has a feeble effect on the overall topic layout regardless of its scale. The group is proportionally leading a handful of topics, and only prevailing with a mediocre difference. The relatively high effects are present at Topic-18, project management, and Topic-22, the experience of space, which is the most prominent topic of the group and completely irrelevant in terms of topic correlation and disciplinary proximity. Furthermore, a somehow distinct proportional difference appears on the subject of computer aided design (Topic-1) and acoustical design (Topic-8). At this stage it is rather difficult to define a characteristic of the research agenda of this group; therefore, to further investigate this low prevalence over the topics, the group is disintegrated into its constituting universities. The effect of the five corresponding universities of GROUP-A is re-calculated and the results are introduced at (Figure 5).

The results of these GROUP-A universities' effects over topics yet again indicate the presence of outliers: which is evident in the GAZI and MSGSU universities who have a discontinuous array of documents between 2005 and 2008. This sparsity is caused by missing theses from the database. In the case for GAZI, it is much visible at Topic-34, where there is a sudden decrease in 2009 and simultaneously a sudden proportional peak on Topic-5 and Topic-9. A comparable situation is also observed for MSGSU: the reduced number of documents in 2006 causes an unexpected proportional increase on Topic-34 while other topics show decreased proportion.

Initially, two major circumstances are revealed. First, the dominant effect of METU over the research focus on architectural theory and criticism (Topic-31). As the results indicate the effect of METU over this topic is higher than the rest combined and without its contribution to this subject, this topic may not emerge with such a high proportion. Second, the effect of GAZI on studies of preservation and conservation, although decreasing since 2015, is still considerably high. In a sense, with reference to these results, the research characteristics of these two universities (METU and GAZI) are revealed.

The effect of MSGSU affirms an out of common comprehension of this university's' research focus. As a renowned fine arts university, it has a prevailing effect on topics related to building science. This can be observed on the proportional extent over the studies on sustainability (Topic-36), construction materials (Topic-15) building systems (Topic-36), and façade design (Topic-13). While its effects on these subjects are not excessive, compared to the technical universities its dominance is rather unexpected.

The remaining two universities ITU and YTU, combined overwhelmingly comprise %46.8 of the corpus, display a very weak characteristic of research focus. While ITU has a dominant agenda towards the non-correlated studies on project management (Topic-18) and space and experience (Topic-22), YTU has no remarkable distinction over the topic proportions. Compared to their corpus scale, this feeble effect is rather caused by their numerous and extended research programs under the architectural faculty. Hence, the divergence within these universities, their research focus and aspect cannot be strictly identified by this model. Their proportional distributions over the topics overlap with the overall layout since they are conducting studies under all topics simultaneously.

Discussions and Conclusion

Although the results of the topic model have acceptable and valid outcomes, there are two main aspects that require highlighting: first, for certain universities, there are missing documents for certain years. Hence the lack of documents causes the sudden rise and falls of the topic proportions (seen in Figure 4 and Figure 5).

Second, different pre-processing methods and topic quality assessments can result in models with different numbers of topics.[11]

Nevertheless, the interpretation of the results has revealed the implicit knowledge over the architectural research agenda. Regarding the mapping of this knowledge, the map contains the layers of knowledge produced per time and per source. This map provides a basis for further critical reading of the architectural research environment of Turkey. The model-based agenda tracking as this study has introduced, excludes from a conventional critical reading of the architecture agenda such as Acar, Y. [12] and Güzer, A.[13] where such studies tackled the mapping of urban design and architectural styles of Turkey. Although this study is limited to the corpus presented and concluded within these limits, with different critical attitudes and interpretations, novel layers can be added to this map within the same corpus. Furthermore, findings of other related works can be superpositioned to this map to expand the overall knowledge discovery.

11. Roberts et al., "Structural Topic Models for Open-Ended Survey Responses."
12. Acar, "Atlas of Urban Design: Textual Analysis and Mapping of Production of Knowledge in Turkish Context."
13. Guzer, "Türkiye Mimarları Haritası."

IMAGES, CHARTS OR GRAPHIC LEGENDS

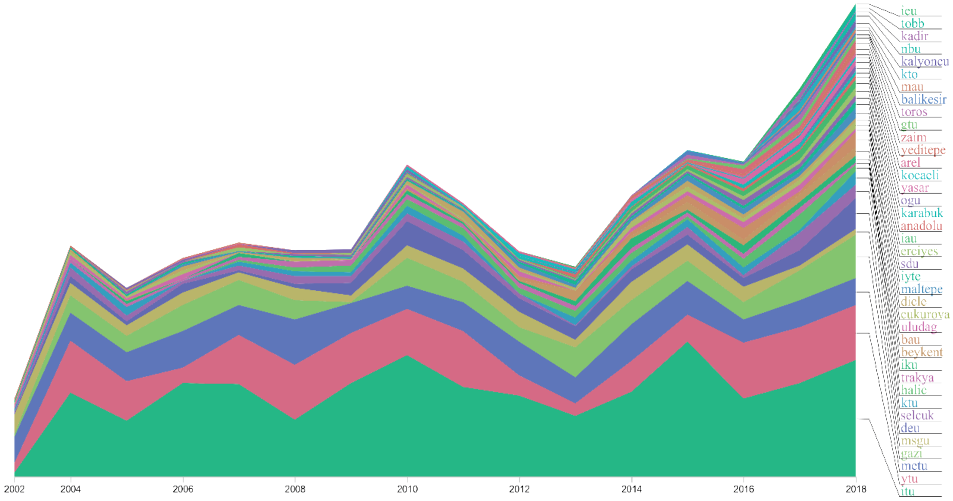


Figure 1: Stacked chart of the corpus over years. Universities that are ordered by the number of documents.

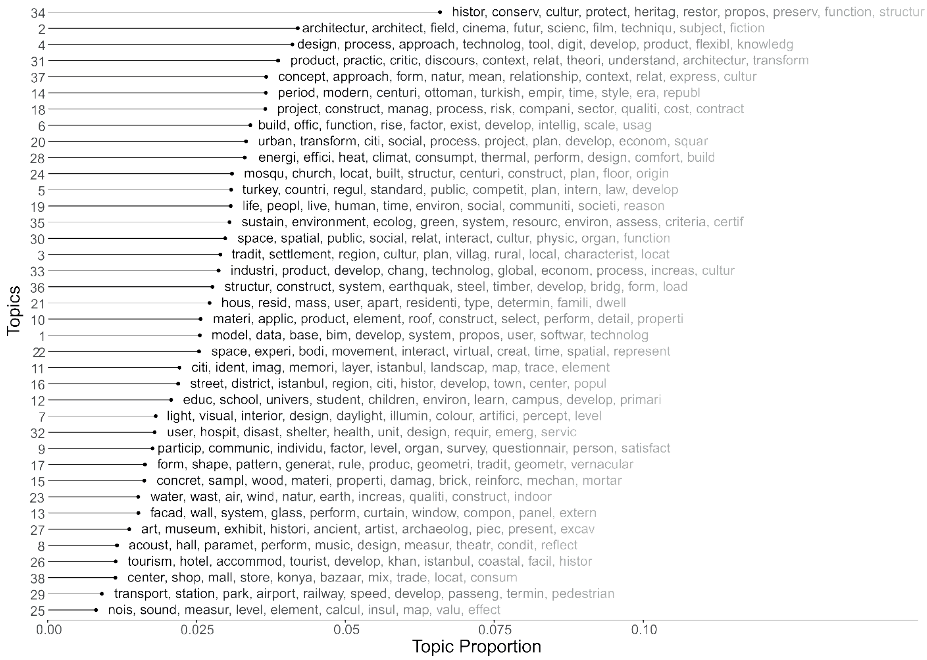
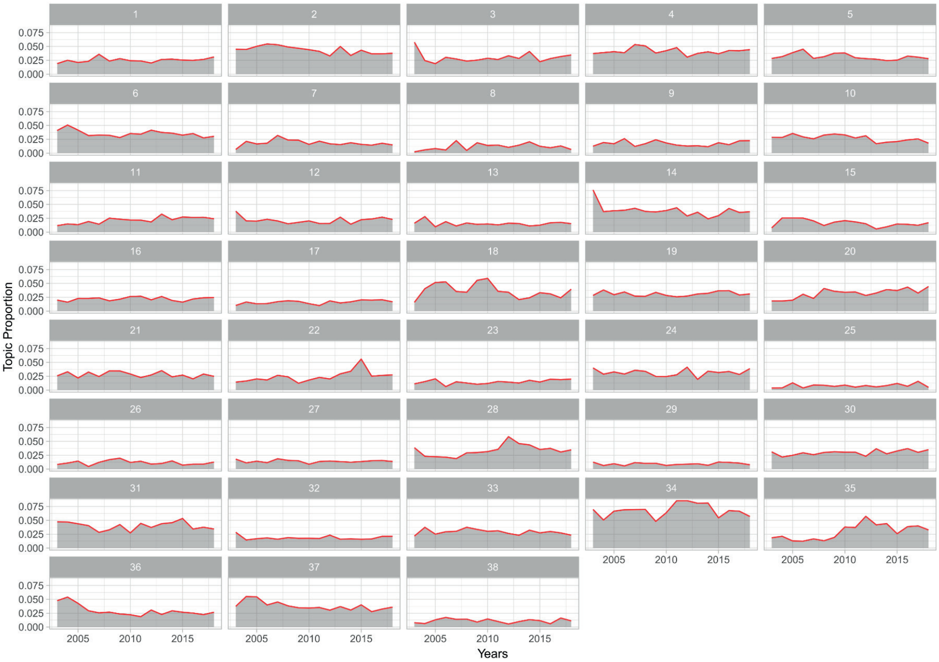
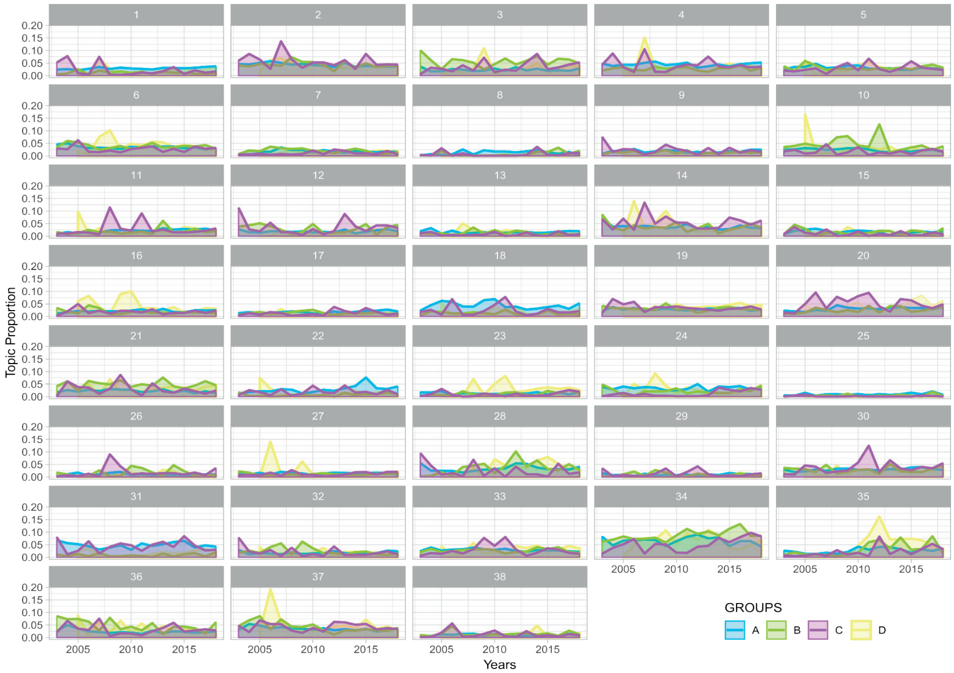
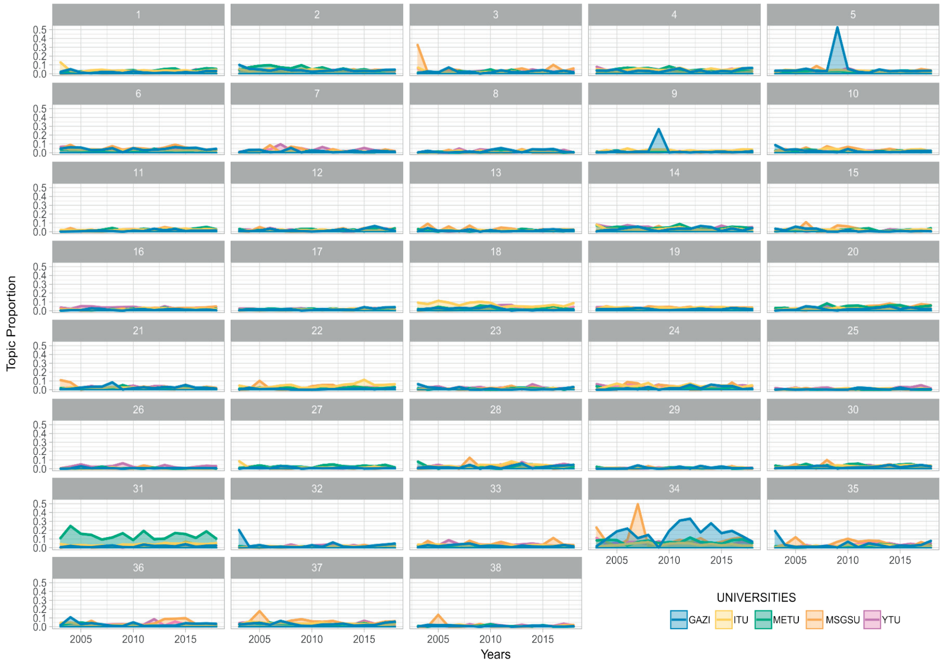


Figure 2: Expected topic proportions with the top 10 keywords. Topics that are ordered by their proportion and keywords that are ordered by their probability (darker is higher).


Topic Proportion
Years
2005
2010
2015


Topic Proportion
Years
2005
2010
2015
GROUPS
A
B
C
D



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FREE FORM ARCHITECTURE AND INTERIOR SPACE: A CRITICAL ANALYTICAL APPROACH

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ABSTRACT

Architecture has been in a period of transformation since the last decade of the 20th century. There have been major developments in architecture in terms of the design and realization processes due to technological advances. The 21st century witnesses the domination of Free Form Architecture on contemporary architectural practices and theories. The use of digital design tools further widens the limits of experimental approaches in architectural design and realization. It is possible to say that formal expression has become one of the focal points of architectural design. In this study, it is supported that the overemphasis on formal expression may lead to an undervaluation of the importance of various key characteristics of interior spaces. Since space is of utmost importance in architecture and the interrelations between form and space constitute the dynamics of architectural design, the characteristics of spaces in Free Form Architectural works are selected as the main topic of investigation. This study focuses on the impact of formal expression of the building skin on interior spaces and adopts a critical analytical approach. A number of cases are selected and a thematic categorization is made based on the architectural drawings in order to be able to analyze the current intentions about space characteristics in contemporary Free Form Architecture. The results indicate that the formal expression of the building skin can be very limitedly perceived from the inside. Therefore, the spatial concerns may have been regarded as a secondary design consideration in Contemporary Free Form Architecture.

KEYWORDS

Architectural design, architectural form, digital architectural design, form reasoning, building skin, form and space, architectural space, visual perception

Introduction

It has been widely argued that architecture has been in a transformation process since the last decade of the 20th century, due to technological advances. Specifically, the development of digital technologies triggered new developments in architecture in terms of design conception and realization and enabled architects to operate with complex computational tools and methods that support the design process (Eekhout et al. 2015). Although digital media can be used for a wide range of activities including design communication, synthesis, and evaluation, its wider implementation in architectural practices has been rather limited to the generation and manipulation of the architectural form (Kalay 2004). For the last two decades, there has been great interest in formal architectural experimentation resulting in the construction of an increasing number of Free Form Buildings (Pottmann, Schiftner, and Wallner 2008). 21st century witnesses the rise of the popularity of Free Form Architecture which started to dominate the skyline of some of the major cities around the world (Wong 2010).

Contemporary architectural production has been criticized for its desire to attract attention through its physical appearance aiming to distinguish from the others with what is purported to be an identity of its own (Hertzberger 2000). The digital developments have been used as a tool of distinction by providing a set of operations of form generation and manipulation (Picon 2004). Experimentation on complex architectural geometry has proliferated by testing boundaries, querying traditional perceptions, and searching for new materials and concepts around the topic of the architectural form (Schittich 2012, 8-27). These newly introduced possibilities increased the impact of the certain aspects of architecture previously considered secondary, such as surface manipulation and articulation, moreover, this change in architectural thinking has led to a displacement of the criteria for judgment, from an evaluation of form toward an assessment of the motivations that lie underneath its conception (Picon 2004). Various concerns can guide the process of design and form reasoning in Free Form Architecture such as rationalization and performance. Materialistic aspects and performance can be regarded as determinant forces that shape the studies on Free Form Architecture and they focus more on the *building skin* and architectural form. The formal expression of the architectural works in terms of the increased complexity that can be achieved with new design tools leads the conceptualization process.

According to Carlos Marcos (2011), the focus on the outward appearance of the architectural works as the objective of the design process runs the risk of leading to a banal formalism inconsistent with architecture's own tradition. During the act of architectural design, form and space can be regarded as a *means* to solve a problem in response to conditions of function, purpose, and context (Ching 2014). According to Edmund Bacon (1967), the essence of design is the interrelations between the two basic ingredients of architectural design, which are mass and space, and since the form is the point of contact between these two, the quality of architecture is determined by the skill of the designer in using and relating the elements of form, both in interior spaces and in the open spaces around buildings. The relation between form and space can be provided by designing from the outside in, as well as, the inside out (Venturi 1992). Regardless of the method adopted, architecture brings new spatial discoveries exhilarating spatial idea not encountered in that form before (Hertzberger 2000). So, architecture is an act of defining spaces, as Edmund Bacon (1967) states: “This is architecture, not to look at, but to be in.”

In contrast, Free Form Architecture usually prioritizes building form and building skin as the focal point of architectural design. Moreover, spaces and their basic qualities provided by Free Form Architecture are usually considered as secondary or subordinate to complex forms. Although Free Form Buildings can be designed focusing on constructional or performative concerns, or as an exploration of the digital possibilities by using from the outside-in approach, the question of architectural spaces as the primary concern of architectural design remains. The studies on Free Form Architecture generally cover the topics of digital architectural design, representation, rationalization, and performative design. As most of the Free Form Architectural works derive their motive from form reasoning through these considerations, the characteristics of interior spaces are rather neglected. Therefore, this study approaches the relationship between complex architectural form and interior spaces in contemporary Free Form Architecture as the research problem. As Herman Hertzberger (2000) claims: “An essential aspect is that space is always present in what we do, as a permanent challenge.”

This study focuses on the impact of formal expression of the building skin on interior space and aims to explore the intentions of Free Form Architecture in spatial characteristics. This exploration is carried out by investigating architectural drawings of Free Form Architectural works. The horizontal and vertical spatial relations can be determinant in defining the relationship between the building form and interior spaces.

Case Study Research

This study can be regarded as an exploration process of the stance of Free Form Architectural works related to interior space characteristics. Therefore, principles of case study research are adopted in order to be able to develop a certain perspective towards the issue. Twenty-eight cases, mostly selected from the 21st century, are examined with respect to the research considerations derived from the principles of space definition and visual perception of architectural space. Thematic categorization will be carried out with respect to the cases with the aim of examining and discussing the spatial characteristics in Free Form Architecture.

A number of research considerations can be introduced with respect to the principles of space definition and visual perception of the building skin to define the relationship between the building skin and indoor spaces such as:

- Form
- Proportion and Scale
- Accessibility (public/private/in between)
- Visual continuity
- Spatial continuity

Cases

Many significant examples of Free Form Architecture were realized during the 1950s as thin shell structures. The first eight of the cases are selected from the representative architects of the thin shell structures from the 20th century, and the other twenty of the cases are from the 21st century examples of Free Form Architecture. Correspondingly, a comparative analysis would be possible. Due to the increasing complexity (both programmatic and formal) and scale of the buildings from the 1950s to the early 21st century, examining the ways in which architectural works have been interpreting such change through architectural expression of space becomes also increasingly important.

Only built works are included in the study since they have an impact on the architectural evolution more than designs that exist only on paper. The cases are not selected from a specific building type since, in the case of a global scale, the conceptualization of Free Form Architecture is not dependent on the type or specific functions accommodated in the building. So, various types of buildings can be selected as examples to examine. The full list of the cases:

1. Kresge Auditorium, 1955, Eero Saarinen, Massachusetts, US
2. Palazzetto dello Sport, 1956, Annibale Vitellozzi, Pier Luigi Nervi, Rome, Italy
3. Los Manantiales, 1958, Felix Candela, Mexico

4. Ingalls Rink, 1958, Eero Saarinen, Connecticut, USA
5. TWA Flight Center, 1962, Eero Saarinen, NYC
6. Yoyogi National Gymnasium, 1964, Kenzo Tange, Tokyo, Japan
7. St. Mary Cathedral, 1964, Kenzo Tange, Tokyo, Japan
8. Sydney Opera House, 1973, Jørn Utzon, Sydney, Australia
9. SEC Armadillo, 2000, Norman Foster, Glasgow, Scotland
10. Auditorium Parco della Musica, 2002, Renzo Piano, Rome, Italy
11. City Hall, 2002, Foster & Partners, London, UK
12. Selfridges Department Store, 2003, Future Systems, Birmingham, UK
13. Walt Disney Concert Hall, 2003, Frank Gehry, California, USA
14. The Hinzert Museum and Document Center, 2005, Wandel Hoefer Lorch + Hirsch, Halle, Germany
15. Chengdu Contemporary Art Centre, 2007, Zaha Hadid, Chengdu, China
16. London Aquatics Centre, 2008, Zaha Hadid, London, UK
17. Novartis Pharma A.G. Campus, 2009, Frank Gehry, Basel, Switzerland
18. Guangzhou Opera House, 2010, Zaha Hadid, Guangdong, China
19. Ordos Art & City Museum, 2011, MAD Architects, China
20. Soumaya Museum, 2011, FR-EE/ Fernando Romero Enterprise, Mexico City, Mexico
21. Dalian International Conference Center, 2012, Coop Himmelb(l)au, Dalian, China
22. Galaxy SOHO in Beijing, 2012, Zaha Hadid, Beijing, China
23. Heydar Aliyev Center, 2013, Zaha Hadid, Baku, Azerbaijan
24. Fondation Louis Vuitton, 2014, Frank Gehry, Paris, France
25. Harbin Opera House, 2015, MAD Architects, Heilongjiang, China
26. Paris Philharmonie, 2015, Jean Nouvel, Paris, France
27. Elbphilharmonie Hamburg, 2016, Herzog & de Meuron, Germany
28. Phoenix International Media Center, in progress, BIAD, Beijing Shi, China

The cases are examined both in plan and section drawings in order to understand the various types of relationships between the building skin and the interior spaces. The categories of the relations, which will be explained in the following section, are derived from this analysis. The cases can be seen in *Image 1.*

Categories of Spaces

Since this study aims to explore the relationship of the building skin with interior spaces, it is important to investigate the spaces that interact with the building skin. The primary medium for analyzing architectural works is drawings (Unwin 2014), so the technical drawings, containing both plans and sections, have been examined with respect to the considerations of the analysis to discover the types of spaces that interact with the building skin. Following this examination, certain categories concerning the horizontal relations of spaces are obtained from the plan drawings. However, when the same categorization is attempted to apply on vertical relations with the examination of the section drawings, a different approach towards categorization is followed. Due to the approach *from the outside in*, the spatial categories derived from plan drawings may end up in different vertical relations with the building skin in cross-sectional views. Thus, a different categorization has been made for the vertical relations of spaces with building skin. The categories that are identified after a careful visual examination of a number of cases will be presented in accordance with the horizontal and vertical spatial organization.

Categories Obtained from Horizontal Spatial Organization

Through the investigation of plan views of the cases, it is possible to regard the building skin as (semi-)vertical space-defining element. In this approach, the way the skin defines spaces or influences the spatial organization is important in terms of categorization. In some cases, it defines the boundary of spaces itself. In some other cases, it may define the configuration of the organization of spaces, and in some other cases, the form of the building skin can be defined by the space and its specific technical requirements. So, the investigation of the plan views of the cases points out three main categories of spaces which are parallel to Ching's (2014) spatial forms: clustered spaces, form defining spaces, and flexible spaces. The differentiation between the categories is not strictly defined; the categories represent the spaces that interact with the building skin coexisting in space configuration of the architectural work with respect to the spatial arrangement proposed by the architect. It is possible to see how the categories apply to the cases in *Image 2.*

Clustered Spaces

Clustered spaces (*Image 3*), Ching's (2014) first category of spatial forms, are typically small scale spaces that have specific but similar functions, such as office units and they can be organized as groups. After a visual examination of the cases, it is possible to expand upon Ching's definition. Clustered spaces are not individually flexible, but they can act flexibly when they are aggregated. The form and organization of the cluster can be defined by the form of the building skin. As can be seen in the cases 5, 7, 13, 14, 15, 16, 18, 19, 20, 22, 25, 26, and 27; they are often adjacent spaces or they can be linked with another space. With respect to their accessibility level, they are usually private or semi-private spaces. Thus, visual and spatial continuity between spaces can be limited or absent depending on the accessibility level and the organization of the spaces.

On one extreme, it is possible to organize a whole building with clustered spaces whose formal organization is determined by the formal expression of the building skin. Alternatively, a more common way of using clustered spaces is to organize a limited portion of the building as in the cases 5, 7, 13, 14, 15, 16, 18, 19, 20, 25, 26, and 27. Regarding the cases 7, 15, 16, 18, and 25, it is possible to say that clustered spaces can function as the service spaces of form defining spaces such as auditoriums and sports halls and they can be positioned between these form defining spaces and building skin. Therefore, the form of the clusters can be defined both by the form defining spaces and the building skin. They can be organized along the building skin in a linear way or they can fill in between the building skin and a form defining spaces.

Since clustered spaces are small-scale spaces, when they are organized adjacent to the building skin, this interaction between the space and skin is rather limited. As a result of their small scale and their low level of interaction with the rest of the building due to the difference in spatial proportions, it is possible to say that the potential for visual perception of the building skin from these spaces is rather limited.

Form Defining Spaces

Form defining spaces (*Image 4)* can be defined, with respect to the second category of spatial form introduced by Ching (2014), as spaces that have specific functional and technical requirements and dictate specific spatial forms, such as concert halls, conference halls, theatres. These spaces can directly affect the formal expression of the spaces around them, and in some cases, they can affect the formal expression of the building skin itself.

It is possible to reinterpret Ching's definition with respect to the visual examination of the cases. In general, form defining spaces are large scale spaces with specific functions. Cases 1, 2, 4, and 6 indicate that in the architectural works from the 1950s and 1960s, form defining spaces constitute the most of the Free Form Architectural works. They were the spaces that determine the form of the entire structure. The visual examination of the cases 20, 21, and 24 from the 21st century shows that form defining spaces may not dominate the overall architectural form, since they usually constitute just a portion of the complex building program. Whereas, cases 10, 23, and 27 indicate the possibility of the dominance of from defining spaces over both the program of the building and the formal expression of the building skin. With regard to the cases 10, 13, 21, 23, 24, and 27, they do not often apply visual or spatial continuity unless a functional or technical requirement dictates so.

The relationship between form defining spaces and the building skin varies in two ways. Firstly, they can define or have an impact on the formal expression of the building skin, although such impact may not be perceived from the interior due to technical and functional adjustments of the spaces. Secondly, although they are form defining, space can be separated from the building skin with a secondary skin and the building skin can be designed independently providing the space no connection or perception.

Flexible Spaces

Flexible spaces, according to Ching (2014), are flexible in nature; therefore, they can be freely defined by the spaces or clusters of spaces around them. It is possible to expand this definition with respect to the visual examination of the cases. Since flexible spaces do not have specific functional or technical requirements they can be defined by the building skin and interact freely with it. Therefore, such spaces are the most common type that the building skin interacts within the cases selected in this study.

Flexible spaces can be of an arbitrary scale or form. They can take place as a large foyer as in case 21 (*Image 5*), or a small exhibition hall as in case 14. Their proportions may also differ. They can be narrow corridor-like circulation spaces as in case 15, or large and high foyers as in cases 9, 21, and 25. Such variations are an important determinant factor in the visual perception of the building skin, and also influential in the categorization which is done with respect to the vertical spatial organizational relations of the cases that will be explained in the following sections.

Flexible spaces are usually used as public spaces such as lobbies, foyers, exhibition halls; or circulation spaces as can be seen in the cases 9, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 23, 24, 25, 26, 27, and 28. They can provide a certain level of visual and spatial continuity in accordance with the spatial organization of the buildings. They can act as a buffer zone between form defining spaces and the building's skin.

Overall, flexible spaces are usually large-scale public spaces having the opportunity of providing spatial and or visual continuity and interact directly (without introducing a secondary skin as can be seen in all cases) with a large portion of the building skin. Therefore, it is possible to say that they have the highest possibility of a comprehensive visual perception of the building skin in the cases selected in this study.

Categories Obtained from Vertical Spatial Organization

Through the visual examination of section views of the cases, it is possible to focus on not only the relationship of the spaces with building skin but also the vertical relationships between spaces. In the categorization of spaces that interact with building skin, the main objectives are scale, proportion, visual and spatial continuity between spaces. The careful visual examination of the cases with respect to the vertical spatial organization identifies four categories: set-back spaces, conjoint spaces, solo spaces, and attic spaces, which cannot be strictly separated and can coexist in the space configuration of the architectural work. It is possible to see how the categories apply to the cases in *Image 6.*

Set-Back Spaces

Set-back spaces (*Image 7)* can be defined as the spaces that maintain visual or spatial continuity by detaching away from the building skin and allowing a wider perspective for visual perception of the building skin. The form of the building skin determines the formal expression of the spaces.

Visual perception requires a certain distance from the target. Moreover, visual perception of the building skin of a large scale building requires either large-scale spaces or small scale ones which are set-back in order to provide a certain distance for the visual perception of the building skin. The mentioned setting back could apply in two ways. It can be provided either with visual and spatial continuity as in cases 5, 9, 11, 15, 17, 18, 20, 21, 23, 24, 25, 26, or visual continuity only as in the cases 19 and 28. When spatial continuity is provided, it is possible to mention the spaces as united set-back spaces which are usually large-scaled. By courtesy of their height coming from the setting back, they are exposed more to the building skin.

Conjoint Spaces

Conjoint spaces, shown in *Image 8,* can be defined as spaces that are located on different levels, completely separated from each other, and directly adjacent to the building skin. The form of the building skin is determinate in a formal expression of the very limited portion of the spaces. Since they interact with very little portion of the building skin, the visual perception of the building skin is very limited.

Conjoint spaces are often small-scale spaces as can be seen in cases 9, 15, 20, 22, 23, 24, 25, 26, and 28, and their formal proportions change in the horizontal level rather than vertical, and these proportional differences are not determinant in terms of visual perception of the formal expression of the building skin. In other words, in accordance with the cases, they often do not reach the height that is needed for a comprehensive visual perception of the building skin, but their width can change according to the functional needs. No visual or spatial continuity occurs between the levels since they are all directly connected to the building skin without any set-back.

There can be clustered spaces, form defining spaces, or flexible spaces on different levels. Regarding the scale of the spaces, visual perception of the building skin may vary. With regard to the visual examination of the cases, it is possible to say that conjoint spaces do not necessarily relate with one another physically, and their relationship with the building skin is mostly related to day lighting rather than other reasons. Since they are usually small-scaled and they do not interact with a large portion of the building skin, their interaction is limited and mostly natural illumination based.

Solo Spaces

Solo spaces can be defined as the single spaces that interact with almost all parts of the building skin in a holistic manner. In this case, it is both possible that the form of the building skin can be determined directly by the solo spaces, or the form of the building skin can define the form of the solo space.

It is possible to say that small-scale solo spaced buildings dominate the 20th century cases, especially the thin shell structures. The examination of the cases from the 1950s and 1960s especially cases 1, 2, 3, 4, 6, and 7, indicates that the early examples of Free Form Architecture were mostly designed as small-scale solo spaced buildings with less complex program. The cases studied in this research include functions such as restaurants, auditoriums, sports halls. Since they are designed for merely one space (sometimes together with their subordinate services spaces) their function is the most determinant factor in the form of the building skin. Since the spaces are in direct interaction with the building skin (without a secondary skin) a comprehensive visual perception of the structure is achieved in indoor spaces as indicated in the same cases mentioned above.

Considering the cases from the 21st century, it is possible to say that this category applies to two different building scales: small-scaled buildings with a simple program containing one major space as case 14, and large-scaled buildings with complex architectural programs containing one major dominant space in terms of function, scale, and proportion as case 10 and 16. In both scales, minor service spaces can be ignored as long as the major spaces constitute the majority of the building program and almost all portions of the building skin.

In small-scale buildings with a simple program, it is possible to assert that there are two possible relationships provided between the solo space and building skin.

The first possibility is that the spatial requirements of the solo space can be determinant in the form of the building skin. The second possibility is that when the solo space does not dictate a spatial form, the formal expression of the building skin is determinant in the form of the solo space.

The same two possibilities apply to large scale solo spaced buildings too. Case 10 shown in *Image 9*, is an example of a form defining solo space. It has a significant impact on the form of the building skin and it can be perceived from the interior. Case 16 indicates a solo space that dominates other small scale service spaces. In both cases, since the spaces have specific functional and technical requirements, secondary skin is needed. Since the spaces are not in direct interaction with the building skin, a comprehensive perception of the building skin is not possible.

Attic Spaces

Attic spaces (*Image 10*) can be defined as spaces located on the highest levels of the buildings interacting with a very large portion of the upper building skin. Their form is almost completely defined by the formal expression of the building skin.

Attic spaces are often large scale public spaces but it is possible for them to take place as both single spaces serving as flexible public spaces as in case 12, 11, 15, 24, 25, and 26 or more private and small-scaled spaces such as offices, as in cases 19, 27, and 28, depending on the functional and spatial organization of the building. In terms of proportion, it is possible to say that the former ones are wide to comprehend a very large portion of the skin but the visual perception depends on the height of the spaces since it requires a certain distance for perception. Visual and spatial continuity can be maintained at a horizontal level but they are not in terms of vertical connections.

Discussion

As this study aims at the relationship between the formal expression of Free Form Architecture and the characteristics of interior spaces, this case-based critical analysis revealed that the scale and programmatic complexity of the Free Form Architectural works may have changed through time. The cases from the 1950s were small-scale buildings with simple architectural programs. They were mostly solo spaced buildings and by courtesy of having one major space, the building skin could have a determinant impact on the formal expression of the space providing a comprehensive perception of the skin. In contrast, the cases from the 21st century reveal that as the scale and programmatic complexity of the building increases, the relationship between the building skin and interior spaces may vary according to the spatial solutions provided by the architect.

In accordance with the findings of the comparative analysis of the Free Form Architectural works, it is possible to say that the maximum interaction and perception of building skin may be provided with buildings of solo spaces in the 21st-century as it was in the 1950s. However, in the case of buildings with complex programs, it is seen that the interaction with the building skin might be limited to the spaces that are organized around the boundary of the skin. The relationship between the building skin and interior spaces depends on the functional and spatial requirements of the spaces, scale, and proportion of the spaces, accessibility levels of spaces, and the visual and spatial continuity between spaces. The visual perception of the building skin can only be possible if the building skin interacts directly with the interior spaces. In other words, the presence of a secondary skin created to define a formal expression for the spaces independent from the building skin detaches the skin from the interior space by providing residual spaces. A comprehensive visual perception of the building skin requires large scale interior spaces, which can be both solo spaces or attic spaces, or setting back of the spaces allowing visual and spatial continuity.

Based on the findings of this research, it is possible to claim that there is a certain intention in reflecting the formal expression of the building skin to interior space in most of the studied cases; however, because of the scale and complexity of the program, it may not be possible for spaces especially following the *from the outside-in* approach. According to the examination of the cases, such reflection is made possible for large-scale public spaces and it may be renounced in small scale private spaces in most of the cases. By considering the positive and negative findings of the interrelations between the building skin and interior spaces, it is possible to summarize the ways to provide relatively better relationships between the building skin and interior spaces based on the categories and the findings of the research. It is possible to address four main results:

1. Direct physical interaction of spaces with building skin is essential. The cases 10, 13, and 27, which contain form defining solo spaces indicate that although the spaces have a direct influence on the building form and the formal expression of the building skin, it is not perceivable from the interior. The reason for this situation is the second skin that is created inside to satisfy the technical requirements of the space. In this case, it is possible to say that in order to be able to discuss the desired interrelations, the building skin might be preferred to be in direct physical contact with the interior space.

2. Visual perception of the building skin from interior spaces may require a certain distance. The scale and proportions of the spaces have a great impact on providing the necessary distance from the building skin. Large-scale spaces that are in direct physical contact with building skin might lead to a more comprehensive visual perception of the building skin.
3. Small-scale spaces can also provide the desired distance when they are organized vertically as set back spaces. When the visual and spatial continuity is provided, the observer might visually perceive the building skin in a more comprehensive way, and the spaces (that are organized by setting back) might generate an integrated relationship with the building skin.
4. Flexible spaces can be better in generating direct physical interaction with the building skin. Since flexible spaces would not have specific technical requirements or proportional restrictions, it might be easier to organize them interacting directly with the building skin.

Regarding the information derived from the case study research, it is possible to say that even though the primary design considerations may not include the interaction of the building skin to interior space, it is not totally ignored too. It is possible to detect a certain effort to reflect the formal expression of the building skin to interior space in the cases. The complexity of building program and the ambition comes from the possibilities of digital tools weakens the possible relations. Therefore, the comprehensive and perceivable relationships may be limited to a small portion of the interior spaces which are usually flexible large-scale public spaces. The rest, such as small-scale private spaces, maybe renounced for the sake of providing a provoking appearance to the city.

The spatial concerns may have been regarded as a secondary design consideration in Free Form Architecture. Free Form Architecture may serve the technical requirements and the iconic statement to the city more than it could serve to interior space.

IMAGES, CHARTS OR GRAPHIC LEGENDS

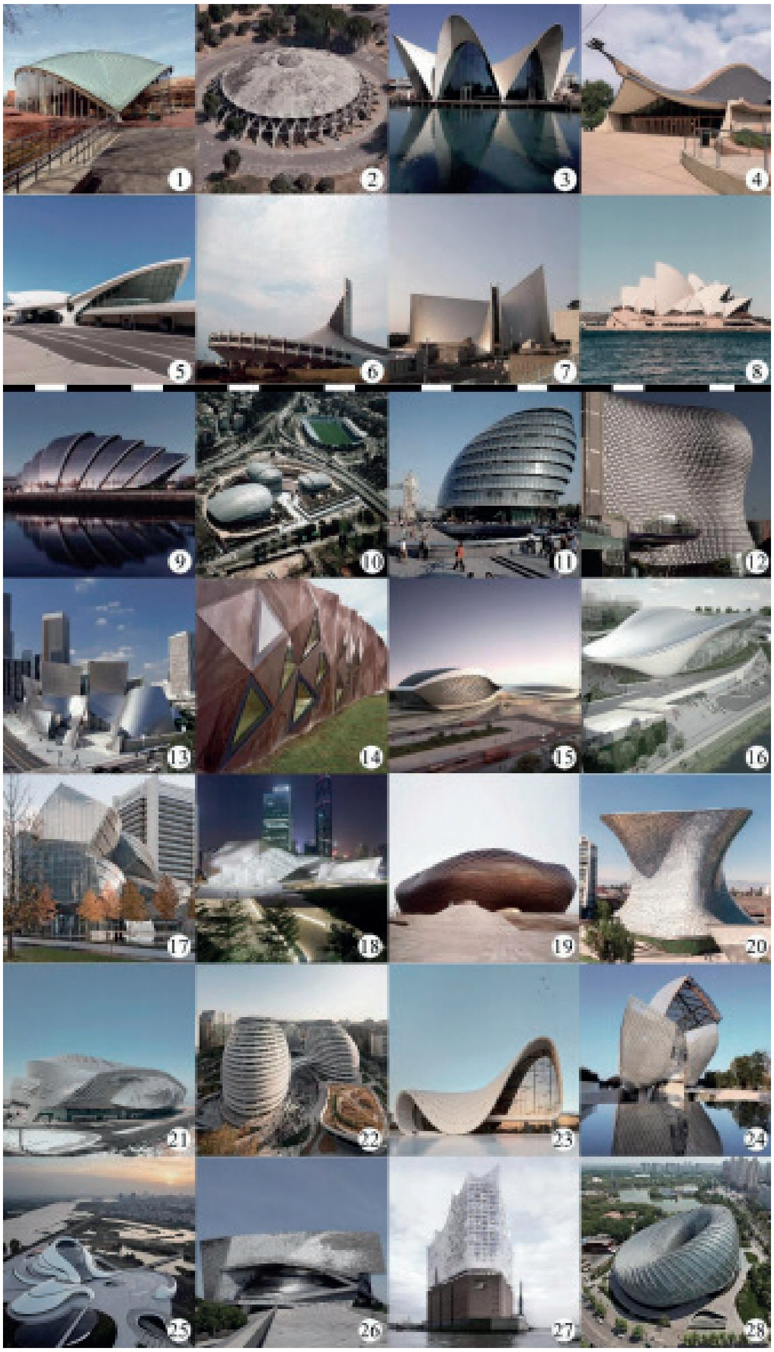

Image 1: External visuals of all cases

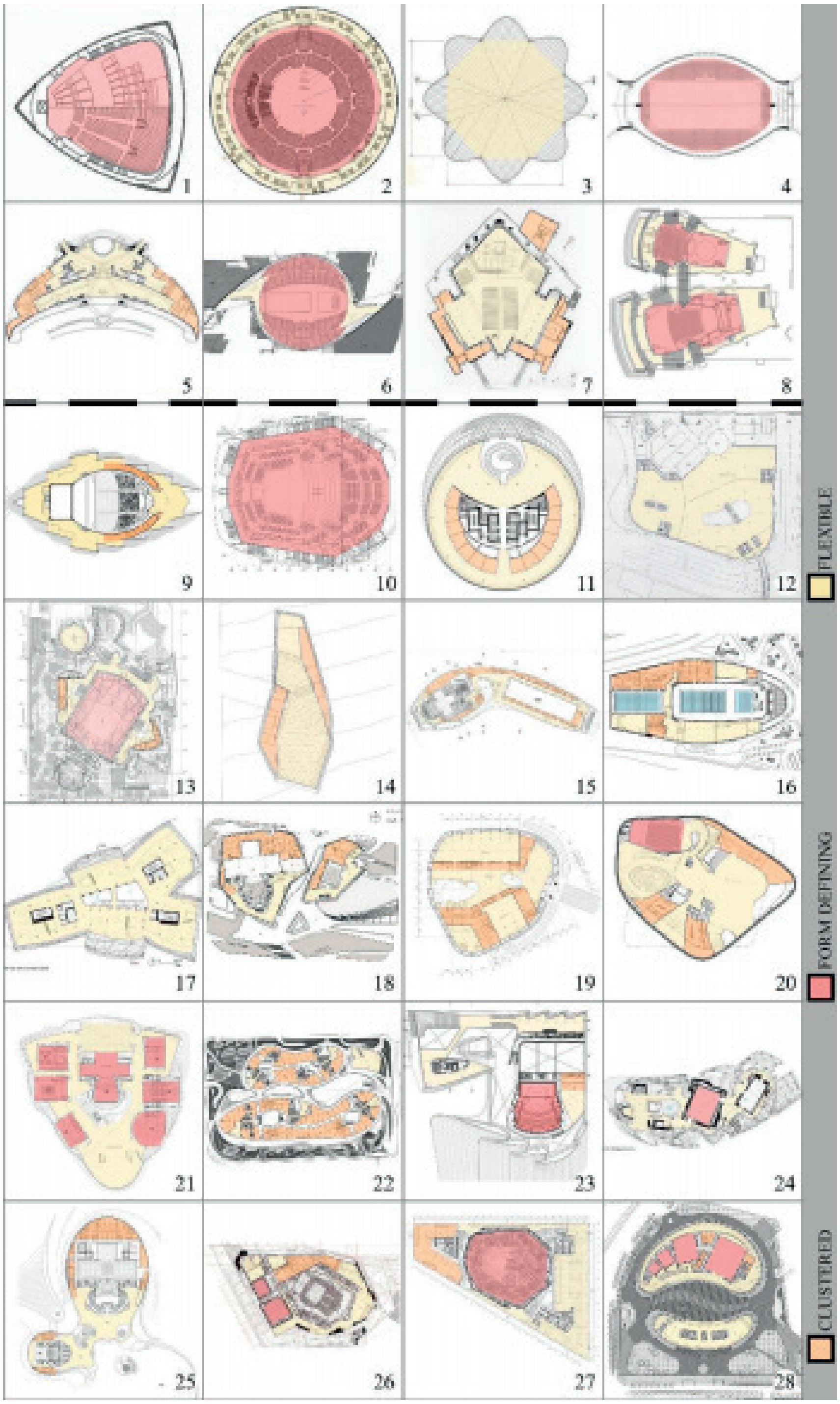

Image 2: Categorization of spaces in plan views

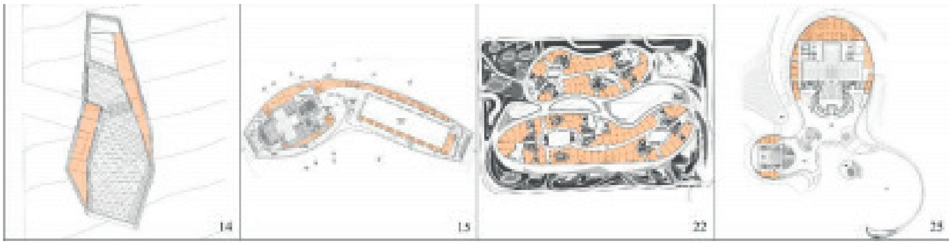

Image 3: Cases exemplifying clustered spaces

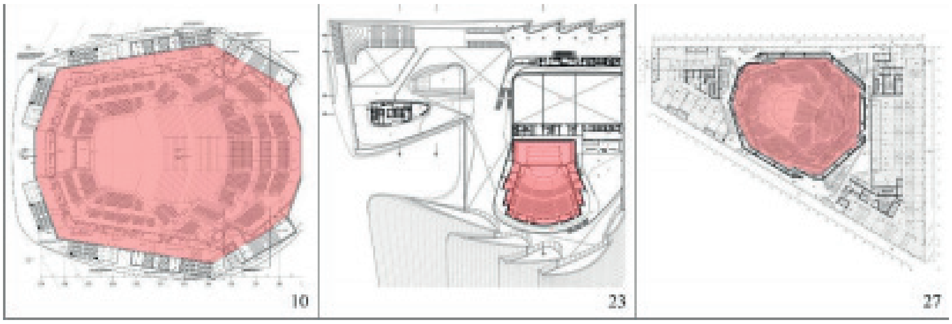

Image 4: Cases exemplifying form defining spaces

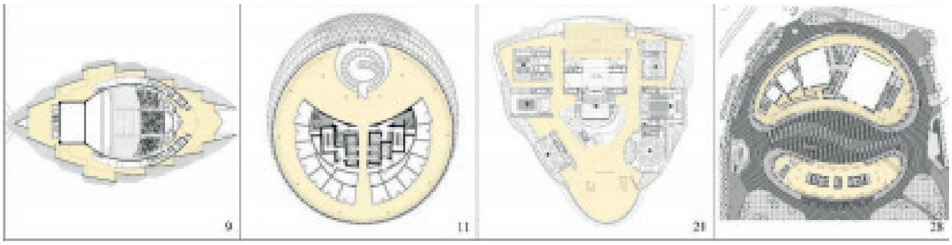

Image 5: Cases exemplifying flexible spaces

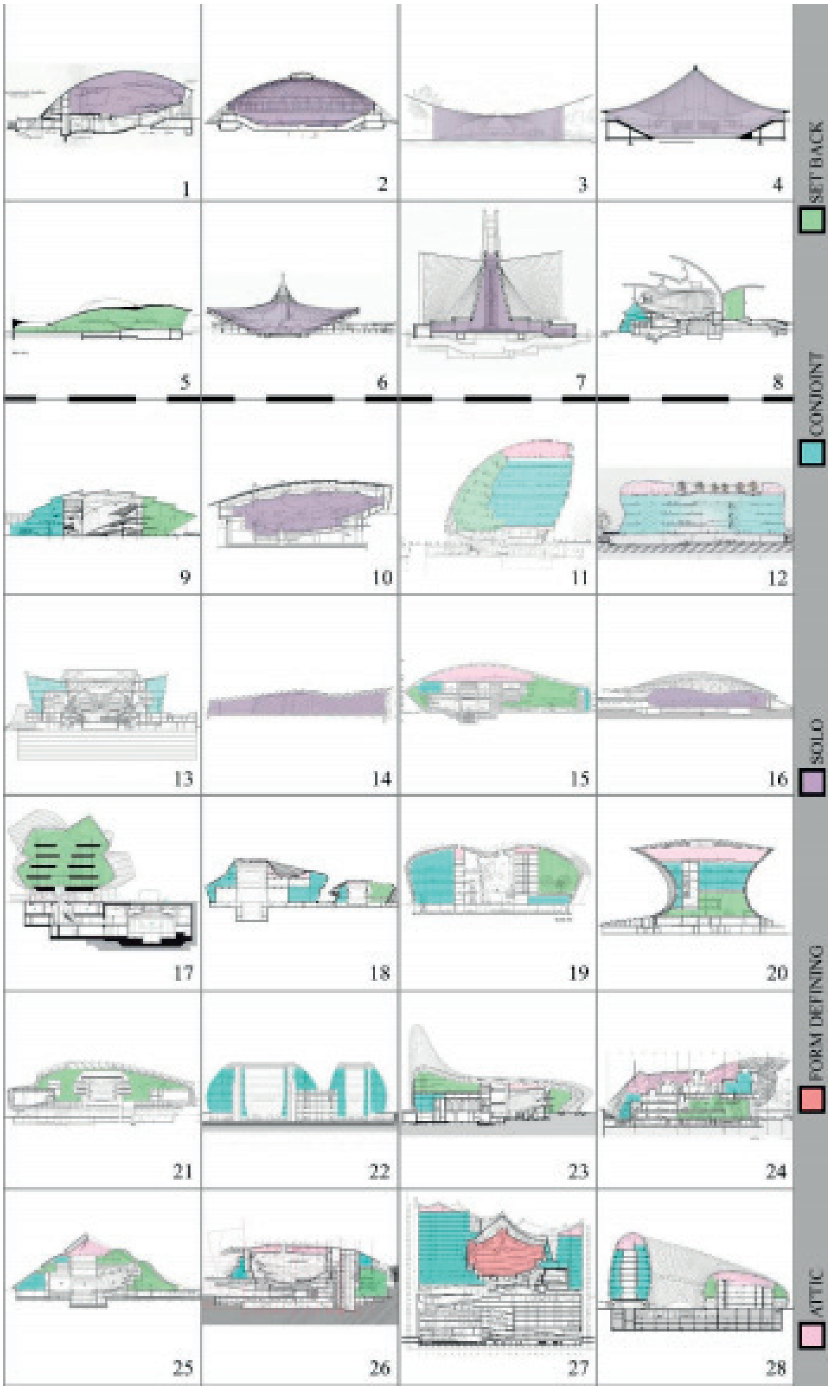

Image 6: Categorization of spaces in section views

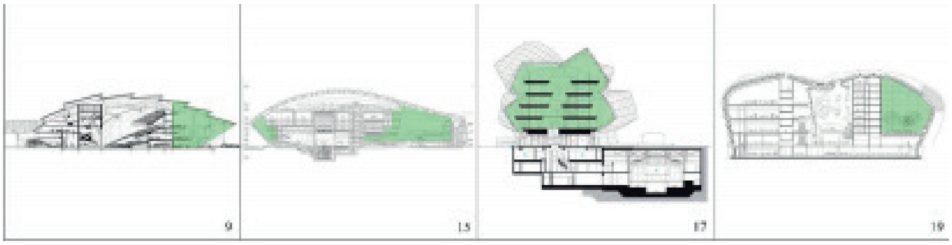

Image 7: Cases exemplifying set back spaces

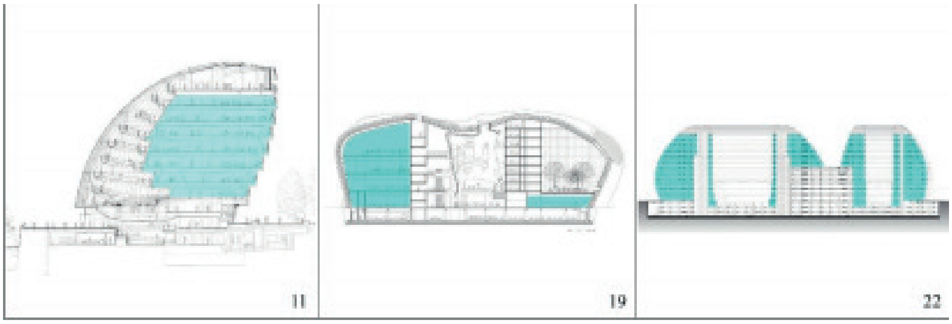

Image 8: Cases exemplifying conjoint spaces

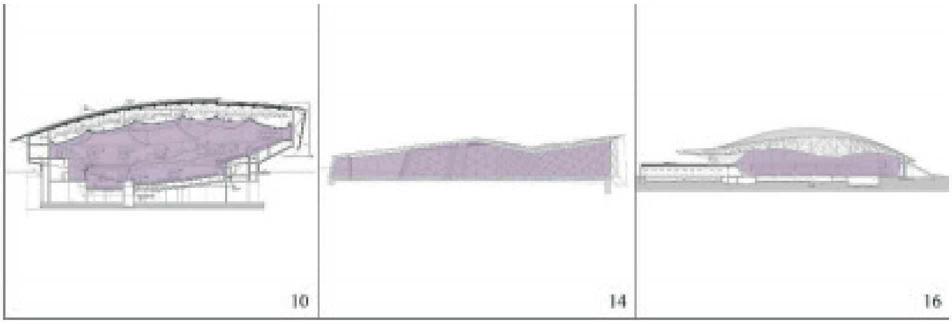

Image 9: Cases exemplifying solo spaces

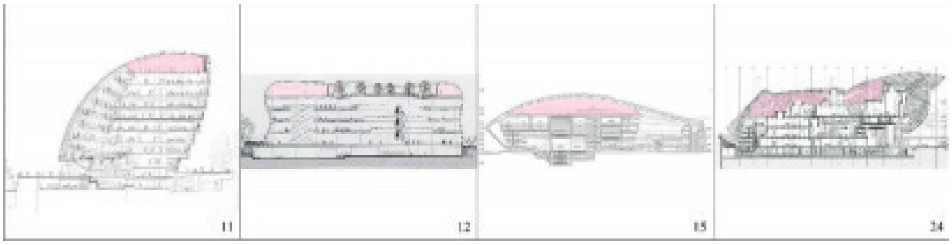

Image 10: Cases exemplifying attic spaces

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AN INQUIRY OF SPACE ARCHITECTURE: DESIGN CONSIDERATIONS AND DESIGN PROCESS

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ABSTRACT
Humans define the spaces of theirs and expand their habitat by creating shelters for themselves for hundreds of thousands of years. The methods and approaches of defining those spaces vary in a considerably wide range. Even if the emergence of architecture as being responsible for the designing and making of those spaces, the role of the architect might be argued to be redefined more as the designer rather than the maker of spaces, for a few centuries. In this context, human-environment interaction might be regarded to become the basis of the field of architecture. On the other hand, for just several decades, the environment of the human has been expanded beyond the protective boundaries of Earth by Space habitats. The design considerations for a spacecraft include a vast majority of technical constraints besides others and historically have been solved within science and engineering disciplines. The need for architectural considerations has appeared after humans started to inhabit those spacecrafts, resulting architects to be involved in the ill-defined problem of Space habitation. The designs of hitherto realized Space habitats can be argued to be under the pressure of excessive constraints. Thus, interdisciplinary collaborations and the role of the architect might be limited during the design process which can become fragmented. The fragmentation based on conventional approaches in the design process might be argued to preclude a comprehensive understanding of the design problem. This issue might become especially relevant in the present day, in which the only currently inhabited Space habitat is near the end of its lifetime, while the plans for future inhabitance of Space are being evaluated. There might appear a brief timespan to let searching for alternative design approaches that might lead to the design solutions that are not eliminating or suppressing the habitat design issues regarding human well-being, while still fulfilling the requirements regarding technical considerations. This paper, which is a partial summary of the thesis with the same title, represents a questioning of the relevance of "designerly ways of knowing" in the designing of Space habitation.

KEYWORDS
Extreme environments design, interdisciplinary design, space architecture, human factors, habitability

Introduction

In the early 1960s, humans started to inhabit Space even for brief durations. As the plans were towards a human presence in Space for longer durations, the need appeared to include living modules in the spacecrafts. The qualitative requirements of these modules could not be satisfied and mostly disregarded by the engineers working on the projects,[1] and architect Galina Balashova – commonly referred to as the first Space architect – was hired to design the interiors of the Soviet spacecrafts.[2] Similarly, when the Skylab project was near-end in America, industrial designer Raymond Loewy has been called to consult on the interior design of the habitat regarding habitability concerns.[3] In the Skylab project, one of the propellant tanks of the launch vehicle was decided to be used as the habitable volume,[4] and there were very few modifications planned on the tank to provide human living until the inclusion of Loewy's firm to the project. Loewy was later congratulated by the mission director Mueller as: "I do not believe that it would have been possible for the Skylab crews to have lived in relative comfort, excellent spirits and outstanding efficiency had it not been for your creative design, based on a deep understanding of human needs."[5] It might be important to note that not only most of the engineers but soon to become residents of Space at that time used to disregard or underestimate the habitability concerns of the spacecrafts during the design process. To sum up, historically, Space habitat designs had not been regarded as an architectural design problem and solved within engineering disciplines. The inclusion of designers and architects to Space habitat designs had been needed regarding the concerns about human psychology in the initial designs of the interiors of early Space habitats, which did not seem "homely"[6] or even habitable[7] to mission authorities. However, the architects' contributions did not stay limited to that extent and the area of interest of architects in spacecraft design has expanded over time.

The field of Space architecture is recently emerging; it has only been six decades since humans have crossed the boundaries of Earth, a few years less since architects started to take place in the design of habitats that are used to accomplish

1. Adeline Seidel, "Interview with Galina Balashova: Only the Watercolors Burned to Nothing," 2015, https://www.stylepark.com/en/news/only-the-watercolors-burned-to-nothing.
2. D. J. Pangburn, "The Soviet Architect Who Drafted the Space Race," 2015, https://www.vice.com/.
3. W. David Compton and Charles D. Benson, *Living and Working in Space: A History of Skylab* (United States Government Printing, 1983).
4. Belew Leland F. and Stuhlinger Ernst, *Skylab a Guidebook* (National Aeronautics and Space Administration, 1973).
5. "Raymond Loewy / Biography," accessed November 27, 2019, https://www.raymondloewy.com/about/biography/.
6. Balashova mentions she was called to design interiors because Feoktistov did not find the proposals made by engineers homely. Seidel, "Interview with Galina Balashova: Only the Watercolors Burned to Nothing."
7. Skylab mission director Mueller states that he asked Loewy to consult on the interiors of Skylab, because he thought no one can stay in the space proposed in the original design. Bergen, "NASA Johnson Space Center Oral History Project: George E. Mueller."

that goal, and not even two decades since Space architecture has been defined as a separate disciplinary field. Hence, the field is considered not fully developed yet.[8] Following the first International Space Architecture Symposium held in World Space Congress in 2002, according to the "Millennium Charter,"[9] the definition of Space architecture has been acknowledged as "the theory and practice of designing and building inhabited environments in outer space" with the motivation of "responding to the deep human drive to explore and occupy new places," and the mission statement followed as:

> Architecture organizes and integrates the creation and enrichment of built environments. Designing for space requires specialized knowledge of orbital mechanics, propulsion, weightlessness, hard vacuum, psychology of hermetic environments, and other topics. Space Architecture has complementary relationships with diverse fields such as aerospace engineering, terrestrial architecture, transportation design, medicine, human factors, space science, law, and art.[10]

Design Considerations

Space is an extreme environment if the word "extreme" is defined with an anthropocentric view as "beyond the optimal range for human survival or development." In that manner, environments with an extremity or anomaly in one or more of the following features might be regarded as extreme: temperature, radiation, pressure, atmospheric composition, gravity...[11] In such environments, it is mostly difficult or impossible to maintain human survival without protection. Those environments share some characteristics such as:

- Hardship of reach
- Autonomy
- Isolation and confinement
- Lack of external stimuli
- Social monotony
- Lack of resources
- Hardship of evacuation in case of emergency

8. Kriss J. Kennedy, "The Vernacular of Space Architecture," *AIAA Space Architecture Symposium*, 2002.
9. AIAA Space Architecture Technical Committee, "The Millennium Charter," in *2nd World Space Congress* (Houston, Texas: AIAA Space Architecture Technical Committee, 2002).
10. Jan Osburg, Constance Adams, and Brent Sherwood, "A Mission Statement for Space Architecture" (Houston, Texas: SAE International, 2003), https://doi.org/10.4271/2003-01-2431.
11. Thiel, "Extreme Environments"; Felipe Gómez, "Extreme Environment," in *Encyclopedia of Astrobiology* (Berlin, Heidelberg: Springer Berlin Heidelberg, 2011), 570–72, https://doi.org/10.1007/978-3-642-11274-4_566.

Architect Olga Bannova suggests that "an environment that poses special limitations and/or hardships for people to survive and maintain relative physical and psychological comfort" can be defined as extreme.[12] In that manner, in addition to Polar, desert, Space, underwater, subterranean, etc. environments; war, disaster, and polluted environments may also be defined as extreme.[13] Even though the definitions of extreme environment vary, design considerations regarding characteristics appear due to the environmental features that might be shared to a certain extent. Therefore, not only extreme environment studies are closely relevant to Space architecture, but the research of Space architecture might find applications in extreme environments on Earth.

"Space" does not define a single location or one specific condition. The Earth surface as well can be included in the Space environments with Fuller's understanding.[14] Even if Space is accepted to begin where the Earth atmosphere ends, it still refers to various environments with various features. Space architect Brent Sherwood draws a conceptual map of the "human-accessible" solar system, illustrating some of the site-specific challenges for possible locations (Figure 1).[15] Variation of environmental features, hardships, and potentials might be observed briefly by this map. However, for almost all Space sites, environmental factors including the following list are altered drastically with respect to Earth:

- Gravity
- Radiation
- Atmospheric composition and density
- Temperature
- Light
- Magnetic fields

To current knowledge, human survival in Space can only be possible in a protective boundary in which the Earth-like conditions are provided to an extent. That boundary might be considered as the whole accessible environment for a Space habitant. As a result, the design considerations of Space habitats should not be limited to the physical and physiological needs of humans but should include psychological needs as an essential part of human well-being. The psychology of humans in Space is widely related to a more extensive definition of living conditions in Space. These definitions can be interpreted as addressing not the environment itself, but the protective environment: the Space habitat. Some psychological

12. Bannova, "Extreme Environments: Design and Human Factors Considerations."
13. Kürşad Özdemir, "Ekstrem Çevre Yapıları," *Yapı* 08, no. 357 (2011).
14. Richard Buckminster Fuller, *Intuition* (New York: Doubleday, 1972).
15. Häuplik-Meusburger and Bannova, *Space Architecture Education for Engineers and Architects*, chap. 2.6.

considerations in Space, which architecture addresses/might address, are adapted from various sources as follows[16]:

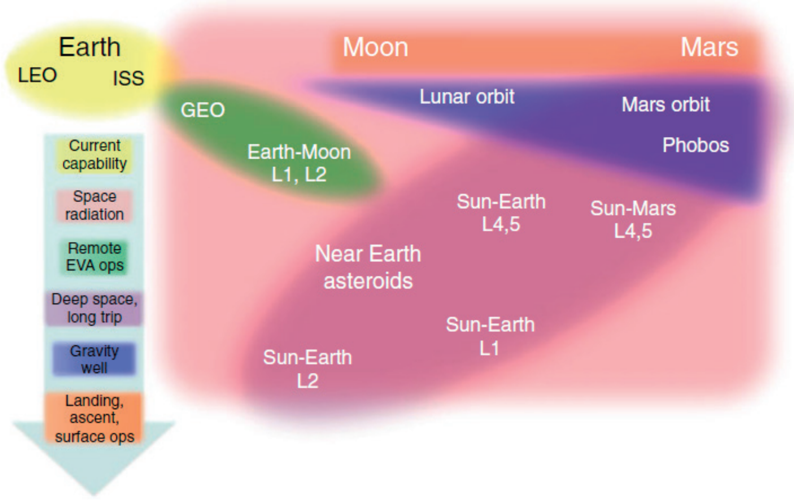

Figure 1: The conceptual map of the "human-accessible" solar system.[17]

- Physical confinement,
- Social isolation,
- Lack of privacy,
- Feeling of crowdedness,
- Under stimulation,
- Over stimulation,
- Limitations of interdependence,
- Dependence on the artificial environment,
- Continuous perception of risk.

Since the first human Space missions, studies focusing on human needs have been conducted. While most of the initial research focused solely on the impact of environmental factors such as noise stimulus, volume requirements, or supplies

16. Harrison, Clearwater, and McKay, *From Antarctica to Outer Space: Life in Isolation and Confinement*; Kanas and Menzey, *Space Psychology and Psychiatry*; Clearwater, "A Human Place in Outer Space"; Harrison, "Humanizing Outer Space: Architecture, Habitability, and Behavioral Health"; Douglas A. Vakoch, ed., *Psychology of Space Exploration* (Washington, DC: National Aeronautics and Space Administration, 2011); Jack Stuster, "Behavioral Issues Associated with Long-Duration Space Expeditions : Review and Analysis of Astronaut Journals Experiment 01-E104 (Journals): Phase 2 Final Report," *National Aeronautics and Space Administration* (Houston, TX, 2016).
17. Häuplik-Meusburger and Bannova, *Space Architecture Education for Engineers and Architects*, chap. 2.6.

such as food, the following research gave attention to interpersonal issues as well.[18] Further studies have included both the human-related issues and the environmental factors, and instead of examining those issues separately, developed an understanding to study the relationship in between.[19]

There are many factors affecting human-environment interaction in addition to environmental factors. To start with, users themselves, as being the interpreter of the environment, might be considered at least equally effective.[20] The physical and psychological condition of the user might be shaped by the combination of many factors, including their profession, training, age, gender, culture, nationality...[21] Secondly, mission duration is one of the main influencers on the weight given to habitability considerations.[22] The roadmaps show increasing durations for missions, requiring further inquiries on habitability. The objective of the mission and relevant schedule during the stay are also definitive on the living conditions in the habitat. Other issues influencing the psychology of the users are also considered as the relationships between habitants (crew heterogeneity),[23] and the relationship with ground-control.[24] Communication with personal relationships is also regarded as crucial. Furtherly, communication with Earth through social media is also acknowledged to be important recently.[25]

It is safe to assume that the knowledge to be gained with upcoming missions with a wider variety in aspects of the user, duration, and aim will provide more data. Nevertheless, while entering the next phase of Space exploration, current knowledge based on previous missions holds valuable insight about life in Space and to define Space habitat design criteria to an extent.

Space Habitat Design Issues

If the Space habitat is recognized as an interface of human-environment interaction, then it should respond to the requirements regarding both ends of this interaction. In that manner, design considerations include quantitative and qualitative issues, some of which might be identified as in Figure 2. It might be important to note that the figure illustrates the design issues in an oversimplified manner. There are many interrelated considerations. For instance, human physiology

18. Marry M. Connors, Albert A. Harrison, and Faren R. Akins, *Living Aloft: Human Requirements for Extended Spaceflight* (Washington: NASA, 1985).
19. Connors, Harrison, and Akins.
20. Harrison, Clearwater, and McKay, *From Antarctica to Outer Space: Life in Isolation and Confinement*, 134–46.
21. Kanas and Menzey, *Space Psychology and Psychiatry*, chap. 1.4.
22. Tommaso Sgobba and Irene Lia Schlacht, "Habitability and Habitat Design," in *Space Safety and Human Performance* (Elsevier, 2018), 653–719.
23. Kanas and Menzey, *Space Psychology and Psychiatry*, chap. 1.4.
24. Kanas and Menzey, chap. 4.
25. Clearwater, "A Human Place in Outer Space."

and psychology are not distinct from each other. On the other hand, design issues such as mass, material, structure, volume, and form might also affect each other drastically. The examples might be multiplied.

Mass, volume, and form of the habitat are mostly dependent on the rocket vehicle capacity. Additionally, the capability of the reach is limited to launch windows and distance. The narrower the windows get and the further the habitat is, the more limited re-supplies and the more impractical unplanned returns become. In-situ resource utilization (ISRU) and redundancy gain increasing importance in that manner. The distance of the environment also causes delays in communication, which might become more than 20 minutes for a Mars mission, preventing any real-time conversation with Earth. The habitats need to become more autonomous as the distances increase.

The habitat's first objective might be recognized as providing a level of protection for human survival. Ionizing radiation and micrometeoroid shielding might become primary concerns for the protective shell, addressing the structural properties, mass, and material choices regarding habitat design, among others. Providing conditions that support human life inside this shell is apt to mechanical systems for today (ECLSS), while the research on supporting these systems with biological processes continue. Space habitats might be considered as one of the most developed examples of artificial closed systems supporting human survival needs.

Due to the challenges posed by the environment and reach capacities, and the dependence on an artificial environment, considerations regarding human physiological and psychological well-being increase in the design of a Space habitat. This induces research on the effects of spatial features of habitat on human. The following topics might be listed as some of the spatial features that are studied in order to provide habitable environments in Space.

- Habitable volume,
- shell form,
- windows,
- lighting,
- colors,
- additional stimuli such as plants and water,
- arrangements for orientation and movement,
- private and common areas,
- emergency egress,
- housekeeping, and
- human-machine interaction.

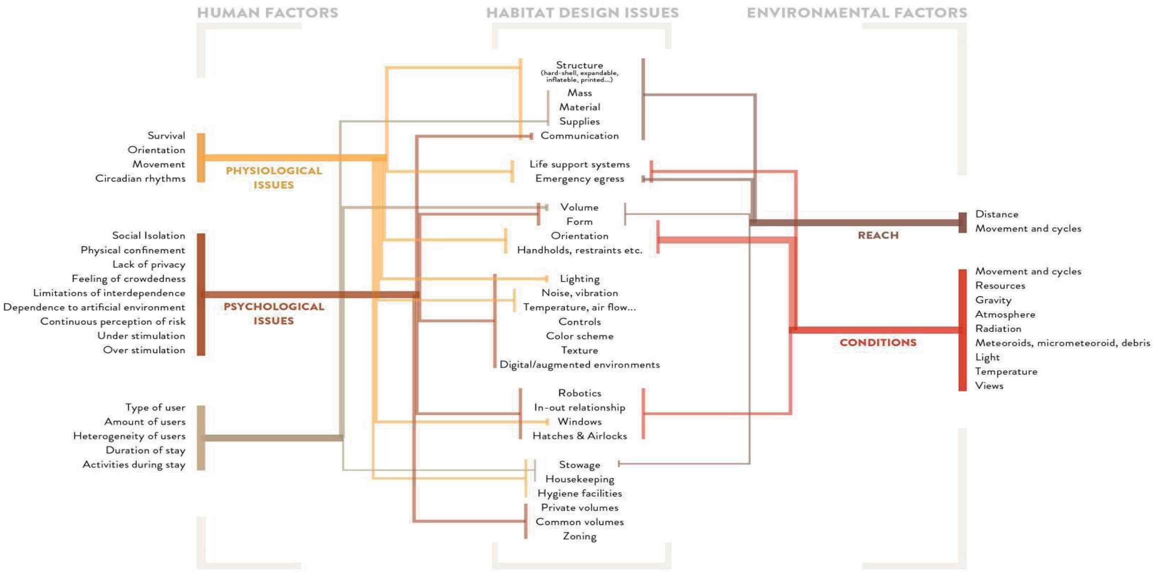

Figure 2: Space habitat design issues26

Design Process

The design of a Space habitat is not only shaped by the requirements of the product but depends on many "designing" issues addressing the design-making process and concerns regarding the capacities and capabilities of realization of the design. Communication capabilities with many disciplines that are involved in design-making become an issue; first, while addressing the requirements of the design, and then to satisfy the addressed requirements in the realized design. Technologies that are planned to be used in the realization of the design need to be proved. Furtherly, the high costs that are needed for the realization of the design lead the designer to address not only the requirements of the product but the values that could be used to support funding. The hardship and the uniqueness of the environmental conditions, added with the impracticality of the trial-error method,

26. Yeğen, E., 2019. *An Inquiry of Space Architecture: Design Considerations and Design Process*. M. Arch. METU.

substitute the need for experimenting the design in Earth conditions. Thus, the design should not only be responding to the constraints of the aimed environment but should be experimented with in Earth conditions to an extent. The issues and challenges of the design process, therefore, add design considerations. The problem definition extends its scope. The weight of these additional considerations might overcome the requirements and become more effective in the definition of the design.

Interdisciplinarity and the Role of the Architect

Through his well-known experiments that have been supported by many following studies, Lawson concludes that the thinking processes of architects and scientists differ.[27] In "Designerly Ways of Knowing," with respect to Lawson's experiments, Cross concludes that: "scientists problem-solve by analysis, whereas designers problem-solve by synthesis."[28] The different approaches and "mind-settings" of engineers and architects are often emphasized in the field of Space architecture. Hauplik and Bannova state that even the meaning of "design" differs among disciplines.[29] At that point, it is important to emphasize that "architecture" does not necessarily refer to the studies of architects through this paper, rather implies the definition and solution of the design problem of human habitation. Likewise, it might be argued that architectural thinking does not have to be in particular to architects.

Loewy, who defines their study on Skylab as the most challenging work of his life, describes their experience in the designing of Skylab as "educated intuition rather than anything else."[30] The lack of experience in the environment poses many challenges and induces comprehensive research upon many subjects, some of which are being discussed in the previous sections. The required knowledge base on the diverse fields results in the interdisciplinary collaboration of researchers, scientists, engineers, medical doctors, psychologists, industrial designers, architects, and artists, among others. The role and the effects of the contributing disciplines in different phases of the design are schematized by Hauplik and Bannova as in Figure 3.[31] However, it might be argued that the estimated weights of the disciplines are interchangeable and not stable. The roles of the many design actors might be defined regarding a specific project and might change for another. As it cannot be claimed a "conventional approach" has already appeared for the

27. Lawson, *How Designers Think*.
28. Cross, "Designerly Ways of Knowing."
29. Häuplik-Meusburger and Bannova, *Space Architecture Education for Engineers and Architects*, 12.
30. "Intetview with Raymond Loewy," n.d., https://youtu.be/fwKu1u7yhpM.
31. Häuplik-Meusburger and Bannova, *Space Architecture Education for Engineers and Architects*, 17.

field of Space architecture, architects' role might alter during the search of possible design approaches.

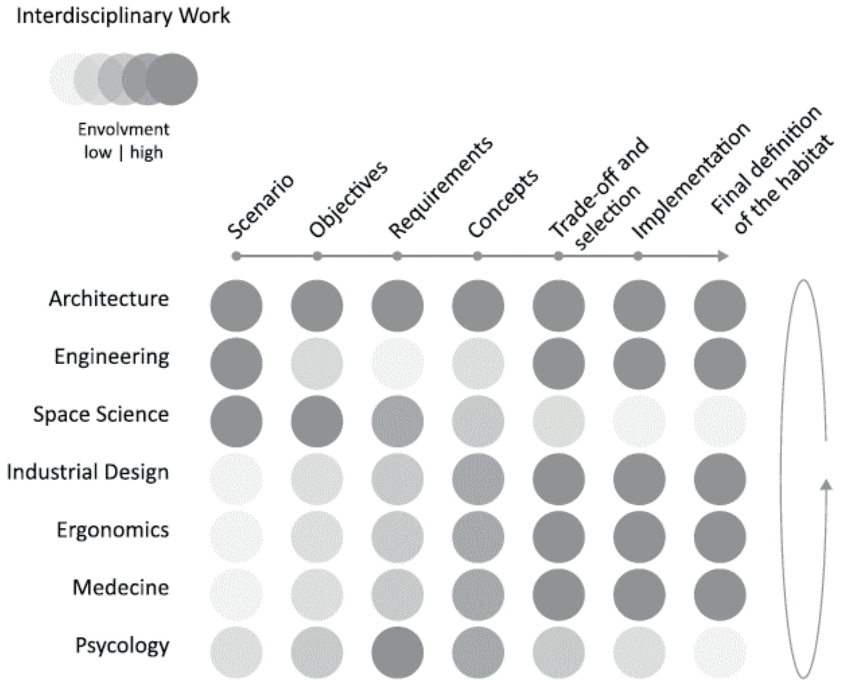

Figure 3: Involvement of disciplines in different design phases according to Hauplik and Bannova32

The aerospace industry is mostly dominated by engineering-based approaches and design methods, thus how much acceptance for architects in the industry might be questioned. Kriss Kennedy describes being an architect in NASA as a struggle due to "being an architect in an engineering environment." From his point of view, in NASA, engineers are the ones doing architecture, and architects are doing interior design. On the other hand, Brand Griffin, one of the first Space architects, draws attention to his current title being Senior Engineer (in NASA).[33] Griffin arrays some of the areas of contribution of practicing Space architects to human spaceflight as mission planning, vehicle integration, habitat design and human factors, and mostly design integration and concept development.[34] Griffin states that

32. Häuplik-Meusburger and Bannova, 17.
33. Ondrej Doule, "Interview: Brand Griffin," *The Orbit*, no. 1 (2016): 5–16.
34. Brand N. Griffin, "Space Architecture: The Role, Work and Aptitude," *AIAA SPACE 2014 Conference and Exposition*, no. August (2014): 1–14, https://doi.org/10.2514/6.2014-4404.

Space architects have to "sneak under the engineering tent masquerading" and have job titles including system architect, space system architect, configurator, subject matter expert, and systems engineer.[35] This masquerade can also be observed in the language of Space architecture. Marc Cohen describes his early experience in NASA while emphasizing the communication issues: "I had to learn how to talk to the engineering world because I was always one architect in a sea of engineers. That meant working to understand their language and what's important to them and how to communicate what I thought was important."[36] He suggests not mentioning the "looks" of a design, as it would possibly create a suspicion in the engineers, even if the choice has not made solely in respect to appearance. He suggests:[37]

> ... talk about the function, the structure, the mass, the cost, the viability, the safety and crew productivity... validate what you're doing empirically, if not quantitatively...

This approach is common in the field of Space architecture, as much as it is in Space psychology. For instance, due to the need for quantification of the design decisions, the need for human well-being is generally supported by evidence of potential hazards (psychological and psychiatric issues that could lead to mission failure) if human well-being is not provided. Furthermore, the choice of a human-centered design approach might be seen to be rationalized as: ". . . it is extremely complex and expensive to take a human being off the planet, and second, being there they have to optimally use the short time to fulfill the assigned tasks 100%. Therefore, this 'up-valuation' is not a question of comfort, but rather one of high mission priority."[38] Many examples might be provided with this approach or this language. On the other hand, the same Space architects might come across with an approach which might seem opposing at first glance, asking questions from another perspective, questioning the choice of providing minimum requirements, while supporting their articles with figures including artworks.[39]

It is not unusual to see the same architect's contribution to Space design all on technical issues, human-centered design, design methodology, and philosophical discussions. This variety in the understanding and questioning capability of the architects might be argued to put them in a position in which they may be able to manage and see a diversity of considerations of design at the same time. This role might resemble the traditional role of the architect as mostly referred to as an orchestrator. The main difference within the field of Space architecture is observed

35. Griffin.
36. "Interview with a Space Architect (Marc Cohen)," Boston Society of Architects, 2010, https://www.architects.org/news/interview-space-architect.
37. "Interview with a Space Architect (Marc Cohen)."
38. Häuplik-Meusburger, *Architecture for Astronauts*, xi.
39. Marc M. Cohen and Sandra Häuplik-Meusburger, "What Do We Give Up and Leave Behind?," in *45th International Conference on Environmental Systems* (Washington, DC, 2015).

to be the requirement of the knowledge base to accomplish such a role. Practitioners and researchers of the field commonly emphasize the relevance of architects to the field and suggest potentials that might be offered to the field by architectural thinking.

> On Earth, architects are the professionals who orchestrate the disciplines necessary to create coherent, built solutions that meet the needs of human use. Thus, to establish practical and noble habitable environments, space architects must master many subjects, and this will challenge historical traditions within both the architecture and space industries.[40]

> ... architectural thinking is comprehensive. Architects are equally comfortable with large scale planning as with detailing a cabinet joint. Within the space community, it is assumed that one person or a small group of people cannot do it all. Much is lost in organizational handoffs and distributed responsibilities. I have often thought that an architectural approach would benefit spacecraft design.[41]

To summarize, while the Space habitat design undeniably requires contributions by many disciplinary fields, architecture is not widely acknowledged as one of those fields in the aerospace industry. Even the long practicing Space architects with many contributions on the realized Space habitats might still be observed to spend some effort in discussing the relevance of the field of architecture to the aerospace industry, to tell the potential provisions of architecture, which are believed to be more than consulting on habitat designs. On the other hand, the attempt (or need) for rationalizing the design considerations is seen commonly. This attempt might be associated with the "struggle" of communication with the fields that are mostly able to quantitate their considerations.

Consequently, the realized and to be realized Space habitats' design approaches can be argued to be following conventionalized methods within the aerospace industry. With an intent to explore the potentials of alternative design approaches within the field, limitations of the research might be expanded to include habitat designs without the requirement of being already realized, while still considering realistic requirements. The proposals by SEArch+ team for NASA Centennial Challenge might be taken as such an example. The team argues:

> If for a moment, we were to equate these requirements... we offer ourselves the opportunity to challenge our conceptions of what an extraterrestrial habitat should be, one that is more than shelter alone.[42]

40. Howe and Sherwood, *Out of This World: The New Field of Space Architecture*, 4.
41. Doule, "Interview: Brand Griffin."
42. Morris, Michael, Christina Ciardullo, Kelsey Lents, Jeffrey Montes, Ostap Rudakevych, Masa Sono, Yuko Sono, and Melodie Yashar. "Mars Ice House: Using the Physics of Phase Change in 3D Printing a Habitat with H2O." In AIAA SPACE 2016. Reston, Virginia: American Institute of Aeronautics and Astronautics, 2016. https://doi.org/10.2514/6.2016-5528.

Based on their statement, it might be interpreted that the design approach of the team presents an attempt to evaluate the design considerations of Space habitat design in a manner that all design considerations being included from the initial decision-making phase, an attempt which might not be possible to see in the present-day aerospace industry. The SEArch+ team has been nominated for all design phases of the challenge amongst some of the technical phases.[43] The nominations were made to the teams that have fulfilled the main objectives of the challenge which were technology development focused. The nomination of the proposals of the team might be interpreted as the approval of satisfaction of the considerations regarding technical constraints. [44] As a result, it might be argued that such a holistic design approach equating the design considerations regarding human-centered design and the environmental conditioning, potentially lead to a result that might satisfy both ends for the Space habitat designs.

Conclusion

The study has started with the initial enthusiasm of finding methods and means of interdisciplinary collaboration, examining the interactions in between human and her/his environment, questioning the influence of built environment on humans, and as a result, exploring paths for addressing human needs by architectural design through Space architecture. This rather optimistic enthusiasm has been stimulated by the apparent potentials of the necessity of contribution by many disciplines in defining and solving the complex design problem of Space habitation, and the extensive research on human-environment interaction as a part of the attempts of defining this problem.

In reviewing the literature, it has been observed that the human – environment interaction is a very broad subject, referring to an excessive amount of interrelated aspects. It has been seen that the effect of – built, natural, or cyber – environment on humans is acknowledged by many. This acknowledgment might suggest that architecture is not only responsible for providing a functional and aesthetic built environment but should respond to many facets of its effects on humans. However, it is also observed that neither the means of these effects nor the human needs might be distinguished in a rationalized way – at least with the present-day knowledge. Yet, the literature includes increasing amounts of studies indicating that the

43. Data from: "NASA's Centennial Challenges: 3D-Printed Habitat Challenge"; "NASA's 3D-Printed Habitat Challenge - Phase 2"; "NASA's 3D-Printed Habitat Challenge - Phase 3"; "Structural Member Competition Rules"; Prater et al., "NASA's Centennial Challenge for 3D-Printed Habitat: Phase II Outcomes and Phase III Competition Overview."
44. Monsi Roman, "Personal Interview," 2019.

qualitative needs of human might become as equal importance to the needs that might be quantified. The hitherto human spaceflight experience seems to suggest the same.

As a consequence, the aerospace industry has long accepted the relevance of the field of architecture in designing Space habitats. Yet, the literature also demonstrates that the design considerations in the industry are not only shaped by the research on human-environment interaction, but the problem definition is also being made by an excessive amount of requirements and constraints needed to be taken into consideration, which is not necessarily in direct relation to the product requirements. It might be claimed that the problem definition is overwhelmed by such considerations. Relevantly, it is observed that the architects' contribution to the field could only be realized as long as it could be rationalized. In this context, it might be questioned if architecture can be "rationalized" when human-environment interaction cannot. The literature includes many examples in which the latter experience and research provide validation for the intuitive suggestions of architects and designers, most of which had been received with objection at first. In that manner, it might as well be argued that the "intuition" of the architect should be valued in the present day when supported by research, even if not yet rationalized. This is not a suggestion to imply disregarding the design considerations by any means.

At that point, few things might be needed to emphasize. First, the field of Space architecture is a newly emerging field and has not been fully established yet. It might be safe to assume that its establishment would be shaped by current studies and approaches. Second, the variety of the research area of architects and designers contributes within the field is noteworthy. The presence of them might be seen while discussing the meaning of human presence in Space, as well as in the production of highly technical concepts. They might collaborate on research with psychologists on the one end, and planetary geologists on the other. Throughout the thesis, "architecture" is used in a manner to refer the studies relevant to human habitation design with contributions by many fields. This is a deliberate choice induced by the acknowledgment of the necessity of evaluation of knowledge from various fields for designing for human habitation in Space. However, if the communication and understanding between those fields are failed to be achieved, it might not be expected to address all considerations of design. Yet, even the aerospace industry has accepted the relevance of the field of architecture, the acceptance of the holistic design approach that architecture might be able to provide does not seem to be recognized commonly.

The issue might become especially relevant in the present day, in which the only currently inhabited spacecraft is about to come to the end of its lifetime, while the plans for future inhabitance of Space are being evaluated with the initiatives of both public and private industries. The current situation might provide flexibility with the relief to a degree on the constraints, regarding the removal of the obligation of designing with already produced hardware and equipment. There might appear a brief timespan to let searching of alternative design approaches that might lead to the design solutions that are not eliminating or suppressing the habitat design issues regarding human well-being while still fulfilling the requirements regarding technical considerations. At that point, architects' one of the most beneficial contribution to the field might be their "designerly ways of knowing."

EXPLORING THE VISUAL MATERIALIZATION IN ARCHITECTURAL RESEARCH

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ABSTRACT

The integration of digital media technologies in architectural research practices is taking on a new significance in recent years. Along with easy access to the source of information that has been mostly digitized, new approaches and methods are being developed to process information in larger amounts. Regarding the information about architectural practices with their background themes and discourse, there are countless digital sources found in different mediums and one of them is the architectural award programs. In this context, this study utilizes the website of the Pritzker Architecture Prize – one of the most prestigious architectural award programs in the world – as a digital information source due to its potential for knowledge generation by using digital tools and techniques. There is a large amount of textual material engaged in this website, thus the aim of this paper is to explore the modes of materialization while developing a research method based on the discourse analysis of the texts. The main point here is to make the invisible information visible by producing visual materials named as "infographics" which represent the visualized form of knowledge created from the verbalized textual materials. The visual and the material are two concepts having a relationship with each other in which new modes and concerns can emerge from their intersection. This research basically practices how knowledge is produced and digitally materialized through visuality. Making visible by practice, process and computational methods of production are the key elements of this contemporary research. Consequently, the paper brings out three different modes of materialization in architecture and research during the process as 1) materializing of the design products and discourse 2) the website (of an architectural award program) as a digital communication material 3) visual materialization of the knowledge extracted from the website.

KEYWORDS

Website as an information source, information visualization, visual materialization, knowledge generation, digital tools

Introduction

The transformation of whole culture and knowledge into the digital environment opened up new challenges and opportunities, as well as new ways of doing research using digital materials and tools. Before the advent of the Internet and the digitization of cultural materials, textual forms were at the core of many disciplinary studies in the field of humanities. However, in the 21st century, text-based studies are often replaced by innovative expressions such as producing interactive visualizations, geospatial or conceptual maps, digital reconstructions, virtual simulations, network analysis graphics, and other kinds of visualizations created in digital platforms representing knowledge. With the emergence of new media technologies, we are experiencing a shift from the medium of print to the medium of digital. So, new methods and practices are being developed to process information and produce visualized forms of knowledge in digital mediums.

Developing new forms of contemporary research is explored through a very wide range of inquiry from large scale patterns to specified subjects. The cultural materials which include all kinds of data - texts, images, videos, etc. - are rapidly produced, stored, shared, and consumed through the World Wide Web (Burdick et al., 2012, p.37). In contrast to traditional humanities practices based on very limited data, today's digital technologies allow storing and analyzing millions of cultural records, therefore new concepts for the flow of human communication begin to appear at a macro scale (Burdick et al., 2012, p.38). Moreover, the sources of information are more accessible and available online than ever before, making it easy to collect huge numbers of research materials/data.

One of the available online sources of information is the websites. For the most part, the websites serve for many different purposes such as receiving news, advertisement, marketing, entertainment, shopping, etc. Indeed, they come to be known as new cultural media objects providing various materials of resources that can be easily used for research purposes and generation of knowledge.

The new media revolution is described by Manovich as "the shift of all of our culture to computer-mediated forms of production, distribution, and communication" and the consequence of this shift "affects all stages of communication, including acquisition, manipulating, storage and distribution; it also affects all types of media – text, still images, moving images, sound, and spatial constructions" (Manovich, 2001, p.43). Furthermore, with the use of computers, the ways in which the information or knowledge is created, recorded, stored, and distributed have been taken new forms, new interfaces, and new design activities.

Within this context, this study practices a research method having its source in websites and utilizes the website of the Pritzker Architecture Prize – one of the most prestigious architectural award programs in the world. Exploring the potential of the website, visualizing the discourse, reviewing the changing values, and producing knowledge through conceptual mapping by use of digital tools are the main objectives of this research.

While developing the method, the process reveals different modes of materialization in architecture and research, and this paper focuses on the visual dimension of materiality through research. Making visible by practice, process and computational methods of production are the key elements of this contemporary research.

Visualizing the Discourse of Pritzker

"Graphics of all kinds have become the predominant mode of constructing and presenting information and experience" (Drucker, 2014) and there are many ways of producing visual materials having different expressive forms. Most of the graphics only present the facts expressing quantitative and statistical information. However, this study approaches the act of visualizing as a process of knowledge generation. Visualization is more than illustrating something, it has many ingredients like means of production or acts of interpretation in which the process requires creative, qualitative, and design-based activities to construct an argument in visual forms. One of the main points during the visualization process of the study is to explore the invisible information and make it visible with the application of computational tools and concepts of digital humanities.

The visualization refers to as illustrating "data through processes of aggregation and distillation" in the digital humanities and it "takes several different forms, all of which are arguments in themselves and must be evaluated in terms of the rhetoric of information design and display" (Burdick et al., 2012, p.43).

As mentioned in the introduction part, the source of data is the website of the Pritzker Prize. The website of the prize has very qualified content that embodies valuable and comprehensive information. It is a rich source having a potential to be explored. The study focuses on the entire period and the most efficient way to examine the entire discourse is performed through mapping and visualizing the information engaged in the website. As the information is mostly conveyed through texts, the main task is to visualize the verbal/textual content and to create interactive maps named as infographics. Producing infographics is based on the strategies of how to acquire, structure, classify, and finally visualize the collected data.

In brief, the Pritzker Architecture Prize, which was established in 1979, is one of the most prestigious prizes in the world, reflecting the most outstanding architecture/architects of the world. The prize is granted annually to a living architect/s in recognition of achievement. It is more than forty years old by now with a well-established respectful position, arousing the public interest and valued by the architectural media. The main goals of the prize are identified as "to recognize excellence; raise public awareness about the field; and encourage other architects to achieve high standards" (Peltason & Ong Yan, 2017).

The website each year publishes the jury citations, announcement reports, ceremony acceptance speeches of the laureates, ceremony speeches of the jury chairs, some critical essays about the prize winners, their biographies, and selected works. The jury citations particularly both describe "the important characteristics of the laureate's architecture" and also "highlights the design intentions of the laureates and places the prize within the broader context of architecture" (Peltason & Ong Yan, 2017). Furthermore, the highlighted qualities of the laureate's architecture have the potential to reflect the traces of their period, outstanding considerations/themes and priorities emerged due to the global changes.

Apart from the website, the study first reviews the most frequently discussed and highlighted architectural themes/paradigms of the last forty years in order to understand the prize within the framework of certain concepts. These primary themes – including their sub-categories – are as follows:

- Body and Senses: Aesthetic/Color/Poetic/Sensorial/Tectonic
- Ecology: Environment/Recycled Materials/Sustainability
- Ethics: Economic/Humanistic/Social
- History: Culture/History/Tradition
- Innovation
- Place: Climate/Context/Local/Nature/Site/Urban Contextualism
- Technology: Material Techniques/Digitalization

This review gives us the chance to explore the reflections of these themes through the awarding criteria of the prize winners and the rationalities behind the selections. Visualizing the discourse of Pritzker through a parallel classification provides an understanding of the thematic distributions over the years and the paradigm shifts.

Methods and Tools

The first phase of the study is the processing of the textual data which involves both distant reading and close reading techniques.

Firstly, the textual materials found on the website are examined through a method called "distant reading" which is a new way of creating meaning from a corpus of texts without reading them at all by using computer technology (Burdick et al., 2012, p.39). This approach is practiced upon the jury citation texts of the Pritzker by generating word clouds as a graphical representation of the most frequent words. The produced word clouds for each citation reflect the conceptual keywords related to the qualities of the laureate's architecture, as exemplified for the jury citation text of Wang Shu who is the 2012 Pritzker laureate (see Image 1). The keywords of conceptual qualities picked up from Wang Shu's word cloud are history, tradition, rooted, past, cultural, context, place, urbanization, environment, construction, recycled, materials, timeless, universal, and unique.

This method constructs a new visual language in which the texts disappear, and the emphasized words become visible. During this experimental study, one can ask some questions about the dominant words such as; what underlying conceptual thoughts give cause for these words appearing as the leading ones? These kinds of emerging research questions are part of the process and these questions find answers in the next step with the close reading technique.

Following the distant reading, the process continues with a deeper discourse analysis of the texts, which is the text mapping strategy for a better understanding of the textual content. Before reading closely and filtering the required data, the texts are divided into four categories according to the author's differentiation. Then, the study concentrates on the filtering process of information for each individual text, as exemplified in the following statement of the jury:

> "The architecture of the 2012 Pritzker Prize Laureate Wang Shu opens new horizons while at the same time *resonates with place and memory*. His buildings have the *unique ability to evoke the past*, without making direct references to history. Born in 1963 and educated in China, Wang Shu's architecture is exemplary in its *strong sense of cultural continuity* and *re-invigorated tradition*. In works undertaken by the office, he founded with his partner and wife Lu Wenyu, Amateur Architecture Studio, the past is literally given new life as the relationship between past and present is explored. The question of the proper relation of the present to the past is particularly timely, for the recent process of urbanization in China invites debate as to whether architecture should be anchored in tradition or should look only toward the future. As with any great architecture, Wang Shu´s work is able to transcend that debate, producing an architecture that is timeless, *deeply rooted in its context* and yet universal".

After exploring the entire content of the website, all the underlined qualities are listed in structured tabular data (see Image 2) and classified with respect to the architectural themes which was reviewed at the beginning of the study.

The last phase is the process of visualizing the tabular data, by using an interactive data visualization tool named Tableau Public. The process of representing data in a visual and meaningful form with an efficient and effective manner is practiced through creating infographics that allow the user to interact and explore the information by the manipulation of visual objects.

By identifying the featured qualities of laureate's architecture and defining their relations with the architectural themes, the study explores its own unique way of generating knowledge. Thus, these techniques and tools – distant and close reading, text mapping, classifying, data visualization – all contribute to extracting meaning and assessment from the materials involved in the website of the prize.

Infographics

The infographics basically represent the re-materialization of the discourse through visuality and interactivity. Constructing interactive maps is a creative and explorative process, in which the end products are discursive and interpretative. Each user can discover a different path with his/her own perception and has a chance to participate in the presentation. Interactivity allows the user a conversational and informative medium where it makes the relations more visible and practically perceivable when compared with fixed presentations.

One essential point here is that in the digital world it is not readable enough when these interactive maps are presented in the printed medium. Since they are not fixed images, the infographics might display missing information where it is only possible to read the knowledge in their own digital medium. As a solution, a connection through "QR Code" is offered which allows establishing a hyperlink between the digital background and the printed version. The hyperlink provides continuity through the discourse and serves as new rhetoric of media for the sustainability of the argument.

Once the data is collected and organized, it is possible to produce numerous infographics, which might be mentioned as the final outputs of the process. For instance, the infographic named as TEXT-2 (see Image 3) which is one of the four categories of the texts, displays the highlighted qualities worded by the jury both in their citations and speeches with relation to the architectural themes. There are also other text categories visualized as announcement texts, critical essay texts, and the ceremony acceptance speech texts of the laureates[2]. Apart from texts, the selected works of the architects are mapped which as well is another infographic visualizing the locational information of their built works on a geographical world map (see Image 4).

This kind of informational visualizations not only reveal the "rhetoric of clarity, precision, and fact" but also, they might be used as interpretative tools constructing visual arguments and illustrating new findings or distillations (Burdick et al., 2012, p.43).

Accordingly, the infographics produced from the discourse both reflect the existing facts of the thematic movements/distributions and bring out the paradigm shifts making a critical assessment possible for each theme individually[3] (see Image 5). They are relational and communicational maps that are open to further discussions about changing priorities and values which might have an impact on shaping the awarding considerations of the prize. Besides, the research methodology that has been developed for this study exposes multiple challenges, possibilities, and expansions while materializing an expressive visual interaction with the information.

Modes of Materialization

Visuality and materiality are two concepts having a relationship with each other in which new modes and concerns can emerge from their intersection. "How things are made visible" is the key question of this constitution. Thus, a focus on practice, process, and interpretation is observed within the theoretical approaches towards these two notions. As stated by Rose "*Visuality/Materiality* is an emergent orientation of research practice that is inevitably critical and constantly reflexive of the power play between representation, text, practice, and technologies of production, display, and performance" (Rose, 2012, p.3). This approach conceptualizes the visual as an embodied/materialized object that becomes meaningful through theory, method, and practice.

In the research, the visual and the material have a relational and continuous dialogue. A retrospective review of the entire research process confirms that the research keeps in touch with three different modes of materialization related to visuality.

The first mode is related to architectural award programs which play a significant role in presenting a large collection of materials - both visually and discursively – based on the most outstanding architectural practices in the world. In this respect, the recognition of the architects by the Pritzker also serves for the production of a new discourse through the realized design products of the prize winners which is the initial data. What is mapped and visualized in the research is this "already-materialized" information collected from web content.

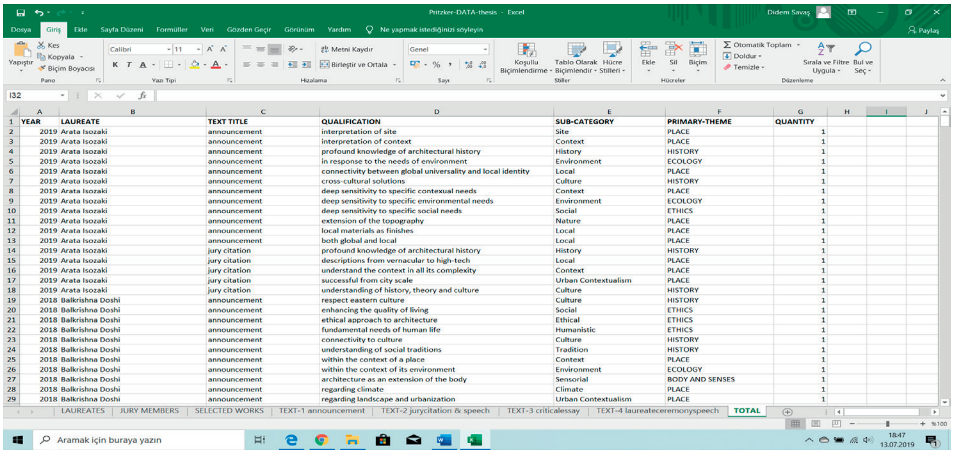
The second mode is experienced while pursuing a continuous interaction with the website throughout the study. Websites function as mediating tools establishing visual communication between the user and the information. As we all know, with the growth of digital media, the ways we interact with the information are re-defined and it is the form of the interface that shapes the user's involvement. The digital products are new media artworks so "it is the work's interface that creates its unique materiality and the unique user experience" (Manovich, 2001, p.78). However, in computer culture, it is also possible to create different interfaces by using the same content because "content is assumed to exist before its material expression" (Manovich, 2001, p.77). The research practices this approach by converting the collected data/content into a more dynamic visual form representing knowledge and explores the implications of digital mediation.

How the information is visualized by the use of digital technologies is the third mode of materialization. Making the overall discourse visible through conceptual mapping is essentially the visual materialization of the knowledge extracted from the textual content (see Image 6). Exploring different perspectives in each infographic demonstrates how conceptual mapping contributes to diverse forms of knowledge production.

These multiple modes reveal the performative materiality of digital artifacts. "Performative materiality emphasizes the production of work as an interpretative event" (Drucker, 2013). In conclusion, each digital re-production introduces a new extension and has the potential to generate an argument from the preexisting content.

IMAGES, CHARTS OR GRAPHIC LEGENDS

Image 1: Word Cloud of jury citation text of Wang Shu, 2012 Pritzker Prize Laureate.



YEAR	LAUREATE	TEXT TITLE	QUALIFICATION	SUB-CATEGORY	PRIMARY-THEME	QUANTITY
2019	Arata Isozaki	announcement	interpretation of site	Site	PLACE	1
2019	Arata Isozaki	announcement	interpretation of context	Context	PLACE	1
2019	Arata Isozaki	announcement	profound knowledge of architectural history	History	HISTORY	1
2019	Arata Isozaki	announcement	in response to the needs of environment	Environment	ECOLOGY	1
2019	Arata Isozaki	announcement	connectivity between global universality and local identity	Local	PLACE	1
2019	Arata Isozaki	announcement	cross-cultural solutions	Culture	HISTORY	1
2019	Arata Isozaki	announcement	deep sensitivity to specific contexual needs	Context	PLACE	1
2019	Arata Isozaki	announcement	deep sensitivity to specific environmental needs	Environment	ECOLOGY	1
2019	Arata Isozaki	announcement	deep sensitivity to specific social needs	Social	ETHICS	1
2019	Arata Isozaki	announcement	extension of the topography	Nature	PLACE	1
2019	Arata Isozaki	announcement	local materials as finishes	Local	PLACE	1
2019	Arata Isozaki	announcement	both global and local	Local	PLACE	1
2019	Arata Isozaki	jury citation	profound knowledge of architectural history	History	HISTORY	1
2019	Arata Isozaki	jury citation	descriptions from vernacular to high-tech	Local	PLACE	1
2019	Arata Isozaki	jury citation	understand the context in all its complexity	Context	PLACE	1
2019	Arata Isozaki	jury citation	successful from city scale	Urban Contextualism	PLACE	1
2019	Arata Isozaki	jury citation	understanding of history, theory and culture	Culture	HISTORY	1
2018	Balkrishna Doshi	announcement	respect eastern culture	Culture	HISTORY	1
2018	Balkrishna Doshi	announcement	enhancing the quality of living	Social	ETHICS	1
2018	Balkrishna Doshi	announcement	ethical approach to architecture	Ethical	ETHICS	1
2018	Balkrishna Doshi	announcement	fundamental needs of human life	Humanistic	ETHICS	1
2018	Balkrishna Doshi	announcement	connectivity to culture	Culture	HISTORY	1
2018	Balkrishna Doshi	announcement	understanding of social traditions	Tradition	HISTORY	1
2018	Balkrishna Doshi	announcement	within the context of a place	Context	PLACE	1
2018	Balkrishna Doshi	announcement	within the context of its environment	Environment	ECOLOGY	1
2018	Balkrishna Doshi	announcement	architecture as an extension of the body	Sensorial	BODY AND SENSES	1
2018	Balkrishna Doshi	announcement	regarding climate	Climate	PLACE	1
2018	Balkrishna Doshi	announcement	regarding landscape and urbanization	Urban Contextualism	PLACE	1

Image 2: Partial dataset from the total structured tabular data.

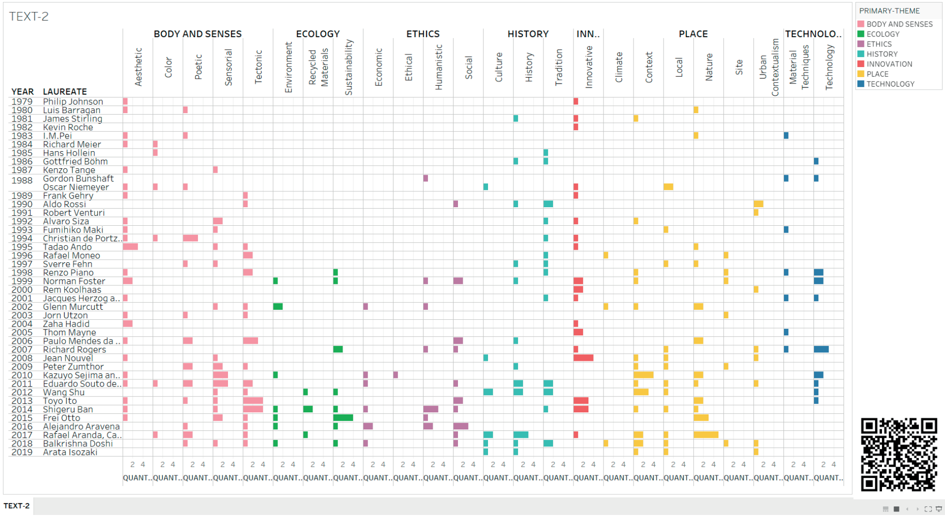


Image 3: The highlighted themes with respect to jury citation & jury speech texts (Text category-2) of Pritzker.

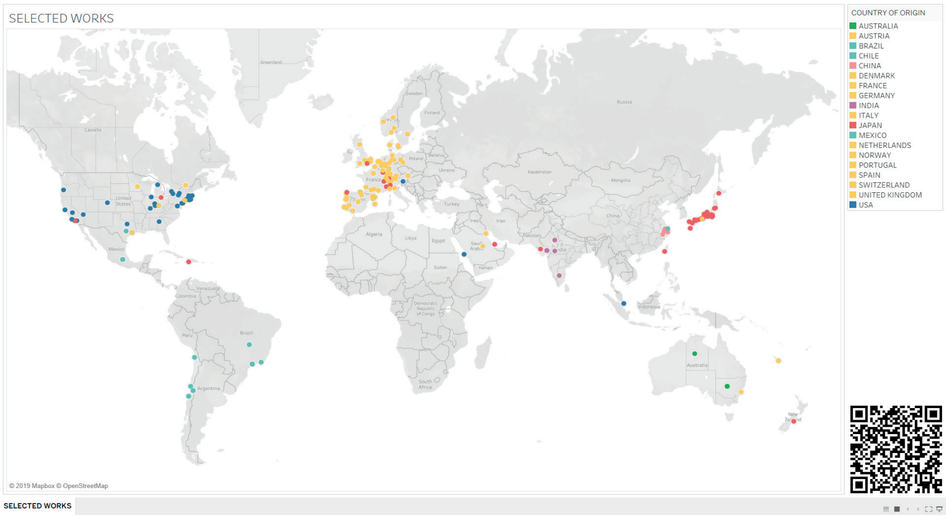


Image 4: Mapping of the selected works of the Pritzker Prize laureates based on their geographical locations.

Image 5: The distribution of the theme "PLACE" in relation to the laureates' architecture.

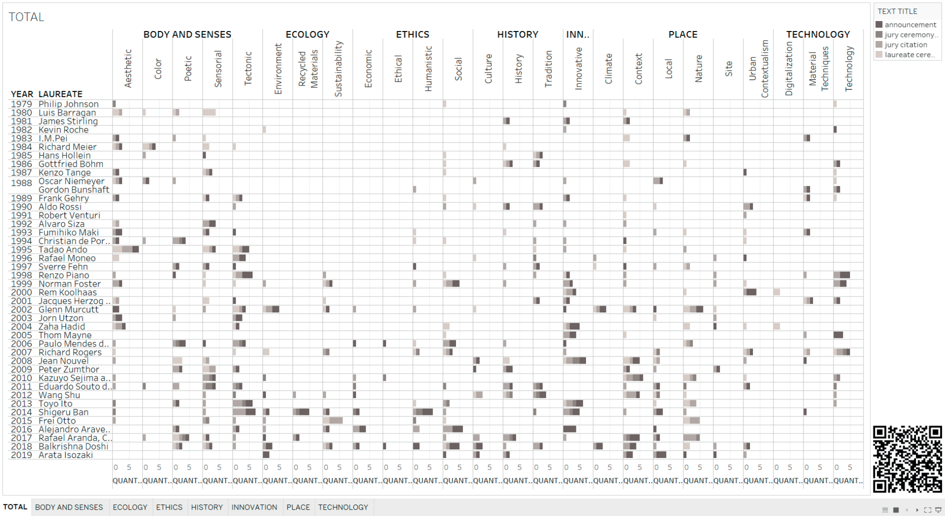


Image 6: Total distribution of the highlighted themes with respect to the sum of the texts (all text categories) of Pritzker

NOTES

1. The method practiced in this paper has been developed for the thesis study of the author for the degree of master of architecture, which is named as "Reviewing the Changes of Architectural Sensibilities within the Scope of Pritzker Architecture Prize", supervised by Prof. Dr. T. Nur Çağlar and studied at TOBB University of Economics and Technology Graduate School of Natural and Applied Sciences in 2019.
2. The infographics taking place in this paper are selected as samples. For all the rest, please refer to the thesis study of the author.
3. The interpretation of the reflections of each architectural theme individually to the awarding considerations of the prize is discussed in the thesis study as a separate chapter.

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CHAPTER III

energy
building
consumption
techniques
passive
heritage
ventilation
tools
cities
traditional
comfort
environment
adaptive
climate
efficiency
city
air
renewable
performance
development
materials
quality
generation
simulation
reducing

INTRODUCTION

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The innovation in the cities' context is promoting cooperation among built and natural environments aiming at boosting energy efficiency and reduction of environmental impacts related to the construction sector. The indoor space, such as the semi-open space has to be connected with the outdoor and the natural flows that affect the energy balance of the constructions to assure users' comfort and energy saving. The challenges underlying the European Green Deal and the C40 initiatives are requiring the adoption of the nearly Zero Energy framework and the use of passive strategies and active technologies to optimize the building behavior and produce green energy for the new and refurbished structures. The energy simulation strategies have to be tested by energy simulation procedures supported by BES (building energy simulation) to provide consistent and effectual predictive models enabling conscious decision processes of designers and owners. In fact, the performance gap, which afflicts the predictive models compared to actual buildings' energy performance is responsible for countless failures in achieving a real NZEB goal and specific KPIs (Key Performance Indicators) are required to investigate and monitor the actual performance during the life cycle. It is thus crucial to understand and simulate natural phenomena (e.g., solar radiation, wind direction, and speed, etc.) and their relationship with building materiality to propose correct strategies for energy efficiency and calibrate the predictive models to identify possible improvements over time related to the actual use and changing in time users' preferences. The time adaptation and the durability of the intrinsic materiality are fundamental features of the built environment that can be concerned by the design re-contextualization of components that enables local creativity and innovation in the urban organization. The designers and academics are called by the municipalities to collaborate for a better future of our cities to guarantee an empowering user experience and endorsing new living models including the community perspective that sustains a resilient and circular urban development.

A Strategy for Designing Semi-Open Spaces: Using Building Energy Simulation (BES) Software as a Feedback Tool

Mustafa Veli Yönder, Gizem Elbiz

Designing and analyzing semi-open spaces that include multi-dimensional problems and multiple independent parameters, as well as iterative phases that have a complicated role, are an essential part of this process. In the initial steps of architectural design, certain inputs are expected to help solve the problems that the architect remains alone. In addition to assisting design decisions, these inputs also enable the building to be enriched with comprehensive datasets. Furthermore, these data obtained through building energy simulation (BES) tools include the actions necessary to construct the character of the building and the emergence of different variations. The relation of the building with the sunlight performance according to the location of the building was examined through the case study. Performance tests are used in a wide range of projects from pre-design to finished project types. Focusing on rational inputs rather than trial-and-error methods provides convenience for the designer, but also results in increased product/design efficiency. The aim of this study is to understand strategies for creating the most suitable semi-open space design types within the framework of daylight and wind analyzes for the users of the İzmir Institute of Technology (IZTECH) Faculty of Architecture. Composing new models on the feedback from the analysis and establishing the relationship between them is another objective of this study. In the methodology section, the current state of the environment (location of buildings, trees, etc.) was formed in a digital platform to form a basis for suggestion models. Proposed models were divided into groups based on physical parameters. In total, these analyses were performed on different computer-generated models. Simulations and analyses were obtained to understand and redefine the relationship of the designed semi-open space with the main wind. In conclusion, the proposals obtained were scored according to a certain system, and the most suitable model was selected carefully. Furthermore, the comparative discussion examined the advantages and disadvantages of the feedback design process on the sample discussed.

Technology and Design for a Carbon Neutral Building in the framework of the C40 Reinventing Cities International contest challenges

Lavinia Chiara Tagliabue, Lorenzo Consalez

LO-DO project involves and synergistically relates all objectives included in the call of the C40 Reinventing Cities International contest. The contest is

based on 10 ecological and efficiency in the built construction sector challenges that will be a future direction for the new regeneration projects in the cities. The proposed project to critical urban issues and road conditions in the intervention area, located in the city of Milan, Italy, aims at diversifying the functions to promote new lifestyle models inside the designed building. The building is required to be carbon neutral and the project proposes an nZEB building-system with a carbon-neutral balance and the construction of a resilient community. The new building becomes a catalyst for activities connected with the services located in the context, providing a dynamic and adaptive container with respect to both urban and private aspects. The residential spaces maximize the internal quality and flexibility for the users, considering the building life cycle and users' variable needs during the lifespan. The user comfort, one of the project core topics, is combined with energy efficiency, including the Behavioral Design concept, which goes beyond building standard evaluation, considering the weight of occupancy variation on the associated energy consumption. The principle of the intelligent city in which connected buildings become elements that produce energy and opportunities for the local community translates itself into a project vision that uses digital technologies to control the efficiency in the design phase, building management, and community development. KPIs (Key Performance Indicators) are identified to perform a building monitoring of the actual performance during the life cycle, to calibrate energy consumption predictive models, and to identify possible improvements over time related to the actual use and users' preferences from a UCD (User centered Design) perspective.

Using Solar Systems for Energy Autonomy in Heritage Buildings

Gizem Nur Aydemir, Soofia Tahira, Elias Ozkan

Vast amounts of energy were being used up in the built environment; therefore, buildings can play an important role in reducing the consumption as well as in the production of energy; one way forward would be to alter existing buildings in a way that they can contribute to the solution. To improve the energy performances of existing buildings, there are several ways. Renewable energy production, which is one of the most effective ways among these strategies, has gained more importance, after the oil crises, to create an alternative way of obtaining energy. The purpose of integrating renewable energy technologies in buildings is to harvest energy in situ and achieve energy autonomy by reducing grid dependency, as well as to produce clean energy with minimal greenhouse gas emissions. Among all the renewable energy generation systems, solar systems are more advantageous than others when it comes to applicability in existing buildings. As rising demand for alternative energy generation, numerous standards, and legislation were developed around the world for energy retrofitting of the existing building stock, which also includes heritage buildings. Nevertheless, in the case of heritage buildings, these accepted standards and legislation are not easy to implement due to their special architectural, cultural, and historical qualities. Aside from the fact that clear guidelines for retrofitting heritage buildings have not yet been established, the interest in both research and practice enhancing the energy efficiency of heritage buildings is increasing. This paper will examine active design strategies focusing on solar energy generation systems, which can be integrated into heritage buildings without defacing them. Additionally, with the help of case studies from France, Germany, Italy, and the United Kingdom (UK), which have integrated renewable energy production systems into heritage buildings, solar energy generation methods and their effects on these heritage buildings will be discussed.

Simulating Passive Ventilation Techniques by Using Different Software

Burak Dönmez, Soofia Tahira Elias-Ozkan

The ever-increasing negative impacts of the global warming phenomenon on nature, the environment, and people can no longer be ignored (Parry et al, 2007). While an important factor causing this increase is the increasing amount of energy consumption and the associated greenhouse gas (GHG) emissions. One of the sources for this increase in energy consumption in the world is the building sector, where construction, operation, and maintenance activities account for approximately 40% of the energy demand, and 45% of the global carbon emission (Calautit et al, 2016). On the other hand, the energy demand for heating, ventilation, and air conditioning (HVAC) systems, which are a part of the building operation activities, is more than 40% of the total energy usage (Chenari et al, 2016). This situation is aggravated further in regions with extreme climates, because of the need to provide thermal comfort to the occupants; i.e. heating in cold climates and air conditioning (AC) in hot climates. Since in such climates people spend most of their time in conditioned spaces, their indoor air quality (IAQ) and energy consumption are both important for human health and for the current energy problem. Consequently, indoor air quality, thermal comfort, occupant behavior, and the building's energy performance have a direct relationship with its energy consumption (Li, 2013). A study into traditional buildings reveals that passive solutions for providing thermal comfort are quite successful in reducing or even doing away with the need for energy consumption. For example, in hot climates, traditional/natural ventilation techniques are useful in reducing cooling loads in buildings, while providing healthier IAQ, concurrently. However, if the most appropriate technique/ technology is not selected, its application can be quite costly. On the other hand, it is possible to simulate the various options on a virtual model of the proposed building by using related software. Hence, this study begins with the investigation of traditional passive ventilation techniques, which have been used since ancient times; such as solar chimneys, wind catchers, underground air passages, and atria. Simulating these passive strategies is a complex exercise using computational fluid dynamics (CFD); therefore, building 2 simulation strategies that can be used for evaluating the aforementioned passive ventilation techniques virtually, will be studied. To this end, a general overview of the problems encountered in CFD based energy simulations will be investigated; and case studies on the application of traditional passive ventilation techniques through various software will be examined. The aim of this research is to determine and select the most efficient methods and techniques for both passive ventilation and simulation of their applications, through a review of the related literature. It is expected that this study will be helpful in conducting future research on the feasibility of adapting traditional architectural techniques that require less cooling/ heating energy for providing thermal comfort, even when they are located in extreme climates. In conclusion, this study examines the benefits of traditional passive ventilation techniques and their adaptation into current architecture by using energy simulation software for predicting the most appropriate solution.

CLIMATE-ADAPTIVE MATERIALITY

Re-contextualizing design components as tools for local creativity and innovation.

Alessia Leuzzo, Consuelo Nava, Giuseppina Irene Curulli

In this article, materiality is meant in two ways: tools and materials that designers can use to work on the built environment. Among tools, instruments of policy and physical elements can be counted respectively as directive and practical components. The instruments of policy are tools for the design of the process (plans, strategies, tactics), the physical elements are tools for the design of the project, in terms of technological products. Materials are materic uses. The built environment is a complex system that has to respond to different situations with its materials. Under climate change conditions it is asked to be ready not only for emergencies but in the everyday life. The article will focus on water-related problems and on possible climate-adaptive approaches locally developed. Sea rising level, flash floods, lack of water during always longer periods of drought are situations to tackle in order to reach a good quality of everyday life in cities. As we know the C40 cities are working on that. Applying general innovative climate-adaptive components would not lead to innovative development if they don't meet the local requirements and uses, by being re-contextualized. Furthermore, agile and circular cities require to respond with the availability of resources/materials coming from upcycling processes with high permeability requirements. The aim of this paper is to show a variety of materialities, representing tools for a water-climate adaptive and design-driven development, that are drawn from Dutch cities. The environmental programs of these cities are both representative of Dutch water-related strategies in urban contexts and differentiate in the choice of tools according to specific themes characterizing each city (heritage, public space, ...). Amsterdam will be the study case. The test area for the re-contextualization of these materialities will be the city of Reggio Calabria, in the South of Italy. This city lacks a climate-adaptive strategy/program and is characterized by uncontrolled urban development. This paper will show possible solutions where materialities can apply through a local-creative approach.

A STRATEGY FOR DESIGNING SEMI-OPEN SPACES: USING BUILDING ENERGY SIMULATION (BES) SOFTWARE AS A FEEDBACK TOOL

Mustafa Veli Yönder, Gizem Elbiz
Izmir Institute of Technology, Izmir, Turkey

ABSTRACT

Designing and analyzing semi-open spaces essentially entail multi-dimensional problems based on multiple independent parameters and count on iterative phases. During the initial phase of an architectural design, architects need to analyze and make apt decisions in order to achieve good results. Thus, one way of approaching this problem is using a series of comprehensive datasets created for various factors affecting the building in the decision-making process. Among many, data obtained thru building energy simulation (BES) tools encompass the actions necessary to construct the character of the building and search for different variations. In brief, focusing on rational inputs rather than trial-and-error methods not only provides convenience for the designer but also results in increased product/design efficiency. Ergo, performance tests are used in a wide range of projects from pre-design to finished project types. In this respect, this case study was contemplated to solicit the location-based sunlight and wind analyzes in a building block located in the İzmir Institute of Technology (IZTECH) Faculty of Architecture in order to understand the benefits of such strategies in proposing semi-open space design solutions. The methodology section commenced with the digital modeling of the as-built environment (location of buildings, terrain, etc.) which also serves as the basis for the proposed solutions. Later, datasets were created thru the analysis of several physical parameters such as sun position, shading time, wind flow on computer-generated models. Hereby, simulations and analyses proved their use in understanding and redefining the relationship of the designed semi-open space under the prevailing wind. Considering these datasets, several models were proposed. In conclusion, the design proposals were evaluated against selective criteria in order to identify the optimum proposals. The pros and cons of the feedback design process in this case study were also discussed thoroughly.

KEYWORDS

Building simulation tools, sun and shade analysis, wind tunnel testing, design feedback

Introduction

The virtual building design process involves a set of steps that strive to find rational solutions to building performance problems of interest. However, this process, which in its own merits requires multidimensional and sophisticated thinking, needs quantitative data to draw sound reasoning. The collocation of digital modeling and virtual analysis has been an effective method of identifying and solving such architectural, mechanical, and civil engineering problems in a building (Hensen, 2004). Addedly, Wang and Zhai (2016) emphasize the frequent and succeeding utilization of computer simulation tools for many decades in building design, optimization, construction, operation, and research. Managing these procedures holistically and making influential decisions based on discernable data help designers to overcome design problems in a more robust and scientific rather than intuitive manner. Early adoption of these performance simulations in the design stage provides flexibility in generating design alternatives (Negendahl, 2015). Supportingly, Moon et al. (2011) avow the importance of testing building models with energy analysis tools in the early design stage. Congruently, Attia et al. (2012) emphasize the importance of building performance simulation (BPS) tools in supporting the design decision-making process in the case of energy-efficient buildings. At this point, simulations can be extended from an individual building analysis to buildings blocks.

The analysis of the as-built environment in terms of physical inputs presents an undoubted opportunity to articulate the advantages, weaknesses, potentials and opportunities of the building within an analytical setting. Daylight simulation, shade analysis, and wind tests are the building performance digital test tools that analyze environmental factors affecting both individual buildings and the city layout. For instance, the shade analysis is as equally important as the daylight model given the fact that the shade duration and area impact design decisions greatly, particularly in assessing the efficient use of open and semi-open spaces throughout the year. Similarly, the wind flow, being another element of environmental data, has an effective function especially in the design of not only multi-story buildings but also detached buildings. Today, wind direction, speed, air density, and intensity of the wind can be modeled with computer-generated simulation tools. Especially with the introduction of virtual wind tunnel modeling, it has been possible to observe the behavior of the building under dissimilar wind loads. These multiple analyses provide valuable information for the designers in creating sustainable spaces.

Understanding the energy consumption of buildings is the main concern for creating a sustainable environment (Pérez-Lombard et al., 2008) and mitigating the high carbon emission foot-print of a building. Hence, examining energy analysis of the building and the as-built environment have a profound effect. Energy consumptions of the buildings in an individual or group setting can be predicted through building energy simulation (BES) tools, and necessary interventions are carried out in the frame of sustainability. Anderson et al. (2015) assert that the built environment is the dominant contributor to high energy consumption and increased greenhouse gas emissions. Thus, incorporating BES tools for generating data in the early design phase remains very crucial to respond to such design challenges. In this study, the as-built conditions and the proposed models of semi-open spaces were examined to microclimate properties. Especially, daylight position, shadow area and durations, and wind flow were among the parameters that are looked at within the simulation tools. As a methodology, it was aimed to analyze the current situation and develop suggestive models accordingly. At this point, feedbacks obtained from the simulations triggered a cycle of revisions and reanalysis till an optimum design solution presented itself.

Understanding Architectural Character of Semi-Outdoor Spaces

Semi-open spaces are known for their social, spatial, and architectural functions in buildings within hot-humid zones (Zhang et al., 2018). Furthermore, these exclusive spaces with a rich variety of typology offer architects the opportunity to alleviate intense outdoor air temperatures. Its response to outdoor temperature and wind help ameliorate user comfort and ease their daily routines. Rightfully, the semi-outdoor spaces in one way or the other have been extensively used throughout history (Sozen and Gedik, 2007) and carried over to contemporary projects. In a broad sense, these unique spaces characteristically help enrich the spatial experience and serves as an integrative element between buildings. Creating dramatic space ambiance is also possible thru the interaction of indoor and outdoor spaces between building groups. While meeting user requirements are of priority in designing such spaces, the sustainability criteria are irrefutably important and need to be examined in terms of adaptation to climatic conditions. According to Philokyprou et al. (2018), the Mediterranean climate and its peculiar way of life enable residents to enjoy semi-open spaces for longer periods throughout the day. Similarly, climatic conditions in Izmir and its vicinity (i.e. Urla, Çeşme, and Foça) have allowed usage of semi-open spaces in residential to commercial structures along the coastline. From a microclimate stand-point, semi-open areas are known to regulate solar heating of spaces (Malaktou et al., 2016) and ease adaptation to the outdoor temperature. All in all, semi-open space design should be investigated in terms of thermal comfort, airflow, and sunlight control from a sustainability standpoint.

Creative Process and Working with Feedbacks

In the architectural design procedure, the weight of complex and creative systems cannot be denied. Nevertheless, it is possible to develop analytic responses to these specific problems with today's digital tools. Hereby, feedback cycles play a great deal in improving the final design as they support the overall design process from inception to delivery. The designers may benefit from this holistic approach where iterative feedbacks and repetitive simulation tasks support the decision-making process. Before advances in computer-aided building simulations, architects and engineers were overwhelmed with a set of manual calculations based on pre-selected design conditions or empirical assumptions in order to achieve designs beyond conventional concepts, however, this came with a penalty of overdesign and marginally lower energy performance (Hong et al., 2000). Sustainable architectural design also takes account of the environmental inputs of the building as the physical characteristics of each land are unique and pose differing challenges. Therefore, analyzing and visualizing the impact of surrounding environment variables through advanced simulation tools is valuable. Notably, the effectiveness of computer simulations is much more appreciated in the event of comparing multiple design solutions in terms of performance rather than assessing a single design solution (Lamberts and Hensen, 2011).

This study makes use of several building performance simulation tools (shading time analysis, overshadowed area, and quality simulators, daylight and wind tunnel testing software). Major software packages used in this case study are namely Autodesk flow design, Shadow analysis software, and Curic Sun plugin. Autodesk Flow Design works in harmony with CAD data (Cadcamcae, n.d.). and supports creative workflow for the analysis. On the other hand, shadow analysis software developed by DeltaCodes (n.d.) creates daylight condition analysis which illustrates shading time in detail and provides several presets that serve best the function and type of the tested building (public, private, outdoor, etc.). Moreover, the Curic Sun plug-in, geared specifically towards architectural projects, is used for making solar charts and daylight analysis in this study. Based on geodata information, this plugin enables the designer to analyze the sun's annual, daily movements. The study framework which establishes cohesion and coordination between disparate computer-generated simulations is as shown in Figure 1. Citherlet et al. (2001) signify the importance of adopting computer simulation in the early design stage to deliver buildings with acceptable performance characteristics. Due to this, disparate analyses should be carried out for each performance criterion. The input datasets for the analysis such as climate data, geographical data, daylight data, and wind data were collected from various scientific surveillance sources.

The area subject to research is located on the Urla Iztech Campus (Figure 2). Urla, being one of the western districts of İzmir in the Aegean Region of Turkey, has a typical Mediterranean climate which translates as dry and hot summers and mild and rainy winters (Meteorological Service, n.d.). Initially, detailed as-built models of the buildings and topography were created respective of their geographical data. The plot topography was modeled with all its components at a medium detail level. Geometrical irregularities found in the surface model were ironed out at this stage. After achieving a clean and detailed terrain modeling, it has been exported into respective simulation environments.

The concepts of shadow and light directly affect architectural design due to their intrinsic relationship to building form (Baker and Steemers, 2014). Therefore, two independent software packages namely Shadow Analysis and the Curic Sun plugin were used to perform shade analysis and examine the behavior of the as-built structure. The position and angle of daylight (Curic Sun), shading times and areas (Shadow Analysis) were studied for differing time sections and corresponding color schemes were created (Figure 3). The design inferences obtained from these analyzes were evaluated to propose accommodating solutions. In particular, the shading time evaluation of the buildings' environment is necessary for making use of daylight in a controlled manner to maintain a high level of comfort in the semi-open space design. Following daylight and shadow analysis of the existing structures, the model was transferred to Autodesk Flow Design software for wind analysis. At this point, the imported model was checked against any loss or irregularities. Missing or incorrect inputs have an inevitable effect on the outcome. Thus, the following steps need to be considered in a file import:

- Checking for missing material
- Checking for missing objects
- Checking for surface subdivision irregularities
- Checking for scaling, position mismatch

After completing the imported model checklist, wind analyses were carried out based on actual wind surveillance datasets (wind flow direction and speed) acquired from the Windfinder (2020) database and meteorological services (Figure 4). The ability of testing design ideas against real-like wind conditions gives designers an edge in the early design stage (Bimoutsourcing, n.d.). Following the completion of wind and daylight analyzes of the existing buildings, several designs were proposed in line with the data obtained. Consequently, the proposed design models were transferred to the simulation tools for analysis. The proposed designs were tested against different conditions to identify the optimum solution (Figure 5). Spring and autumn seasons were of particular interest for those simulations as the occupant density was observed to be higher during these seasons. Running iterative simulations and receiving related visual feedbacks helped identify the most harmonic options with the building.

Conclusion

Environmental factors such as daylight, wind, and shadow complicate the decision flow of the design process. However, each of these components plays an important part in building energy simulation (BES) and reserves potential environmental impact. Therefore, inputs for the analysis process should be carefully examined and verified. Working with different digital simulation tools and gathering datasets for different characteristics of the building design means working with dissimilar file extensions and accruing loss of geometry during the conversion process. Therefore, a mutual file extension should be preferred to avoid such problems for inter-software collaboration. The difficulties noted in this case study were enumerated as follows:

- Consistency between design solution according to shading and wind parameters
- Conflicts between the designer concerns and the simulation outputs
- Issues in managing design process
- Issues in exporting model surfaces and materials
- Lack of qualified hardware for running computer-generated simulations
- Software bugs in certain scenarios

In conclusion, the visual results derived from the simulations were used to select the optimum models that satisfy the performance criterion. Working with feedback was seen to make a positive impact on the design flow as the design decisions tested thru numerical analysis and models undoubtedly accelerated the process with the caveat that the analysis framework needed to be organized like a Building Information Modelling (BIM) environment in order to provide a user-friendly

IMAGES, CHARTS OR GRAPHICS LEGENDS

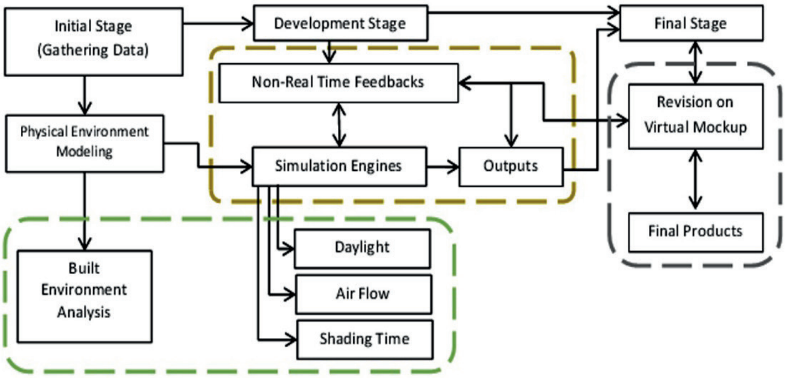

Figure 1: The design process framework with simulation feedbacks

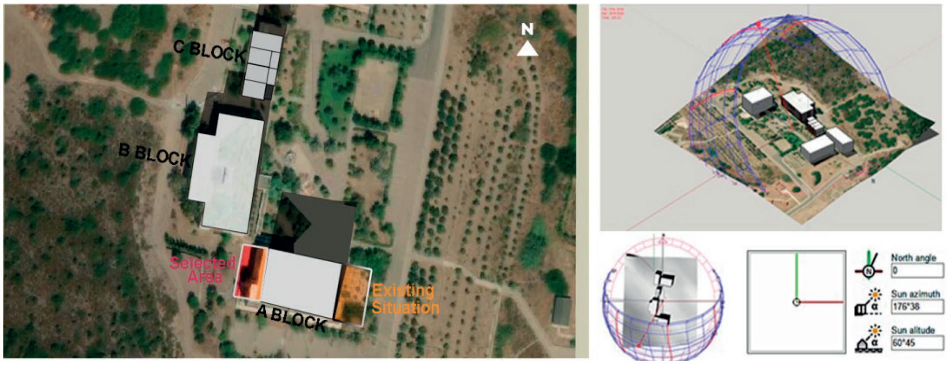

Figure 2: Site Plan and Daylight Analysis

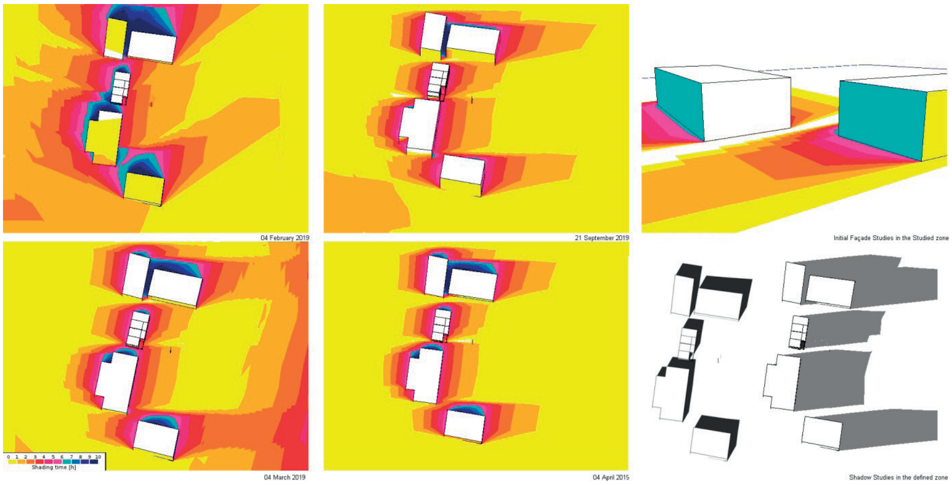

Figure 3: Shade area and shading time analysis of the studied zone

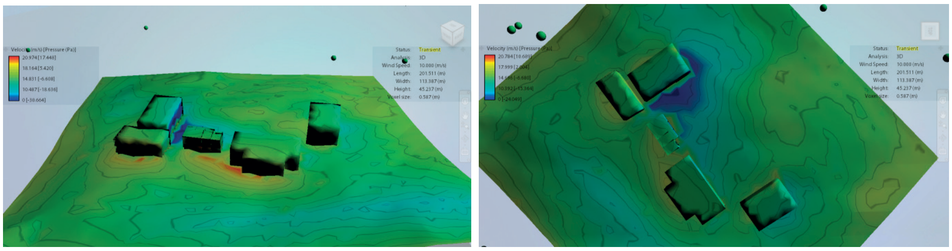

Figure 4: Wind flow analysis of the studied area

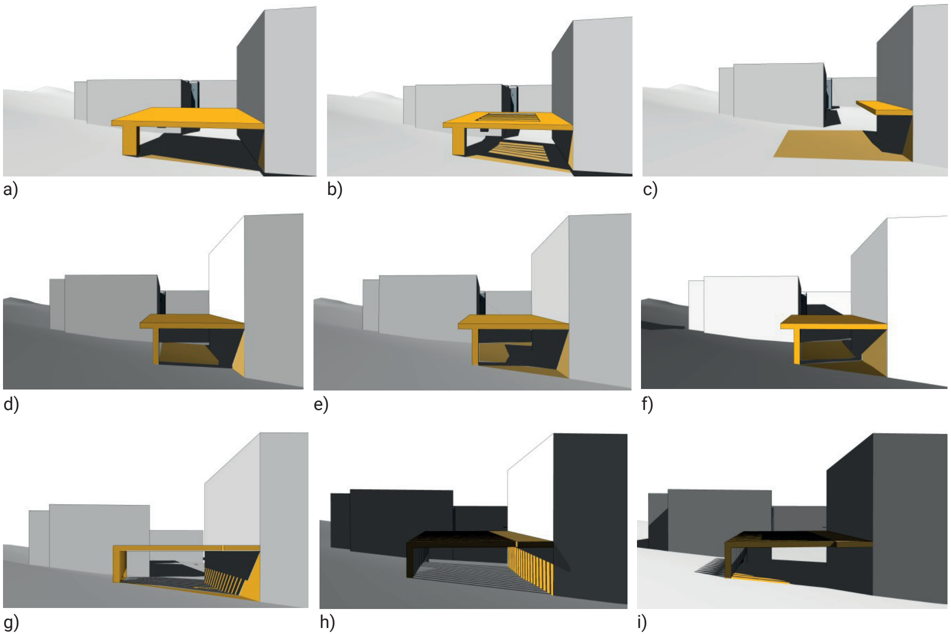

Figure 5: Proposed models in various daylight conditions

integrated solution. The extend of this study will be broadened in the future contemplating the entire campus area in a similar setting. Considering the weighted disposition on detaching the canteen and catering areas as a long-term goal, the value of this study becomes even more obvious.

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TECHNOLOGY AND DESIGN FOR A CARBON NEUTRAL BUILDING IN THE FRAMEWORK OF THE C40 REINVENTING CITIES INTERNATIONAL CONTEST CHALLENGES

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ABSTRACT

LO-DO project involves and synergistically relates all objectives included in the call of C40 Reinventing Cities International contest. The contest is based on 10 ecological and efficiency in the built construction sector challenges that will be a future direction for the new regeneration projects in the cities. The proposed project to critical urban issues and road conditions in the intervention area, located in the city of Milan, Italy, aims at diversifying the functions to promote new lifestyle models inside the designed building. The building is required to be carbon neutral and the project proposes an nZEB building-system with a carbon-neutral balance and the construction of a resilient community. The new building becomes a catalyst for activities connected with the services located in the context, providing a dynamic and adaptive container with respect to both urban and private aspects. The residential spaces maximize the internal quality and flexibility for the users, considering the building life cycle and users' variable needs during the lifespan. The user comfort, one of the project core topics, is combined with energy efficiency, including the Behavioral Design concept, which goes beyond building standard evaluation, considering the weight of occupancy variation on the associated energy consumption. The principle of the intelligent city in which connected buildings become elements that produce energy and opportunities for the local community translates itself into a project vision that uses digital technologies to control the efficiency in the design phase, building management, and community development. KPIs (Key Performance Indicators) are identified to perform a building monitoring of the actual performance during the life cycle, to calibrate energy consumption predictive models, and to identify possible improvements overtime related to the actual use and users' preferences from a UCD (User-centered Design) perspective.

Introduction

C40 Reinventing Cities [1] challenge suggests a structural integration of the project actors by identifying an evaluation grid that sets on the same level architectural, urban and social quality, energy-environmental aspects [2], financial and urbanistic features, and the monitoring of all the installed devices for the on-time management. In fact, the design process extends its influence to buildings' life and to the community of the district [3], both residential and urban [4]. Therefore the proposed project integrates from the beginning different actors that contribute in order to offer a synthesis that, alongside the resulting quality, intends to shape to innovative appeal regarding the process [5] that the international competition format boosts [6][7]. The C40 Reinventing cities International contest introduces 10 challenges (Table 1). In the proposed project, namely the LO-DO project, the challenges have been adopted as a guide to strategic choices starting from the fundamental Challenge 1 and the appropriate challenges in relation to the Viale Doria site. Energy efficiency has been linked to environmental impact and CO_2 absorption measures by proposing a building that endorses sustainable urban development, in connection with built, cultural, social, and green urban systems.

Challenge	Content	Typology
1	Energy efficiency and low-carbon energy consumption	Mandatory
2	Life cycle assessment and sustainable construction materials	
3	Low-carbon mobility	Site specific
4	Climate resilience and adaptation	
5	Ecological services for the neighbourhood and green jobs	
6	Sustainable water management	
7	Sustainable waste management	
8	Biodiversity, urban re-vegetation, and agriculture	
9	Inclusive actions, social benefits, and community engagement	
10	Innovative architecture and urban design	

Table 1: Challenges of C40 International contest.

Case study: Via Doria, city of Milan, Italy

The location of the project is the Viale Doria area is a limited but prominent area, in the Viale Andrea Doria and Piazzale Loreto. The project entails the call opportunity to offer, alongside specific objectives, a solution to critical urban issues, and the Viale road network critical conditions. The building intervention is a driver for collective interest regeneration. The building's first four levels are dedicated to neighborhood functions, it is a mix modulating public to private transition through the building section. The functions modulation within the plot and the garden permeability towards the new square allows the public and private spaces expansion depending on times, days, or periods of the year with the same land consumption. The upper floors residences define the home-work relationship through the uses integration to support family management and the combination with the coworking or other shared activities. The building uses are supported by sustainable mobility services and green spaces with different resilience objectives and enhancement of well-being lifestyle models and environment healthiness, considering a user-centered design. Energy-saving starts from the construction of a building with high thermal insulation and inertial mass that reduces the energy demand, adopting high-efficiency active foundations, using renewable energy to cover the 80% of the energy consumption. The building covers the energy imported by the public grid by planting green systems on the north façade, on the rooftop, and by creating green spaces in the garden of the new building and along with Viale Doria. The tree species allow low VOC emissions, CO_2 absorption, and capture of fine particulate due to urban pollution.

Energy efficiency and supply of clean energy

Shape efficiency and envelope features

The building compactness allows redefining the image on the Viale Doria and preserves the permeability at the ground level for users and community. This approach allows the community to access the services at the lower floors of the building and towards the green courtyard. The general compactness of the building provides a good S/V ratio with a value of 0.27 m-1. The shape of the building has been designed in order to be efficient, exploit the solar radiation through active solar systems on the south facade, and to absorb CO_2 and street noise on the green north façade. The ratio of transparent surface to opaque surface is 50% on the south facade and 60% on the north facade to optimize daylighting in the residential spaces. The performance of the building envelope includes a high-performance opaque and transparent curtain wall to optimize the energy management and the material flows, use solar gains through the thermal mass and envelope insulation. As far as the opaque envelope is concerned, natural and high-performance materials are used, which allow high both in winter (reduction of transmission losses) and in summer (high thermal inertia, time lag, and decrement factor). The vertical envelope has U value 0.15 W/m^{2}K, Y_{ie} periodic thermal transmittance of 0.01 W/m^{2}K, a good time lag, decrement factor 0.06. For transparent surfaces, double-glazed argon glass is used:

- average U thermal transmittance value of 1.1 W/m^{2}K,
- Solar Heat Gain Coefficient (SHGC) of 0.64
- light transmission factor τ_v of 0.7.

Solar and shading analysis and uses

The study of the shadows by the built environment on the new building allowed identifying the incident solar radiation and the "productive" portions of the facades. The solar analysis allowed the definition of the active solar systems located on the roof and on the higher portion of the south facade in order to minimize mismatching losses. The solar facade has also non-active panels to preserve the technological aesthetic chosen for the "productive" facade. The organization of the floors has been studied in order to locate the functions with the highest internal gains (i.e. the number of people, lighting, office, and commercial equipment) on the lower floors. In the lower floors commercial and offices/services with higher occupancy density have been located while the residential section starts on the upper floors.

Use of renewable energy sources

The shading analysis excluded the possibility of installing the PV modules at the lower levels, and the roof of a greenhouse on the top of the building has been adopted as a suitable surface (Figure 1).

The third and fourth floors are not productive enough, while the upper floors can guarantee values from 800 kWh/m^2 year with a sloped surface at 30°, with annual radiation of 1461 kWh/m^2 year. The panels assumed for installation on the south façade use crystalline silicon technology while for the roof of the greenhouse the transparency is 15%. The panels can be customized in shape and transparency in order to optimize energy performance and solar shading. For the vertical facade, they represent the external layer and therefore perform multiple functions: external finishing layer, waterproofing layer, energy production element to support the building's consumption, the aesthetic finish of the facade towards the courtyard with iconic value for the inhabitants with respect to sustainable behavior and social commitment to the use of clean energy.

Energy efficiency and HVAC systems

The building is energy efficient with a total energy consumption of about 34 kWh/m^2 year, 13 kWh/m^2 year for thermal use, and 21 kWh/m^2 year for electrical use. As far as the production of thermal energy is concerned (heating, cooling, DHW), heat pump systems are used. The heating, air conditioning, and ventilation system involve the installation of machines divided according to their main functions and consequently:

- n. 1 a water-to-air heat pump for the restaurant and office area combined with a system of 4-pipe ducted fan coils;
- n. 2 water-water heat pumps for residences with a radiant system with dehumidification integrated in the VMC (Controlled Mechanical Ventilation) with compressor for cooling 1.3 kW.

The planned generation system exploits the thermal capacity of the aquifer through an underground storage system with a volume of 30 m^3, a volume that is able to allow appropriate compensation between the peaks in demand and the capacity of water supply in the aquifer. In addition, the accumulation acts as an energy reservoir, storing and returning energy by means of heat pumps according to the different operating profiles of the users. The planned TES (Thermal Energy Storage) system maximizes the production, together with the optimal management of the pumps. The thermal storage described above is also expected to have coils embedded in the foundation slab to be used as an additional tank for heat exchange with the ground. In this way, it is possible to reduce the withdrawal of groundwater and optimize the excavations and the structures for the underground car parks. The system guarantees high efficiency with nominal seasonal efficiency (COP 4.6-5; EER 4.4-4.5), for the production of DHW the efficiency is 3.14.

The renewal of the air inside the residential and working environments is allowed by single high efficiency (up to 90%) units of heat recovery and adiabatic dehumidification. The units, of the compact type, are installed in the rooms and allow the constant renewal of the internal air. The units used in the housing are equipped with an adiabatic dehumidification system for the thermo-hygrometric control in the summer period.

Monitoring and detection of consumption

The project aims at maximizing the comfort, safety, efficiency, and usability of the building considering the needs of the users. For that reason, a BMS (Building Management System) is proposed integrating different disciplines with a BACS (Building Automation and Control Systems) and TBM (Technical Building Management) system class A (Figure 2) which means high efficiency with automatic control of the needs of the rooms, scheduling of maintenance procedures, energy monitoring and sustainable optimization of energy [8].

The principle adopted for the monitoring system is to start from the standard measurements provided to monitor 1) the consumption of thermal energy and 2) electricity, 3) the production of electricity, 4) hot water for thermal use and 5) sanitary water and the equipment of the security system, and to integrate the data with additional information and sensors to optimize the management through the use of environmental data and intelligence introduced with additional sensors (Figure 3).

Therefore, some specific measurement points are envisaged within both residential and coworking spaces in order to control energy and water consumption, indoor comfort conditions, and Indoor Air Quality (IAQ) in the living spaces (a measurement of indoor air temperature T, indoor relative humidity UR, and CO_2 concentration) and it is planned to use sensors relating to the anti-theft alarm system to obtain information on the level of occupancy. These systems make it possible to implement energy savings and comfort conditions. The CO_2 concentration allows to optimize ventilation changes and the PM10 sensor provides information about IAQ compared to urban conditions. In the coworking spaces, the illuminance sensor will allow the adjustment of artificial LED lighting with the contribution of daylighting. The monitoring system will communicate the data in the cloud to a platform for the visualization and control of the energy trend and consumption of the building allowing the operator to maximize energy savings and to intervene in case of malfunctions. Users will be informed of the internal conditions and consumption of the building in order to activate conscious and virtuous behavior as well as to provide customized service on the needs and preferences of end-users.

Management of sustainable materials and circular economy

Embodied energy

The embodied energy in the proposed envelope has been calculated in order to assess the environmental and energy impact in the life cycle. The result has been compared with the envelopes adopted in the national construction market.

n.	layer	s thickness m	ρ density kg/m^3	NRE Non-renewable energy MJ//kg	GWP Global Warming Potential $kgCO_{2eq}$./kg	NRE Non-renewable energy MJ//m^2	GWP Global Warming Potential $kgCO_{2eq}$./m^2
1	Plaster	0.015	700	1.740	0.110	18.27	1.15
2	Fibreboard*	0.10	90.25	46.503	0.055	419.69	0.49
3	Cellular concrete**	0.25	380	3.820	0.450	286.50	33.75
4	Mineral insulation***	0.15	107.5	14.961	0.078	241.25	1.25
5	Plaster	0.015	700	1.900	0.170	19.95	1.78
	Total	0.53				985.66	38.44
	*Gyproc ** YTONG CLIMA *** Multipor						

Table 2: Embodied non-renewable energy and environmental impacts of the envelope.

The proposed envelope is below the average value of 1332 MJ/m^2 of building envelopes with 15 cm of insulation (Figure 4).

This average is surpassed when brick masonry is used but also in systems with an aquapanel, platform, and x-lam. The proposed materials allow a reduction of the embodied energy of -20% than the average and -41% than the envelope with maximum value. The only technologies that have lower values of embodied energy are substantially those that use stone and raw earth which are not suitable for a multistory building in an urban context. For the insulation material to be combined with the YTONG system, different solutions have been evaluated. A comparison has been performed between materials such as EPS, Multipor, rock wool, and glass wool, also verifying that the choice of fibrogypsum was not detrimental compared to common plasterboard. Compared to the stratification in Table 2, the insulating material has been changed with: (1) EPS, 2) Multipor, 3) rock wool, 4) glass wool). The case which indicates "plasterboard" uses the base solution (2) replacing the fiberboard with the plasterboard. In Figure, the values in the semi-dynamic calculation are shown [9].

It can be seen that the thermal transmittance U and the periodic thermal transmittance Y_{ie} are the same for the proposed solutions while the parameters related to the frontal mass show higher values with the plasterboard and Multipor. As far as the decrement factor is concerned, the hypotheses have an excellent performance, while for the time lag the values are distributed between discrete and good, a lower value is found for plasterboard (Figure 6).

Life cycle efficiency

However, if the thermal performance can be considered as comparable, from the point of view of embodied energy and environmental impacts the solutions vary considerably (Figure 7).

The solution that combines the Multipor with the YTONG block has less embodied energy (20% less than EPS, -11% than rock wool, and -14% than glass wool while the use of plasterboard would have an impact of only +1%). The environmental impacts widen the gap and comparing the global warming potential, the proposed solution decreases the impacts compared to the use of EPS by 25%, to plasterboard by 28%, to rock wool by 35%, and to glass wool by 29%. In addition, the proposed solution allows for a substantially mono-material when end-of-life disassembly is considered, and the two materials can be considered recyclable in the same way even when fixed together. The stratification of the wall also includes in the ventilated photovoltaic facade. The PV production has zero CO_2 production and the embodied energy of PV modules is pay backed in 3.3 years. The production of the main materials (YTONG and Multipor) occurs 80 km away from Viale Doria allowing low impacts for the supply chain (about -40% than the average distances covered for material supply).

Materials certification

The envelope materials are certified with EPD [10] and this has allowed performing a specific calculation of the embodied energy and environmental impacts. The EPD certification permits to obtain the transparency on the sustainability of the material by reporting data about impacts. Table 3 shows the indications of the environmental certifications of the proposed building materials. Some certifications (1,2,3,4) are specifically related to the LCA (Life Cycle Assessment), which quantifies thermal and electrical energy consumption, water consumption, and environmental impacts, while the certification 5 verifies the criteria of the Environmental Energy Certification Protocols: Itaca [11] (Italian Rating System) and LEED (The Leadership in Energy and Environmental Design) [12].

With regard to the CO_2 associated with the structural solutions materials, it is possible to verify a saving of CO_2 when a wooden or a mixed structure is adopted compared to the traditional concrete structure. The CO_2 emissions for the designed building with a concrete structure are 7962.19 $kgCO_2$, with a wood structure it is possible to reach -8544.58 $kgCO_2$ (-107%) and with a mixed structure (wood for horizontal structures and concrete for the vertical structures) -6035.48 $kgCO_2$ (-76%).

	Symbol	Certification	Materials
1	EPD®	**EPD** Environmental Product Declaration	• **Multipor** panel • **YTONG** blocks • **Gyproch** panel
2	natureplus	**Naturplus** certificate	• **Multipor** panel • **YTONG** blocks
3	ACERMI	Association pour la certification des materiaux isolants	• **Multipor** panel • **YTONG** blocks
4	eco INSTITUT	ECO Institut	• **Multipor** panel • **YTONG** blocks
5	ANIT	LEED Rating System and ITACA with ANIT	• **Multipor** panel • **YTONG** blocks

Table 3: Environmental certifications of the proposed construction products.

Urban re-vegetation in the project

The urban re-vegetation concerns Via Doria, the courtyard, the rooftop, and the north façade. On Viale Doria trees are used, trees and shrubs for the garden, fruit trees, and urban agriculture on the terrace, while the facade is made with two types of creepers. Table 4 the specifications for each section of the greenery of the project. The use of vegetation makes it possible to mitigate the conditions of the local microclimate thanks to the transpiration effect of the leaves and the absorption of pollutants. An active effect is possible to achieve by absorption and adsorption with the removal of particulate and air pollutants linked for 80% to urban traffic.

Trees have a greater deposition capacity of pollutants compared to shrubs thanks to the structure of the canopy. The proposed strategy integrates both solutions, allowing the protection of the inner courtyard from the road. Indirectly, the vegetation modifies the airflow and the turbulence caused by the transport of pollutants towards the courtyard where the residential spaces are facing and where the community and social activities are located.

Building	Location	Typology	Unit	Quantity	Total
External spaces	Viale Doria	Celtis australis	n	31	31 trees
Internal spaces	Garden	Cinnamomum camphora Gleditsia triacanthos Trachycarpus fortuneii Sarcococca confusa Begonia evansiana Anemone 'Honorine Jobert' Dryopteris erythrosora	n n n n	3 7 11	21 trees 450 herbaceous and perennial undergrowth
Building	Roof North facade	Eriobotrya japonica backgrounds with vegetables backgrounds in greenhouse Hedera helix Vitis coignetiae Total	n m^2 m^2 m^2	5	5 trees 33 12 420

Table 4: Quantification of the vegetative system included in the project.

Results

Energy demand

For the evaluation of the thermal energy demands for heating and cooling EnergyPlus calculation engine was adopted [13]. For spaces for community use, coworking and housing profiles, internal loads, ventilation rates, and setpoint temperatures have been defined, considering intermittent operation and 14 hours of use as defined in the regulations [14]. Table 5 shows the input data of the simulation and figure 9 of the setpoint temperatures.

n.	Parameter	Unit	Housing	Coworking	Services
1	Zone people occupancy rate	people/m^2	0.04	0.8	0.12
2	Electrical equipment thermal load	W/m^2	4.0	6.0	6.0
3	Ventilation airflow rate	air change/hour	0.5	0.7	1.0

Table 5: Setting the thermal zones with respect to the uses.

The thermal zones are organized by floor and by use. The hourly weather file for the location of Milan [15] has been used. The calculation of the total building requirement amounts to 42'199.29 kWh/year for heating and 28'735.25 kWh/year for cooling. Figures 10 and 11 show the results for floor and usage.

Building consumption

The building energy consumption is distributed according to uses for the spaces for the community, the cooling is higher than the heating demand and this is the most energy-intensive section. The distribution between heating and cooling demand is 59% due to heating and 41% due to cooling considering movable shading systems. More than 60% is due to electrical needs (internal and external lighting, electrical equipment, vertical distribution, and ventilation). The solar cover by PV production is 80% (heating, cooling, ventilation, lighting, and DHW) with a minimum of 40% and a maximum overproduction of 9% (Figure 12). The variability of consumption related to occupants is about 20%, the building BMS control system class A can assure about 15% of energy-saving on electrical consumption and 26% on thermal consumption.

CO^2 absorption

The vegetation system of the project allows absorbing the CO_2 (4793 kgCO_2/year) related to the 20% of the total consumption, provided by the public grid. The trees in Viale Doria, on the roof and in the courtyard act, in collaboration with the green facade to create the zero-carbon building with mitigation of the local microclimatic conditions. In the following table, the trees that contribute to the CO_2 absorption are reported. As far as the green façade on the northern front (420 m^2) is concerned, it has a coverage variability in the different seasons(Figure 13):

- Spring: 100%.
- Summer: 100%
- Autumn: 80%.
- Winter: 35%.

The vegetation system can absorb 5.7 tons of CO_2 emission every year.

Tree typology	Plant size and growth type	Unit	N. trees	CO_2 absorbed in 1 year [kg di CO_2]
Celtis australis	II size (h 15-25 m)	n.	31	3782
Cinnamomum camphora	rapid growth	n.	3	58
Gleditsia triacanthos	III size (h 8-15 m) rapid growth	n.	7	504
Eriobotrya japonica	Evergreen tree with a maximum height of 8 meters	n.	5	97
Hedera helix Vitis coignetiae	Creepers Creepers	m^2	420	1260
		Total		**5701**

Table 6: Green system of the project.

Clean energy production and CO_2 balance

The BIPV (Building Integrated Photovoltaic) system has a peak power of 57.4 kW_p and provides the 80% of the electricity requirements by producing 46'282.20 kWh/year, the 64% of PV production is for housing, the 17% to public spaces, and 19% to the coworking spaces. Table 7 provides a detailed report of project KPIs.

KPI	*Unit*	*Housing*	*Co-working*	*Public*
Specific thermal energy for heating	kWh/m^2 year	19.86	27.15	22.37
Specific thermal energy for cooling		12.70	14.11	26.74
Specific heat energy for DHW		20.00	5.49	20.00
Specific electrical energy		7.00	10.00	10.00
Thermal energy for heating	kWh/ year	23653.32	8632.86	5772.01
Thermal energy for cooling		15129.8	4485.59	6899.56
Thermal energy for DHW production		23820.00	1746.74	5160.00
Electrical energy by function		8337.00	3180.00	2580.00
Electrical energy for other uses		22809.43		
Electrical energy consumption	kWh/ year	61689.09		
Total photovoltaic power	kW_p	57.4		
Photovoltaic surface per m^2 of building	m^2/m^2	0.2		
Photovoltaic energy	kWh/ year	46282.20		
Solar fraction	%	**80.0**		

Water saving	%	50		30	-
Grey water saving		100		100	100
CO_{2eq} emissions saved with BIPV	kgCO_{2eq} / year		**21284.30**		
CO_{2eq} emissions to be captured		**5439.41**			
CO_{2eq} emissions per m^2 per function		25.80	25.80	24.58	34.27
CO_{2eq} emissions captured by green structures		1260.00			
CO_{2eq} emissions captured by trees		4441.00			
Total CO_{2eq} emissions captured		**5701.00**			
CO_{2eq} balance		-261.59			
Number of trees to be carbon neutral	n.	46			
Green façade	m^2	420			
LEED - Leadership in Energy and Environmental Design points		100			
LEED - Leadership in Energy and Environmental Design level		PLATINUM			

Table 7: Key Performance Indicators.

The photovoltaic production is given for 64% by the south facade and for 36% by the greenhouse rooftop (Figure 14). Clean energy production avoids 21 tons of CO_2 emissions per year. The emissions due to the grid electricity amount to 5.4 tons CO_2/ year, that are absorbed by the green system that is able to absorb 5.7 tons CO_2/year achieving the Carbon Neutral goal.

Distribution of energy consumption

The distribution of energy by using shows how electrical devices are higher compared to electricity needs for thermal uses due to the high efficiency of the heat pumps. For housing we have roughly the same weight, while for coworking the air conditioning is higher and also in the public spaces cooling is particularly significant. Figure 15 shows the distribution of overall energy consumption and share per usage.

All the chosen systems save energy compared to traditional systems as they adopt high-efficiency devices for stairs (-35%), outdoor and indoor lighting (-85%), energy-saving devices for the water system (-30-50%).

Integrated design for LEED

The LEED sustainability protocol has been used as a project guideline and the project can reach a Platinum level (100/110 points) (Figure 16). This top-level of environmental quality is achieved with particular systems and procedures in the design phase (72%) and then in the construction phase (21%) and management (7%).

The integrated design, therefore, allows optimizing the choices in the design phase in order to reduce the diseconomies and possible adjustments in progress. As far as the figures involved in the project team are concerned, the greatest contribution to the achievement of LEED objectives is made by environmental experts (31%) and mechanical plant engineers (27%), while the company and developers play a significant role (20%) together with the architects (13%) (Figure 17).

Conclusion

The project respects the building volume definition maintaining the height of the surrounding buildings, it organizes the square in front of the new building and in Viale Doria to provide an urban green space, adopting urban greenery to support resilience measures in order to reduce the urban surfaces temperature in summer, to increase soil permeability, to promote photosynthesis process and CO_2 absorption, to increase pedestrians and safety and sustainable mobility. Starting from the existing context data and the BAU (Business as Usual) data, the building aims at improving energy efficiency by reducing by 33% the building thermal consumption considering the lower values in the existing built environment and up to 75% compared to more energy-intensive ones. Electricity needs are reduced by about 50-60% compared to the best conditions in the building context up to 72% compared to buildings with higher consumption. The new building uses LEED criteria up to a Platinum level as a guideline for its sustainability choices. The significant reduction of the energy demand allows radical resource saving and it is complemented by high-efficiency systems and devices for consumption management during the life cycle. Green solutions, suitable to guarantee to build resilience to future climate changes, become symbols of site redevelopment and the key to activate synergies between urban, social, technological, and natural elements.

IMAGES, CHARTS OR GRAPHICS LEGENDS

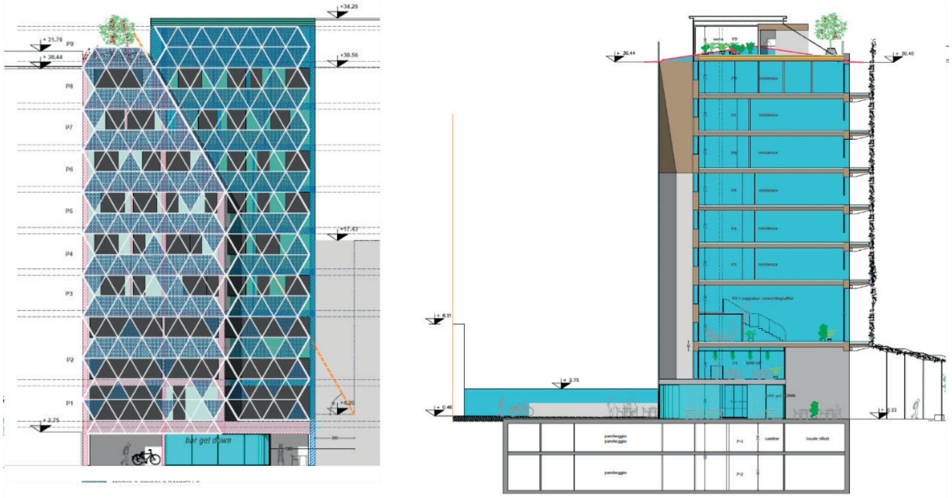


Figure 1: Design of the south facade equipped with solar panels.

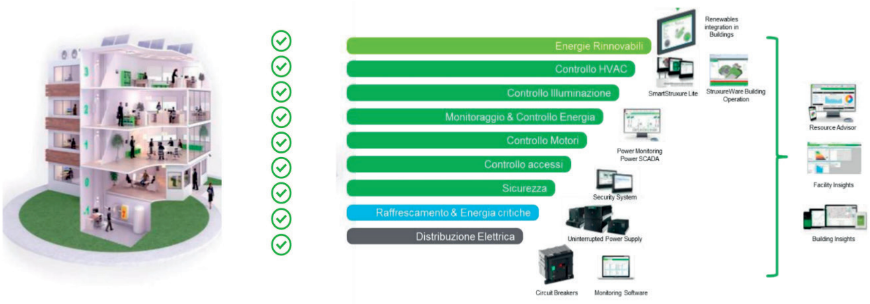


Figure 2: Areas of the integrated monitoring system in the management and control platform.

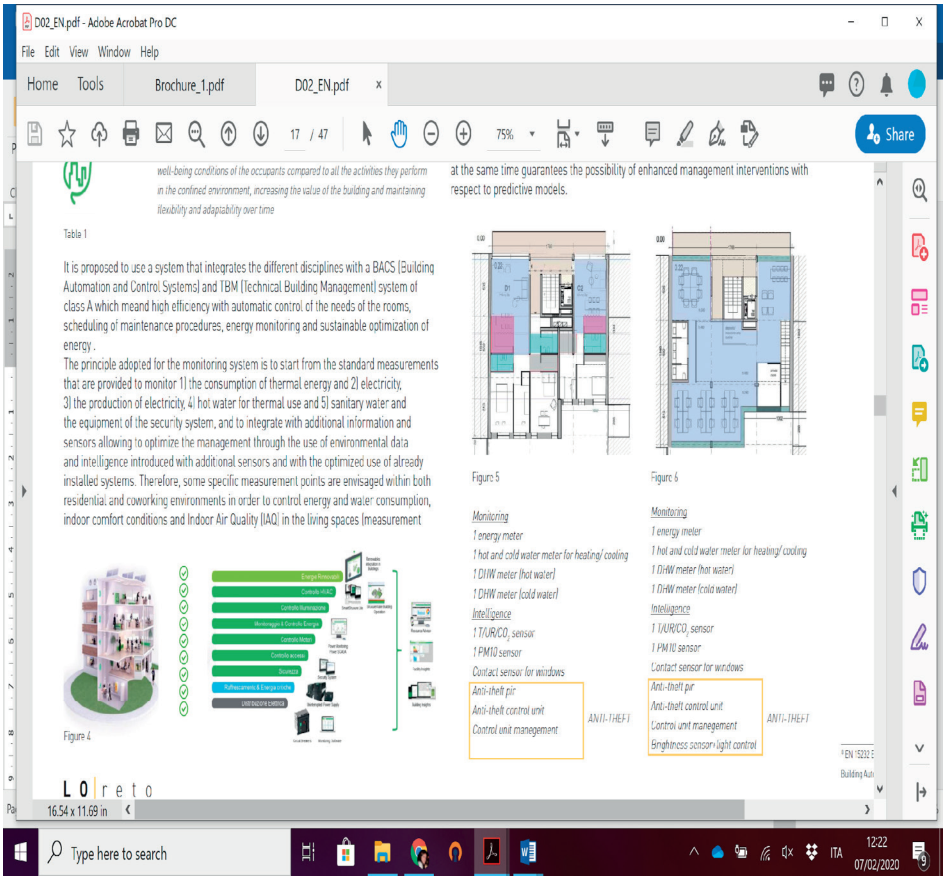


Figure 3: Monitoring devices for residential sections of the Viale Doria building.

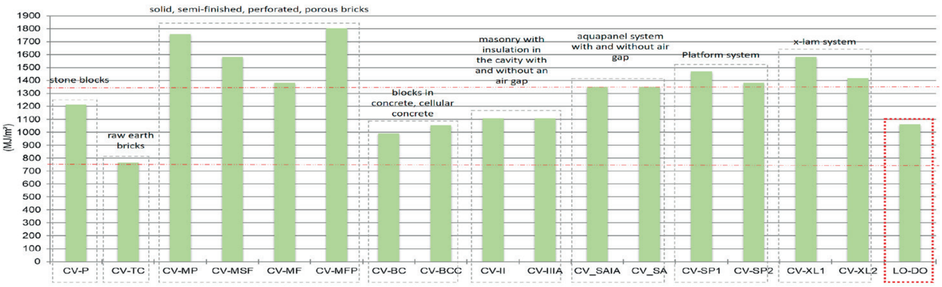


Figure 4: Comparison of the project envelope embodied energy with common solutions.

			EPS	Multipor	Plasterboard	Rock wool	Glass wool
Steady-state analysis parameters	Symbol	Unit	Value	Value	Value	Value	Value
Superficial mass	Ms	[kg/m2]	129.23	141.15	217.13	137.65	133.53
Thermal resistance	Rt	[m2K/W]	6.62	6.62	6.62	7.02	7.02
Transmittance	U	[W/m2K]	0.15	0.15	0.15	0.14	0.14
Conductance of component	C	[W/m2K]	0.15	0.15	0.15	0.15	0.15
Areal heat capacity	Cta	[kJ/m2K]	131.51	146.26	221.96	135.34	132.00
Time constant	t	[h]	241.92	269.05	408.31	263.74	257.22
Dynamic (sinusoidal) analysis parameters	Symbol	Unit	Value (moc	Value (moc	Value (modu	Value (modulu	Value (modulu
Periodic thermal transmittance	|Yie|	[W/m2K]	0.01	0.01	0.00	0.01	0.01
Internal thermal admittance	Yii	[W/m2K] , [h]	1.54	1.54	2.65	1.54	1.54
Time lag of internal thermal admittance	ΔtY11	[h]	2.97	2.97	2.05	2.97	2.97
External thermal admittance	Yee	[W/m2K] , [h]	0.97	1.25	1.25	0.47	0.41
Time lag (external thermal admittance)	ΔtY22	[h]	4.60	4.29	4.29	2.81	2.62
Decrement factor (attenuation)	f	[-]	0.08	0.06	0.03	0.06	0.06
Time lag (decrement delay) of periodic thei	Δtf	[h]	9.08	6.62	3.08	7.18	7.77
Surface factor	F	[-]	0.87	0.87	0.73	0.87	0.87
Time lag (surface factor)	ΔtF (CIBSE Gui	[h]	-0.62	-0.62	-0.93	-0.62	-0.62
Internal areal heat capacity	k1	[kJ/m2K]	21.12	21.05	36.34	21.07	21.09
External areal heat capacity	k2	[kJ/m2K]	13.26	17.02	17.06	6.45	5.55

Figure 5: BAU (Business As Usual) comparison of insulation materials performances.

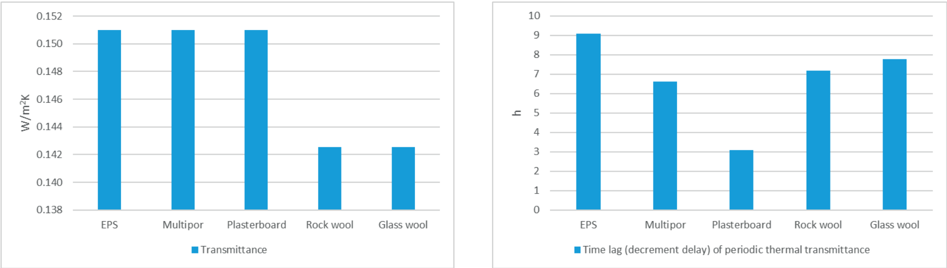


Figure 6: Thermal transmittance (quality in winter) and time lag (quality in summer).

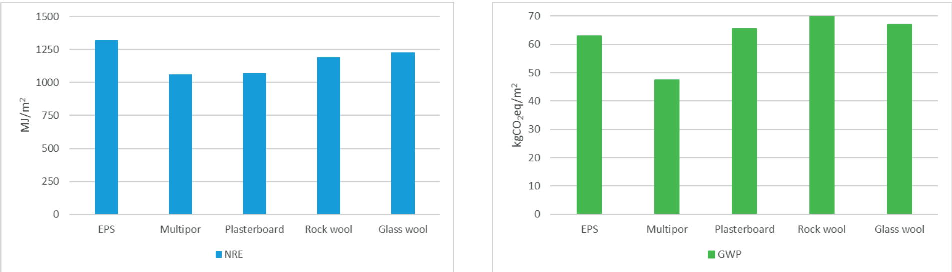
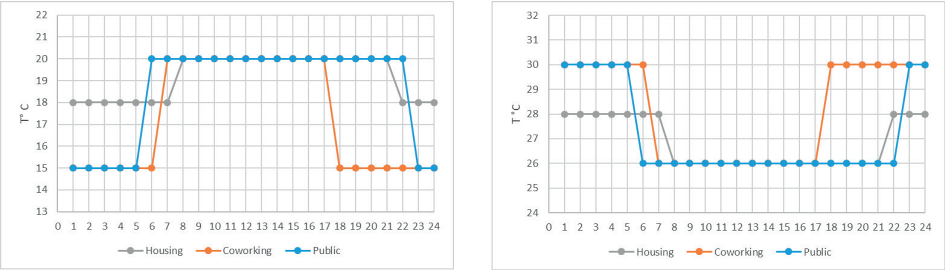
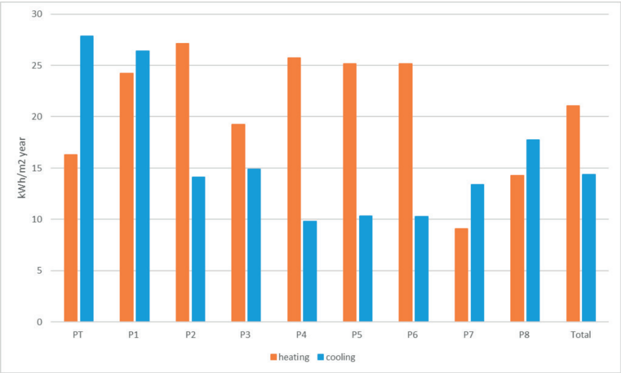


Figure 7: Non-renewable embedded energy NRE and Global Warming Potential GWP.



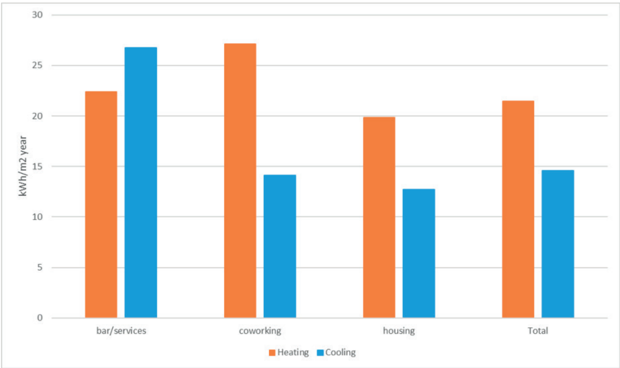
a) b)

Figure 9: Setpoint temperature profiles for a) heating and b) cooling.



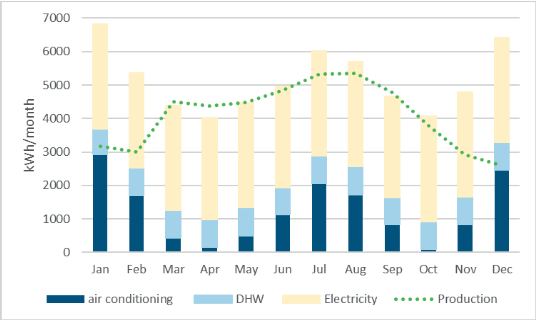
	Heating	Cooling
PT	16.29	27.85
P1	24.23	26.40
P2	27.15	14.11
P3	19.26	14.92
P4	25.73	9.81
P5	25.16	10.34
P6	25.13	10.28
P7	9.08	13.39
P8	14.27	17.77
Total	21.08	14.35

Figure 10: Winter and summer demands by floor.



	Heating	Cooling
Services	22.37	26.74
Coworking	27.15	14.11
Housing	19.86	12.70
Total	21.45	14.61

Figure 11: Winter and summer demand by use.



Production	Consumption	Solar Cover
3167	6820	46%
3002	5367	56%
4507	4394	103%
4374	4022	109%
4489	4466	101%
4834	4964	97%
5322	6022	88%
5345	5694	94%
4787	4664	103%
3792	4061	93%
2922	4797	61%
2593	6417	40%
49133	61689	80%

Figure 12: Building energy balance.

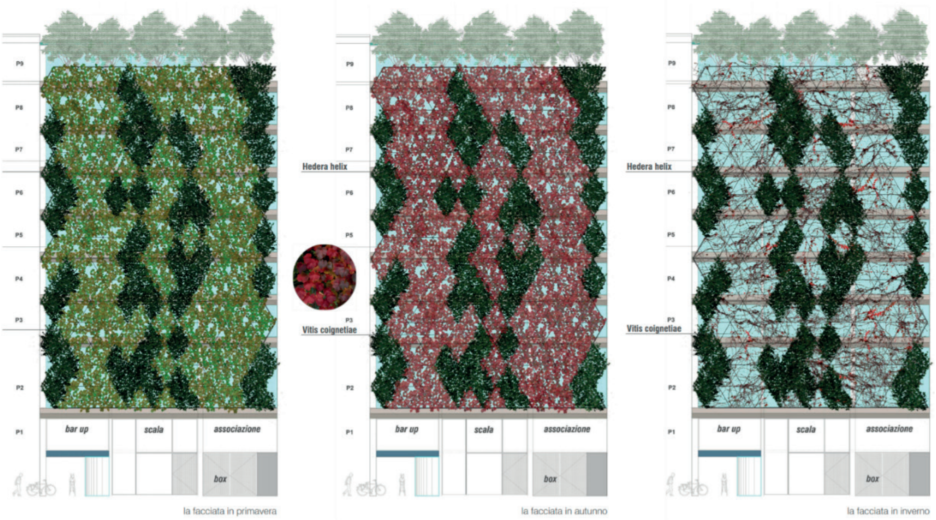
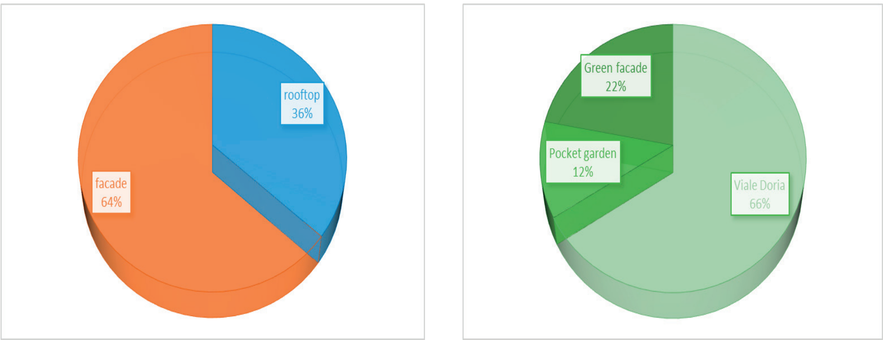
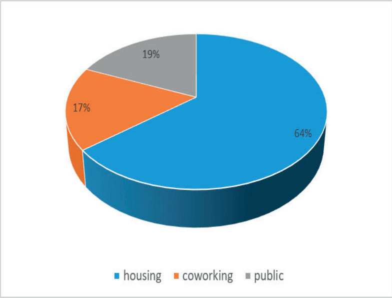


Figure 13: Green north facade in the three main seasons.

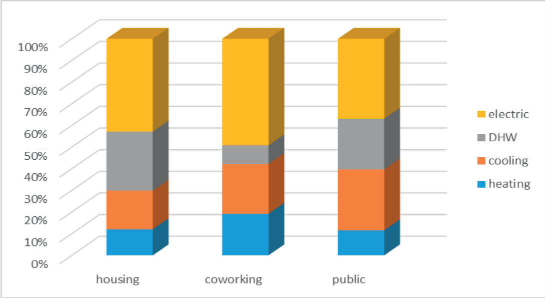


a) b)

Figure 14: (a) Share of solar electricity production and (b) contribution of green systems to CO_2 absorption.



a)



b)

Figure 15: a) Distribution of consumption by use, (b) distribution by use and energy segment.

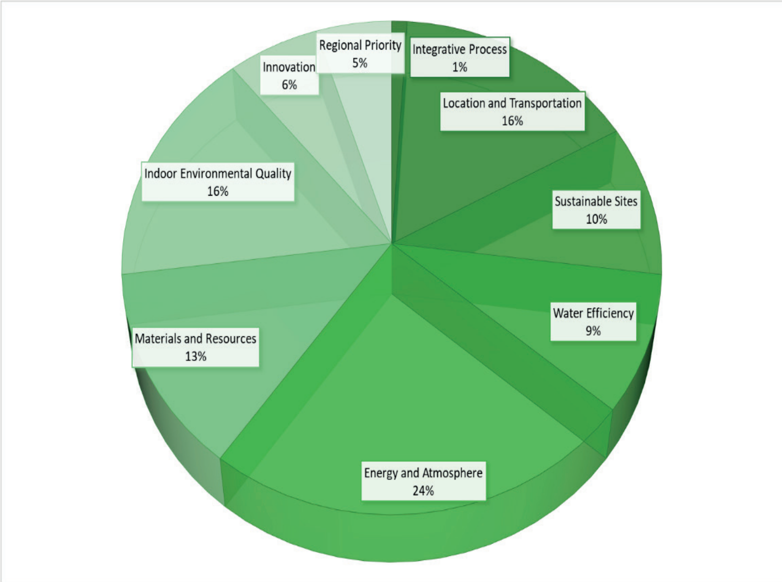
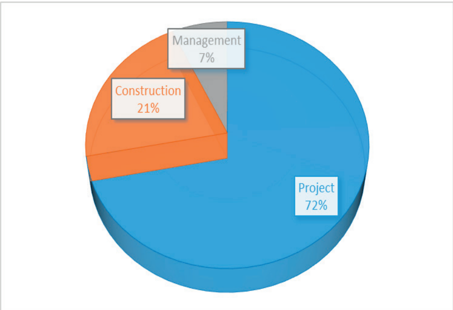


Figure 16: Scorecard for the project in the weight of the areas of sustainability included in the LEED protocol.



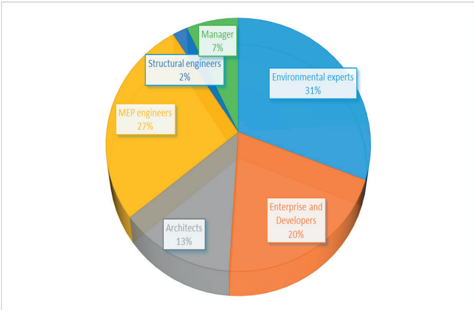


Figure 17: a) Distribution of LEED criteria in building life cycle;
b) Role of TEAM in achieving energy-environmental objectives.

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USING SOLAR SYSTEMS FOR ENERGY AUTONOMY IN HERITAGE BUILDINGS

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ABSTRACT

Vast amounts of energy were being used up in the built environment; therefore, buildings can play an important role in reducing consumption as well as in the production of energy; one way forward would be to alter existing buildings in a way that they can contribute to the solution. To improve the energy performances of existing buildings, there are several ways. Renewable energy production, which is one of the most effective ways among these strategies, has gained more importance, after the oil crises, to create an alternative way of obtaining energy. The purpose of integrating renewable energy technologies in buildings is to harvest energy in situ and achieve energy autonomy by reducing grid dependency, as well as to produce clean energy with minimal greenhouse gas emissions. Among all the renewable energy generation systems, solar systems are more advantageous than others when it comes to applicability in existing buildings. As rising demand for alternative energy generation, numerous standards, and legislation were developed around the world for energy retrofitting of the existing building stock, which also includes heritage buildings. Nevertheless, in the case of heritage buildings, these accepted standards and legislation are not easy to implement due to their special architectural, cultural, and historical qualities. Aside from the fact that clear guidelines for retrofitting heritage buildings have not yet been established, the interest in both research and practice enhancing the energy efficiency of heritage buildings is increasing. This paper will examine active design strategies focusing on solar energy generation systems, which can be integrated into heritage buildings without defacing them. Additionally, with the help of case studies from France, Germany, Italy, and the United Kingdom (UK), which have integrated renewable energy production systems into heritage buildings, solar energy generation methods and their effects on these heritage buildings will be discussed.

KEYWORDS

Energy retrofit, heritage building, building integrated photovoltaic, solar thermal, case studies

Introduction

Data published on worldwide energy consumption in the built environment mirrors the enormity of the problem and the dire need to solve it. According to the US Energy Information Administration (EIA), 21% of worldwide energy is used up by the commercial and residential buildings' sector (IEA, 2017); while in Turkey this amount was declared to be 35% of the total energy consumption, in 2012 (TurkStat Sustainable Development Indicators Report, 2013). Additionally, according to the TEDC report on Electricity Distribution and Consumption Statistics in Turkey, the share of households in net electricity consumption in the country was 21.8% and that of the commercial sector was 19.8%, in 2017 (TurkStat, 2018). Hence, any strategy to establish energy autonomy in the existing building stock, which includes heritage buildings, has a great potential to solve the energy problem.

In other words, this problem can be mitigated to a significant extent by reducing energy consumption in the built environment and meeting the remaining demand by producing energy from renewable resources. One way forward would be to alter existing buildings in a way that they can contribute to the solution; however, heritage buildings pose special problems in the application of such solutions.

The depletion of non-renewable energy resources and climate change has triggered technological developments in renewable energy generation systems (Suppes, & Storvick, 2016) and this advancement has made it easier to produce clean energy for use in buildings. On the other hand, most of the energy consumption in buildings is due to the ineffective usage of active systems for maintaining human comfort in the buildings. Hence, using appropriate active systems and applying suitable passive design strategies are important goals to improve the interior comfort conditions without excessive energy consumption in the buildings (Ubinas, et al., 2014).

Although there are many renewable energy resources such as the sun, wind, water, geothermal, oceanic tides, etc., solar energy is the most widely available and most easily applicable resource that can be used for buildings. In this regard, firstly, solar energy generation systems including solar thermal technologies and photovoltaic (PV) typologies are discussed. To this end, PV technologies were examined according to their types and mechanisms as well as technological improvements over time.

As a second step, the integration of PV systems into new and existing buildings was studied and it was seen that all active and passive systems cannot be applied easily to heritage buildings due to their unique architectural, cultural, and historical features. Hence, this paper discusses the technologies and applications of solar energy and their integration into heritage buildings without harming the character-defining features of historic resources. In this regard case studies from France, Germany, Italy, and the UK that have integrated photovoltaic systems in heritage buildings have been presented.

Solar Thermal Technologies

Solar thermal energy has been utilized in traditional buildings as an important feature of passive design strategies; which in turn are defined as "… a set of architectural design strategies applied for supporting human comfort with the help of properly used environmental factors including climatic and locational conditions" (Kroner, 1997, pp. 381-393). In addition to the passive use of solar energy, active methods were also developed and improved gradually. The first attempt at using active solar energy technology was made in the 19th century when the first solar-powered water pump that used a parabolic solar collector was produced by a French inventor, Augustin Mouchot, and introduced at the Universal Exposition in Paris in 1878 (Walker, 2013).

With the increased need for alternative energy sources, solar thermal technologies were improved and became varied. According to their mechanisms, solar thermal systems can be divided into two types; active and passive systems. These systems have two main types which are air collectors and hydraulic systems (Figure 1). Passive solar thermal systems are mainly related to passive solar design strategies of gaining heat through the building envelope and storing it in the building mass itself such as high-mass floors, walls, and ceiling (Ching, & Shapiro, 2014). On the other hand, active solar systems used air or liquids. Air-operated solar systems have lower operational costs than hydraulic systems, but they are less efficient (Munari Probst, & Roecker, 2012). Depending on the connection of air with the absorber, air collector systems have four types which are named as flow over, under, on both sides of, and through absorbers as shown in Figure 2 (Earthscan, 2010).

As opposed to the air collector systems, hydraulic collectors provide easier storage and are more effective for domestic hot water (DHW) production and for space heating (Munari Probst, & Roecker, 2012). There are three types of hydraulic collectors: evacuated tubes, glazed flat plate and unglazed, flat plate collectors.

Photovoltaic Technologies

PV technologies are the latest improvements in solar energy generation systems. Unlike solar thermal systems that produce heat energy, PV systems can produce electrical energy; i.e. direct current (DC) by converting solar radiation. Electricity can be generated from arrays of solar cells in the PV panels, which are connected to inverters and batteries to make up the PV system (Sanna, 2015). These systems can be integrated into buildings and used as a standalone system like a mini electric power plant.

Thanks to technological developments over time, photovoltaic cells have been improved greatly based on the type of materials used in the PV panels and their mechanism of operation. There are three main types available: wafer-based crystalline silicon cells, thin-film cells, and advanced thin film cells (Figure 3).

The wafer-based crystalline cells (C-Si), also called the first-generation solar cells are the most widely used ones in the world; i.e. about 85% of the PV cells being used currently (Weller et al., 2010). Crystalline cells are subdivided into two categories; mono-crystalline (sc-Si) and multi-crystalline (mc-Si); the former have a homogeneous structure and a dark blue/blackish color (Figure 4), while the latter cells have a more heterogeneous structure, lighter color, and shinier surfaces, and are cheaper to produce (Figure 4) (Weller et al., 2010 and Munari Probst & Roecker, 2012).

The second type of PV cells are called thin-film solar cells are classified as second-generation solar cells; they consume lower energy and cost less to produce than the first-generation ones because they are composed of thin layers of solar material and low-cost backing material (Reinders et al., 2019). This type of PV panel can be silicon-based or compound semiconductor-based; while amorphous silicon is the most commonly used thin-film PV material because it is more diffusible, compound semiconductors are less costly and easy to manufacture and one of their types (the copper indium gallium diselenide cells) has the highest conversion efficiencies among thin film PV cells (Sanna, 2015; and Munari Probst, & Roecker, 2012).

The third type of PV panels use advanced thin-films and are called third-generation solar cells with emerging and novel PV technologies still under development. They are mainly composed of organic materials, which are divided into hybrid organic (in which inorganic components are also used) and full-organic solar cells. By using renewable materials for PV cells, the carbon footprint of the manufacturing process of the cells was tried to be decreased. The other distinguishable study of the third generation PV cells is related to shifting the two-dimensional planar paradigm with three dimensional design approaches. With the help of this shift and developments of technology, we can place PV modules almost everywhere. Furthermore, mass- and clean-production of these cells are easier due to printing technologies in the production process of the cells (Figure 5) (Sanna, 2015).

Building integration of photovoltaic panels

The application of PV systems on buildings started in the 1970s, mostly in remote areas without access to an electric power grid, but by the 1990s, PV technology became widely available (Eiffert, & Kiss, 2000). The installation of PV modules on buildings can be grouped into three main categories; roofing systems, façade systems, and external devices. Additionally, they can be differentiated as Building Added Photovoltaics (BAPV), which are PVs applied on top of the building skin, and Building Integrated Photovoltaics (BIPV) that are PVs integrated into the envelope and/or construction system (Reinders et al., 2019). While BAPV systems are just components/ devices added to the building, BIPV systems are integral parts of both construction systems and architectural concept, and result in more innovative projects (Munari Probst, & Roecker, 2012). When the modules are used as a building element, they can contribute to both the energy needs of the building and its hi-tech image (Roberts, & Guariento, 2009).

BIPV roofing systems are mostly based on replacing conventional roofing materials with PV integrated ones such as BIPV shingles, BIPV metal roofing, and BIPV exterior insulation (Eiffert, & Kiss, 2000). This application is possible for pitched, flat roofs, and skylights (Figure 6). Transparent or semi transparent PV panels are available on the market to provide a fully transparent shading roof and/ or skylight. First-generation cells are widely implemented in BIPV roofing systems as monocrystalline in cold climates and multi-crystalline in hot Mediterranean regions (Sanna, 2015). However, these roof tiles are measured as unsustainable, mainly because of their low cost-effectiveness and criticized for their lack of aesthetics (Reinders et al.,2019). Therefore, new technologies such as advanced thin-film cells are more promising than the first and second-generation ones, both technically and aesthetically.

BIPV façade systems can be designed as the external skin and/or weather barrier as part of the building envelope (Eiffert, & Kiss, 2000). These systems are available as opaque-cold facades, opaque-non-insulated glazing, and warm facades, and for semi-transparent and translucent façade parts (Munari Probst, & Roecker, 2012). Cold facades are constructed like double-skin façades where the PV panels are usually ventilated at the back to prevent heat build-up and thus improve the thermal performance of the interior spaces; as well as to improve the electrical performance of the panels (Sanna, 2015). PV integration on warm facades could be accomplished with the help of curtain wall systems with adequate U-values. This system is applicable for both opaque and semi-transparent/translucent surfaces (Munari Probst & Roecker, 2012) which are generally used for atriums or skylights to control heat, sunlight, glare, etc. (Sanna, 2015).

BIPV integrated external components can be integrated with sun protectors such as canopies or louvers, movable shutters with semi-transparent crystalline or thin-film cells, spandrels, balconies, parapets, and so on. According to the architectural concept, these panels can be custom made.

Heritage Buildings and Solar Energy

Countries around the world have accepted the energy problem and agreed upon the solution by signing treaties and declarations, starting with the Stockholm Conference. Since then, in order to honor their commitments, these countries have tried to alter the existing buildings and improve their energy performances by using different strategies, including active design strategies, and implementing various energetic technologies into existing buildings. With the rising demand for alternative energy production, various codes and regulations have been established around the world to streamline energy retrofitting initiatives for the existing building stock, which also includes heritage buildings. However, these agreed codes and regulations are not easy to implement in the case of heritage buildings; because of their unique characteristics; hence the EU Directive 2018/844 of the European Parliament and of the Council of 30 May 2018, which states that "Research into, and the testing of, new solutions for improving the energy performance of historic buildings and sites should be encouraged, while also safeguarding and preserving cultural heritage."

Thus, interventions for enhancing the energy performance of heritage buildings should be made carefully by considering not only their character and/or appearance (Lidelöw, Örn, Luciani, & Rizzo, 2018) but also several other issues such as protecting the architectural, cultural, and historical features, and improving the energy and comfort requirement for people and also the artworks (López & Frontini, 2014).

A study on the integration of energy production systems into heritage buildings has revealed that solar energy systems were the only ones considered suitable. Information on four such cases is provided in the following sections.

PV panel application on heritage buildings

As a result of international declarations related to energy issues and standards, it was easier to design new buildings that complied with them rather than to implement them in existing buildings, particularly in historic buildings (Garau, & Rosa-Clot, 2017).

On the other hand, heritage buildings that fail to provide satisfactory thermal comfort with reasonable energy consumption are being abandoned; thus, their long-term use and preservation should be considered together with appropriate energy retrofit strategies (Broström & Svahnström, 2011). Since every heritage building has unique features and different environments that need preserving, every intervention needs to be planned according to the authenticity and aesthetic values of these buildings (Sudimac, Ugrinović, & Jurčević, 2020). Consequently, it is essential that the application of PV panels should not change the existing building character and their visibility should be minimized (Lingfors, Johansson, Widén, & Broström, 2019). This can be achieved by working in close coordination with the restoration experts to determine the character-defining features of the building and the placement of PV panels. The National Trust guidelines for installing PV panels on historic buildings states that the location of the solar panels may be on the site of a historic structure or on a new construction nearby. However, if these two options are not possible, the panels should be placed in areas that minimize their visibility from a public thoroughfare; and the character-defining features are left untouched while the removal or permanent alteration of the historic fabric should be avoided (Kandt et al., 2011).

PV panel integrated heritage buildings

There are several successful applications related to the implementation of PV panels on heritage buildings, like the Tourist Office of Alès in France, the Reichstag Building in Germany, 'Paul VI' Audience Hall in Italy, and the Gloucester Cathedral in the United Kingdom. These applications have been mentioned briefly in the following sections.

France (Tourist office of Alès)

The 16th-century stone-built building of the Tourist Office in Alès (France) is a remnant of a church that was transformed into an energy generating building by the municipality of Ales city (Heracleous et al., 2019). For this purpose, the photovoltaic modules made from crystalline silicon solar cells were applied to the facade of the building, in 2001, under the leadership of architect Jean-François Rougé (Baum, 2011). There is a three-belt conveyor system on the building façade, each 6m wide and approximately 5m high (Figure 7), and an integrated PV design is applied to each belt cavity. Double glazing was applied to the back of the PV facade with an air gap of 11cm between them (Kanan, 2012). The integrated PV panels with 100 m^2 area installed in the southeast direction can generate 9.2 kWp of energy (Baum, 2011). The structure is ventilated by an air gap in summer and heated in winter.

The semi-transparent panels selected for aesthetic concerns are covered with a brown anti reflection coating (Kanan, 2012). The photovoltaic modules used in this project were chosen considering the social and cultural values of the structure. The materials of the panels were adjusted to maintain the overall appearance of the building and to support the building in harmony with the built environment. Thus, the material of the panels was able to make a design statement while preserving the cultural values of the building (Heracleous et al., 2019). To illustrate, the color was selected to match other materials used on the building facade and the shape and design of the module were used as a new façade cladding (Farkas et al., 2009).

Germany (Reichstag Building)

The six-story complex of the Reichstag was designed by architect Paul Wallot and the 13,290 m^2 building was completed in 1894 (Encyclopaedia Britannica, 2014). In 1933 it was heavily damaged in a fire; and rebuilt and extended as the new Parliament building by British architect Norman Foster in 1999 (Figure 8) (Encyclopaedia Britannica, 2014). It was re-designed in line with the social and cultural values of the building, while its energy consumption and production were being considered carefully (Arandelovic & Bogunovich, 2014). The energy generation and supply systems were based on ecological and economical machinery, installations, and transmission systems for energy generation and consumption. Hence, the Reichstag building was one of the first major projects in terms of integrating solar energy into a historical building (Sudimac, Ugrinović, & Jurčević, 2020). A total of approximately 3,600 m^2 of photovoltaic modules of monocrystalline silicon solar cells were mounted on the roofs of the Reichstag House, the Paul Löbe Building, and the Jakob Kaiser Building. The power generated by these panels is able not only to meet the demand of the building (Deutscher Bundestag, 2010) but, also, under peak conditions it can generate more electricity than it consumes, which can be supplied to the new government quarters in the vicinity (Foster+Partners).

Italy ('Paul VI' Audience Hall)

The Paul VI Audience Hall in Rome, having a seating capacity of 6,300, is a reinforced concrete structure designed by Italian architect Pier Luigi Nervi and opened in 1971 ("Paolo VI Audience Hall in Vatican City", 2011). In May 2007 the building's roof required major repairs and a novel approach was used by including energy retrofitting into the refurbishment project. The roof was covered with 2,400 photovoltaic modules made from crystalline silicon solar cells, thus generating enough electricity to supply all the building's heating, cooling, and lighting needs throughout the year. The completed project was publicly launched on November 26, 2008 and was awarded the 2008 European Solar Prize in the category "Solar design and urban development" (Heracleous et al., 2019).

The 2,400 PV modules facing the exact south were installed to replace the deteriorated concrete roofing panels of the historic building and were reproduced to fit the size of the replaced panels according to Pier Luigi Nervi's original project (Chiorino) (Figure 9). These PV modules fulfill the dual "passive" function of protecting the building against radiation and the "active" production of electricity, thus giving an exemplary added-environmental-value to its aesthetic value. The average power of the modules is equivalent to 90 watts each, and the output of the 2,400 panels facing south is improved by about 5 percent (Heracleous et al., 2019).

United Kingdom (Gloucester Cathedral)

In the UK, a decision was made to use renewable energy sources, i.e. PV panels, on 5,500 churches (Sudimac, Ugrinović, & Jurčević, 2020) in order to reach the target for carbon footprint reduction that was set as 80 %, by 2050 (Khatri et al., 2019). The 1,000 years old Gloucester Cathedral became one of the oldest churches where this decision was implemented. Consequently, 150 PV panels, called REC 255PE BLK2, which consists of multi-crystalline cells according to the supplier of the PV panels of the building, were installed on top of Gloucester Cathedral's roof in 2016 (Figure 10) (Novak & Vcelak, 2019). According to Bairstow (2016), when the panels were installed, it was expected that the energy production of the 38kW solar array would meet 25% of the cathedral's demand. In 2017, the performance of the panels was recorded as better than predicted and the integrated photovoltaic system was seen to have the ability to produce energy for seven semi detached houses also.

Conclusion

In order to solve the energy consumption problem, existing buildings can play an important part by integrating appropriate retrofitting strategies. While the use of active energy production systems in existing buildings is an efficient solution; heritage buildings, owing to their architectural, cultural, and historical qualities, are not as easy to retrofit. Production of clean energy, using solar energy generation systems is becoming a necessity. For this purpose, BIPV systems are very useful; and while such systems can be easily applied to existing conventional buildings, their application to heritage buildings needs carefully handled in view of the unique characteristics and values of these buildings. Although there are many heritage buildings in which renovations using BIPV systems have been successful, specific solutions have to be produced for each building in collaboration with restoration experts regarding the location of the PV panels, in order to minimize their visibility and preserve the historic fabric.

As can be seen from the case studies presented in this paper, using PV cells on top of the roof of the heritage buildings is the most common way, both to protect the value of the building and to produce clean energy advantageously. However, the color of the panels should be chosen carefully according to the location and context of the buildings so that they can blend into the background inconspicuously. Also, to ensure maximum compatibility of the panels with the building and the surrounding, the type of PV panel gains importance. Although thin-film and organic cells could offer more efficient solutions due to their advanced technological features, such as less energy consumption and production cost of thin-film cells, and the flexible structure of organic cells, the most commonly used PV panel type was first-generation solar cells, probably because thin-film and organic cells are still under development.

IMAGES, CHARTS OR GRAPHIC LEGENDS

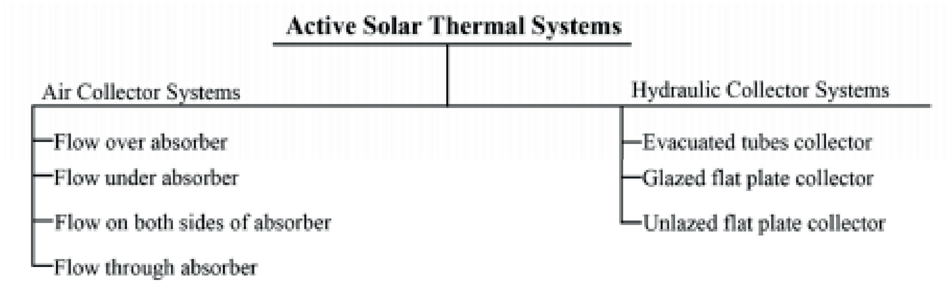

Figure 1: Solar thermal system types according to their mechanisms

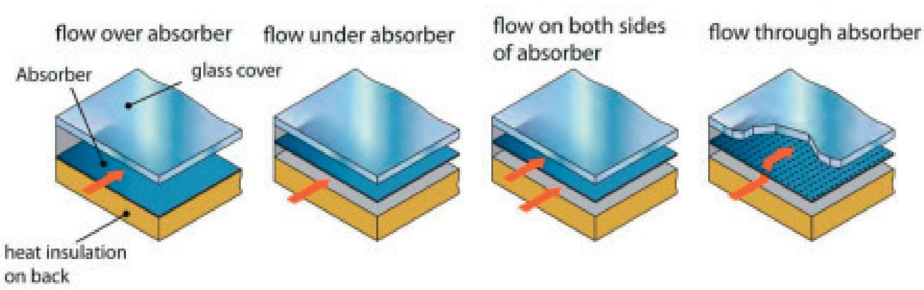

Figure 2: Air collector system types according to connection of air with the absorber (Earthscan, 2010)

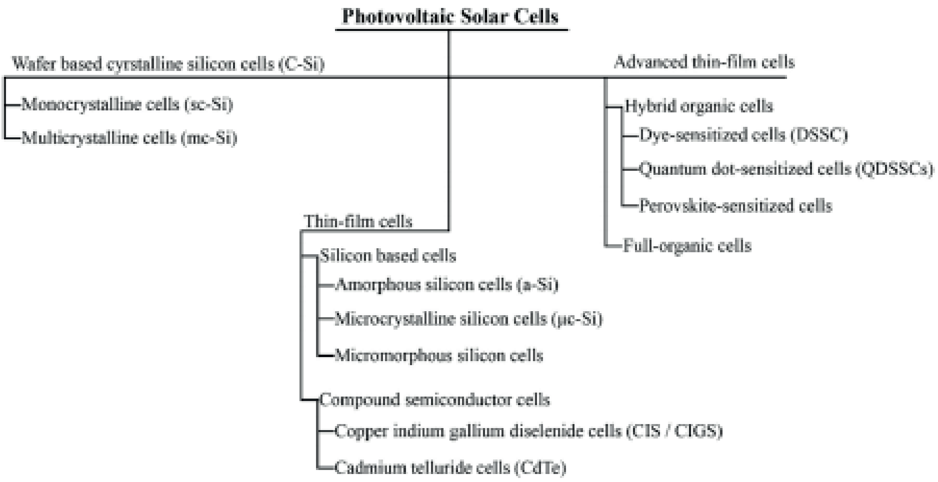

Figure 3: PV solar cell types according to their mechanisms and the technological improvements over time

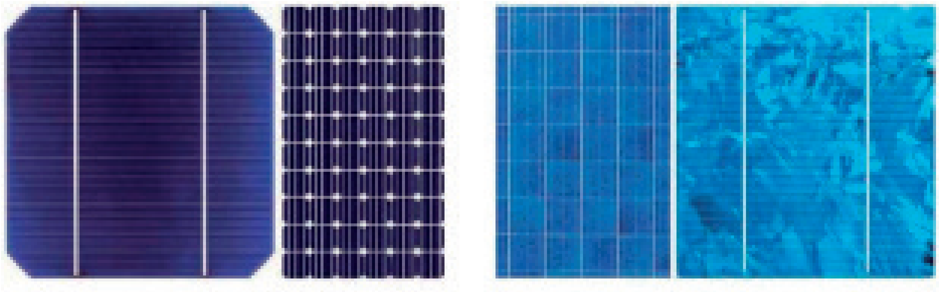

Figure 4: Crystalline silicon solar cell types (Left: monocrystalline solar cells (sc-Si), Right: multicrystalline solar cells (mc-Si)) (Sanna, 2015)

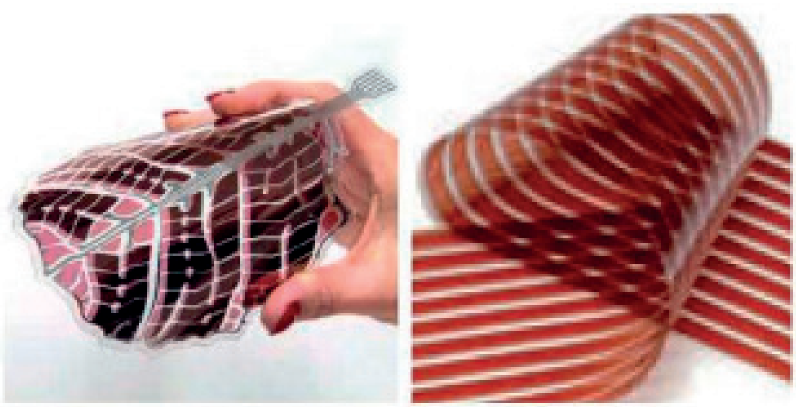

Figure 5: Samples from organic printed solar cells (Sanna, 2015), (Weller et al., 2010)

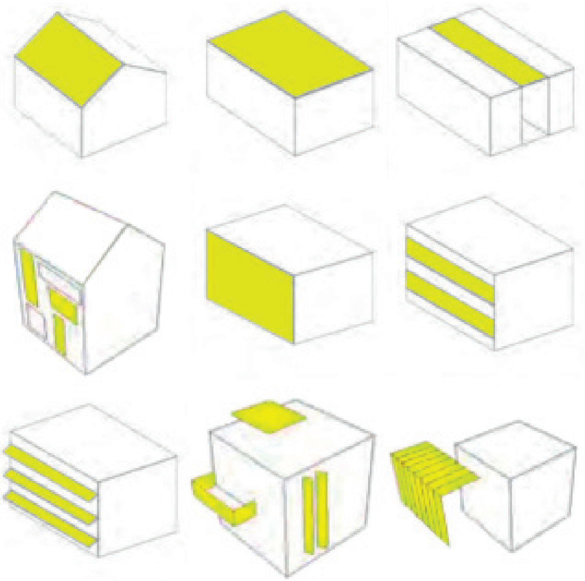

Figure 6: BIPV: 1st row: roof systems, 2nd row: façade systems and 3rd row: external devices (Munari Probst, & Roecker, 2012)

Figure 7: PV panel integrated façade of Tourist office of Alès (Heinstein, Ballif, & Perret-Aebi, 2018)

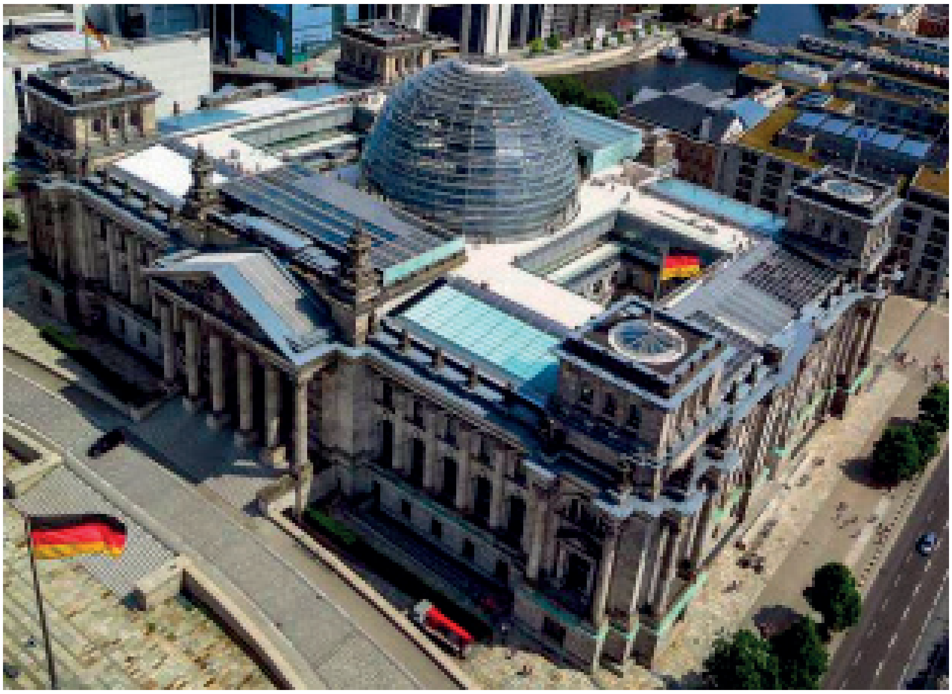

Figure 8: Reichstag Building from above showing the PV modules located on top of the roof

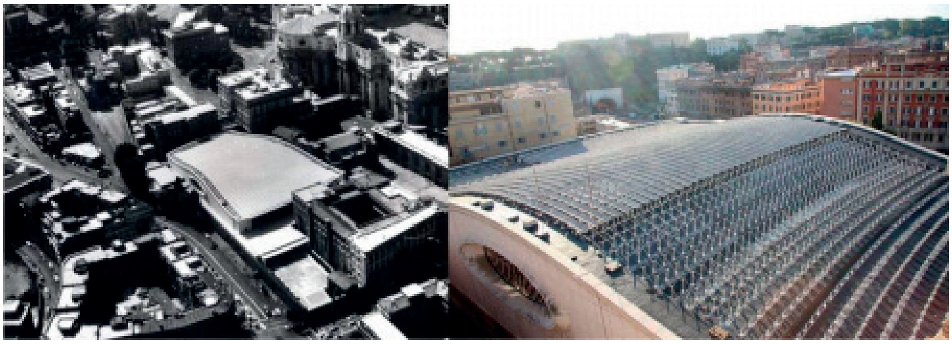

Figure 9: Left: Original roof of Paul VI Audience Hall (Chiorino) Right: PV panel integrated roof of Paul VI Audience Hall ("Paolo VI Audience Hall in Vatican City", 2011)

Figure 10: Photovoltaic panels on top of the roof of Gloucester Cathedral (mypoweruk.com)

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SIMULATING PASSIVE VENTILATION TECHNIQUES BY USING DIFFERENT SOFTWARE

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ABSTRACT
The ever increasing negative impacts of the global warming phenomenon on nature, environment, and people can no longer be ignored (Parry et al, 2007). While an important factor causing this increase is the increasing amount of energy consumption and the associated greenhouse gas (GHG) emissions. One of the sources for this increase in energy consumption in the world is the building sector, where construction, operation, and maintenance activities account for approximately 40% of the energy demand, and 45% of the global carbon emission
(Calautit et al, 2016). On the other hand, the energy demand for heating, ventilation, and air conditioning (HVAC) systems, which are a part of the building operation activities, is more than 40% of the total energy usage (Chenari et al, 2016). This situation is aggravated further in regions with extreme climates, because of the need to provide thermal comfort to the occupants; i.e. heating in cold climates and air conditioning (AC) in hot climates. Since in such climates people spend most of their time in conditioned spaces, their indoor air quality (IAQ) and energy consumption are both important for human health and for the current energy problem. Consequently, indoor air quality, thermal comfort, occupant behaviour, and the building's energy performance have a direct relationship with its energy consumption (Li, 2013). A study into traditional buildings reveals that passive solutions for providing thermal comfort are quite successful in reducing or even doing away with the need for energy consumption. For example, in hot climates, traditional/natural ventilation techniques are useful in reducing cooling loads in buildings, while providing healthier IAQ, concurrently. However, if the most appropriate technique/ technology is not selected, its application can be quite costly. On the other hand, it is possible to simulate the various options on a virtual model of the proposed building by using related software. Hence, this study begins with the investigation of traditional passive ventilation techniques, which have been used since ancient times; such as solar chimneys, wind catchers, underground air passages, and atria. Simulating these passive

strategies is a complex exercise using computational fluid dynamics (CFD); therefore, building 2 simulation strategies that can be used for evaluating the aforementioned passive ventilation techniques virtually, will be studied. To this end, a general overview of the problems encountered in CFD based energy simulations will be investigated; and case studies on the application of traditional passive ventilation techniques through various software will be examined. The aim of this research is to determine and select the most efficient methods and techniques for both passive ventilation and simulation of their applications, through a review of the related literature. It is expected that this study will be helpful in conducting future research on the feasibility of adapting traditional architectural techniques that require less cooling/ heating energy for providing thermal comfort, even when they are located in extreme climates. In conclusion, this study examines the benefits of traditional passive ventilation techniques and their adaptation to current architecture by using energy simulation software for predicting the most appropriate solution.

KEYWORDS

Traditional passive ventilation techniques, building simulation, computational fluid dynamics (CFD)

Introduction

In recent years, it can no longer be ignored that negative impacts of the global warming phenomenon on nature, the environment, and people (Parry et al, 2007). One of the main factors causing this impact is the increasing amount of energy consumption and related greenhouse gas (GHG) emission. The building sector leads the increase in the energy consumption in the world because of the rapid growth of the construction sector (Chu et al, 2017). In other words, the building sector which includes construction, operation, and maintenance, accounts for approximately 40% of energy demand, and 45% of the global carbon emission (Calautit et al, 2016). In addition to that, heating, ventilation, and air conditioning (HVAC) systems are also one of the main factors of energy consumption for buildings. This energy demand is more than 40% of the total energy usage (Chenari et al, 2016). This situation has extremely increased in the regions with extreme climates to provide the indoor thermal comfort by using air conditioning (AC). In addition to that, since people spend most of their time in conditioned spaces, indoor air quality (IAQ) and energy consumption are both significant for human health and for the current energy consumption problem. On the other hand, HVAC systems consume the vast majority of electricity needs and they have great importance in maintaining the quality of life and thermal comfort of the world population (Desideri et al., 2009). Economic growth and improvements in living standards continue to increase HVAC use and need (Isaac & Van Vuuren, 2009). It is estimated that the electricity needs of HVAC systems will increase 33 times over the next century (Axell, 2015). Therefore, the relationship between IAQ and heating and cooling systems has also great importance due to the issues such as decreasing world energy use and carbon dioxide gas emissions and controlling climate change (Ma et al., 2019). Therefore, there is a direct relationship between energy consumption and, indoor air quality, thermal comfort, occupant behavior, and energy performance of the building (Li, 2013).

In order to reduce the negative impacts or to solve the issues and problems mentioned, it is also necessary to address the issue of sustainability. Sustainability has been defined as the need to protect current natural resources in order to continue the earth's resources for future generations. (Costanza & Patten, 1995). Two of the most important factors that negatively affect this sustainability are energy consumption and CO2 emissions. Thus, responsibility has occurred to ensure that the resources in the world are not exhausted. Factors that need high energy such as heating, cooling, and lighting, which are necessary for the building to maintain, cause CO2 emissions. Reducing energy needs and CO2 emissions in the construction industry contributes greatly to sustainability. Achieving this situation is a great challenge both for architects and engineers (Vethanayagam & Abu-Hijleh, 2019). Consequently, there is a need to further decrease energy consumption or change the type of energy sources due to the risks of global warming and depletion of fossil fuels (Xu et al., 2016).

Studies about traditional ventilation techniques and their applications investigated by using related software and technology give passive solutions related to existing energy problems. On the other hand, passive ventilation techniques help to create healthier spaces that provide IAQ. When selective the most appropriate method for passive ventilation, this situation ensures decreasing the cost in the stages i.e., construction, utilization, and maintenance. In addition to that, the buildings can be modelled and simulated to test the building behavior and to obtain realistic predictions about building performance by using related software. Therefore, this study begins with the investigation of traditional passive ventilation techniques which have been used for ancient times. These passive ventilation techniques are determined as solar chimneys, wind catchers, underground air passages, and atria. Moreover, how building simulation techniques can be used for re-evaluating these passive ventilation techniques are studied. In other words, a general overview of computational fluid dynamics (CFD) and application of CFD by using related software are also investigated. The aim of this research is to determine and select the most efficient methods and techniques for both passive ventilation and simulation. To realize this purpose, the literature is reviewed to examine the benefits of traditional passive ventilation techniques and adaptation of them to current architecture by using energy simulation software.

Traditional Passive Ventilation Techniques

Natural ventilation is one of the key factors of passive cooling systems. The meaning of the word ventilation is the circulation of air (Merriam-Webster, 2019). Ventilation methods are used for supplying fresh air for interior spaces and cooling the interior of the buildings when the outside air is cooler than the interior, and for increasing the evaporation rate of the human skin (Watson & Labs, 1983). On the other hand, IAQ has a great effect on human health and quality of life. Because people spend the most of their time in conditioned interior spaces, this issue becomes more important (Jomehzadeh et al, 2017). Figure 1 illustrates the relationship between energy consumption, thermal comfort, and IAQ.

In addition, Brophy & Lewis (2011) states that while changing on the building typology and construction styles and techniques, the ventilation rate of the spaces is lowered. This situation causes increasing the need for adequate ventilation and IAQ. Passive ventilation systems are important strategies for sustainable strategies to obtain thermal comfort by decreasing the energy demand of the building. Etheridge (2011) states that ventilation systems are important factors for building design. The reason for that is the system helps to provide adequate conditions for the occupancies of the building. The design process of the ventilation strategies is listed into five stages (Table 1). These stages are helpful for adapting natural ventilation strategies into the building design. The first step is to evaluate whether natural ventilation is possible. If so, the next step is to decide on a ventilation strategy. The third is to design the envelopes and openings to achieve natural ventilation. In the fourth stage, calculations about indoor comfort are made. When satisfactory results were obtained from the third and fourth stages, the last stage is commissioned.

Design Stages of Natural Ventilation System	
Stage 1	Analyze whether natural ventilation is technically feasible or not
Stage 2	Design of the natural ventilation strategies by integrating cooling and heating systems
Stage 3	Determination of windows' and openings' size and position
Stage 4	Checking the internal conditions whether they are satisfactory or not
Stage 5	*Commissioning of control system and associated systems *Post-occupancy evaluation

Table 1: The design stages of natural ventilation systems determined by Etheridge (2011)

In addition to that Brophy & Lewis (2011) mentioned that to provide sufficient ventilation some techniques and strategies can be applied. These are listed below:

- The rate of ventilation should be determined according to the standards.
- The ventilation strategy should be designed to be effective and easy to use.
- Hot air in the interior spaces should be escaped from the ceiling of the building.
- The location of the windows should be determined to allow ventilation.
- Windows should be easily operated and controlled.

Natural ventilation, an energy-saving alternative to reducing building energy consumption, has become a promising passive cooling strategy to reduce problems caused by air conditioning systems. Natural ventilation concepts have two main functions: they provide good IAQ without any electrical demand to move air and improve thermal comfort by directly ventilating users when the airflow increases the sense of thermal comfort (Daghigh, 2015).

In this study, solar chimneys, wind catchers, underground air passages, and atria, which are all traditional passive ventilation techniques have been used since ancient times, are investigated.

Solar Chimneys

The application of solar energy has been a critical topic because of the increasing trend in fossil fuel usage. One of the most important solar energy systems is solar chimneys which have been used for increasing the ventilation of the building (Duan, 2019). Because this ventilation technique is an important green architecture element, they help to reduce the energy usage of the conventional buildings by 10-20% (Khedari et al, 2003).

Solar chimneys provide airflow by converting thermal energy into kinetic energy by using the pressure difference at the inlet and outlet of the chimney. They are used for both heating and cooling. The working mechanism of solar chimneys is very similar to the Trombe wall. It provides heating by converting the collected hot air to the room with ventilation. In hot weather, it helps to provide thermal comfort by increasing natural ventilation and providing thermal insulation (Chan et al, 2010). Figure 2 illustrates these three modes of solar chimneys.

Because solar chimneys are efficient methods for passive ventilation systems, a lot of researchers made studies about this issue. The performance of solar chimneys can be affected by some parameters which are listed below (Shi et al, 2018).

- Height
- Channel width
- Sizes of inlet and outlet
- Inclination angle
- Types of glazing
- Material of solar absorber

Solar chimneys are located at the façade which gains most sun radiation (Xaman et al, 2019). Shi & Chew (2012) compared the vertical and roof solar chimneys (Figure 3). Roof solar chimneys have larger areas to collect solar radiation. However, roof solar chimneys can cause more pressure loss than vertical ones. On the other hand, vertical solar chimneys have no height restriction and also, they allow direct airflow.

Wind Catchers

Windcatcher is a natural ventilation method based on the use of the pressure difference and the buoyancy principles generally used in hot and dry climates. Windcatchers, which is a traditional method, are used mostly in the Middle East countries especially in Iran (Afshin, Sohankar, Manshadi & Esfeh, 2016). It is a sustainable method since it is a natural ventilation technique providing fresh air by taking advantage of the climate. At the same time, it improves thermal comfort as it provides passive cooling in the inner space.

As can be seen in the Figure-4 below, wind catchers are generally tall tower-shaped structures that rise above the buildings. It catches the wind through the openings in the upper part and delivers it to the interior (Calautit & Hughes, 2016).

According to Calautit & Hughes (2016), windcatchers can be integrated with evaporation pools or wet surfaces on the ground to cool the incoming air and increase thermal comfort (Figure 5).

Windcatchers can have rectangular or circular sections, and also, they can be varied according to the number of openings on the facade, such as one-sided, two-sided, four-sided (Goudarzia & Mostafaeipourb, 2017). Multi-sided ones can be built in where wind direction cannot be predicted.

Underground Air Passages

Earth has been used as a thermal absorber since ancient times. For instance, underground air tunnels (UAT) have been used since 3000 B.C (Ozgener, 2011). This system has been used as a heat source and heat sink to change the heat of the outdoor air. When air passing through the tunnel, the temperature of the outdoor air is getting closer to the temperature of the soil. Because the temperature of the soil is almost constant, the air in the passage helps to heat and cool for the buildings (Yang & Zhang, 2015). Nowadays, UAT is known as earth to air heat exchanger (EAHE). This system is a passive technique to reduce the energy demand of the building for heating and cooling. Ozgener (2011) mentioned two types of EAHE or UAT i.e., open loop and closed loop (Figure 6). In addition to that, Goswami & Ileslamlou (1990) stated that pipe material, the circulating fan, soil characteristics, and moisture content affect the energy performance of EAHE. Moreover, the depth and length of the tunnel are very important parameters for EAHE systems. They affect the air outlet temperature and cooling capacity of the tunnel or pipe (Wengang et al, 2019).

A similar method was realized by architect Selçuk Avcı in the building of the Turkish Contractors Association which was constructed in 2013 in Ankara. A reinforced concrete labyrinth is designed under the parking lots in the basement floors to minimize the energy consumption in heating and cooling by using the temperature difference between day and night, which is the typical climate feature of Ankara. This labyrinth acts like a battery that helps passively cool the daytime air by storing night heat in the summer (Figure 7).

In winter, it uses the core heat of the soil and passively conditioned the daytime air. Figure 8 illustrates the section drawing of the building.

Atria

The term atrium means 'the central room of a Roman house' (Merriam- Webster Dictionary). In the current world, the atrium has a glass-covered roof and it is used as the intersection space which connects galleries and stories (Moosavi et al, 2014).

The use of atria in buildings has the potential to consume less energy than normal buildings. The design of the natural ventilation system is due to the pressure difference. This pressure difference is affected and performed by wind and buoyancy forces (Hussain & Oosthuizen, 2012). Atria enhance the connection between the indoor and outdoor and this situation provides decreasing the energy demand both for lighting and heating/ cooling (Vethanayagam & Abu Hijleh, 2019). Saxon (1984) also mentioned that when atria are designed properly, the building gains adequate lighting and ventilation are promoted. This situation provides reducing the energy demand of the building.

Chu et al (2017) investigated the effects of air supply angle on airflow organization, air supply speed on atrium airflow, air temperature difference on indoor airflow, and air supply height on indoor airflow. These parameters were tested by using FLUENT software which is a platform designed for efficient and flexible workflows, and powerful capabilities in geometry modeling and meshing.

If the roof of the atrium is openable, it stimulates the stack ventilation and provides natural ventilation for decreasing the heating and cooling energy demand. In the buildings, thanks to designing proper atrium, stack ventilation is enhanced by accumulating buoyancy effect (Figure 9).

Building Simulation Techniques

Building simulation has emerged in order to reduce energy demand with sustainable applications and to test variables that affect human health and thermal comfort. Thus, technology and practice have found a common working environment. Building simulation is needed to test traditional and current design techniques and to obtain predictions and suggestions about their performance and cost (Clarke, 2007). In addition to that, Ostergard et al (2020) mentioned that building performance simulation (BPS) software is an important tool to trigger the making decisions about designs. In other words, BPS helps not only to create a balance between the energy demand of the building and IAQ and thermal comfort but also to make predictions about the building behavior.

Many of the existing buildings need to be retrofitted with improvements to building performance. While making these improvements, a number of analyzes are needed to test, evaluate, and compare the results of various variations before the application phase (Fan & Xia, 2018). These analyzes can be technical, technological, social, comfort-related, acoustical, aesthetic, thermal, etc. All these systems seriously affect the performance of the buildings. Since analyzing and calculating these parameters is a very complex process, building simulation programs are needed to achieve the correct and reliable results. Thus, these tests and analyzes form the basis for increasing the thermal comfort of new buildings or existing buildings, reducing environmental impact, and reducing the energy need of the building (Ceballos-Fuentealba et al, 2019).

Chokwitthaya et al (2019) also stated that BPS tools provide predictions about a lot of parameters which are listed below:

- space heating
- air quality
- artificial lighting
- illuminance
- temperature
- occupancy status
- solar irradiance
- human interactions with building components such as light switches, blinds, and windows
- energy usages

Aksamija (2015) mentioned that BPS tools provide different data for designers and engineers. While predictions are enabled by these data, uncertainties about the building behavior can decrease. This decrease can be achieved at different design stages, yet the most efficient application can be obtained at the concept design stage (Figure 10).

General Overview of Computational Fluid Dynamics (CFD)

When natural ventilation methods are used correctly, it provides great importance in increasing thermal comfort and IAQ. To successfully implement these methods, it is necessary to understand and evaluate how the external wind environment interacts with the internal components of the structure (Meroney, 2009). To realize these implementations, analytical methods and experiments are used to estimate and evaluate the airflow of buildings related to natural ventilation at the design stage. Computational fluid dynamics (CFD) is a method used to test and simulate natural ventilation strategies. With this method, great benefit can be achieved in understanding the performance characteristics of the structure, flow rate, and fresh air distribution at the design stage. On the other hand, CFD provides data on airflow velocity and temperature inside and around the building, and this makes savings on time and cost according to experimental methods (Ji et al, 2007).

Etheridge (2011) mentioned that CFD can solve the problems of the building about the airflow by using mathematical, numerical, and physical parameters of the environment or space. Basic types of CFD that are used in current studies are illustrated in Figure 11.

On the other hand, De Wilde (2018) states that CFD is mainly related to airflow. There is a need for CFD to determine the ventilation and infiltration at single zone or multi-zone models, airflow patterns, and distribution of air pollutants. Buoyancy, stratification, and turbulence are the parameters that affect this situation.

Moser et al (2001) mentioned the advantages of CFD tools which are listed below:

- Allowing detailed analysis
- Suitable for solving the wide range of problems
- Providing the execution of different flow elements
- Achieving reliable parameters for different situations
- Saving on time and cost.

Applications of CFD

CFD has been practicing by both engineers and architects for obtaining data about building behaviors about airflow. Yuah & Ng (2014) created a framework which demonstrates the practical application of CFD in the architectural design (Figure 12).

Firstly, a suitable modeling method should be selected for the start in step 1. This method includes the wind velocity in the current environment and the roughness in the environment. The next step is to choose a suitable CFD simulation method according to the need and available resources. Step 3 includes data collection and interpretation of the architectural design process. In the last step, decisions should be based on statistical modeling of wind data collected at appropriate test points to ensure that it is sufficient to make informed decisions. As shown in Figure 1, data analysis should be done globally and locally to evaluate both the wind environment around the building to be tested and the impact of the design strategy. Both are of great importance for making decisions in the architectural design process.

Etheridge (2011) determines some application of CFD for naturally ventilated buildings as:

- Calculations about the velocity of the air inside and the temperature of space
- Calculations about the flows on the external surface of the building
- Calculation of the external pressures on the building facade
- Calculation of flow according to different states of openings
- Moser et al (2001) also mention the applications about airflow which can be tested by using CFD. They are listed below:
- The effect of mechanical equipment on the flow in the room
- Effects of pollutants on the space
- Airflow through openings
- Airflow through the inside spaces and exterior
- Movement of heavy gases and smoke from a fire

External flow, internal flow, and flow through openings are the parameters for natural ventilation (Figure 13). These flows can be tested, examined, and organized by using CFD.

Conclusion

Recently, energy consumption has become more important because the effects of climate change have been experienced seriously. The construction sector is one of the major factors that cause an increase in energy consumption. For future generations, using energy types based on fossil fuels should be minimized and abandoned in time. The energy consumption issue should also be addressed by promoting passive heating and cooling techniques. To realize this purpose, the studies about passive cooling and heating systems, which are solar chimneys, wind catchers, underground air passages, and atria, and CFD simulations for the purpose of decreasing the energy demand of the buildings were investigated. In short, this study generally consists of a review of the literature. It is expected that this research will be helped to design the process of next studies and researches about adapting traditional architectural techniques related to the energy to today's architecture, and also to demonstrate that buildings can be designed and utilized, in the manner using less energy for cooling and heating, by providing thermal comfort even when they are located in extreme climates. In conclusion, this study examines the benefits of traditional passive ventilation techniques and adaptation of them to current architecture by using energy simulation software which provides predictions.

IMAGES, CHARTS OR GRAPHIC LEGENDS

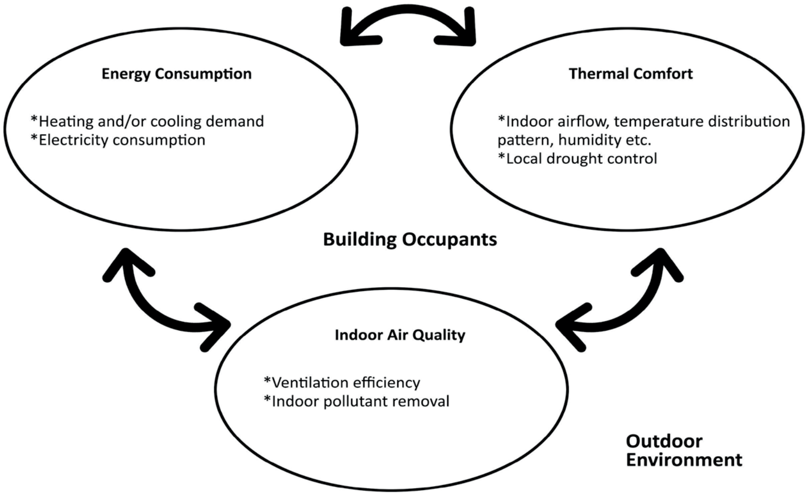

Figure 1: The relationship between energy consumption, thermal comfort, IAQ related to building occupants and outdoor environment illustrated by Li (2013)

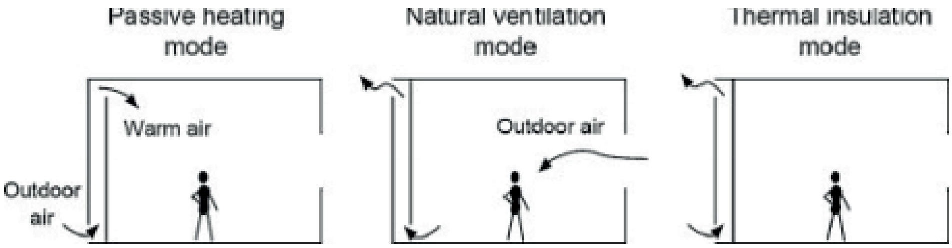

Figure 2: The working modes of solar chimneys illustrated by Chan et al (2010).

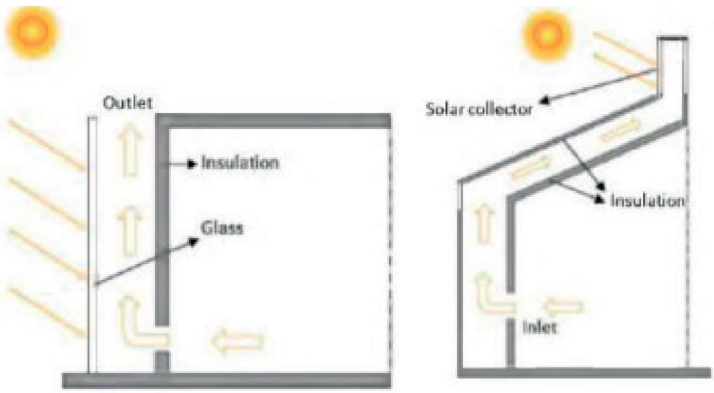

Figure 3: Vertical solar chimney (left), roof solar chimney (right) drawn by Shi & Chew (2012).

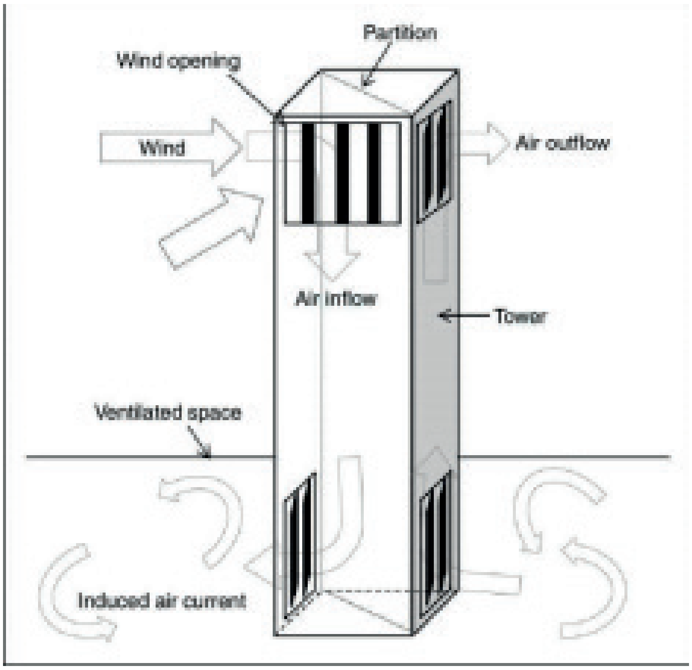

Figure 4: Basic principle of traditional windcatchers (Kassir, 2015).

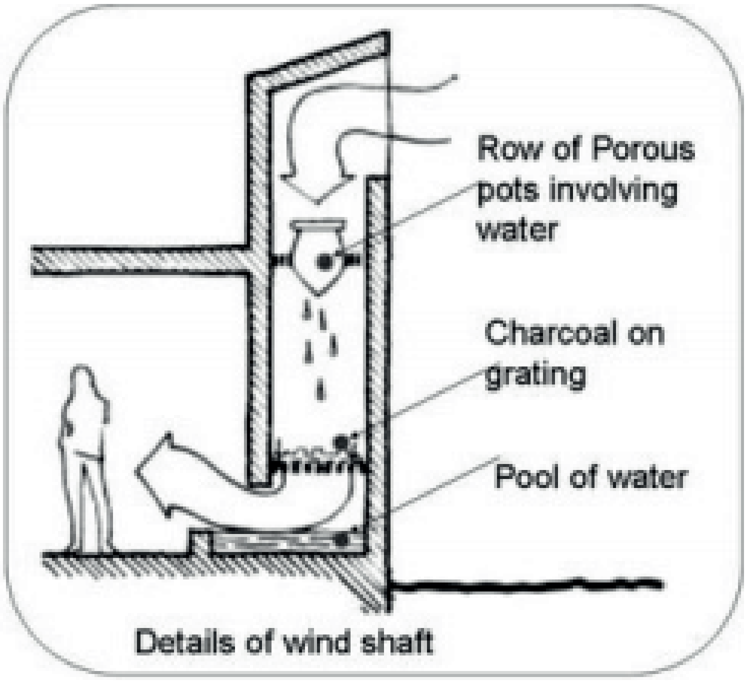

Figure 5: Use of water for thermal comfort in windcatchers (Hassan, Lee & Yoo, 2015).

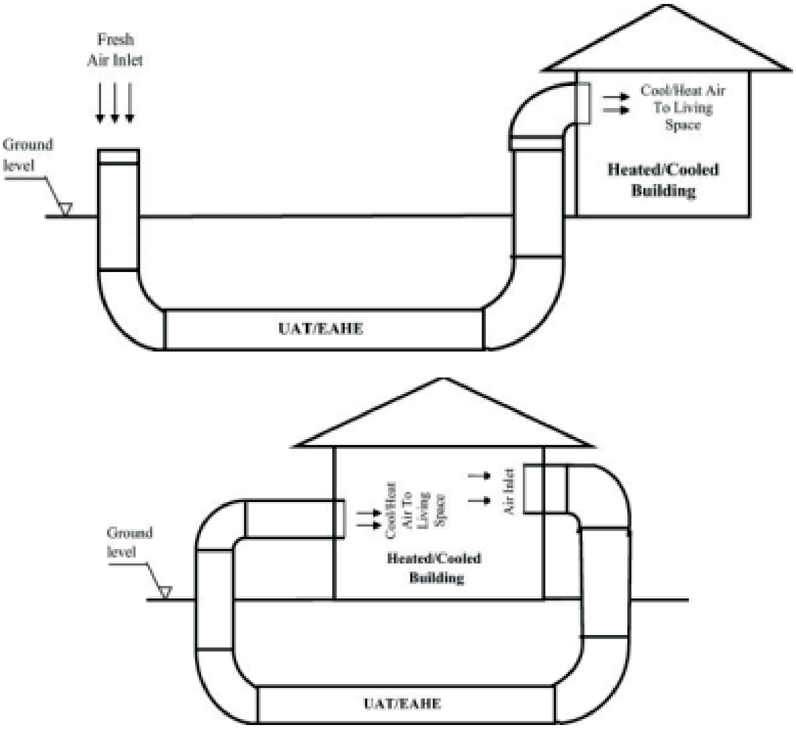

Figure 6: Open loop EAHE (upper), closed loop EAHE (lower) illustrated by Ozgener (2011).

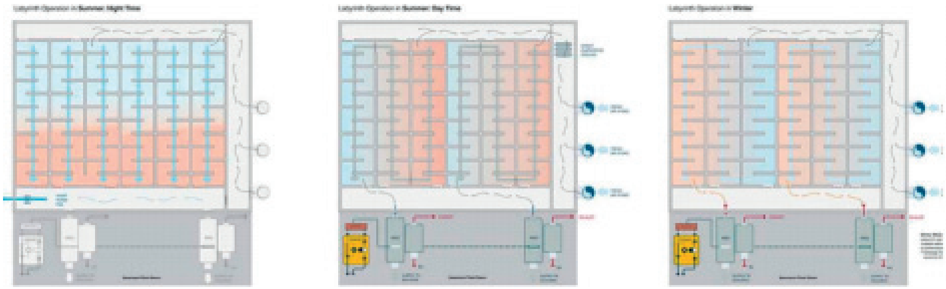

Figure 7: Plan of the labyrinth retrieved from https://avciarchitects.com/tr/proje/tmb-merkez binasi/.

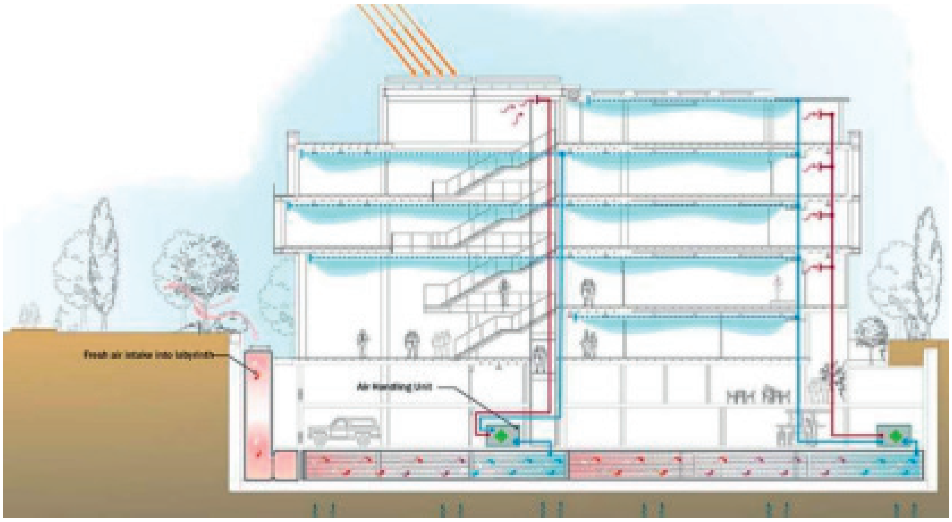

Figure 8: Section drawing of Turkish Contractors Association building retrieved from https://avciarchitects.com/tr/proje/tmb-merkez-binasi/

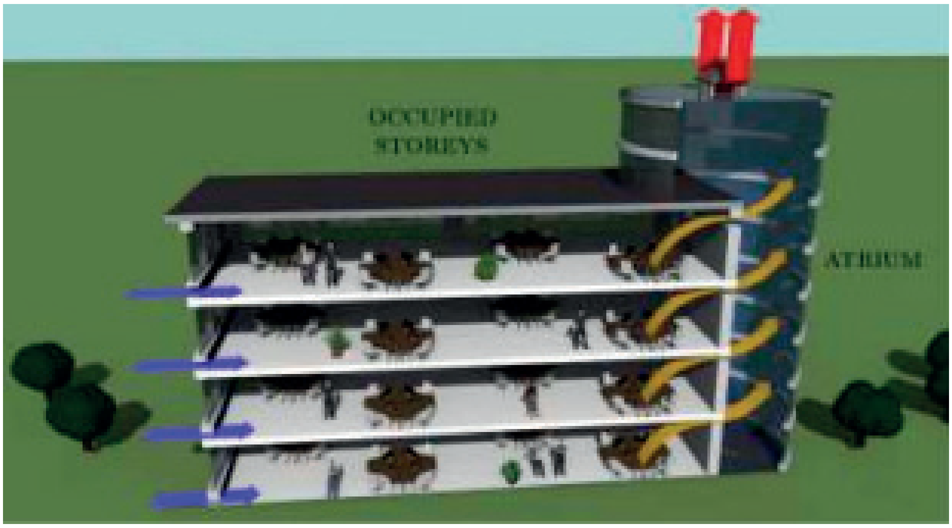

Figure 9: Example of the multi-story building with an atrium drawn by Acred & Hunt (2014).

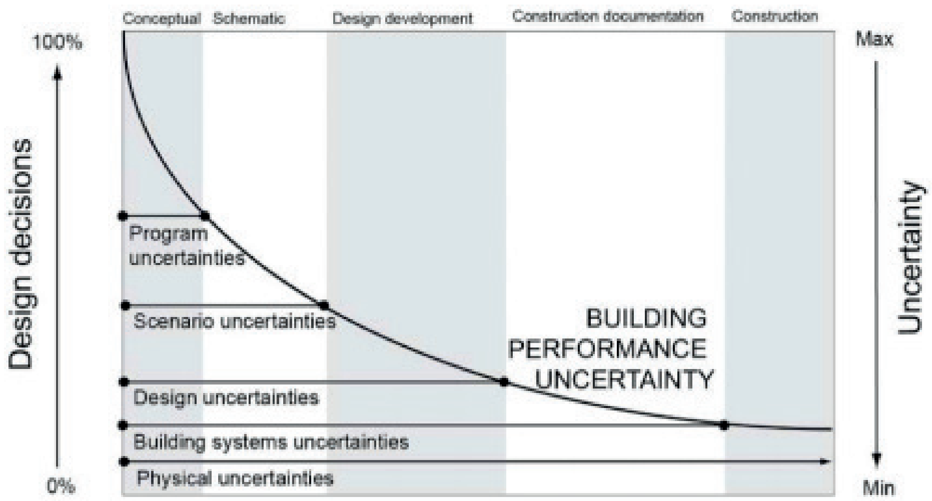

Figure 10: The effects of design decisions and effects on building performance uncertainties for each design stages of architectural design demonstrated by Aksamija (2015).

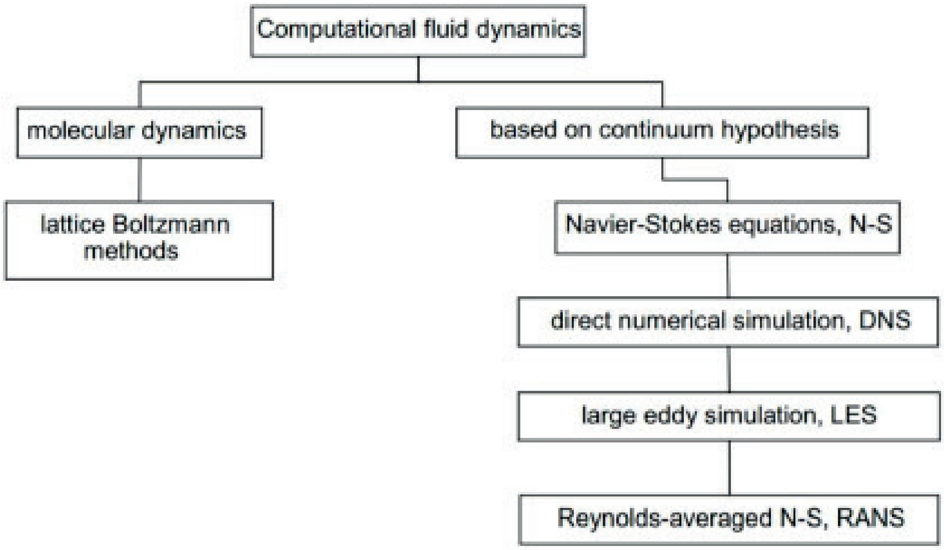

Figure 11: The types of CFD demonstrated by Etheridge (2011).

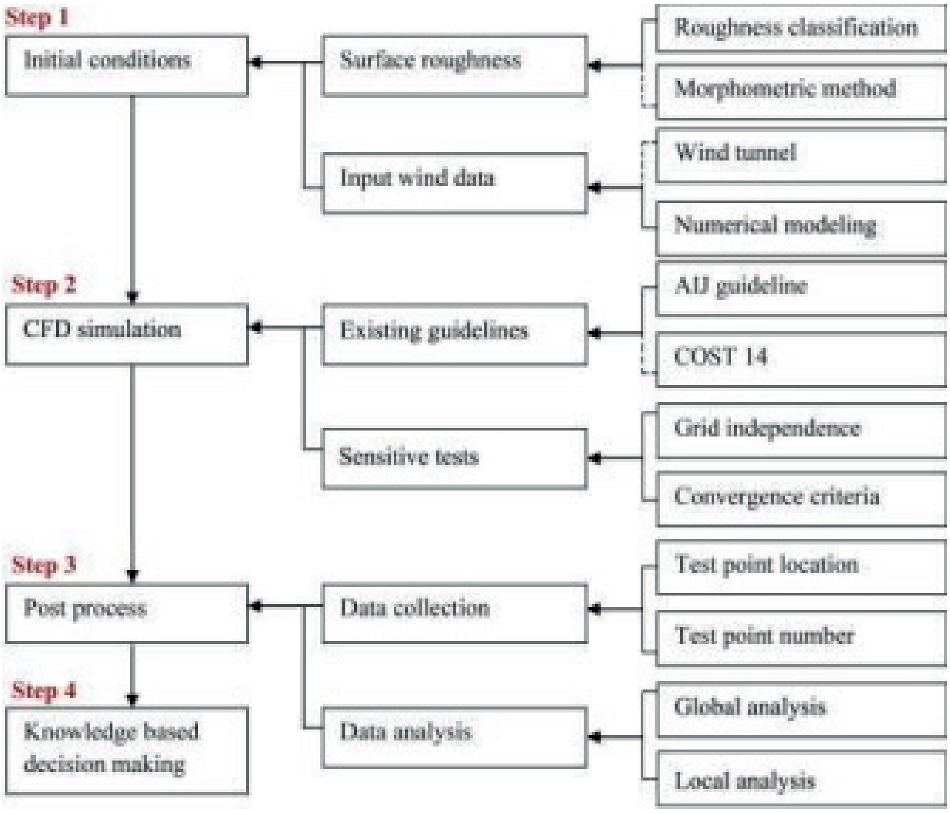

Figure 12: Framework of the CFD application drawn by Yuah & Ng (2014).

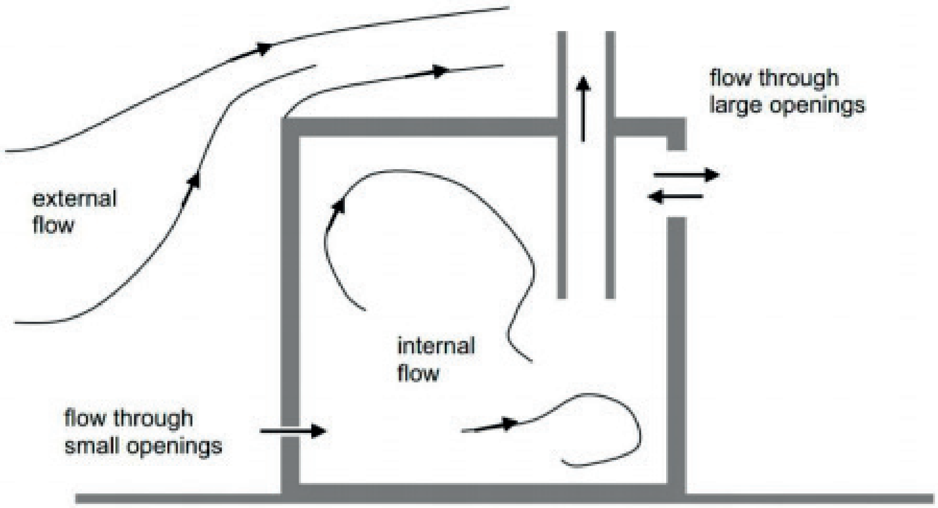

Figure 13: Flows related to the natural ventilation illustrated by Etheridge (2011).

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CLIMATE-ADAPTIVE MATERIALITY

Re-contextualizing design components as tools for local creativity and innovation.

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ABSTRACT

In this article, materiality is meant in two ways: tools and materials that designers can use to work on the built environment. Among tools, instruments of policy and physical elements can be counted respectively as directive and practical components. The instruments of policy are tools for the design of the process (plans, strategies, tactics), the physical elements are tools for the design of the project, in terms of technological products. Materials are for materic uses.
The built environment is a complex system that has to respond to different situations with its materials. Under climate change conditions it is asked to be ready not only for emergencies but in everyday life. The article will focus on water-related problems and on possible climate-adaptive approaches locally developed. Sea rising levels, flash floods, lack of water during always longer periods of drought are situations to tackle in order to reach a good quality of everyday life in cities. As we know the C40 cities are working on that. Applying general innovative climate-adaptive components would not lead to innovative development if they don't meet the local requirements and uses, by being re-contextualized. Furthermore, agile and circular cities require to respond with the availability of resources/materials coming from upcycling processes with high permeability requirements. The aim of this paper is to show a variety of materialities, representing tools for a water-climate adaptive and design-driven development, that are drawn from Dutch cities. The environmental programs of these cities are both representative of Dutch water-related strategies in urban contexts and differentiate in the choice of tools according to specific themes characterizing each city (heritage, public space,…). Amsterdam will be the study case. The test area for the re-contextualization of these materialities will be the city of Reggio Calabria, in the South of Italy. This city lacks a climate-adaptive strategy/program and is characterized by uncontrolled urban development. This paper will show possible solutions where materialities can apply through a local-creative approach.

KEYWORDS

Climate-adaptive materiality, process and triggers, local creativity, innovation and recontextualization

Introduction

Every innovative process has different forms of materiality that depends on different factors. Materiality is meant in two ways: immaterial *tools* and *physical elements* that designers can use to work in the built environment. Instruments of policy and physical elements can be counted respectively as directive and practical materials. The first ones are tools for the design of the process, namely plans, strategies, tactics. The second ones are tools for the design of the project and identify technological products. Therefore, this understanding asks for the adoption of materials in their physical, environmental, and figurative characteristics.

Nowadays, circular approaches are needed and the concept of proactivity, more than reactivity, is on the increase in the processes of construction and implementation of the built environment. Moreover, changes in the urban context require also design changes, and accordingly, they involve materiality. Finally, a variety of geographical areas, societies, cultures, climate, and traditions have new needs and require new solutions.

This paper will explain why it is important to identify the right materiality while working on the innovation of the design of the built environment, which must adapt rapidly to human-induced climate change. Moreover, it will show how new adaptation approaches in an existing urban context can "learn" from other contexts, even though different, by recontextualizing the design components of the latter.

The paper will begin with the study of the relationship between global warming and materiality; then, the authors will explain the key elements of the climate-adaptive materiality for both the innovation process and innovative design implemented in the Dutch cities. In particular, the climate-adaptive materiality of the cities of Amsterdam and Rotterdam will be in focus as they show two different paradigmatic approaches adopted in the country. Afterwards, the ongoing innovation processes and products in the city of Amsterdam will be the study case in The Netherlands; while the city of Reggio Calabria (Italy) will identify the new context where the adaptive innovation might occur. To conclude, the authors will highlight the benefits and limits in the exportation of climate-adaptive materiality from different contexts.

Climate change and materiality

The relationship between global warming and materiality in the built environment exists in the very nature of both of them. Climate and design are mostly dependent on the multifactor context, and when one of these two leads the urban and socio-economic environment towards change, the other has to adapt. In other words, to climate-adapt. According to the IPCC, 2018 (Intergovernmental Panel on Climate Change), *"climate adaptation refers to the actions taken to manage impacts of climate change by reducing vulnerability and exposure to its harmful effects and exploiting any potential benefits."* (IPCC SR1.5b) . To this aim, materiality is a decisive and urgent agent for adaptation. This means that we must consider a large variety of tools, including policies, water-related technologies, urban configurations, local strategies, people and funds needed; and also key infrastructures, possible connections between them, private possibilities, and public dues. The process of adaptation is complex for every built environment because it directly coincides with an innovation process. Starting from the challenges posed by the current climate and innovative process, is it possible to identify climate-adaptive materiality that can be of inspiration for completely different urban environments?

Climate-adaptive materiality for innovation process

The focus of innovation, meant as the ability/agility to respond to changes caused by the effects of global warming, questions the transformation process of the built environment in its multiple aspects. Therefore, it is useful to define the meaning of "process innovation towards the product, under climate change" in relationship to materiality.

Firstly, we should consider the significant transformation of the cultural scenario, which goes beyond the concept of eco-compatibility of materials and techniques, towards design construction systems that are integrated into the constructive systems. Secondly, materiality refers not only to buildings production and development but also to public spaces, mobility flows, networks of urban metabolism (water, energy, waste). There is a new need to design the soil and subsoil of cities, not only as a foundation plan for buildings but as a reactive and resilient skin of the inhabited territory.

The Climate-adaptive materiality process can respond to this emerging question through the "advanced design". The concept of 'advanced design' makes a shift from the idea of "material as a product" to the idea of "materiality as a proposal/experience" and it creates new conditions of reference for the project. In so doing, advanced design connects design construction processes to events of social, economic, and environmental impact, which are the contemporary effects of human-induced climate change.

The table below [TABLE 1] clearly explains this shift in focus in the design disciplines by comparing traditional practices with emerging ones. In fact, "(…) *Sanders* *and Stappers highlight how reading design fields in a traditional key outlines areas, which are defined not by the outcome of the project but by the social need that generates it*" (Celi, M., 2010).

It is evident that the new paradigm that relates the *materiality* of innovative processes to resilient proposals is characterized by a multitude of aspects: 'across-scale' level of interaction between building and its context, 'interaction' between products-materials, 'education and information' (to assess physical and morphological environmental characteristics), until the definition of new 'architecture' and 'planning' scenarios. Accordingly, a project is capable of producing services and performances and also to control transformations under the effects of climate change.

Urban form, buildings typologies, construction systems, and materials, at both urban and building scale, contribute to the complex and multidimensional process that must respond to the resilience of contexts, through the research for an advanced, adaptive, and across-scale design which aim is to respond to the fragility of the built environment.

This means re-envisioning traditional design concepts and innovating their field of action. As a consequence, designers take the challenge to further research into new socio-cultural and technological paradigms. This is the most useful position to approach climate adaptation, also in terms of "new materiality".

As a matter of fact, '[…] the processes of '*urban, architectural, and territorial recycling* can trigger new life cycles by acting on their re-production processes to save new materials and flows. […] Water cycles, waste, and all forms of energy from storage, transformation, regeneration processes are clear examples. These regenerated and regenerative forms find a new configuration of spaces and functions, but also a new condition for the management of resources, which is useful for making them work. It is a new metabolism, of ecologic nature, capable of triggering long networking processes, even outside the borders of the physical context as a recycling site" (Nava, C. 2019, p. 115).

To succeed in the application of these processes (that include the new components of the built environment), enabling technologies must instruct new operative forms. They occur through the adoption of methods and models from the circular economy and eco-design, starting from the physical, structural and chemical characteristics of the materials/raw materials. Or they also adopt new resources that are able to form a highly recyclable and assimilable product that is compatible with the environment, during all the product phases, namely: production, use, disposal, and recycling.

In the circularity value chain and in the production of a new cycle, materials and components from waste or waste processes contain already very different energy and environmental profiles. Therefore, it is extremely important to re-read the assessment methods of the environmental weight of products, their structural and physical quality, etc. in relation to the new circular models and sources from eco-design for upcycling. This could be the new frontier for product technologies (Nava, C. 2019, p. 384).

1.2 Climate-adaptive materiality for innovative design in Dutch cities

The available techniques and technologies that help manage climate risks are manifold and very different from each other. They have been tested under different forms in order to respond to specific project requirements in each context. One of the best working approaches in the Netherland can be found in the integration of these technological solutions into both building and urban design and in the connection of the private and public environments with the nodes of their infrastructural systems (de Graaf, R. *et al.,* 2010). For this reason, Dutch designers are leaders in the processes that define strategies and tactics of development, paying attention to urban metabolism. The challenge is to understand which are the elements, or namely *materiality* (including both material and immaterial tools), of the design in the built environment that can enable climate-adaptive design processes.

Most cities in The Netherlands aim at the innovation of the process as an objective requirement that can have either a purely technological characteristic or a system one (Han van der Meer, 2007). These innovative processes have high consensus in all Dutch cities, despite differences in dimension, geographical position, or whether they are facing droughts and floods issues. In fact, innovative design has the capacity to respond to its purposeful requirements and to implement its own performances when it is put in a network. This means that a construction technology, as an example, has to allow openness to new performances when it connects with other elements of the same level of innovation that come from other fields of the urban metabolism.

In analogy with the digital factors that are implementing the cities of the Fourth Industrial Revolution, the innovative materiality behaves like an algorithm. In the design process and in the language of the algorithms, when it is given a series of inputs (project requirements) a series of outputs are resulting (performance technologies or “behaviors” with respect to the requirements). Digital climate-adaptive materiality stands at the core of the Dutch projects. It consists of data collected from research programs, platforms for the exchange of direct information, mobile systems, etc. They assist in many ways: from the activation or de-activation of roof technological systems of water collection/runoff to real-time control of infrastructure functionality, just to mention a few.

A notable and clear expression of this innovative materiality is the iconic Dutch project named Windwheel by Doepel Strijkers, Meysters, and BLOC (Windwheel Corporation). The intended location of the Dutch Windwheel is the world port city of Rotterdam. This project highlights two climate-adaptive materialities: *cooperation of research teams* and *'transparency for understanding'*. The first one envisions the cooperation of research teams as widely inclusive of the various professional fields and its goal is "*to dramatically increase the quality and sustainability of buildings with the help of climate architecture and advanced technology*" (Strijkers, E., 2019, p. 48). The second one, *'transparency for understanding',* refers to the physical transparency of parts of the building in order to make more visible climate-adaptive and sustainable actions.

The materiality expressed by the Windwheel project is highly supportive of the circular model in the built environment. In fact, the project anticipates a high experimental level of organization in the project functionalities (management of waste, water, air, electrical energy, wind, private and public spaces, temporary and adaptable uses) so as to integrate it in the urban metabolism. This approach is typical of a circular urban system and of a proactive organization that fits the sustainable development parameters of adaptation.

The Dutch municipalities and designers, applying climate-adaptive materiality, have at the core of their research the same questions asked by the Windwheel project. How to trigger innovation processes nowadays? How to manage high-level information while taking into account vulnerabilities and potential? How to embed them in the process of climate-adaptive design in order to be reactive and/or proactive?

In the Dutch cities, the adoption of climate-adaptive materiality does not only bring in new strategies, but it also promotes changes. In fact, climate-adaptive materiality urges the evolution of the already consolidated historical Dutch design solutions for the exacerbation of the conditions of life in the built environment. (Brink, M.van den. *et al.*, (2011). This change already appears in the newly acquired attitude towards water that no longer focuses on the defence from it but on its acceptancy.

Considering the Dutch cities of Rotterdam and Amsterdam, we can distinguish two different approaches to climate-adaptive materiality.

The big port city of Rotterdam seems to adopt a top-down strategy that focuses on governance in order to achieve a strongly innovative urban development. As a delta city, Rotterdam is cyclically under water threats and for this reason, climate adaptive materiality aims at minimizing the vulnerability of infrastructures and to strengthen safety during flooding events. To do this, the municipality operates through infrastructural projects. In general, design interventions consist of program requirements, stakeholders, funds, a timeline of realization, and expected impacts. The large-scale of Rotterdam public climate-adaptive operations allow sectorial participation in the process of decision making. the community has an important role in the evaluation for implementation in this process.

Besides the important issue of safety, the idea of an innovative and always reinventing city is the underlaying aim of the policies from the Rotterdam municipality. This is an important cultural support that increases the attitude toward large changes in the built environment. The contribution to the recently completed program “Room for the River” (2006-2018, that gives the river more room to be able to manage higher water levels) and the ongoing program “River as a tidal park” (launched in 2015, on the transformation of tidal areas into tidal parks and green corridors) are concrete demonstrations of such aim.

Differently from Rotterdam, the municipality of Amsterdam adopts a deep circular approach to climate-adaptive materiality. The strategy combines top-down and bottom-up actions. Specifically, top-down trajectories for process innovation by the municipality set the directions for both bottom up actions and public interventions. Considering the limitations posed by the high urban density of the city center and the architectural heritage that characterizes it, climate-adaptive materiality can occur only on a small scale and through distributed interventions and relies on an active community. The city proposes the “Building blocks for the new Amsterdam Circular 2020-2025 strategy” (Gemeente Amsterdam, 2019) and the “2016-2018 circular innovation program with a glimpse into 2025” (Gemeente Amsterdam, 2016), that gives the trajectories of deep innovation of the city systems; furthermore, it closely connects private and public spaces, while offering the possibility of a network of different technological solutions, as they will be illustrated in the next section.

Amsterdam as a study case

Materiality as innovation of processes

The innovation process of Amsterdam is a case in point for the city of Reggio Calabria, which is our second study case and will be discussed later. In fact, Amsterdam has an urban configuration and water-related issues that allow us to draw a parallel with the Italian city and the climate adaptive materiality of the Dutch city could potentially be exported to the city of Reggio Calabria.

According to the KNMI’14 climatic scenarios, based on the global IPCC scenarios, forecasts highly dry summer in The Netherlands. In fact, the temperature will continue to rise while mild winters and hot summers will become more common. At the same time, precipitation will increase in general: there will be extreme precipitations during winter and the intensity of extreme rain showers will increase in summer;

hail and thunderstorms will become more severe. Finally, sea- level rise is expected to continue, and its rate change will increase. (KNMI'14, *overall changes*, p 7*)*.

The different built density of the city, high in the historical center and low in the periphery, determines the climate-adaptive materiality to be adopted [image 1]. The approach taken in the old city center is of interest. It consists of policies, coalition, circular innovation programs, and triggers. In particular:

- *policies* regard climate adaptation, circularity, green in the city, sustainability, and infrastructures
- *the coalition* is an agreement between citizens willing to be involved in the city processes as it is stated in *"A new Spring and a new voice"* coalition agreement dated 2018
- *triggers* are the institutions of (information) knowledge, researchers (innovation), a municipality (incentives, communication, and infrastructural actions), and the community (individual actions).

This climate-adaptive materiality is supported by regulated investments, incentives, and tax weight.

The above-mentioned list results from the 2018 IPCC, (SR1.5 Special Reports on global warming of 1.5°) that states "*barriers for transitioning from climate change mitigation and adaptation planning to practical policy implementation include finance, information, technology, public attitudes, social values, and practices*". Accordingly, the innovation process must occur at the same time on different levels and a coalition is probably an appropriated starting point as *material* for innovation.

The program for the improvement of circular innovation *"Circulaire innovatie programma*" (*2016-2018 circular innovation program with a glimpse into 2025*) is explicative of such attitude. It describes three different levels of action *[Fig.2]*. They are circular living labs, circular ecosystems, and the circular city. Furthermore, the organization of the program considers three different typologies of materiality as trajectories of innovation: technology, process, and system.

With reference to the technology, the "*technological design-driven innovation opens to a way of competition through the radical innovation of significances*" (Verganti, 2009, p. 5). If "competition" is read as the condition that involves continuous improvement of performances, the design-driven innovation in the built environment transforms the way of considering spaces, their relations, and functions; it can re-read as the relationship between spaces, infrastructures, and their significance (their essence). Accordingly, a building is understood as a system connected to the urban metabolism, which is capable of transforming flows of resources and to produce new ones. For this reason, "technological design-driven innovation" is the driver in the innovation of the process. Improving the process with innovative thinking enables the activation of innovation of the system of the built environment, reaching the circularity of the city. In this process, Municipality and stakeholders are triggers and play an important role in the materiality for climate-adaptive design.

As shown in figure 1, the *circular living lab* aims to gain knowledge and insight more quickly through three different levels: circular investigation, insight into urban metabolism, and knowledge application. The innovation strategy defines a clear distinction between triggers (knowledge institutions) and information (municipality).

The circular ecosystem points to probative values and implementation in four different areas: construction chain, organic chain, circular energy, and industrial symbiosis. The identification of companies and partners as a trigger of the process is relevant. The municipality offers space for innovation through investments, incentives, and taxes with the intention to attract innovators to establish in the city while reducing the number of people that come only to profit of lower taxation.

Finally, *the circular city* condition is reached with the implementation and upscaling of the circular ecosystem through municipal policy. The municipality has most of the responsibilities in this stage. It is a trigger that launches customers, monitors, and controls the process and share insights. It is important to note how, at the level of the circular living labs, Amsterdam policymakers recognize both knowledge and insights on urban metabolism as main actions in the technological innovation phase. This acknowledgment is the first step on the trajectory for innovation.

For this reason, knowledge and community information/connection are recognized as the first typology of materiality toward innovation in processes *[image 2]*.

In coping with climate adaptations, the above-mentioned program needs to take into account the impact of design on the urban heritage that distinguishes Amsterdam city center. In fact, the historical and consolidated urban center does not allow for large areas of alterations, thus setting limits in the application of technological climate-adaptive materiality. For this reason, designs of adaptation consist of a network of small interventions with active community participation.

Materiality as innovation of products

In the historical city center of Amsterdam, private and public sectors collaborate strongly for climate adaptivity: the public adopts measures of promotion of circular assess management, while the private take individual actions. Depaving and urban flood solutions are the main technological actions. As for the trajectories of circular innovation, Amsterdam uses communication strategies to promotes effective graphic explanations for transparency between the municipality and the community and above all for the awareness and deep understanding of the flows involved in urban metabolism. These tactics of promotion and communication are among the fundamental materiality for climate-adaptive design since they enable all the strategies and actions following the first phase. Then, the community carries out the individual actions that are proposed by the municipality.

The municipality of Amsterdam aims for an active community and the network of punctual interventions serves this scope. Technological solutions are proposed in relation to water threats in the built environment that help to relate *water tactics (see www.rainproof.nl)* to the grid of connected systems from different urban spaces.

The municipality of Amsterdam identifies five different tactics: water retention and storage, drainage, infiltration, private and public use, water-robust building. These water-related tactics are meant to be located in seven key spaces of the built environment: neighbourhood, buildings, roofs, streets, squares, parks, and private gardens.

In particular, at the *neighborhood scale,* the actions consist of: water courses daylighting, urban infiltration strips, infiltration fields, green areas between tram rails, draining blocks for parking and slow street, water squares, infiltration crates, etc. *[image 3a/b].*

At the *building scale*, technological solutions are thought for green/water roof, green facade, infiltration crate, rainwater ponds, etc. Every water-related materiality is directly connected to soil treatment, e.g.: infiltration is one of the most important tactics to enhance soil natural process of evapotranspiration.

Exportation and re-contextualization of materiality: a Climate-adaptive Program for Reggio Calabria.

Reggio Calabria is our test-case for the exportability of the innovation process. Reggio Calabria is a coastal city with less than 180.000 inhabitants, in the South of Italy. The relationship with water is in two ways: with its stretched waterfront along the Mediterranean Sea (on the Strait of Messina) and through two large seasonal rivers (*fiumare*) that cross transversally the city *[image 4].*

According to the Representative Concentration Pathways for climate modeling and research (RCP4.5 and RCP8.5 scenarios from fifth IPCC Assessment, AR5, 2014), it is expected for the period 2021-2050: a significant increase in annual mean temperatures, summer rainfall, and days of summer (± from 12 to 14 per year), thus longer periods of *droughts*; an overall reduction in evaporation (average value of reduction is equal to 8%) and winter rainfall, with respect to the period of reference 1981-2010 (CMCC, 2017).

Additionally, the city has problems with water scarcity and dry soil that increase the land vulnerability to the more frequent flash flooding.

The city has one of the most artificial coastal areas in the Calabria region, which makes it the fourth most impactful region in the national territory for soil consumption (ISTAT, 2019). Furthermore, the southern periphery of the city, which is of our interest, presents the *highest density* in the whole municipality; this anthropic condition makes the periphery highly vulnerable to every rainfall.

Briefly, most of the territorial extension of the city could be included in a climate-adaptive program.

Many are the differences between Amsterdam and Reggio Calabria and at first sight, it seems very difficult to export design elements from one context to the other.

This assumption could change if we think of adaptation not only as *climate* driven action but as a *locally* climate driven force. The reason is that there is a strict connection between local socio economic conditions and climate and therefore, to export a model from a different geographical context is misleading. In fact, the current *"differences in the risks* [related to global warming] *among regions are strongly influenced by local socio-economic conditions (medium confidence*[1]*)"* (IPCC SR1.5a).

If the focus is the local, then a geographic location is no longer the matter and the design approach can become an experimental model (pilot) that can be exported from/to any place in the world. To experiment through pilots [is] *"a way to break some rules, make changes, provide inspiration, and help get to the big picture. Pilots and wins produce a ripple effect that leads to structural change."* (García, 2019).

Coherently, taking inspiration from different social and urban contexts can help to concentrate on experimenting, to test new ways of thinking, to take into account other possible organisations, to understand needs beyond local uses, and to aim for structural change.

Another issue in support of the exportability of the 'local model' is provided by the IPCC measurements of the contrast in precipitation between wet and dry regions and wet and dry seasons. Forecasts predict that some seasonal factors will worsen, while others (in different regions) will slightly or completely "overlap". Based on these future conditions, the exportation and recontextualization

1. In the Fifth Assessment Report of the IPCC, the term confidence "synthesizes the author teams' judgments about the validity of findings as determined through evaluation of evidence and agreement". The level is expressed as "very low", "low", "medium", "high" and "very high" and it should not be interpreted as "statistical confidence" (IPCC Cross-Working Group Meeting on Consistent Treatment of Uncertainties, 2010 p. 3).

of models/pilots find fertile ground for experimentation within an innovation process.

Returning to the climate-adaption materiality in the southern periphery of Reggio Calabria, we should point out various limiting conditions: the consolidated urban asset, which is comparable to a densely built urban center, the cultural context, and the deficiency of urban infrastructure *[images 5-6]*.

Despite the climate paradox, Amsterdam climate-adaptive materiality remains a good start for the innovation process and design in Reggio Calabria. The difficulty to learn from Amsterdam lies in the strong interconnection between the innovation of technologies and innovation (local) process that the circular approach of Amsterdam generates. But policies and technologies can be abstracted and scrutinized so as to understand on which materiality Amsterdam is leveraging, with respect to its contextual variables.

With reference to the cultural context, Reggio Calabria could start climate adaptations by introducing policies and technologies that enhance knowledge; and this could happen despite the big difference with Amsterdam on the social attitudes/faith in the territory governance and willingness to change.

From a technological point of view, Reggio could learn from Amsterdam by initiating a network of design projects (as depaving). Accordingly, through this approach, it is possible to implement the relation between local innovation of products and local innovation processes. In this sense, water-related materiality meets the requirements for a multi-benefit starting point.

Both the private and public sectors should take action at the same time.

Conclusions

Climate-adaptive materiality is a key factor in the design-driven innovation process. To apply it, the designer should use both immaterial tools and physical elements of materiality. This approach demands a broad understanding of 'materials', ranging from their physical to the environmental and figurative attributes they embody. The two case studies analyzed in this paper showed the methods used in the adopted innovation processes and the numerous opportunities that this approach can offer to the achievement of a climate-adapted city.

The success lies in the link between *immaterial* and *physical* components of materiality that are embedded in the innovation process. This recognition has a dual value: it highlights the central role played by the cultural and technological materiality and it also promotes the development of pilot experiments for climate-adaptation in various built environments.

However, the application of climate-adaptive materiality should not underestimate the various requirements that are needed. Firstly, it requires a strong integration among policies for circular models, climate-adaptation strategies, and participation; secondly, it needs sequential links among the urban, neighbourhood and building scales of the design; thirdly, it urges a strong synergy between private and public sectors.

The same is for the exportation of pilot experiments to different geographical-urban contexts. The process of their re-adaptation into the new environment is of crucial importance, as the discussion on the Italian case has pointed out. This process implies a thorough analysis of the local factors (social, urban, and environmental) in relation to the benefits that the pilot experiment provides. Moreover, high consideration must be given to the necessary time that is required by the process of re-adaptation.

Finally, the exportation of climate-adaptive materiality can lead to various and multilevel benefits: it strengthens the capacity of change; it enables the innovation process for circular approaches; it could inspire new designs and critical insights. In fact, new ideas can be conceived when taking into account different ways of facing the same global problem.

IMAGES, CHARTS OR GRAPHIC LEGENDS

TABLE 1. Comparison of traditional and emerging design practices (Sanders and Stappers, 2008)

The traditional design disciplines focus on the designing of "products"	*...while the emerging design disciplines focus on designing for a purpose*
Visual communication design	Design for experiencing
Interior space design	Design for emotion
Product design	**Design for interacting**
Information design	**Design for sustainability**
Architecture	**Design for serving**
Planning	**Design for transforming**

Table 1: Comparison of traditional and emerging design practices (Sanders and Stappers, 2008).

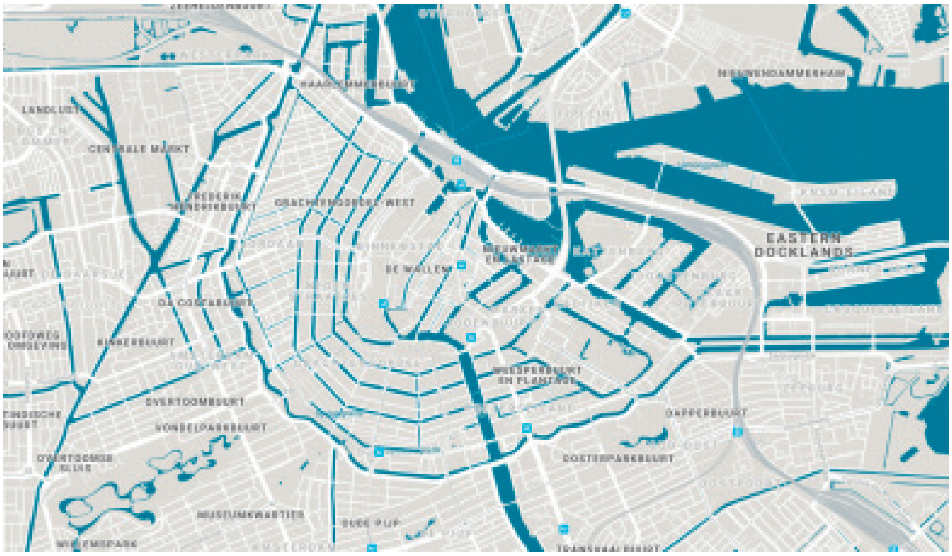

Image 1: Amsterdam water map (image generated from https://snazzymaps.com).

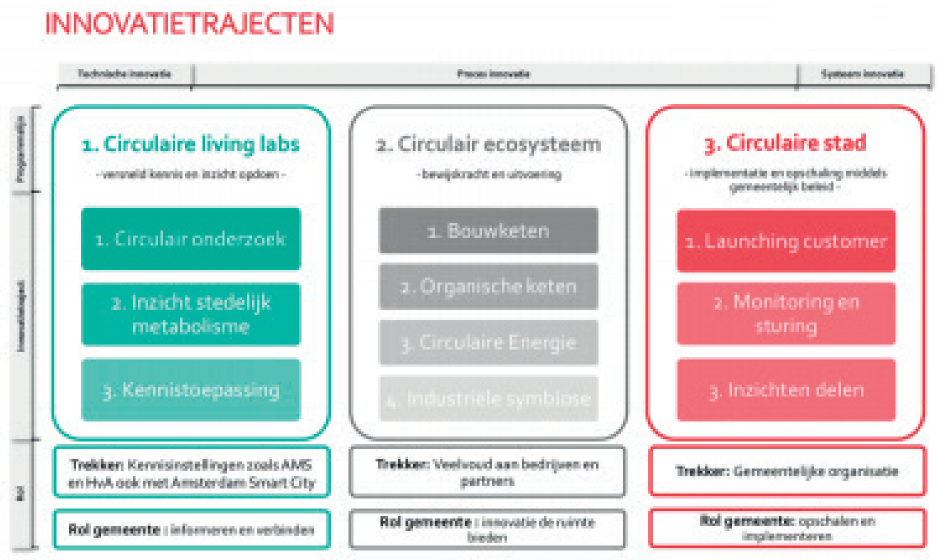

Image 2 – Circular Innovation Program (Circulaire Innovatieprogramma, available at https://www.amsterdam.nl/en/policy/policy innovation/policy-circular-city/).

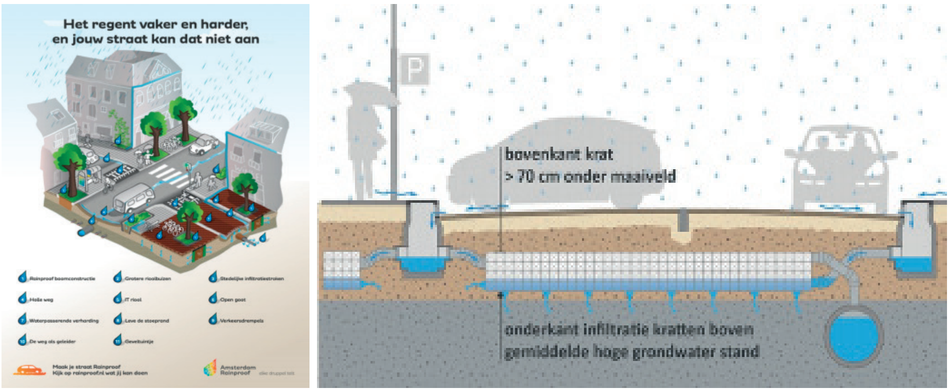

Image 3a/b: Technological punctual solutions in the Built Environment (Amsterdam Rainproof Program, 2019).

Image 4: Reggio Calabria water map (image generated from https://snazzymaps.com).

Images 5-6: Views of the city during low intensity rainfalls..

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SECTION II

ARCHITECTURAL THEORY AND CRITICISM

CHAPTER I

thinking
making
dematerialization
medium
theory
changing
disciplines
disciplinarity
technology
digital
alternative
architecture's
theoretical
concept
contemporary
art
matter
disciplinary
techné
surface
journals
matters
notion
interrelated
screen
attempts
tracing
mutual
questioning
technics
discipline
agent
attention
material
knowledge
asserts
arq
articles
attempt
authority
studies
aside
attributed
study
discursive
analyzing
possibilities
aesthetics
meaning
1990s

INTRODUCTION: ARCHITECTURE THEORY-*WISE*: A NOVEL IMPETUS TO FOUR ENDURING THEMES

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Despite current doubts regarding its potency and vitality, theory matters. New truths and conditions in socio-cultural, economic and political realms suggest the weakening, if not the outright impossibility of strong doctrines and totalizing ideas in the twenty-first century. Whether this phenomenon implies the failure of theory has emerged as a point of contention in numerous disciplines. The account of this special session should not be considered as a futile architectural extension of this argument. Nor, should it be considered as an imprudent commitment to the cachet of architectural theory. Through its four essays, *Architecture Theory-Wise* marks the position of theory as an enabler of thinking/materializing otherwise. Those, who understand theory in architecture not as a matter of representation, but a matter of entanglement, as architecture is entangled with a multitude of complex socio-ethical, politico-economic, and spatiotemporal connections, know that there always exist terrains for frameworks beholding either *pro tem* tensions and contingencies, or long-lasting paradigms and atemporal insights. Still, how theory situates itself on new terrains emerges as a relevant concern of the recent theoretical turn, which is now favored by architectural intelligentsia through a myriad of texts. Today's prevailing cognizance implies that architectural theory may no longer master the core of the discipline through authoritative tones; similarly, erudite enthusiasts may not place it in margins. Rather, it is perhaps expeditiously everywhere, though, with recognition of a meticulous particularity. The new-modern-culture milieu motivates multiple forms, scales, and tactics of architectural thinking; and accordingly, creates new tolerance zones in the mainstream conception of a theory that has long been criticized for its limited energy and hegemonic discourse. The abundance of knowledge and hyperawareness of researchers, as the twofold outcome of the new era, manifest not only new domains of inquiry but also appropriate new encounters with some enduring themes. Without loosening their theoretical grips, the essays of the session explore a constellation of themes, *disciplinarity, medium, techne,* and *matter*, through which architectural understanding materializes in different ways.

As discussed by Zuhal Acar in her essay on *disciplinarity*, theory, as the most fundamental defining element of discipline, enables architecture to form a relationship with other disciplines, even to an extent that eventually leads to the questioning of the disciplinary autonomy of architecture. Despite the diversity of research and recent discourse on the disciplinary character of architecture, the actual processes of cross-disciplinary relationships architecture have with other disciplines remain unaddressed. As an attempt to scrutinize the disciplinarity of architecture and the presence of other disciplines in establishing architecture's own disciplinarity, this study aims at mapping the current theoretical work in the field as it is "materialized" through the scholarly journals.

The essay by Duygu H. Simser focuses on different processes of material change which finds reflection in theory through the discussions of dematerialization. Aiming to interrogate the impact of technological development on architectural theory, the concept of the *medium* is deployed as a reconciliatory category in contrast with polarizing approaches that place material *vis-à-vis* immaterial. It also enables discussing architecture in relation to socio-technological developments. Two periods at that stage the discussions of dematerialization enable pinpointing the problem in certain accounts. These two periods mark extensive use of glass in modern architecture and the impact of digitalization in the early 1990s. Thus, the effects of technology are unfolded not directly through new materials but through the interpretation of material transformations in architectural theory.

M. Pınar Uz Baki investigates the notion of *techne* on architectural making with its philosophical and theoretical expansions technology, technics, and aesthetics. Elaborated within historical and contemporary discussions, *techne* is re-conceptualized as an expedient agent both in criticizing current contemporary approaches often resulting in "technic lack of meaning" and also generating alternative design solutions through "the problematic of architecture making". The notion of *techne* is discussed within changing and sometimes challenging conditions and processes of making, theory and design resulted in the redefinition of the roles of actors, the ways of using/interpreting tools, materials, technics and technologies in the process of actualization of the material object. In her study, it is believed that the act of making in relation to *techne* may have the potential to situate architecture within a larger classification of knowledge because it determines, directs and shapes a significant domain in architectural discourse in relation to scientific and aesthetic experimentation.

In her essay on the *matter*, Günce Eşingen states that "matter," the subject of philosophy, is as well a motive core for art and architecture. It is a much-debated concept that can re-inform the problem of contextualization and reification in art and architecture theory since "matter" expands in-between *māteria* and *idea*. The metamorphosis of both coexists with paradigm shifts unfolding within art and architecture of the last century, which has inquiries about what matters in response to the prospective restructuring of the fields. The paper, then, aims to draw a mutual identification spanning the portrayals of the late nineties through art|architecture|theory and discuss how "contemporary" matters emerged out of turbulence by the displacement of *relāta* and its correlation to value and validation. In her essay on *matter*, Günce Eşingen states that "matter," the subject of philosophy, is as well a motive core for art and architecture. It is a much-debated concept that can re-inform the problem of contextualization and reification in art and architecture theory since "matter" expands in-between *māteria* and *idea*. The metamorphosis of both coexists with paradigm shifts unfolding within art and architecture of the last century, which has inquiries about what matters in response to the prospective restructuring of the fields. The paper, then, aims to draw a mutual identification spanning the portrayals of the late nineties through art|architecture|theory and discuss how "contemporary" matters emerged out of turbulence by the displacement of *relāta* and its correlation to value and validation.

DISCIPLINARITY OF ARCHITECTURE: A MAPPING OF CROSS-DISCIPLINARITY IN THE ARCHITECTURAL JOURNALS

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ABSTRACT

The disciplinarity of architecture has always been a contentious issue due to the extensive amount of extra-disciplinary references architecture has within its own field. In order to strengthen its disciplinary authority, architecture forms connections with more established disciplines by utilizing tools, methods, and theories that are originally formed in those disciplines. In return, as a material discipline, the architecture supports them in their attempts to concretize certain concepts. In an attempt to scrutinize the disciplinarity of architecture and the presence of other disciplines in establishing architecture's own disciplinarity, this study aims at mapping the current theoretical work in the field as it is 'materialized' in the scholarly journals by analyzing the extra-disciplinary references given in the articles that are published between the years 2000 and 2010 in three selected journals: Architectural Theory Review, arq-Architectural Research Quarterly, and Journal of Architecture.

KEYWORDS

Architecture theory, disciplinarity, discipline of architecture, interdisciplinarity, multidisciplinarity, transdisciplinarity

Introduction: Architecture as a Discipline

Architecture's 'disciplinarity', the way it "defines, creates, disseminates, and applies the knowledge within its domain of influence", is one of the most fundamental issues of the field since architecture depends on and integrates many different kinds of knowing (Robinson& Piotrowski, 2001, p.ix). The boundaries of the discipline of architecture are widely disputed as the identity of architecture has been "constructed through exchanges with other disciplines". (Linder, 2005, p.12) There are various interpretations of the disciplinary status of architecture. As Jane Rendell suggests "[i]f we define discipline as a system of rules of conduct, or as a method of practice," then architecture is not a discipline; "yet it is disciplined, codified and bounded in various ways, through the institutions that regulate it" (Rendell, 2004, p.143). It is also argued that architecture's disciplinarity, "its version of what it is to be a discipline, is [] itself an inter-, trans-, super, even un- or a-disciplinarity" (Troiani& Ewing& Periton, 2013, p.9).

A contrasting approach is introduced in the book entitled Discipline of Architecture, in which Julia Williams Robinson indicates that "[t]he field of architecture is in the process of evolving from what has been a practice, informed by other disciplines, into a discipline with its own body of knowledge" (Robinson, 2001, p.61). As she further claims, "though the boundaries of architecture are unclear, the subdisciplines retain segregation and integrity defined by the boundaries of their discipline of origin" (p.72). Robinson further suggests that the knowledge base of architecture is broad and fractured because each subdiscipline exists without reference to the others. In another article in the same book, Andrzej Piotrowski underlines that "[a]lthough architectural knowledge is frequently presented as interdisciplinary or crossdisciplinary, it is explicitly divided into a set of distinctive subfields, which have been constituted after, and rely on, the epistemological authority of their "pure" models, such as physics, history, or sociology" (Piotrowski, 2001, p.49).

Two conflicting general tendencies in defining the disciplinary status of architecture could be drawn out here. While the first approach claims that architecture's relationship with other disciplines impel it to be an inter-, trans-, super, un- and a-discipline; according to the second approach, other disciplines strengthen the disciplinarity of architecture through the formation of subdisciplines. The essential point for this study is the favoring of the presence of other disciplines in establishing architecture's own disciplinarity in both approaches;

even though they differ in defining the impact of these relationships upon the disciplinarity of architecture[1].

The Concept of 'Disciplinarity'

The discussions regarding the nature and the borders of the disciplines are not specific to architecture but rather pertain to the entire realm of knowledge production. Stimulated by the conviction that the current knowledge production exceeds the boundaries of disciplines, the most recent literature on disciplinarity is mainly focused on three types of cross-disciplinary relationships: multidisciplinarity, interdisciplinarity, and transdisciplinarity. Even though they are usually used interchangeably, they refer to different kinds and levels of collaboration or relationship between two or more disciplines. Therefore, it is suggested here that, in order to provide an account of 'disciplinarity of architecture', an overall review of the literature on the notion of 'disciplinarity' and the proliferating discussions on the relationships between disciplines since the 1970s, is required.

"Disciplinarity has been a focus of debate for many years in what has been an argument between those who regard the restraints it imposes as a condition for the production of ordered and transmissible knowledge, against those who regard disciplinary boundaries as cementing orthodoxies, or at least, as constraining possibilities for original analysis and [...] critique" (During, 2006, p.266). The main change in the nexus of disciplines, since the 1970s, has been the proliferation of interest and proposals for, multidisciplinarity, interdisciplinarity, and, transdisciplinarity of various kinds (Osborne, 2015, p.4-5). The discourse on disciplines has become "increasingly and successively differentiated and theoretically reflexive, with the introduction not only of the concept of transdisciplinarity but also of anti-disciplinarity, indisciplines, antidisciplines, postdisciplines and de-disciplinarization" (p.4-5). However, three most widely used terms 'multidisciplinarity', 'interdisciplinarity', and 'transdisciplinarity' constitute a core vocabulary for understanding the cross-disciplinary relationships (Klein, 2010, p.15).

Since all of these terms are formed with an addition of a prefix to 'disciplinarity', the definition of 'discipline' has to be investigated first. Disciplines are the principal

1. İnci Basa also favors of the presence of other disciplines in establishing architecture's own disciplinarity. Basa builds a relationship between architecture and other disciplines through the 'objects' of architecture. As she underlines, architecture's 'objects' "do not exist in a disciplinary coherence" since "they have their intellectual roots not only in 'architecture', but also in numerous different disciplines like sociology, psychology, mathematics, engineering, philosophy, art, science." For a discussion on the reasons of the recognition of architecture as a 'distinguished discipline' see İnci, Basa. Linguistic Discourse in Architecture. Unpublished Ph.D. dissertation. METU Department of Architecture, 2000.

organizational units for the production and diffusion of knowledge. Even though we tend to perceive disciplines so natural and "fail to imagine how else we might produce and organize knowledge" in a different way, disciplines are relatively recent phenomena. In fact, it is only for two centuries, "knowledge has assumed a disciplinary form," and even "for less than one, it has been produced in academic institutions by professionally trained knowers" (Shumway& Sylvan& Messer-Davidow, 1993, p. vii.).

The term 'discipline', in the most basic sense, refers to a branch of knowledge. However, in order to be acknowledged as a discipline, a field of study should have a set of defining elements specific to itself, such as assumptions, epistemology, concepts, theories, and methods. Allen Repko defines 'discipline' as "a particular branch of learning or body of knowledge whose defining elements—[its] phenomena, assumptions, epistemology, concepts, theories, and methods—distinguish it from other knowledge formations" (Repko, 2012, p.4). Theory, as one of the defining elements of discipline, is regarded as the most fundamental one. As Paul Alan Johnson argues, a discipline "participates in the alignment of ideas and knowledge, and various combinations of alignments form the separate disciplines" and "[w]hat determines and maintains any alignment, what gives it its singularity and delimits its boundaries what assist in adjudicating its decisions, is its theory" (Johnson, 1994, p.2).

Dictionary provides two broad definitions of theory. In daily usage, "theory designates a more or less organized abstract and speculative concepts; here, theory is the opposite of practice." In the scientific conception, "theory designates a coherent group of general propositions used as principles of explanation for a class of phenomena" (Martin, 2009, p.155). In addition to its central role in a disciplinary context, the etymological roots of the term itself also reveal theory's importance with regard to cross-disciplinary knowledge production on which this study focuses (Crysler& Cairns& Heynen, 2012, p.12). As it is "derived from the Greek words *theoros* and *theoria*, which embody ideas of viewing and of sacred duty", 'theory' "used to connote openness, participation, generosity and mobility as well as authority and clarity" (p.12). While "[t]he conventional, scientific use of the term tends to emphasize the authorizing, ground-truthing and systemic aspects of its archaic meaning"; "theory, as a nickname for interdisciplinary styles of scholarship, activates the mobile, estranging, relative and contingent aspects of the archaic meaning"[2] (p.12).

2. Interdisciplinarity is generally used both as an umbrella term referring to all kinds of relationships between disciplines; and also as one of the relationship types along with multidisciplinarity and transdisciplinarity. These authoritative and disruptive dimensions of theory is emphasized here because it shows that 'theory' has a place in both systematic disciplinary knowledge production and the interdisciplinary scholarship that works to disrupt that system.

This central importance of theory to the formation of discipline is acknowledged in architecture as well. As Giorgio Ponzo asserts, “theory is the instrument that redefines architecture disciplinary boundaries continuously, and re-position architecture in relation to other disciplines” (Ponzo, 2017, p.197). Stan Allen also considers “the invention of theory” and “codification of architecture as a discipline” as simultaneous acts (Allen, 1999, p.114). Similarly, Andrew Leach defines architectural theory as “an ordering mechanism for architecture” which constructs and defends the borders of its discourse and its capacity for disciplinarity. (Leach, 2006, p.20) Following Leach’s argument, Maarten Delbeke claims that “[t]heory defines architecture’s disciplinarity, delimiting its proper goals, tools, the field of action by means of a discourse” (Delbeke, 2008, p.261).

Therefore, in an attempt to scrutinize the disciplinarity of architecture and the presence of other disciplines in establishing architecture’s own disciplinarity, this study aims at mapping the current theoretical work in the field as it is ‘materialized’ in the scholarly journals by analyzing the extra-disciplinary references given in the articles that are published between the years 2000 and 2010 in three selected journals*: Architectural Theory Review, arq-Architectural Research Quarterly, and Journal of Architecture*.

Selection of the Journals

Journals are the most up-to-date sources for knowledge production compared to dissertations, books, or other types of academic writing. Although digital processes have profoundly transformed entire printing, publishing, and distributing practices; journals still play an essential role in defining the limits and scope of the discipline of architecture. Since their reach is beyond their material existence, and they typically focus on what is current, journals are particularly selected for such an analysis. Textual production of theory in the selected journals will be the primary object of investigation for this study, as it utilizes the advantages of ‘text’ over other types of scholarly communication. The text could be searched, cited, read, interpreted, borrowed, and all of these activities could be traced easily among different texts. Three terms ‘multi-, inter- and trans-disciplinarity’, as the core vocabulary defining different levels of relationships across disciplines, will serve as a framing device to understand how and to what extent architecture forms a relationship with other disciplines and to find out whether these relationships correspond to one or more of multi-, inter- or trans- disciplinarity.

For the discipline of architecture, three kinds of journals could be specified. The first one is the academic peer-reviewed journals that are indexed by databases. The second one is trade journals that are intended for the professionals of the discipline. Journals such as *Architectural Review, Architectural Design, El Croquis* belong to this category. Lastly, the third one is the journals published by schools of architecture where Ph.D. students and scholars of these schools provide the journal's content. *Perspecta, Footprint, AA Files,* and *Assemblage* are prominent examples of this type of publication. The three journals selected for this study, *Architectural Theory Review, Architectural Research Quarterly*, and *The Journal of Architecture*, are the academic peer-reviewed journals indexed in the Arts & Humanities Citation Index of Web of Science database[3]. All of the articles published in these journals between 2000 and 2010 are included in the study[4]. Although the aim of this paper is not directly related to the content of the articles, the content of each article is examined to create the statistical data from which conclusions will be drawn.

First of all, the aim and scope of these journals should be explained. *Architectural Theory Review* is described as "an international forum for generating, exchanging and reflecting on the architectural theory". The journal investigates relationships between current critical issues, the legacy of past debates, and the continued reconfiguration of architectural theory's enduring concerns. *Architectural Research Quarterly* publishes articles covering all aspects of the architectural endeavor. The journal's content includes building design, urbanism, history, theory, environmental design, construction, materials, information technology, and practice. *The Journal of Architecture* covers subjects including "writings about individual architects, theoretical texts, design theory, architectural culture, sustainability, technology, everyday building, pedagogy, visual culture, artistic practices, and urbanism." These journals are included in this study both because of their broad scopes and their emphasis on architectural theory.

Method of the Study and the Cross-Disciplinary Terminology

Instead of solely claiming that architecture is 'inherently interdisciplinary' because of its broad scope, this study aims to decipher the extent and nature of cross-disciplinary relations in the textual theoretical production of architecture and emphasize

3. I also use of the subject lists of each index to compile the table in the next section.
4. There are total of 804 articles, 213 of them are from Architectural Theory Review, 257 of them are from Architectural Research Quarterly, and 334 of them are published in Journal of Architecture. I did not include the reviews and interviews.

the fact that terms ‘multidisciplinarity’, ‘interdisciplinarity’, and ‘transdisciplinarity’ describe different levels of the relationship among disciplines despite they are used interchangeably. The ambiguity of the term ‘discipline’, as discussed above, also reflects on the definitions of these terms. In addition to that, the prefixes of each of these terms signify the differences between them as each prefix connotes with different notions. The prefix multi- is the most evident one, which has its roots in Latin *multus* meaning ’much, many’. Multidisciplinarity specifically includes the juxtaposition of two or more disciplines, which fosters “wider knowledge, information, and methods” (Klein, 2010, p.17). Yet, while producing a multidisciplinary work, disciplines involved in the knowledge production remain separate and retain their original identity and the existing structure. In different definitions of the term ‘interdisciplinarity’, the emphasis is usually given to the concept of ‘integration’. It is suggested that interdisciplinary studies draw on disciplinary perspectives and integrate their insights through the construction of a more comprehensive perspective. According to this definition, there is a need for a disciplinary base to accomplish interdisciplinarity; however, some authors argue that interdisciplinarity “can also mean establishing a kind of undisciplined space in the interstices between disciplines, or even attempting to transcend disciplinary boundaries altogether” (p.15).

Derived from the Latin preposition ‘trans’ meaning “across, to or on the farther side of, beyond, over,” the term ‘transdisciplinarity’ connotes “going across and through the disciplines, and beyond each individual discipline” (Alvargonzález, 2011, p.388). Such an approach naturally questions the fundamental assumptions behind the segmentation of knowledge into disciplines. As Jane Rendell asserts, “if interdisciplinarity is concerned with working in places between disciplines in order to question their edges and borders, the term transdisciplinarity is more often described as a horizontal movement, concerned with moving across disciplines, transversally” (Rendell, 2013, p.130).

Findings of the Study

This study aims to challenge some of the common preconceptions about the disciplinarity of architecture by reviewing the articles in the selected journals for the chosen time range[5]. To scrutinize the disciplinarity of architecture and the presence of other disciplines in establishing architecture’s own disciplinarity, the references to other disciplines in the articles are listed. The relationship of each discipline

5. It should be stated that this study might bring different outcomes if it is performed with different journals or if the method of the study is designed in another way.

with architecture will not be explained in detail; only the issues that are remarkable for the purposes of this study will be indicated.

The first preconception is that architecture is inherently interdisciplinary because of its broad scope[6]. Rather than confirming or rejecting an interdisciplinary position for architecture; this study aims to detect the specific disciplines that architecture refers to the most or the least, or if there is indeed a dominant referencing to other disciplines, and to find out if there is a pattern in this. As this study shows, the number and variety of disciplines that architecture refers to is remarkable. There are references to twenty-eight disciplines (i.e., subject categories), which could be seen as an indication of a broad scope; however, almost half of the references are to the disciplines of philosophy, art, and urban studies[7]. So it is claimed here that architecture, in fact, has relations with a limited number of disciplines and a single reference to dance or physics does not necessarily mean that architecture is 'inherently interdisciplinary'.

Another main focus of this study is to figure out which one of the terms interdisciplinarity, multidisciplinarity, and transdisciplinarity best describes the status of architecture's relationship with other disciplines. Based on the brief summary of their definitions and differences, which is provided above, it is claimed that architecture's relationship to other disciplines could be best defined as 'multidisciplinarity'. The main tendency in these articles is to borrow notions, a term a method from other disciplines, and use it solely for the purposes of architecture. For a discipline to be 'interdisciplinary', it should contribute to both disciplines' knowledge. That is why; I believe this kind of referencing to other disciplines in architecture can be called 'multidisciplinarity' rather than 'interdisciplinarity'.

Since architectural research can operate using different methodologies, the various research outputs have been equated with those produced within the areas of building science, social science, humanities, and art and design research. Crudely put, technical and material-based research is usually taken to operate following the science model, whereas scholarly research into architectural history and theory is understood to adopt either social science methodology, on the one hand, or humanities on the other, while architectural design research has, to date, been related to other practice-led research, for example in art and design."

6. The phrase "inherently interdisciplinary" is used by Julie Thompson Klein and she lists philosophy, literary studies, religious studies, anthropology and geography as examples without including architecture. Klein strongly emphasizes that "[a] wide compass alone, [] does not constitute interdisciplinarity." It is Linda Groat and Sherry Ahrentzen who claim that architecture could be characterized as "inherently interdisciplinary," with reference to Klein. As cited in Julia Williams Robinson. "The Form and Structure of Architectural Knowledge: From Practice to Discipline," Discipline of Architecture. ed. Julia Williams Robinson and Andrzej Piotrowski. Minnesota: University of Minnesota Press, 2001: 63.

7. It should also be noted that the references listed in this chart are the ones that are fundamental for the related article. Even though 213 articles listed in this chart; probably in all of the articles investigated in this study, there are references to other disciplines since knowledge cannot be produced in isolation. However, references that do not frame the general structure of the articles are not included in the study.

The second preconception is that architectural research is dissected into specific categories that comply with the research methods of the broad areas of knowledge, i.e., natural sciences, social sciences, and humanities. As Jane Rendell suggests, while technical and material-based research is usually taken to operate following the science model, research into architectural history and theory adopts either social science or humanities methodology. Architectural design research, on the other hand, is related to other practice-led research, for example, in art and design (Rendell, 2004, p.143). That is why disciplines are categorized according to the three Web of Science citation indexes in this study (Arts& Humanities Citation Index, Science Citation Index Expanded, and Social Science Citation Index). Framing disciplines as such enables identifying the number of references to the disciplines, belong to each category. If the total numbers of referred disciplines in each index are concerned, there are 101 references to ten different disciplines from Arts and Humanities Index; 45 references to ten different disciplines from the Science Citation Index Expanded and 67 references to eight disciplines from Social Sciences Citation Index. However, if their ratio to the total number of disciplines is concerned, the situation changes and gives more accurate outcomes. Architecture relates itself to one-third of disciplines from Arts and Humanities Index, fifteen percent of the disciplines in the Social Sciences Citation Index, and only six percent of the disciplines in the Science Citation Index Expanded. Even the majority of the references are to the Arts and Humanities disciplines, there is also a significant number of references to Natural Sciences and Social Sciences. It can be stated that architecture has the ability to utilize theories, tools, and methods from all of these broad areas of knowledge.

Besides these preconceptions, this study investigates if there is a substantial difference between the references given to design disciplines and the other ones (9). Twenty-seven articles refer to the discipline of urban planning and only six articles referring to landscape architecture, which only equals the four percent of the total articles. Therefore, it can be stated that architecture does not benefit from other 'design' fields whose working principles are more similar to itself. The reason behind anchoring itself to disciplines that are very distinct from architecture, such as philosophy or sociology could be the desire of architecture to bring itself closer to 'stronger' fields.

This study is conducted to decipher the disciplinarity of architecture through a set of concrete data. It is neither aimed here to call for the return to discipline nor to promote or discard one of the multidisciplinary, interdisciplinary, and transdisciplinary positions in general. However, what is claimed here is that these terms should not be used haphazardly, rather a clear understanding of each of them is required. The assertion of this study is that it is necessary to recognize the origins, meanings, and differences of these terms to determine whether architecture is actually a specific kind of a 'discipline'. Without having been equipped with these discussions, such claims do not provide profound contributions to architecture.

IMAGES, CHARTS OR GRAPHIC LEGENDS

Arts & Humanities Citation Index	
Category Name	#
Art	15
Cultural studies	2
Dance	1
Film, Radio, Television	10
History & Philosophy Of Science	2
Language & Linguistics	2
Literary Theory & Criticism	13
Music	1
Philosophy	49
Religion	6

Science Citation Index Expanded	
Category Name	#
Acoustics	1
Biology	6
Computer Science, Artificial Intelligence	6
Ecology	3
Engineering, Multidisciplinary	9
History & Philosophy of Science	1
Mathematics	3
Geometry	11
Physics, Applied	1
Psychology	4

Social Sciences Citation Index	
Category Name	#
Cultural Studies	8
Economics	4
Environmental Studies	12
History & Philosophy Of Science	1
Linguistics	2
Sociology	9
Urban Studies	27
Women's Studies	4

Figure. 1: List of the disciplines referred in the articles. Compiled by the author.

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MEDIUM: IN BETWEEN MATERIAL AND IMMATERIAL

Architecture Theory-*Wise*: A Novel Impetus to Four Enduring Themes

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ABSTRACT

This study tackles different approaches to dematerialization and aims to reconcile the division between immaterial and material via the concept of medium. For this, it first decodes the emergence surface of dematerialization in Giedion's space-time conception and traces ideational ramifications of his ideas in Gyorgy Kepes and Marshall McLuhan. Following these interrelated approaches, it embarks on to elucidate the re-surfacing of the concept with the prevalence of digital technology in architectural theory after the 1990s. This examination limits its scope to the ideas presented by Bernard Tschumi, Beatriz Colomina, and FAT in different studies. Not directly interrelated as in the first case, yet encapsulating similar endeavors, these studies exemplify an attention shift toward the impact of technology on architecture, which becomes evident in architectural theory after the digital turn. This two-phased reading of dematerialization maps a change in focus thus marks a difference in architecture's changing agenda. When effacement of surface and interpenetration of volumes give way to screen-bounded thinking in the 1990s, architecture is seen to be re-examined with the terminology of digital communication. This changing approach to dematerialization especially consolidates the need for what is suggested to be developed as "medium thinking"; relying on the meaning of medium as "intervening substance", this mode of thinking requires to embrace the intervention of outside circumstances on architecture's agenda and the degree of their impact on architectural thinking. Thus, "medium thinking clarifies variable meanings attributed to dematerialization in architecture. Leaving aside the dissolution of the matter and foregrounding the medium that is created, this approach signals the possibility of viewing architecture as an interface as opposed to a screen or surface.

KEYWORDS

Dematerialization, immaterial, space-time, medium, communication technologies

Introduction: Positioning Theory

In 2006, the Yale Architectural Journal Perspecta set its 38th issue's agenda as "Architecture after All", "after" implying "the breakdown of consensus". The altering landscapes of theory, in the issue, are portrayed via different and challenging approaches that try to estimate new paths for theory in the 21st century. Remarkable in the same issue, Ashley Schafer's posthumously influential article "Theory After (After-Theory)" was a response to those who claim the end of theory.[1] The after-theory era, for Schafer, emerged as the side-product of a recalibration of practice toward more mundane issues. This was an autogenous response to economic pressures; but as Schafer suspects, there were other agents that have been critical in the change of architecture's agenda. To pinpoint these influential agents, Schafer suggests looking into the previous generation, the aftermath of May 1968, and the "appropriation of cultural theory into architecture" to recover "anti-intellectual and socially disengaged practice" (Schafer, 2006). However, the relationship between theory and practice was ill-formulated from the start; the theory's function as pre or post rationalizer of practice was problematic. Thus, in Schaffer's proposal imagining the conditions of theory after "after-theory" requires to view it as "a culturally and socially engaged" practice *per se*, rather than an applied cultural theory. Building upon Schafer's argument, architectural theory can be claimed to exist as a heterogeneous and autonomous medium that is open to exploration, experimentation, and development. This paper affirms this view of theory and aims to operate within it.

Salving theory from its overloaded and somewhat artificial rationalizing function does not mean an ultimate liberation from the burden of worldliness. Albeit celebrating a certain autonomy by comparison to practice, the theory does not exist in an isolated niche, in vitro. On the contrary, it is as alive as the "influential circumstances" that surround it[2]; the degree and scope of reaction to and interaction with these circumstances determine theory's relevance for culture.[3] At this point, this paper problematizes discursive formations of architecture's immaterial existence that surface with the concept of dematerialization. These formations primarily emerge from scientific and artistic hinterlands in architecture's theorized history. In the later periods, they are seen to evolve into a willingness to read architecture

1. Discussing the theory's afterness, Schafer refers to the claim presented by Ben van Berkel and Caroline Bos an article that dates to 1998, "there is only after-theory" see Ben van Berkel and Caroline Bos, 1998, "Diagrams: Interactive Instruments in Operation", ANY: Architecture New York, No. 23, Diagram Work: Ata Mechanics For A Topological Age, pp. 19-23. Also see Christopher Shea, 2003, "Theory is Finished", New York Times headline.
2. A metaphorical reference. In original use French natural scientist Jean-Baptiste Lamarck develops the idea of "influential circumstances" to explain the living things' interaction with their environments. Lamarck's use is considered as one of the ideational emergences of *milieu* as a concept. See Georges Canguilhem, 2004, "The Living and Its Milieu." *Grey Room*, no. 27.
3. Culture here used in the sense human-made system of values and assets that are historically constructed and shared.

via the lenses of technological determinism. However, semipermeable boundaries of theory require an attentive approach in viewing the impact that technology created on architecture's materiality. The historical conditions that pave the way for such a change, as well as disciplinary reactions to the encounters with emerging technologies are important to elucidate what dematerialization genuinely means.

Dematerialization: From Space-time to Acoustic Space

Mapping discussions of dematerialization requires to mark conceptual nodes that precondition dematerialization's formation and emergence as a discursive unit. These conceptual nodes may act as anachronic fulcrum points that tie spatial and temporal differences. In other words, what conditions a discourse around architecture's dematerialization in different contexts can be revealed via elucidating these conceptual nodes that accompany the discursive formation of the matter.

The attempts of scrutinizing architecture as material manifestations of socio-technological changes implicitly articulate architectural artifacts as cultural products. Bearing in mind technical development's relevance to culture, how architecture's theorized history aligns the ethos of time with architecture's material existence appears as a question to be answered. At this point, Sigfried Giedion's interdisciplinary endeavors to bridge architecture with the scientific, artistic, and technological zeitgeist requires particular attention. Notably, his Space, Time, and Architecture features refined explorations that weave architecture into a complex web of relations that characterize the era. Beyond its robust status in theory and history, Giedion's study acts as a keystone that reflects the exposited interaction between architecture and historical conditions of its existence; in other words, technical, social, and cultural limitations that predetermine architecture's materiality. Therefore, the way Giedion conceives the use of transparent surfaces and architectural acts that enable the interpenetration of spaces is substantial to understand the type of dematerialization that he addresses.

Injured after the Great War, Europe has faced a vast cultural crisis. In this context, the trustworthy status of science has been relied on to rebuild culture upon firm foundations of objective knowledge. Embarking on to merge art, science, and technology with architecture for a new vision for society, Giedion's approach should be seen in this light. His reference to the concept of dematerialization is not as bold as his conception of space-architecture, but his addresses to the different uses of glass starting from the 19th-century hint a change behind large transparent surfaces, the idea of dematerialization starts to be signaled. Large-scale use of transparent surfaces first comes into the stage in the case Henri Labrouste's design of Bibliotheque Nationale, Paris (1858-68). It is the "glass wall" between the stacks and reading room that draws Giedion's attention (Giedion, 1959,223). Following that Giedion refers to engineer Eiffel and architect L. A. Boileau's work, a department store; The Bon Marché's glass roofs over skylights become a "true glass architecture" (Giedion, 1959,237). For him, this glass-roofed interior court vibrates a joy emanating from the play of light a similar of which can be found in Le Corbusier's interiors and exteriors and the way they interpenetrate each other. These two examples, Bibliotheque Nationale and glass surfaces that cover Le Bon Marché, thus become where Giedion originates the idea of interpenetration.

Futurism provides a fertile ground where Giedion can test the limits of the entrancement with movement that defines the era and Cubism provides with him the ultimate breaking point from the conventional way of seeing and the required lexicon with which he can define a novel perception of space. However, his conception of space-time primarily owes to scientific theories of the early 20th century. The emergence of new conception between space and time with Einstein's relativity designates an important fulcrum on which Giedion can lay the foundations of his architectural conception of space for the era. The reflections of Einstein's theory can be seen often; Giedion refers to the relativity of space occasionally and his concept space-time is a direct reference to these developments in Physics.

Giedion's laudatory words about the new conception of space are epitomized in Gropius' design of Fabrik. For Giedion, the building is a part of the tradition that connects it to the great iron constructions of Eiffel in the last quarter of 19th century evokes The Bon Marche and before that the Bibliotheque Nationale that he elaborated. Especially the corner of Fabrik where a glass enveloped staircase hovers is described by Giedion as "movements seized and immobilized in space" (Giedion, 1959, 480-482). However, it is the Bauhaus complex that truly reflects Giedion's space-time concept. As he professes, this complex embodies the fulfillment of "two major endeavors of modern architecture". These are the relational space in the hovering vertical grouping of planes, and "extensive transparency which enables simultaneity of exterior and interior, *en face* and *en profile* like Picasso's L'Arlésienne of 1911-12".

In Giedion's view, two-dimensional reform on the painting surface that challenges the conventional way of seeing, finds reflection in architecture with the interpenetration of spaces and dematerialization of the boundaries between inside and outside. To explain the importance of the Bauhaus complex for architecture, he articulates it as the use of new space conception to organize a building complex. Giedion professes that the aim of juxtaposing cubes was "not to anchor them to the ground but to have them float and hover upon the site"; "wing-like connecting bridges" and the way glass used was to strengthen this feeling of floating. As Giedion puts it, "the glass was called in for its dematerializing quality" and although the material is the same, the way it is used was different from previous generations. The interrelated cubes, their interpenetration to each other brings forth the inability to perceive them from above. This is explained by Giedion as an absorption of many-sidedness, a cubist originated notion's translation into architecture. For Giedion, what Gropius designed on the planimetric layout for the ground level is reminiscent of the hovering staircases of Fabrik where movement is frozen as if a Futurist drawing. The materiality of Bauhaus is the uttermost crystallization of Giedion's conception of space-time.

In line with Giedion, Hungarian-born art theorist Gyorgy Kepes regards the prevalence of new immaterial approaches in art, and the use of technologies of light, video or laser as the artistic stamp of a new way of thinking that he observed in science as well. He imagines a collaboration between artists and scientists to improve one another's work. Similar to Giedion, Kepes pursues a reconciliation of art and science beyond visual analogs. Kepes celebrates "space interval" with reference to Eastern visual culture and stresses the importance of emptiness in this culture via a quotation from Chinese philosopher Lao Tse: "a vessel is useful only through its emptiness. It is the space opened in a wall that serves as a window. Thus, it is the nonexistence in things which makes them serviceable" (Kepes, 1969). The effectiveness and the role of empty space in image prove Lao Tse's point; empty-large paths on the painting-surface enable the surface to be divided into unequal intervals, this enforces the eye of the spectator for movements of different paces; thus, creates a unity. Similarly, Chinese and Japanese calligraphy is seen to endorse a parallel approach in terms of unity coming from the attentive consideration of the relationship between figure and background. In Kepes's view, this unity of reciprocal collaboration points to an integrated existence achieved through "progressive recognition of the interconnection of figure and background". As he observes, the one-sided, surface-bonded approach to architecture is being broken down, and it gives way to "the active envelope". Instead of "interpenetration", Kepes refers to the "integration" of the materials with spaces in-between. Dematerialization, therefore, for Kepes is dissolved via light screens, curtains, glass walls which strengthen this integration optically; they thus form a living that is single and united, characterized by flowing of space from every view. In other words, Kepes decodes the meaning of space interval as an architectural reflection of the figure-ground relationship and he finds this in dematerialization. He interprets new, permeable, and emptied approaches of modern architecture as a result of the development of this understanding. It is no coincidence that Kepes and Giedion are contemporary; moreover, Giedion's preface to Kepes's Language of Vision confirms their scholarly alliance (Kepes, 1969).

Pioneer in looking at the historical and contemporary phenomena from a new direction, Giedion's influence echoes beyond the limits of art and architecture. His stimulating ideas find reflection among cultural and literary theorists. Among these, Marshall McLuhan holds a notable position in the way he incorporated Giedion's space-time concept into acoustic space.[4] Thus, architecture's dematerialized character has been reformulated in a different context. Furthermore, it was not only the content but interdisciplinary mode of analysis that Giedion exemplified has become what McLuhan and his fellows at the University of Toronto endorsed. McLuhan's acquaintance with Giedion's work on a deeper level owes much to the intercessions of Jaqueline Tyrwhitt[5], whom Giedion had recommended for McLuhan's interdisciplinary research group.[6] The weekly seminars held in this institution provided a fruitful ground to discuss and digest Giedion's studies and develop a novel understanding of technology's and media's impact on culture. Giedion's link to McLuhan is crucial to understand how multifaceted the question of space, technology, and media that even though their belief in the new space, one calls "space-time" others refer as "acoustic space", becomes their uniting point; their endeavors to deploy this space in relation to human is quite different.

To elaborate on McLuhan's understanding of acoustic space and this conception's genealogical link to Giedion, the example of Eskimos is worthwhile. In Gutenberg Galaxy, McLuhan refers to the space concept of the Eskimo, their non-visual attitude to spatial forms and orientations shows that they do not have formal units of measurement either for space or for time. Additionally, they don't regard space as something static. McLuhan moves on to Eskimos' oral tradition to exemplify how the dissemination of speech was not one-directional; it was intended to vibrate from anonymous to all, which is reminiscent Giedion's anonymous history. McLuhan puts forward this elucidation to favor the multi-directional perception of work of art, which again echoes Giedion's ideas (McLuhan, 1962). Since he situates the underestimation of acoustic space as opposed to the overestimation of visual space, he links the advancement of the latter to those modes of thought, those ideologies, produced along with it by alphabet technologies and further extended by print. Therefore, while this reference to the Eskimos' multi-directional and immaterial conception of space equates to acoustic space, visual space hints the one-directional conception that becomes touchstone with perspective and that prevails since Renaissance.

4. Giedion's impact on McLuhan can be traced on the letters that they wrote to each other. Moreover, McLuhan directly refers to Giedion in his studies. For instance in *Gutenberg Galaxy*, see, p. 44, 65, 67, 107, 147.
5. Jaqueline Tyrwhitt is an important figure who is actively engaged in the translation and editing processes of Giedion's studies.
6. For an overview of the interactions of Tyrwhitt, McLuhan, and Giedion, see Michael Darroch, (2008) "Bridging Urban and Media Studies: Jaqueline Tyrwhitt and the Explorations Group, 1951–57," *Canadian Journal of Communication* 33, 147–169.

Discussions of Immateriality on a Different Temporal Ground

The other chain of relations that this paper tackles with marks how (im)materiality enters into the architectural theory's agenda one more time about 50 years following Giedion. Whether these two different contexts share certain commonalities, or how the position of technology in relation to (im)materiality changes are questions to be answered via in-depth examination of the claims presented. The transforming impact of technology on architectural theory becomes evident, especially in the 1990s. Not directly explaining dematerialization via a new conception of space but interrogating its meaning vis-à-vis pervasive feature of digital technology has been an attempt that strongly felt in the publications of the period. The third issue of ANY appeared in 1993 is quite important in this regard. Focusing on "Architecture and the Electronic Future", this issue brings up the electronic impulse in architecture via the discussions of many important figures among which Colin Rowe, Mark Taylor, William. J. Mitchell, Bernard Tschumi can be named.

In "Ten Points Ten Examples", that appeared in this issue, Bernard Tschumi refers to the transition from materiality to immateriality. By reading technology's reflection on architecture as a linear and continuous progress that leads to changes in the matter, he expands this progressive transition within the history of architecture. As he describes, this impulse move "from the heavy stones of the Egyptians to Roman vaults, then Gothic arches, then iron construction, the curtain wall, structural glass, immaterial light screens, Albert Speer's Cathedral of Light, holograms, and now a virtual reality" (Tschumi, 1993, 41). For Tschumi, dematerialization in architecture is intrinsically linked to the development of technology, which is architecture's integral part. Following this explanation, he points to an in-between space; "between the tectonic and the electronic, between the building and the billboard, between the city of places and the space of flows" (Tschumi, 1993, 41). He sees these in-between spaces potentially the spaces of the event. Tschumi's ideas reflect the capacity and flexibility he sees on the "dematerialization".[7]

As Tschumi interprets dematerialization via developing technologies, thus changing mediums, Beatriz Colomina provides striking and overlooked insights when it comes to architecture's entanglement with media and technology. In *Privacy and Publicity: Modern Architecture as Mass Media*, she presents the way media enable, challenge and change the development and conception of modern architecture (Colomina, 1996), complementarily in the article "Unclear Vision" she

7. In this article Tschumi continues with questioning the possibility of an in-between in literal sense and asks;" is there an inhabitable space between the billboard and the building?" For him there are a few architects addressing this question, they often identify as significant a layer of catwalks, ramps, escalators, a space of movements that echoes distantly the frenzy of the ever-changing flat images of the screen." Thus, he addresses to redefinition of the screen as image and enclosure a filter and barrier.

formulates a more compact and less direct relationship between communication technologies and architecture signaling similar points with the aforementioned book. In “Unclear Vision”, she interprets an architectural element, glass as a communication apparatus where the fluidity of communication finds reflections in architecture through the immense use of glass. Not only passively reflecting but conditioning the social and cultural ethos of the time, the role architecture acquires appears as a strong fulcrum to probe on possible alliances between architecture and communication thus mediation. As Colomina puts it:

> “If communication is basically about bringing the outside in (as when reading a newspaper to bring world events into your life) and getting the inside out (as when sending a letter) then glass unambiguously represents the act of communication. It is as if glass literally takes over more and more of a building as the systems of communication became more and more fluid” (Colomina, 2009).

Basing on the role of glass as a mediator, she embarks on to explain how “the glass box has become something else altogether” in the case of SANAA’s Glass Pavilion in the Toledo Museum of Art. To elucidate this architecture of “unclear vision”, she develops an argument deriving from the relationship between medical imaging technologies for the human body and the transparency in modern architecture. In other words, Colomina not only links architecture to the communicatory innovations of the time, but she also interweaves it to a broader network of relations including medicine and technologies of screening. She narrates the development of imaging technologies and their correlation to architecture through well-known modern figures and their canonical works; Le Corbusier, Mies van der Rohe, Philip Johnson. For Colomina these explanations serve as the proof for “changing definitions of public and private” and the impact that this change had on the understanding of architecture (Colomina, 2009). In the concluding remarks, it becomes evident that the most intriguing aspect of this relation for Colomina was not transparency’s dislocation into other fields or architecture’s effect on others, but what is intriguing for her is the way architecture absorbs latest communication systems, in other words, the transformations that the discipline undertakes via novelties.

Similarly, the essay “Everything counts in large amounts” repositions modernism and communication technologies interrelatedly. In this essay, the now-closed architectural studio FAT develops both a critique and a novel reading of Modernism by hinging their approach to new communication technologies. The article successfully brings together daily experiences with architectural aspirations, assumptions, and projects. Thus, on the one hand, communication is connected with modernism and on the other hand, it is marked out as the expositive quality that underlies the contemporary condition. The article provides two striking claims; it develops a sub-text to modernism and reinterprets it as "the sign of architecture that seeks to respond to the new experiences of communication". Giedion's "interpenetration" is deciphered by FAT as the dissolution of space, emanates from wireless communication reflects in architecture. Modernist architectural acts; connection once separate places, the disappearance of boundaries that exist within the building, and that between the inside and outside aid to epitomize this observation. The second and rather original interpretation seeks a base in the connection between abstraction and media theorist Marshall McLuhan's famous saying**,** "medium is the message". By pointing out McLuhan was half-write in his conception, thus the content mattered as much as the medium, the way this problematic found**,** an echo in architecture is expanded through the binary opposition between abstraction and ornament. According to FAT, the misconceived notion of abstraction acquired a central position in modernism, then it evolved into a "mystical belief"; however, the information revolution rendered decoration the visible structure of communication. All in all, this study develops a critique of modernism that is enriched by the impact of communication technologies.

As these three studies imply, communication technologies provide a ground to probe architecture's reflective potential of the technological ethos of the time. While Tschumi reads architecture and technology's alliance on a linear continuum, FAT reflects on modern architecture. Colomina**,** on the other hand, brings together modern and contemporary thus provides atemporal observations. These attempts can be considered as the reflection of "outside" within the "disciplinary" thought and practice, the limited map provided here nevertheless echoes the impacts of mechanical and digital revolutions on the material and ideational body of architecture. This is evident in the interpretations that align architecture with new communication technologies.

Conclusion

The discussion initiated at the start points to an ambiguous positioning of theory following the debate on its after-ness. Yet, today it is possible to see more clearly the evolution of this debate towards different approaches. Those who declare and advocate the end of theory tend to focus on a form of theory that arises from practice and prioritize technological novelties. Those who consider the so-called end as a "revision" keep striving to understand, deploy, surround, and update the discipline within its latent potentials (Hays and Kennedy, 2000). In-between these two approaches, this paper can be situated somewhere at the threshold; a threshold between technologically and socio-culturally engaged approaches. By positioning technology not next to practice but next to social and cultural, it pursues both discursive and material interactions among architecture, technology, culture, art, and science.

Albeit excessively broad in terms of its historical coverage, the focus on contextually akin conditions in the paper emanates from the main object of inquiry; discursive formations of dematerialization appear at different times with changing focuses. When one tries to see on which ground these varying explanations and inquiries come together, one realizes underlying and repeating patterns; a need to align architecture with the ethos of the time via technology, science, or art. This reconciliatory impetus is scientific and artistic in Giedion and Kepes. However, in McLuhan, the direction verges to a more intertwined end; dematerialization becomes a pinnacle state that governs even the materiality of bodies for extension and mediation. Acoustic space aims to replace and erase the hegemony of visual, rather than interacting with it. Rather mild explorations of Tschumi, Colomina, and FAT, do not touch upon pure scientific developments; in theirs, technology hovers somewhere in between communication and media. This idea that aligns the fluidity of communication systems with extensive use of glass relies on the increasing transposition between inside and outside, the simultaneity of time and superimposition of spaces. A familiar idea whose roots can be found in Giedion's space-time conception.

As these approaches lay bare, architecture's connection to a broader realm is enabled by a vantage point that frames architecture together with other developments that are imprinted on culture. At this point, the track that dematerialization provides help uncover different alliances between architecture and medium in which it is handled, approached, theorized. Henceforth, the study concludes that discussions of dematerialization cannot be confined with the increasing lightness of the matter, a mere practical interpretation of matter is insufficient. Contrastingly, as the content that is elaborated in the previous parts prove, dematerialization indicates more intertwined processes from which conception of space should not be separated. This requires to deploy a synthesizing and reconciliatory approach to the existing discourse around materiality and immateriality in architectural theory. Though developing such an approach requires a deeper and comprehensive endeavor, this paper can introduce a suggested start and the potential of the concept of medium for such an attempt. As a mediating category at the intersection of material and immaterial, the medium provides a new platform to view the embeddedness of material in immaterial and vice-versa. A change of focus from material/immaterial towards medium requires to leave aside the superficial urge to read transformation of the surface as a screen but puts emphasis on their togetherness; in a word, interface. With this revision, dematerialization can be placed beyond abatement, lightness, or dissolution. Thinking of not the material or immaterial but the medium that intervenes both of them, renders dematerialization as a generative concept. Beyond that, not the matter but the medium of an architectural artifact makes it possible to question how mediatic and technological intersections exist in architecture; how do they affect the discourse and what is perceived and understood from architecture? Interconnectedly, this approach opens up the possibility to alter media-architecture from something as static and limited as media installations in space to a notion to a more inclusive conceptual category that enables one to think technology's interaction with architecture via cultural technics. The hidden agencies that embedded in socio-technological interventions on culture can be thus revealed. In brief, two different layers that form the content of the paper can be reframed via medium-thinking: first, merging material with immaterial and second, bridging the medium of architecture with the predominant ethos of the time. Thus, the limited vision of dematerialization that is equated especially with increasing digitalization in the early 1990s can be expanded and the immaterial can be rearmed as a complementary concept that changes the agency of materiality.

IMAGES, CHARTS OR GRAPHIC LEGENDS

299. WALTER GROPIUS. The Bauhaus, Dessau, 1926. *Corner of the workshop wing. In this case it is the interior and the exterior of a building which are presented simultaneously. The extensive transparent areas, by dematerializing the corners, permit the hovering relations of planes and the kind of "overlapping" which appears in contemporary painting.*

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Figure 1: The Bauhaus Complex by Walter Gropius, Excerpt from *Space, Time and Architecture* (Giedion, 1959).

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TECHNÈ AS A CREATIVE AGENT IN ARCHITECTURAL MAKING

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ABSTRACT

The word techné is a significant notion in questioning and tracing the possibilities of alternative ways of making in both the discipline of architecture and different related fields. It is conceptualized not only as of the technics of making yet, the significance of making by building knowledge. It can be evaluated as an expedient agent both in criticizing current contemporary approaches often resulting in "technic lack of meaning" and also generating alternative design solutions through "the problematic of architecture making". The paper thus, is a theoretical inquiry into the discursive formations of architectural design, questioning its changing and challenging conventions in tracing possibilities for developing an alternative thinking and architectural making. It opens up the notion of techné within changing discourse of architectural theory on making by means of craftsmanship and making in the digital world. Given its references to materiality, tectonics, aesthetics, technics, and technology, the paper presents various theoretical discussions and discursive practices with a philosophical understanding in an ever-changing context. It asserts that the techné can be designated as a creative agent and the premise of hope in developing a critical comprehension through the current systems of production and reconstruction of new spatialities by building knowledge rather than focusing on the construction of a building.

KEYWORDS

Techné, architectural making, craftsmanship, digital technologies, knowledge production

“The Art of Inquiry”: Generative Thinking through Making

The act of making suggests a series of responses on the meaning of creation, design, perception, forming, materiality, and the usages of tools; the work of the hand, various technics, and technologies. It draws on practices and experiments ranging from the primitive hand tool to industrialized machines, from mounds to monuments and from drawing to building. Making “creates knowledge, builds environments and transform lives” by ensuring a way of thinking in which “sentient practitioners and active materials continually answer to, or correspond with one another in the generation of the form”. (Ingold, 2013) Besides being a medium conditioned by culture for dwelling, living in from the very first definition of it, making in architecture is a visual, textual, social, and operational act. Therefore, it is both creative and interpretive action that offers a translation from an inquiry into an act by the aid of critical thinking design and production of knowledge. Generating knowledge by means of *techné* has been mainly consolidated with an exploration of materiality through working with tools. Thus, it is possible to mention a twofold exploration; one is on the material itself (structural potential, behavior, specialty…) and the subject (revelation, intentionality, usages of tools…)

The connotation of “learning by making” on *techné* means that the maker does not have any accepted prescient at the initial stage of making except prerecorded experiments on materials and tools. The activity of making proposes situation-specific processes of production including learning experimentation generated from the relationship between the maker and physical specialty, material conditions, or orientation of tools. Knowing can be defined as a process of active following, of going along. The way one can know things emerges from the very inside of one’s being through a process of self-discovery. The maker, working as a craftsman thinks through making. Knowledge can be comprehended by the physical engagement of the subject in the act of making. It results in generating a unique view that operates the spatial and temporal reconstitutions in theoretical understanding. The way of making means to allow knowledge “to grow from the crucible of our practical and observational engagements with the beings and things around us”. (Dormer, 1994) (Adamson, 2007) The knowledge of making has emerged with a particular role and means of material in the face of thinking and form in different fields. In different related fields, new making strategies have been acknowledged. Developments in critical and creative researches made an extensive comprehension of the process of making and the way that it is practiced. New approaches to the fundamentals of making (materiality, physicality, tools, processes, etc.) have become a determinant notion in current thinking and the production of knowledge in both art and architecture. Tim Ingold (2013) interprets making for instance, as a process of curiosity about the physicality of an idea and defines the process as an "art of inquiry". The materialization of thinking or the conduct of thought as an "art of inquiry", "goes along with, and continually answers to, the fluxes and flows of the materials with which we work" (Ingold, 2013). It is the process of experimentation on materiality, physicality between ideas in the head, and the facts on the ground. Therefore, it is something natural and spontaneous in it yet, at the same time it is planned, worked, and premeditated.

Besides the physical capabilities of making gained by various technics and tools in the process of self-discovery and creative thinking, the socio-political awareness of the subject is crucial for architectural making. Materiality on making is both an effect and a result of relational production that is not stable and unchangeable. Johannes Beetz (2016) conceives materiality as a matter in motion in which the subject is seen as "an effect of material conditions, relations processes, and practices". The question of space, the role of the architect, and even architecture itself have been revised and redefined under both the influence of socio-political contexts and the progressing technologies. The way architects think, analyze, use their tools, and make architecture has changed and sometimes challenged in relation to one and other. Therefore, the conventional account of making a trajectory between design problem, the maker, and its possibility has been challenged with various changes in the definition and the nature of design thinking, tools, and methods. In this sense, the condition of change itself has become one of the main subjects of architectural theory, current discussions, and discursive practices with dynamic analogies as "process, flow, and emergence" (Braham & Hale, 2007). The notion of technology has been declared as a synonym for the digital realm in which the whole apparatus of networked information flows. Within a rapid change, the tools of making and the notion of materiality in architectural design and construction have emerged as "a matter of processes, networks, and systems".

This paper is both a philosophical and a theoretical inquiry into the discursive formations of architectural design, questioning its changing and challenging conventions in tracing possibilities for developing an alternative thinking and architectural making.[1] The word *techné* is selected as an auxiliary concept in grounding a theory on architectural making with its expanded means in the philosophy of technology, technics, and aesthetics. It is believed that the act of making in relation to techné determines, directs, and shapes a significant domain in architectural discourse in relation to scientific and aesthetic experimentation. In this aspect, *techné* is a long-established, yet still a significant notion in questioning and tracing the possibilities of "alternative ways of making". It denotes not only the technics

1. This study has been studied as a part of a PhD study supervised by Prof. Dr. İnci Basa since 2016 at Middle East Technical University, Department of Architecture, Ankara/TURKEY.

of making, yet more importantly the significance of making and building knowledge. It can be evaluated as an expedient agent both in criticizing current contemporary approaches often resulting in technic lack of meaning and also generating alternative design solutions through the problematic of architecture making. The intention of the paper is thus, to re-conceptualize *techné* within the changing discourse of architectural making in relation to craftsmanship and making in the digital world. The philosophy of technology necessitates questioning; a way of critical thinking which offers a way of interrogating the essence to open new possibilities in constructing new and free relationship towards contemporary matters of making. It is believed that the redefinition of architectural making on *techné* may have the potential to situate architecture within a larger classification of knowledge in the matter of change.

Techné: a Stimulus between *Theōría* and *Poiēsis*

Signifying "the logos of making" from the classical discourse on architecture, the notion of *techné* has reconnoitered from comprehensive discussions of philosophy. Depending on the variety of the production itself referring to materiality, tectonics, aesthetics, technics and technology, discussions on *techné* in architecture address different intentions when approached by different philosophers and theoreticians. It has been intertwined with the notion of "worldmaking" from antiquity. The ancient Greek *techné* began and evolved with "the woodwork of a woven house" in which "knowledge specific to determinate subject matter and to the distinctive and specific objective of producing something functional and useful" (Roochnik, 1996, p.19). It was acquired through apprenticeship and acknowledged as an act of making for public goods. Constructing a close relationship between "knowledge production by making" *techné* has been declared with two other notions; *episteme* and *poiēsis*. Although the binary relationship between *episteme* and *techné* has been interpreted in various approaches, it is an accepted result of the discussions in many articles that one of the defining signifiers of *techné* is the notion of *episteme* looming over its historical double. It is assumed as the kind of knowledge indicating such determinate, specific, qualifying criteria while *techné* as the kind of knowledge arising from the practice of experience, that was on the material. It identifies the essence of the subject's relationship to material technics, object, and nature toward a specific kind of knowledge. Conceptualized mainly with *episteme* by the Ancient and Classical Greek philosophers, *techné* has also been declared with *poiēsis*, "to produce", or a "process of creation". *Poiēsis* as an activity of doing, achieving an end, also an approach inherent to the maker. (Irwin, 1999) The emphasis here is lying behind the notion of repetitive making and self-enhancement. All of the endeavors regarding fine art, craft, and architecture were encompassed by techné, which has acquired during their development into a civilized culture (Parcell, 2012, p.21). Different than a mere collection of technical skills for making, techné is interpreted as a larger realm of knowledge and intervention that encompassed not only artisans yet ancestors. It was relied on "cultural memory", "empirical experience", and "strategies for circumventing limits". (Parcell, 2012, p.21) Knowledge generated from *poiēsis* constitutes *theōría* and it becomes "the enabler" of both thinking and making as well.

The nature of this relationship is not constant rather continues to expand in terms of what it indicates in current time. There are contentious philosophical and theoretical means of *techné* including various approaches to the generation of knowledge and generative technics. One of the first interpretations of *techné* was explained with art and craft notion which could not be separated from theoretical knowledge. Knowledge intimately has a strong connection with know-how in a matter of questioning that resulted in the organization of knowledge designated by *techné.* [2](Merchant, 1979)

Indra Kagis McEwen (1993) investigates an interval of a common revelation within both architecture and philosophy and asserts that "architecture is about revealing ideas". Craft is interpreted as *techné* that denotes to making things visible and enabling for "the exploration of cosmos". The uniformity between philosophy and architecture is ordered, harmonious, and self-conscious. However, *techné* for McEwen (1993) is different than *poiēsis*, making or doing rather it is a discovery and use of words. It is a way of comprehension and transformation of knowledge into a statement. The artifacts existed in the process of "discovery through their making, use, and memory". They were constituent in the development of knowledge itself as explained by McEwen (1993). This argument reflects the significance of craft in the self-consciousness in which "the cosmos or order of civilization embraced through the making of the artifact". The possibility of *theōría* was in prose of things seen objectively came into being. Reconciling *theōría* (gained) and *poiēsis* (learned) together, *techné* is a tool for understanding.

The process of transformation of knowledge from theory into a set of technical rules with the implicit intentions is elaborated by Alberto Perez Gomez (1990). With a historical analysis of the changing meaning of geometry and number with architectural intentionality during the seventeenth and the eighteenth centuries in

2. One of the first discussions on *techné* is based on Xenophon's interpretations in relation to *episteme* which firstly appeared in Socrates' works. Referring to Socrates' definitions of *technai* (activities defined as astronomy, mathematics, housebuilding, making money, painting and flute playing) and *epistemai* (closely connected to skill, practice and *techné*) Xenophon explains *techné* (craft or skill) without any distinction from *episteme* (theoretical knowledge).

relation to scientific and epistemic turns is questioned. In the light of Platonic cosmology, Galileo's revolution, astronomy, the eighteenth-century Newtonianism, Renaissance cosmology, the developments in mathematics and Euclidean geometry, number and geometry are represented as "the instruments for the technical control of practical operations" for an effective "technological domination of the world". Before the seventeenth century "the primacy of perception" was the ultimate evidence of knowledge, never questioned. (Gomez, 1990, p.9) Geometry and number were "prototypes of the ideal" and "the symbols of the highest order". In the Aristotelian period, there was no distinction between theory and practice as Gomez (1990) explains. The former endured as "the elucidation and justification of the latter" that existed as the notion of *poiēsis* (different than praxis), and the latter was expressed as a form of reconciliation between man and the world. They were acknowledged as the two poles of a sacred, living totality" (Gomez, 1990, p.9). With a reference to *mathesis* Gomez (1990) explains what could be thought and learned was the first appearance of *theōría*. The exploration of *theōría* meant the beginning of architectural theory, which is "*logos* of architecture". Until the end of the Renaissance during the seventeenth and eighteenth centuries theory has always contained the necessary complement of the mythos. During Renaissance "theory was not merely a series of technical precepts but was underlined by metaphysical preoccupations often implicit in the mathematical rules themselves" (Gomez, 1990, p.9). As he asserts that was Alberti, who distinguished theory and practice, design, and real building.

Considering *techné* and its cognate bonds with *poiēsis* "a mode of revealing" in relation to and *theōría* emerged from *technai*, the generation of knowledge as a practice has been fundamentally consolidated within the discussions on "craftsmanship". It alludes to critical research resulted from exploration by using tools. In this sense, the hand is an ontological tool that provides a way of physical exploration of materiality and directly the generator of the knowledge. The connection between the hand and the head has examined by various studies. The inclusion of the entire body in the making process is elaborated on medicine, philosophy, and such names; Darwin Charles Bell and Frederick Wood Jones who mined the potential of "moving body" in the reception of information by the brain by Richard Sennett (2008). The definition of a craftsman is expanded with a reference to Hannah Arendt as "a specialized human condition" on the ability to make things and "constructing knowledge by using hands". The author addresses two arguments regarding craftsmanship; the first is "the craftsman's desire to do good work" while the second lies in "the abilities to do good work". It suggests ways of using and organizing bodily movements, considering materials that remain alternative, practicable proposals on how to conduct life with learning by making.

The hand is interpreted as the ultimate *technai* for the generation of knowledge and the propellant of materialization by Juhani Pallasmaa (2009). The hand works for the revelation of "the possibilities and the limits of the materials and crafts". All the work of the hand rooted in thinking since the hand is mind's extension. Besides exploration, the hand is a structure for the expression of "personality, social class, wealth, allegiance, occupation, and association". In a similar manner with Sennett (2008), creative thinking is explained as work and labor by Pallasmaa. The significance of bodily engagement in achieving freedom by identification of the maker's own territory and personal limits is emphasized. The hand and the body generate different alternative possibilities than the head for Pallasmaa (2009) since the latter is conceptual, intellectual, and geometricized while the former refers to spontaneity, sensuality, and tactility.

The prose of things came into being has been generally associated with forming in architecture. The architectural object, therefore, can be interpreted as a disciplinary product and knowledge work in which theoretical and intentional approaches of the maker are readable. It connects knowledge and imagination through exploration. Geometry, ratio and proportion, structure, materiality, technics in either conventional or digital can be evaluated as the tools of an architect. Since the question of space itself has been being revised and redefined under both the influence of progressing digital technologies and socio-political contexts, the way architects think, analyze, use their tools and make has changed and sometimes challenged. Thus, the way of bringing knowledge and imagination in a developing critical practice of spatio-technological theory emerges as a significant concern. Current approaches through making the urge to redefine the maker and work through the design and their relationship with the object. This shifting conceptual and theoretical vocabularies in architecture, therefore, lead to rethinking the changing meaning of the maker as a drawer, craft as a product, technics as operations and making as production.

High *Techné:* Making in Digital World

Contemporary developments, new techniques, socio-cultural admissions affect theory and practice as they altered the way architects, designers, and planners think and make. Being an initiator for expressive technics, the generator for new forms, and the invention of new modes of architectural production, technology offers alternative possibilities in constituting architectural knowledge. Assuming each technological development corresponding both a theoretical and a technical shift or a new "tabula rasa", one can claim that the comprehension of experimental and operational architectural interventions through technological-technical advancements has the power to enable directing the processes of making through design or production of new spaces. Furthermore, architecture connects knowledge and imagination through exploration of form and articulation of contexts, informed by the means of making within changing technological, ontological, and cultural discourse. The roles of actors, processes of making, theory, design, and the ways of using and interpreting tools, materials, technics, and technologies in the process of actualization of the material object should be questioned. The notion of *techné* is hanging in-between the excitement over the possibilities of the digital era and a desire to obtain a historical and theoretical perspective of making.

Within the last decades, besides its practical appeals and evolving discourse, digital media and computation technologies have accelerated the disciplinary transformation of architecture. The discipline of architecture has been redefined by the evolving perception of making and the profession itself. It has been transformed from the activity of crafts into an activity of design performed through various tools and technologies. By deflecting the disciplinary nature of problems, changing conventional definitions, expanding fields of references, and applications, the digital turn can be read on contentious discussions.

The notion of craftsmanship has been reintroduced by Michiel Riedijk (2011) with the changing precepts in the act of making in the digital era. Architecture is elaborated both as "self-contained craft" and "a discipline" producing alternatives to the question of design. Architecture is not related to making buildings, but it is a disciplinary act and production of representations. The craftsmanship of the architect is, therefore, mainly hidden in the ontological instruments. Architecture may still be considered as a craft, due to mainly representing the designer's conceptual position on the project, the range of different ideas, and also it is a discipline due to its disciplinary conceptualization of knowledge based on a system and skills developed in the course of the act. For Riedjik (2011) architecture stands in-between craft action and disciplinary thinking within ever-increasing possibilities and going beyond the act of making through the practices of design.

In an ongoing evolution, the age of tools has given a direction to the age of systems in which the shift is defined on the transformation of the tools of design and construction into "a matter of systems" by Ivan Illich (2007, p.xxi). The current design technologies aimed at comprehending external content through information processing that works with constructing and configuring relationships in which many possible outcomes can be comprehended by one code. For Mario Carpo (2011) with the rise of digital technologies, the modern power of the identical came to an end. The author of the original script may not be the only author of the end product, and may not determine all the final features of it. The transition from design to fabrication in the latest generation of making is immediate and requires no additional information between these processes as he indicates.

The current definition of craft is evaluated by various theoreticians in different aspects. Scott Marble (2010) for instance, asserts that the notion of craft is no longer described with the hand. With the changing definition of the maker and labor, the meaning of craft is expanded and gained a new life by the developed digital technologies and fabrication techniques. The current interpretation of craft in the architectural making has become closer to the production of detail. Contemporary details are based on management and organization of information in which tolerances and even assembly procedures can be numerically controlled and parametrically integrated with the process of design as he indicates. Although this new method of production detracts architects from working with their hands, it reconnects them with making based on a relationship between human intelligence and machine capabilities. Therefore, craft does not disappear rather it generates with an extended definition by inclusion to not only making yet design processes.

Contemporary Expansions: *"Autopoiēsis"* of Architecture

The discipline of architecture as one of the practical arenas of design thinking has been affected by the conceptual and theoretical shift. With the transformation of the age of systems, architecture as a matter of change in discursive, practical, and theoretical means has gained an autopoietic dimension. Autopoiesis has been first introduced to "describe the essential characteristic of life as a circular organization" reproducing "all its specific components out of its own life-process". Patrick Schumacher (2011) has been integrated and translated the term "autopoiesis" into architecture as a "self-production system" and "an overall discursive self-making of architecture". It refers to an overall self-referential making of architecture that is a continuous historical process including new theoretical efforts in an ongoing evolution. Supporting a comprehensive and unified theory of architecture across a multiplicity of projects, aspects, and components of contemporary architecture by means of programmatic agendas, Schumacher (2011) claims that autopoiesis provides an extensive theoretical system, offering "its self-description". A unified theory should be embraced to manage various design approaches that lead to different directions as he indicates. Thus, architecture constitutes itself self-referentially, due to its own autonomous, disciplinary discourse. He believes that theory necessitates disciplinary autonomy with a sharp demarcation from both art and science. Self-descriptions in architectural history and theory as a reflective overview of the discipline's premises, values, and methods are analyzed in "The Autopoiesis of Architecture". Architecture is defined as a system of communication encompassing three notions; artefacts, knowledge**,** and practices that all connect to each other "in an ongoing recursive network". They conceptualized as autopoietic systems generating their own components and structures within the ongoing flow of communications. Autopoiesis in this sense reflects the premise which the discipline of architecture can be theorized as a distinct system of communications. Architecture is not an action anymore yet a system offering a distinct subsystem of society. Then, theory can offer a coherent framework that allows the architecture to analyze itself in comparison with other subsystems of society like art, science, and politics. Parametricism is elaborated by Schumacher (2011) in further discussions within this self-referential and descriptive settling of architecture. The architecture was re-defined as a united self-descriptive discipline however, the vocabulary of architecture was expanded by adding various rational and poietic meanings generated from its ontological and discursive potential compatible with the matter of changes.

Digital understanding of making has been acknowledged and applied with great euphoria into design analysis, practices, and research. This interest has been maintained through a great expansion in the possibility of making towards an unpredictable arena of experiments. The exploration of new generative potentials of forming and emergent capabilities of complex systems of research directed to privileging new technics, methods, and tools. The ability to compute extensive data within the self-organizational and ontological capacity of making processes has been empowered by the idea of the autonomy of architecture which can be self-descriptive, self-organize, and adapt itself through the changing progress. This autonomous behavior of architectural thinking causes to redefine the profession itself, the acts, the roles, the processes, and the tools.

Beyond being just a construction of form, architectural production in addition to questioning the ongoing situation that we are in, could have the potential to constitute creative alternative solutions to the design problematic. It should be described with all its symbiotic, tangible, and intangible connotations. It cannot be a mere archive of technical or artistic skills for making products, rather a larger realm of knowledge. Considering the current role in the process of making by exploration and circumventing limits, *techné* combines tooling from the contemporary digital era with craft and skill-based knowledge. It is beyond making an end rather experiencing new phases, matters, and means of making. Building scale printers, forms from salt, contemporary fabrication techniques can all be evaluated as "circumventing limits" of materiality, tools, and interaction with all. Techné generates in the development of intimacy with the excitement of new materiality and even a craft sensibility in order to translate digital comprehension into compelling physicality.

The emergent properties and creative capacities of the tools of the maker can be conceptualized as "intellectual and emancipatory agents" in generating new novels, creative thinking, and making. In order to correspond to the notion of *techné* in contemporary architectural theory, the concept of *poiesis* can be discussed within the emergent properties of new technologies through which *techné* is extended as a creative agent in the intersection of craft notion and the production of new possible alternatives.

Developing a criticism of architectural production including the disposal of the maker and the intuitive faculties in the contemporary modes of making *techné* manifests itself with micro creations at the interface of *poiesis* and technology that recognizes the contributions of productivity in the experience of making. It can trace the possibility of a modest, elaborative, micro-scale understanding of architectural making through an emancipatory, yet conservator on a spatial and tectonic inquiry into the potential of architectonic elements, experimentation on materials, information on joints and accumulation of knowledge. In a time of rapid urbanization by globalization, ecological degradation, migration, destruction of vernacular and modern architectural heritage, architectural concerns for the maintenance of local cultural identities, and awareness in providing a holistic approach have become intriguing. It is believed that knowledge learned from craft notion with a tectonic inquiry, ontological experience, methods of thinking, and modes of making can still have a significant contribution to the creation of local, conservatory solutions and to manifest creative capacity and novelty in making as well. It has a creative potential to contribute to current architectural theory with the recognition of meticulous particularity. In this sense, it can be acknowledged as a creative agent based on the ability of critically thinking and creatively producing singularities as a part of a social construct. Therefore, the interpretation of making with a philosophical understanding in an ever-changing context in design and theory may be the premise of hope in developing a critical comprehension through the current system of urban production and reconstruction of new spatialities by building knowledge rather than focusing on the construction of a building.

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TOWARDS THE *RELĀTA* OF ART | ARCHITECTURE | THEORY: “CONTEMPORARY” MATTERS IN-BETWEEN VALUE AND VALIDATION

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ABSTRACT
“Matter,” as the subject of philosophy, is as well a motive core for art and architecture. It is a much-debated concept that can re-inform the problem of contextualization and reification in art and architecture theory since “matter” expands in-between māteria and idea. The mutual transformation of both coexists with paradigm shifts unfolding within art and architecture of the last century, which has inquiries about what matters in response to the prospective restructuring of the fields. The paper, then, aims to draw a mutual ontological identification spanning the portrayals of the late nineties through art|architecture|theory and discusses how “contemporary” matters emerged out of turbulence by the displacement of relāta and its correlation to value and validation.

KEYWORDS
Architecture theory, matter, value, validation, contemporariness

The debate on "matter," initially a philosophical phenomenon, has its own intellectual historiography crossing the borders of artistic and architectural practices at times. The "matter" straddles the line between *māteria* and *idea*, the significance of which is context-dependent and diachronic. Correspondingly, a paradigm shift regarding the "matter" becomes visible through the mutual appropriation of any possible metamorphism concerning both *māteria* and *idea*. For art and architecture of the last century, a discursive fracture or to put in another way, a theoretical consciousness was hinged to the transmutation of the modes of conventional production, which the paper aims to highlight by period-specific portrayals. These involve a depth of analysis towards "what really matters," concentrating on the relationality between value and validation projected onto "*relāta*," a Latin word denoting to the objects related by a relationship, and their transcendence into the theoretical contours of art and architecture in general.

The work of contemporary theorists relies on the relationality between the production of art|architecture and the trajectory of an ongoing worldview. The intellectual shift and its transformative potential circulate and become solid through a new discursive formation following a closure of indefinite enunciative struggle to identify the dormant orientations within the materiality of art|architecture. The rupture from dominant modes of *māteria*, *idea,* or both have articulated within a peculiarly isolated discourse, which found itself a place as "turns" or "paradigms" in disciplinary authorities such as the cases for the linguistic turn, the postmodern turn, the digital turn, etc. These evolutionary cycles immediately reproduce themselves through the theoretical challenges underlying de-reification. De-reification is a constitutive conceptual apparatus for this study, which suggests the disentanglement of any relationship into its *relāta* that assigns the current value and validity to the milieu of art|architecture. In other words, what matters is confined through the dialectics between the changed features of *relāta*.

Following the discursive shifts that have occurred parallel in art|architecture theory, this study aims to focus on the causal exploration behind the ontological recognition of art|architecture. Through the displacements of the *relāta* and its discharged validation, the quest on "value" produces an expanding material for the art|architectural criticism and theory. Consequently, any scholarly endeavor necessitates historical contextualization to read the non-discursive cartographies through a critical distance. K. Michael Hays, in "Notes on Narrative Method in Historical Interpretation," highlights the intrigue relation between theory and history since both have inhered the inert substances of each other to accord the reality (2007). He states: "Theory takes history as its subject matter, and there can be no writing of history without theory. The more theory, the more access to history. The theory is the practice that produces concepts and categories to map the Real of History. So the practice of theory will ultimately have to deal with some versions of the Imaginary and the Symbolic since in this schema, these are the orders that attempt to manage and make sense of the Real" (p. 23). Therefore, the 1990s is approached as a coherent historical period in which there had been conceived parallel trajectories. Beyond the distinct conventional biases that were established to validate the matter of art, architecture, and architecture theory, these detours have indeed redrawn the disciplinary boundaries for each.

Thus, mapped respectively through art|architecture|theory, the intention in this triangulation is to identify the common ontological convergence over the quest on what matter is and what it mattered. As the first node, the altered relationship of art and its object has been proposed as in the case that has been grounded by the art philosopher and critic, Arthur C. Danto, and his three-decade-long investigation on art over Andy Warhol's 1964 dated exhibition. In 1964, Andy Warhol truly replicated the original packaging of a box of Brillo Soap Pads by screen printing ink on to the wood and exhibited towering boxes of 'much the same' supermarket cartons at the Stable Gallery in New York. "Brillo Box is a work of art, unlike the Brillo box in the store, which looks essentially similar" (Carrier, 2013). The exhibition gained vast attention in the art world and kept busy the agendas of art critics in a long period questioning how to locate the mimicked Brillo Boxes within acute criticism crossing over the established art history. Arthur C. Danto situated a radical perspective over boxes with consumer product logos printed on, suggesting a philosophical inquiry above the criticism's mainstream, asking what made it art? What was the matter? And in 1964, just after the exhibition, in *The Journal of Philosophy*, Danto had a prelude for "The Artworld:"

> What in the end makes the difference between a Brillo box and a work of art consisting of a Brillo box is a certain theory of art. It is theory that takes it up into the world of art and keeps it from collapsing into the real object which it is. [Warhol's Brillo boxes] could not have been art fifty years ago. The world has to be ready for certain things, the artworld no less than the real one. It is the role of artistic theories, these days as always, to make the artworld, and art, possible (Danto, 1964, p.581).

However, what Brillo Box has signaled constituted Danto's investigation on art for the following thirty years since the relāta of art, and its percept has irreversibly changed. A fundamental question towards the very definition of art is occupied the core in his famous book published in 1997, *After the End of Art*. That search for re-identification of art has turned out a very outstanding thesis stating anything could be art, which fulfills the artistic freedom that ceased from any historical validation. The original mattered for centuries has been discharged for the identical, which in turn has afflicted the very ground matter of art. He declared the shifted status of art as “the Post-Historical Period of Art” and believed that “there is no reason for it to come to an end. Art can be externally dictated to, in terms either of fashion or politics, but internal dictation by the pulse of its own history is now a thing of the past” (Danto, 1998a, p.9). His statement commenced a break-out of art’s very own containment, yet the very end of art.

Danto has his theory of the end of art superimposed on Hegels’ End of Art thesis, which was constituted in the early nineteenth century. In Hegel’s philosophy, art’s death has been postulated over the deviation of the Romanticist narration of art towards the conception of Reason. The supra-status of art over philosophy is withered away, formal law of art once seen as the only condition for the aesthetic has dissolved into a state of freedom. Eventually, artists have become liberated from the preset roles and constraints of art practice inherited through Romanticism (Danto, 1999) and lost their heroic characterization depicted within art history. Now, flown through the spirit of the time, “the whole internal logic of the history of art culminates in absolute artistic freedom” (Ibid). In Hegel’s’ moment, what has been transformed through the epoch was the relationship between “the vehicle of art and its meaning” (ibid). Yet, for the artworld posterior a century, art has almost lost its vehicle, and equated to its essence, the philosophy. “All there is at the end is the theory, art having finally become vaporized in a dazzle of pure thought about itself, and remaining, as it were, solely as the object of its own theoretical consciousness” (Danto, 1986, p.110-111).

The end of art thesis situated within the nineties coexisted with a fraction in art’s decent mode of production; that radically contested the ontology of art and the understanding behind its aesthetic value. The echoes of Brillo Box have been placed alongside the conflict of original versus identical; Andy Warhol brought pressure to the ontological boundaries of art, even destroyed its ontological content. Brillo Box became the capitalist conquest of mechanical reproduction over uniqueness, originality, and authenticity, which were nothing, but the premises of the aesthetic value drawn within art history treatise (Artun, 2018). The breach of art indeed embodied the breach of history, and it was a way beyond the declaration of artistic freedom. The slippery ground has been put within what Danto has underlined, as “the definition [of art] itself had become attenuated to the point where pretty much anything could be a work of art” (Danto, 1998a, p.40). He further exemplified his argument: “Once art had ended, you could be an abstractionist, a realist, an allegorist, a metaphysical painter, a surrealist, a landscapist, or a painter of still life or nudes. You could be a decorative artist, a literary artist, an anecdotalist, a religious painter, a pornographer” (Danto, 1998a, p.9).

What Danto further embraced points out a demarcation from determinism on the form. What has been brought with the end of art narration through the nineties was beyond the conception of style or an expression of the spirit of the age. It was so powerful that it constructed its discourse as the end of cycles; indeed, what has pointed at was an age of relative values, which forced the ontological core of art to be disentangled, hence it could be reconstructed beyond being paradigm-bound. He depicted the art world after the end of art as stated: “If everyone goes off in different directions, there is no longer a direction toward which a narrative can point. It is a wholesale case of living happily ever after. And that has claimed, is the state of the art-world after the end of art” (Danto, 1998b, p.128).

Parallel to the debate intersecting art with philosophy, architecture has also already been dealing in a period liberated from its historical ties; the post-historical era of architecture perched right on the binary opposition of modernism/ postmodernism. In the meantime, when Danto wrote defending essays on his theory of the end of art on how artistic practice lost its own progressive ideology, architecture was just on the verge of the digital revolution searching the contours of its technical lore. Mario Carpo, in his book The Alphabet and the Algorithm, addresses the shifted status of architecture as: “Any revolution, even a technical one, by definition changes the course of history, but this one had no clearly identifiable, preexisting course of history to refer or call into question... it had no preset destination: no target, as it were, and *almost no end in mind” (Carpo, 2011, p.100-111)*. Carpo’s rendering of architecture, as its digital turn has no historical referees, is analogous to what has been advocated for the post-historical period of art and its continuum.

The liberation from the existing modes of practice of designing and building through emerging technologies has challenged the architect’s relationship with time since any possible number of outputs for one single architectural task can be produced. Architecture has stepped into the endless number of variable prescriptions, while only one could be executed in the real world. “The modern power of identical has come to an end with the rise of digital technologies” (*Carpo, 2011, p.x*). Therefore, architecture has come to the point that its conventional *relāta*, the identical, now has been substituted with the variable. The unfolded virtual technologies imposed new visions on contemporary practice that made possible formal freedom beyond any technical validation.

To illustrate, Ben van Berkel and Caroline Bos, the founders of the well-known Netherland architectural office, UNStudio, in their book *Move: Imagination*, outline their contemporary practice evolving around the invention of new operative design technics (1999). Moreover, that has made the traditional debate on a form much more contested than ever and nullified the probe of form as Berkel and Boss stated: “to redefine organizational structures means that if the information on which a building is based possess proportions that sounds right, it can take any form; blob or box – it doesn’t matter anymore (Berkel, B. & Bos, C., 1999)” which opens up a quest on prospect aesthetic value. While the materialized engagement of technology in architecture seems to challenge the traditional understanding of style, indeed, it proposed an emergent mode of production accompanying a co-emergent aesthetic. The interchanged form has initiated further inquiries for the theoretical causation underlying, which was undermining through the priority attached to form. Nevertheless, the contested status of the aesthetic value has challenged the ontological identification of architecture in the same way rendered for art. In this foreground, Lebbeus Wood points out the immateriality undermining behind the infinite formal exploration through the digital turn, in his article "After Form." Woods reveals the disassociation of architecture into its mere materiality; as he states: "When anything is possible and built or imagined forms can be posited, distorted, combined and recombined ad infinitum, the idea of the form itself is devalued. In that case, it is in its making no longer a discipline uniting thought, feeling, aspiration, and modes of social construction, but the manufacture of commodities, to be bought and traded as products" (Woods, 2006, p.131). The queried status of value and validation on artistic|architectural relata has inquiries on the ontological substance of fields, and as for the search of architecture beyond digital, the discursive formation around it once again ascertains the totality of architecture as Woods' concluding statement in his article: "After forms, we might say, comes architecture" (p.132).

Architecture must revise the historical connection established once with the identical, now with the variable. The contemporary architecture was at the edge of a fracture that has rewritten the technical logic beneath its roots, and contemporary discourse again turned back the fundamentals of architecture to intuit any symptoms that will possibly reconstruct the nature of architecture's very own being. The change within the architectural profession in the early 1990s has been put by Carpo around that seminal problematic whether that change is a "paradigm shift." "If the digital is an 'a paradigm shift,' which paradigm is shifting?" (Carpo, 2011, p.ix). The articulated discourse is now solidified on the problematic of ontological identification of architecture.

Coextending the subject of this study to the third node of triangulation Art|Architecture|Theory, concurrent with the former two, the seminal anthology of architecture theory, *Architecture | Theory since 1968,* as edited by K. Michael Hays, has been published in 1998. Described as a "reconstruction of the history of architecture theory (Hays, 1998, p.xii)," it has reviewed the extended field of architecture and mapped architecture's encounter and engagement with different discourses in relation. The book has drawn out the lines of the intellectual history of architecture and uncovered a period when the textual productions of architecture have become prominent as the theory has been put in place of practice. Hays explains the shift in architectural production as: "theory is an appetite for modifying and expanding reality, a desire to organize a new vision of a world perceived as unsatisfactory or incomplete" (Hays, 1998, p.xiv). The discursive expedition that architecture took since the 1960s onwards nourished speculative research on architecture not only through authored expatiation but also through organizing intelligentsia. An influential representative of an architectural agency, Anyone Corporation, an architectural think-tank established in New York, has contributed to the Anglo-American architectural discourse between 1991-2000. The intellectual milieu pursued the strong sense of an architectural community and consolidated their agency with international conferences and exhibitions but, more importantly, with circulated publications, the annual ANY books, and the bi-monthly magazine ANY. The intention to disseminate the critical approach onto architecture during the nineties has been associated with former intellectual movements of the twentieth century, which is remembered by their organizational collectivity and their will to share their "new" statements to the public. Reminiscent of 1910s' Futurists, 1920s' CIAM; OSA, 1930s' Razionalismo Italiano, 1950s' Team X, 1960s' Archigram; Metabolists; Tendenza, it was 1990s' ANY. Each year, in different locations around the world, they held themed conferences as the core of Anyone project, which later turned into ten annual volumes of a book series titled as one of the any- words of the English lexicon; *anytime, anyone, anywhere*… However, ANY completed their decade-long association announcing of the tenth and final volume, which has been ironically named as *Anything;* quoting from the overview of the book: "At a time when the fragmented ideas and styles in architecture make it seem as if "anything goes," Anything asks whether there are constraints to thought and action that change "anything" to "the thing."[1] Their assertion has consolidated what Michael Hays encapsulated in the introductory chapter of *Architecture | Theory since 1968:* "From Marxism to semiotics to psychoanalysis and rhizomatics, architecture theory has freely and contentiously set about opening up architecture to what is thinkable and sayable in other codes, and, in turn, rewriting systems of thought assumed to be properly extrinsic or irrelevant into architecture's own idiolect" (Hays, 1998, p.xii). In that terms, as this study postulates, for the third node of triangulation – for the absolute discourse as well- the *relāta* of architecture theory has become ever changing. Therefore, architecture theory has freely ceased an intrinsic validation, and its expanding territories have no end.

The debate on the theoretical overproduction has exceeded the nineties' loci, recently Douglas Spencer in the subchapter entitled "Architectural Theory" From May 68 to the Real of the Market" in his book *Architecture of Neoliberalism: how contemporary architecture became the instrument of control and compliance* debates theory's supremacy (2016). The *demonic quality of theory*, in Spencer's words, is fused into the margins of contemporary architecture practice, which uses theory to legitimize its implicit neoliberal bias. While the relations between theory, practice, and neoliberal managerialism are beyond the scope of this paper, yet this contemporary rendering of theory clues in the undermining matter of theoretical *relāta*. He constructs his argument on Francois Cusset's portrayal of "the madness of theory" of the late twentieth century According to Cusset, "Theory as we most often understand it today is the name given by the English-speaking intellectual community to a certain type of contemporary Continental (largely French) philosophy" (Cusset, 2011, p.24). It is the discourse on theory, which is heavily manipulated by seizing the bits and pieces of philosophy by any means to fit within different disciplinary and political grounds to pave the way for an odd transdisciplinary fashion. Yet, "theory" has been dissociated from its Continental roots and became attached within the English and American intellectual dialogue; it survived outside the original as a "surrogate philosophy" (Cusset, 2011, p.24). The theory has escaped from its predefined outline, desisted being reasonable, and being meant something. Moreover, in the end, to Cusset, theory turned crazy. In parallel to Cusset's retrospective problem of theory in general humanities, architecture theory has belatedly had its share of that 'surrogate philosophy' 1970s' onwards. What is intrinsic to architecture has been dislocated by what is extrinsic to the discipline, which unsettled the inherited disciplinary value and validation, de novo, the ontology of architecture.

"Matter" re-informs the problem of contextualization and reification in art and architecture theory since "matter" expands in-between māteria and idea. "Contemporary" matters are emerged out of turbulence by the displacement of *relāta* and its correlation to value and validation. Their contested status draws a mutual ontological identification spanning the portrayals of art|architecture|theory. The mutual transformation of both *māteria* and *idea* coexist with paradigm shifts unfolding in response to the prospective restructuring of the fields, these portrayals inquiries about what matters ontologically.

NOTES

1. From the MIT Press overview on the book *Anything* edited by Cynthia C. Davidson (2001). Retrieved February 19, 2020, from https://mitpress.mit.edu/books/anything

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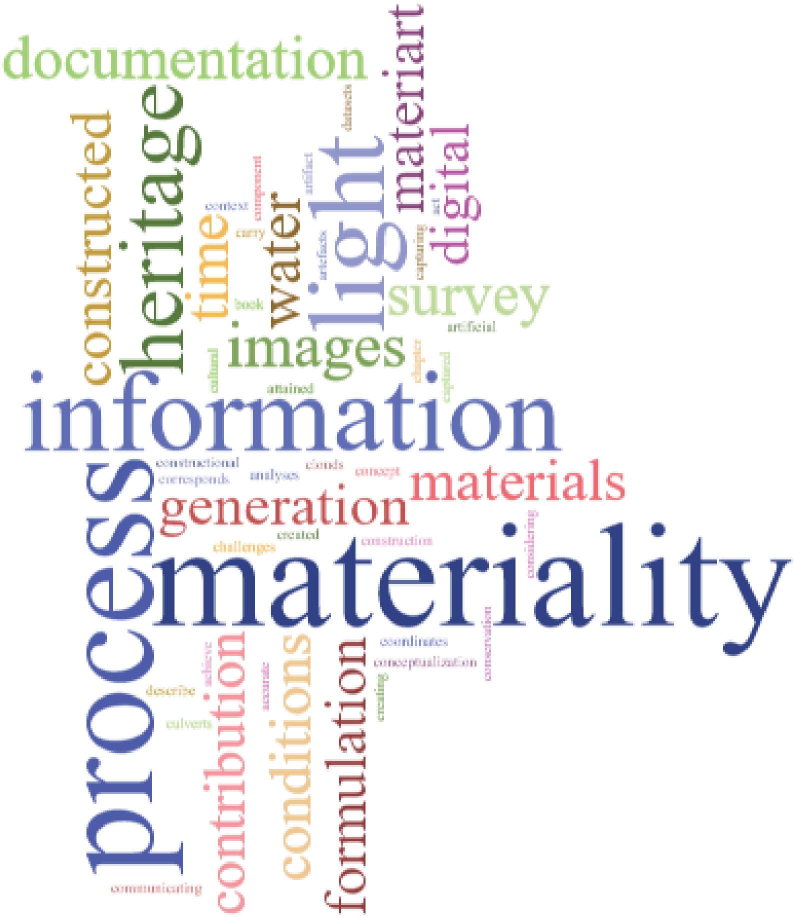
CHAPTER II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INTRODUCTION

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The concept of materiality has emerged in recent decades as an intriguing and powerful theme in architectural research, education, and practice. However, materiality has always been intrinsic to architecture. In the Harvard lecture on the aesthetic perception K. Michael Hays argues that architectural thinking is inseparable from materiality and, referring to the famous Aristotelian sentence "the soul never thinks without phantasm", Hays argues that "thought needs a material image, something to carry the thought" (Hays, 2020). New insights into the role of the material medium have emerged in the last decade with the acknowledgment of the research by design as a valid form of generating knowledge and understanding (EAAE Charter, 2012). Within the research by design practice, as Holger Schurk argues, "doing and gaining knowledge coincide" even to the moment, "when designed object and cognition come (…) to the state of converging. Material and virtual are closely linked in this transitory iterative process" (Schurk, 2015, p. 31).

While the whole history of architecture could be re-written with the focus on materiality, immateriality appears instantly as a meaningful counterpoint; visible coincides with invisible, tactile with imaginative. Relations between materiality and spirit took a prominent position in Hegel's aesthetics. For Gottfried Semper, the nineteenth-century German architect and theoretician, who searching for human relations with the natural environment delved into the origins of materials and recognized them in the concept of the Primitive Hut, materiality is a means of creating a "true atmosphere". As Mark Wigley argues, for Semper "the full force of architecture is to be found in its outer surface, the decorative layer through which the atmosphere seemingly percolates" (Wigley, 1998, p. 41). Materiality and collective memory took a dominant position in Aldo Rossi's concepts. Materiality and its role in evoking experiences inspired the whole generations of architects who rooted their investigations in the phenomenology and studied sensations related to the direct encounter with the volumes, light, or surfaces.

Interestingly, the constant re-negotiation of the delicate balance between material and immaterial may be considered as a significant driving force in architecture. For Hegel, the spirit interpenetrates into classical forms of ancient temples, while in the later epochs, according to this great philosopher, this balance was distorted, with the seminal exemplification in gothic architecture where light metaphorically, dissolves material forms. Centuries later, in the well-known essay "Materiality and time" Finnish architect Juhani Pallasmaa argues that "The flatness of today's standard construction is strengthened by a weakened sense of materiality (…) The current overemphasis on the intellectual and conceptual dimensions of architecture contributes to the disappearance of its physical, sensual and embodied essence" (Pallasmaa, 2013, p. 34). The emergence of land art and minimalism that awaked interest in elemental properties of materials was a critical response to conceptualism. Countering conceptual art, Michael Heizer, Robert Smithson, and many other artists created site-specific works as highly articulated forms made of earth, rocks, and water. Mary Miss investigated the densities of materials, their pliability, and transparency (Robins, 1984). As Kenneth Baker indicates, the introduction of raw materials such as aluminum, steel or heavy plates of lead in the works of Richard Serra, Tony Smith, or Donald Judd were devices to observe "kinaesthetic responses to the mass and precariousness of (…) structures components", giving insights "how body and mind interact" (Baker, 1988, p. 111 and 81).

The references to land art reveal the broader issue that the concepts of materiality in architecture has always been transdisciplinary and linked not only to art but also to other spheres of human activities, such as philosophy, aesthetics, science and technology, and even politics. This pertains to the more general conclusions that architecture is located in a hybrid dynamic field between many disciplines where one instigates another. For instance, there are clear links between concepts of John Dewey, who in 1934 published the ground-breaking work Art as Experience, Husserl's idea of the "kinaesthetic consciousness" and Maurice Merleau-Ponty's writings that inspired artists and architects toward investigating the inseparability of intellectual understanding and the direct experience. It is the philosopher and science researcher, Gernot Boehme, who expounds on the binary character of the aesthetic concept of the atmosphere – the specific arrangement of materials may produce it, but it needs a perceiving subject: "atmosphere is something between the subject and the object" (Boehme, 1988). This "between" situation resonates in Peter Zumthor's words; when asked on the choice of materials, this great architect explains: "site's elements react, like alchemy, with my emotions on the site and my personal idea about the use of it" (Saieh, 2010).

Moreover, our perception of materiality in architecture changes in time. Antoine Picon argues that this perception highly depends on changing human subjectivity, so our sensations are evolving. In effect, the way we experience encounters with buildings evolves as well: "Sensory is envisaged as partly dependent upon historical factors such as the science, technology, social organization, and systems of belief that prevail at a given moment in time". That is why "the sensory appears as a cultural construct just like the symbolic" (Picon 2020).

Important insights into materiality in architecture relate to the advancements of technology and science, with the production of trans-materials, materials that operate as optical filters, with computational design and development of new digital fabrication tools. The emergence of the new spectrum of digital crafts poses new questions over architectural representation, ornament, and broadens our understanding of materials. Digital revolution is often associated with the dematerialization of architecture and art, and with replacing a physical palpable object with imaginative, virtual, and digital. Referring to these observations, Bernard Stiegler proposes a new concept of hyper-materiality, which refers to a process of designing where materiality remains digital throughout the whole process as a "complex of energy and information" (Doreen and Ríos). Delving into the relationship between digital technologies and materiality Christiane Paul proposes the term neo-materiality referring to these forms of artistic expression where works are informed by digital technologies but finally are materialized as physical objects. This condition Paul specifies as "the confluence and convergence of digital technologies in various materialities" (Paul, 2015).

In this chapter, the three essays are presented that explore different concepts of materiality and its relations to the immaterial, imaginative, virtual, and digital. Vaso Trova investigates the role of physical models in architectural thinking and discusses how working on models entails both intuitive experimentation and understanding. Models are analyzed as material artefacts through which the ideas are generated, translated, and conveyed. The work on models is presented as a continuous iterative process of materialization of imaginative concepts. On the other hand, the process of doing realized on the materiality of physical objects that are transformed, distorted, or observed in different perspectives becomes a source of knowledge and inspiration. It involves questioning and speculating, conceptualizing, and doing to the stage where imagination and the material object become inseparable, and one gives reason to another.

Proposing a different perspective, Manuel Couceiro da Costa delves into the issue of materiality and memory analyzing the changes of the social neighborhood "Santa Cruz de Baixo" in Lisbon. Referring to the concepts of Kevin Lynch, the author investigates how a built environment becomes a medium for carrying the memory and supporting the personal image of time. Insights into creative synergies of materials, colors, and textures that maintain the image of time and history are juxtaposed with an observation of how this materiality is being slowly dissolved. Questions appear such as how to sustain the quality of a historical built environment and at the same time adjust it to the new expectations, and what is even more challenging, how to awake sensitivity of inhabitants towards this genre of everyday materiality in architecture.

Materiality is inextricably linked to technology and technology has always been decisive in how we perceive materiality. The essay of Fatih Uzun and Mine Özkar presents photogrammetry as a documentation method used for the digital survey of historical structure, a unique underground water reservoir made of the carved rock and stones. The authors present the process of producing the digital representation of a historical material object. This digital "twin" gives insights into the materiality of the walls, their surface textures, continuities, and distractions. The study endorses the relevance of Historic Building Information Modelling as a valuable tool supporting heritage management processes and gives new original insights into the relations between material and digital.

This chapter confirms that materiality became a powerful concept through which we can analyze the process of conceptualizing architecture and delve into the imaginative and invisible. The three essays reveal that materiality in architecture is a fragile and complex medium that never can be taken for granted, but should rather be constantly discovered, questioned, negotiated, and reinvented.

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MATERIALITY AND CREATIVITY IN THE DESIGN PROCESS

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ABSTRACT

Models are key elements in architectural design. They enable architects to convey information to others, to help them to visualize a project to be, while at the same time they form an essential component for the formulation of ideas during the design process.
Models are artefacts, they are material objects. They convey information through the materiality of the whole and of the parts. Their contribution to the formulation of ideas during the design process is being performed through their constructed materiality. Quite a number of architects have argued that experimenting with materials can both enrich the message of models and influence the generation of ideas as the materials are worked (Moon 2005).
This paper will focus on the contribution of materiality to this communicating/thinking/design process. It will try to investigate the various ways that materiality is shaping the generation of ideas regarding the design process. It will also try to describe the dynamic and versatile relation between the designer and the artifact in the making.

The versatile identity of the model

Models are a common denominator in architectural design. It is an artefact with a role conventionally summarized under two broad headings, study, and communication. Model is an artefact designed and constructed to convey ideas to outsiders and/or assist architects to formulate the real project. It is a manufactured object, built with materials from and for ideas. Jackelin Robertson has called it "an ideal scaffold" for the real thing" (Frampton and Kolbowski, 1981).

In both cases, the model claims a relative autonomy from the real project. For Hani Rashid, the model as such is a piece of architecture and it has all the implications of the building. But of course, the model is not equivalent to a building. First, the scale of the object obliges the designer to select which elements will be presented and which will be omitted. Secondly, the model is a manufactured object and its construction is subject to available techniques concerning the materials chosen. These construction techniques are different than the ones used for the construction of a building. Finally, it does not include the relation between the spatial organization and the human body, a relation which constitutes the fundamental basis of architectural practice.

In any case, a model is an object with its own identity and performance. As it is being built it can take the architect by surprise. As Graves argues "Once we have modeled or represented an idea, that representation, the object made, begins to have a life of its own, somewhat separate from or beyond our original conception" (Frampton and Kolbowski, 1981).

The model as an artefact embodies an abstract model. The projection of a final architectural construction through the model theoretically should be able to transfer the principles of the abstract model. The architectural model and the building (or any other designed outcome) are two independent embodiments of the same abstract model which is reshaped through the necessary translations as a different set of restrictions apply.

The model attempts to represent ideas and relationships. It is an artefact with material properties through which the ideas are represented. Its use is rooted in a strong tradition for resemblance translation and determination (Bertram 2012). At the same time, it is an agent in another space, that of the real architectural project. Together the physical characters and the formless relations comprise the versatile identity of a model.

Architectural models/ Strong and weak notational codes

A basic function of the architectural model is to project a form not yet realized. This is normally the kind of model used to explain to a client the final outcome (how a building, a piece of furniture, an urban design scheme will look like when materialized). The most important property of such an architectural model is the ability to serve as a projection of an architectural space to come. This model should be easily "translated" into an architectural construction or edifice through the representational logic of the metric scale. This "translation" is a rather complicated issue and it heavily depends on the notational codes embedded in the material artifact. A notational code is a set of rules and signs which allows the user to understand what the object represents. A *strong notational code* doesn't allow for vagueness or abstraction. It is normally used for models that should easily convey a final outcome to non-experts. In this sense resemblance is a key notion of the code. Materials used to construct the physical model tend to abide by simple rules of basic similarities. For example, a green material will be used to represent the existence of an element that will be green when constructed (i.e. a garden or a copper roof). The use of just one material for all components of the model, tends to emphasize the volumes of the final project, especially when it is presented embedded in context (i.e. a new building within its urban context).

On the other end, a *weak notational code* allows for multiple "translations" regarding the final outcome. It is used to express ideas rather than *finalities* therefore there are no direct or indirect rules of similarities. A weak notational code does not enable the translation of the measurements of the model directly to architectural construction. On the contrary, a weak notational code produces abstract models that are presenting sets of relations rather than final outcomes. In such models, the scale is not an essential issue. Some parts may be exaggerated if this could emphasize the principal idea and representational dissimilarities may occur. A wall, for example, could be represented by a transparent material although the final product could be a solid wall. As Graves commented, "we are not making real buildings we are making models of ideas…the metaphors of the rituals or the ideas of a kind of a formal structure are more to the point than trying to imitate some sort of miniature reality" (Moon,2005:100).

In architectural practice, the degree of abstraction in physical models ranges between the two extremes. For Sorkin, it is important to find techniques of modeling that dwell in that intermediate zone as it is one of the most productive and creative areas of architectural creativity (Moon, 2005).

Modeling the Process/Processing the Model

Groak (1982) has argued that drawing is a form of thinking, not merely a record and presentation of thought already completed. Similarly, we can argue that modeling is also a form of thinking. This is not a new idea, as we are used to the notion that speech, writing, mathematical reasoning, carving, and handcrafting are all ways of thinking, not records after the event. Indeed, we can argue that if one is not model-making during the architectural design process certain thoughts are somehow "unthinkable" (fig.1).

During the design process, architectural models are developed through a continuous negotiation between the physical appearance of the object and an immanent abstract model. Abstract models are the starting point during the design process. They tend to formulate systems of relations that on the one hand define individual elements and on the other explore their mutual influences.

During the first stages of the design, process models operate as diagrams. Diagrams are graphic designs that explain rather than represent. Anderson (1997) defined diagrams as pictorial, yet abstract, representations of information and he included architectural sketches in the paradigms of diagrams. Hall (1996) described diagrams as simplified figures intended to convey essential meanings.

A diagram is a machine in the sense that it includes several possibilities. A good diagram should be able to produce multiple outcomes all expressing the same set of internal relations. It's clear therefore that the concept of diagram is closely connected to the production of variations and consequently to innovative thinking.

The diagram reveals relations between its components. It is a map of relations related to another system of interrelated parts. An architect's sketch, for example, explores relations between spaces on a piece of tracing paper. It has its autonomy as a product, but it is also related to another system of building construction and the connectivity of spaces within the building.

Models during the first stages of the design process are called sketch models and they operate as material diagrams. They organize *abstract* relations between elements (as the sketch in the drawing) but instead of lines they are using *materials.* In the beginning, the notational code used is extremely weak. For example, we may use a piece of cardboard, a piece of plastic, a piece of wood, a bunch of tooth sticks, to indicate a partition. Scale, height, or width are irrelevant. We are trying to project an idea in the making. As we formulate the design, step by step, more definitions and restrictions are imposed on the process. These restrictions are expressed with the addition, subtraction, or transformation of materials. As said before, modeling is a form of thinking, and the choice of materials, their physical properties are contributing to this thinking process. Some choices may be random, for example, we are creating a partition by using a transparent material because it is handy. When we do this, transparency becomes a component added to the abstract model and we might start thinking along with this idea. Working with weak notational codes enables us to move beyond the logic of representation while at the same time we are subject to negotiate material properties (fig.2).

Models based on weak notational codes do not have a visual likeness to the modeled structure. Its contribution to design thinking is based on the reciprocal construction process. As a physical entity, it is a system of interrelated parts subject to manipulation. The actual manipulation of the parts of the physical model is the diagrammatic labor through which the architectural model is developed. No matter the degree of abstractness, the physical model cannot be separated from the actual material system in which it operates.

Materials and techniques

To construct a model we use materials and techniques. Materials used for the construction of models as artifacts contribute to the cognitive process with their material properties, the texture, color, softness, thickness, transparency, etc.

For Toyo Ito, material constitutes an important factor for defining the character of the model. His choice of material for a model depends on which materials permit the clearest and most successful depiction of the concept of the envisaged building (Moon, 2005). But this selection process is not as simple as it sounds. The materials chosen can influence and inspire architecture but at the same time, they may create contradictions. Frank Ghery has pondered the ambiguities involved in the choice of model materials. "The models are ephemeral and it is like ripping a piece of paper. The ripped edge can be beautiful. But you can't make architecture do that. That indeterminacy that you get when you are not certain what it is…" (Friedman 1990:50)

For model making architects use new materials (wood boards, acrylic sheets, aluminum surfaces, etc) or they re-use materials, sometimes even objects from everyday life taken out of their context. The process of their re-contextualization in model making informs the design process with traces of previous autonomous material life (fig.3).

Working models or rough sketch models are models that operate mainly as mechanisms for simulating ideas as the artefact is being formed. They operate as three-dimensional diagrams allowing for multiple steps and therefore for variations of outcomes.

In this reciprocal relation, materiality does not play a neutral role. Particles used have material properties. We may choose a thin transparent surface to experiment with the idea of transparency in a structure. Then we need to fix it on a base using a fixing technique suitable for the transparent material. We can glue it or we can fix it on the base material (ie a cardboard surface) by creating a slit. As soon as we construct it, the combination of the slit and the thin surface may start forming the notion of sliding particles in the structure as a key component of the project. It's clear that both the materials chosen and the techniques used for model making may inform the overall design process. Gluing, nailing, or slot joining are producing different artefacts and therefore are shaping ideas in different ways. We start by choosing materials for representation reasons or because they are handy and then craftsmanship or specific material or structural properties are imposing new ideas and therefore shape our thinking towards an innovative direction (fig.4, 5).

The model as an artefact is associated with the structural behavior of the materials chosen in multiple ways. We choose materials because of their visual characteristics (color, transparency, texture, etc) but also because of their structural properties (elastic material easy to be bent). A string can be stretched but not bent, a piece of carton can be glued or torn but cannot be in proximity to water. A thin aluminum beam is soft therefore it can be bent. A piece of cement is hard and so on so forth. Normally our choice is based on one of the material characteristics (ie softness, or color) we want to bring forward. The moment we introduce the specific material into the model making we also insert all the other properties of the material chosen. They lay there, at the border of the design process, indirectly informing the representational system of the model.

A combination of materials produces more complex structural behavior. A thin vertical surface glued on a horizontal base is steady and immobile. The same surface located in a slit constructed in the same base can slide forward and backward. Therefore it creates a possible action that may enrich the way of thinking and can be explored further. The model is not the outcome of a set of ideas formulated before the process of construction but the step by step result of the selection of materials and techniques, fueled by ideas which are reshaped [from their original form] because of the process of constructing the model. The human factor [the designer] is a part of this process. With his or her actions [by fixing, rotating, stretching, pressing, cutting, etc] reorganizes the particles into a new order and creates possibilities of a variety of outcomes.

IMAGES, CHARTS OR GRAPHIC LEGENDS

Figure1: Sketch model and final model. First-year design studio (2004), Dept. of Architecture, UTH (Tutor V. Trova).

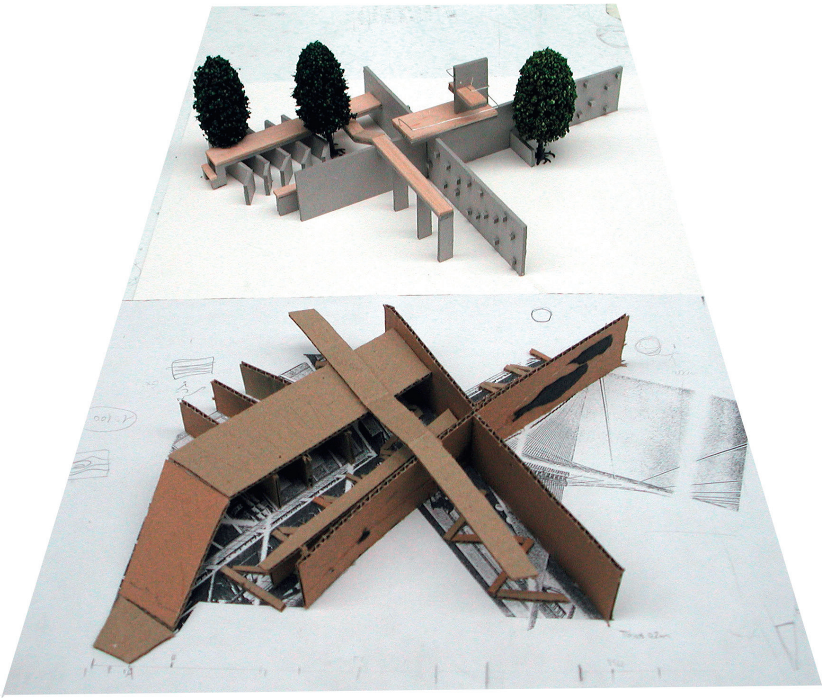

Figure 2: Series of sketch models through which the final architectural design has been formulated. Third-year design studio (2007), dept. of Architecture, UTH (Tutor V. Trova).

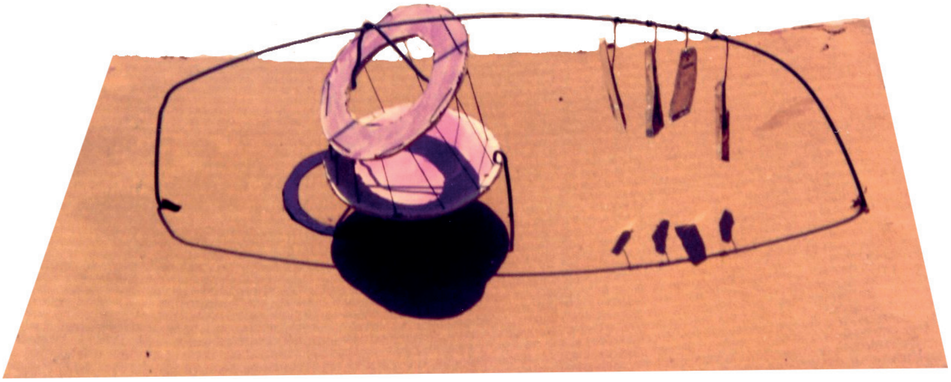

Figure.3: Abstract model for a playground. Re-used cardboard, pieces of glass, wire, paint (architect: V.Trova, 1986)

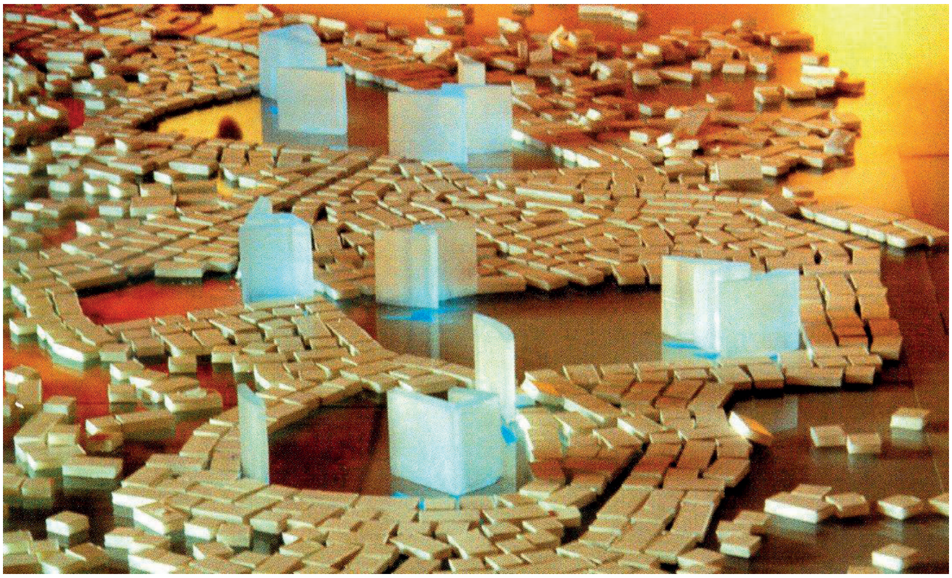

Figure 4: Model for the Architectural competition for Redesigning the West Arc in Thessaloniki. Cardboard and plexiglass pieces on a glass surface. The choice of glass base was arbitrary as we used the glass top of an existing table but this choice introduced issues of transparency in the design process. (architects: V. Trova, Th. Kanarelis,1997).

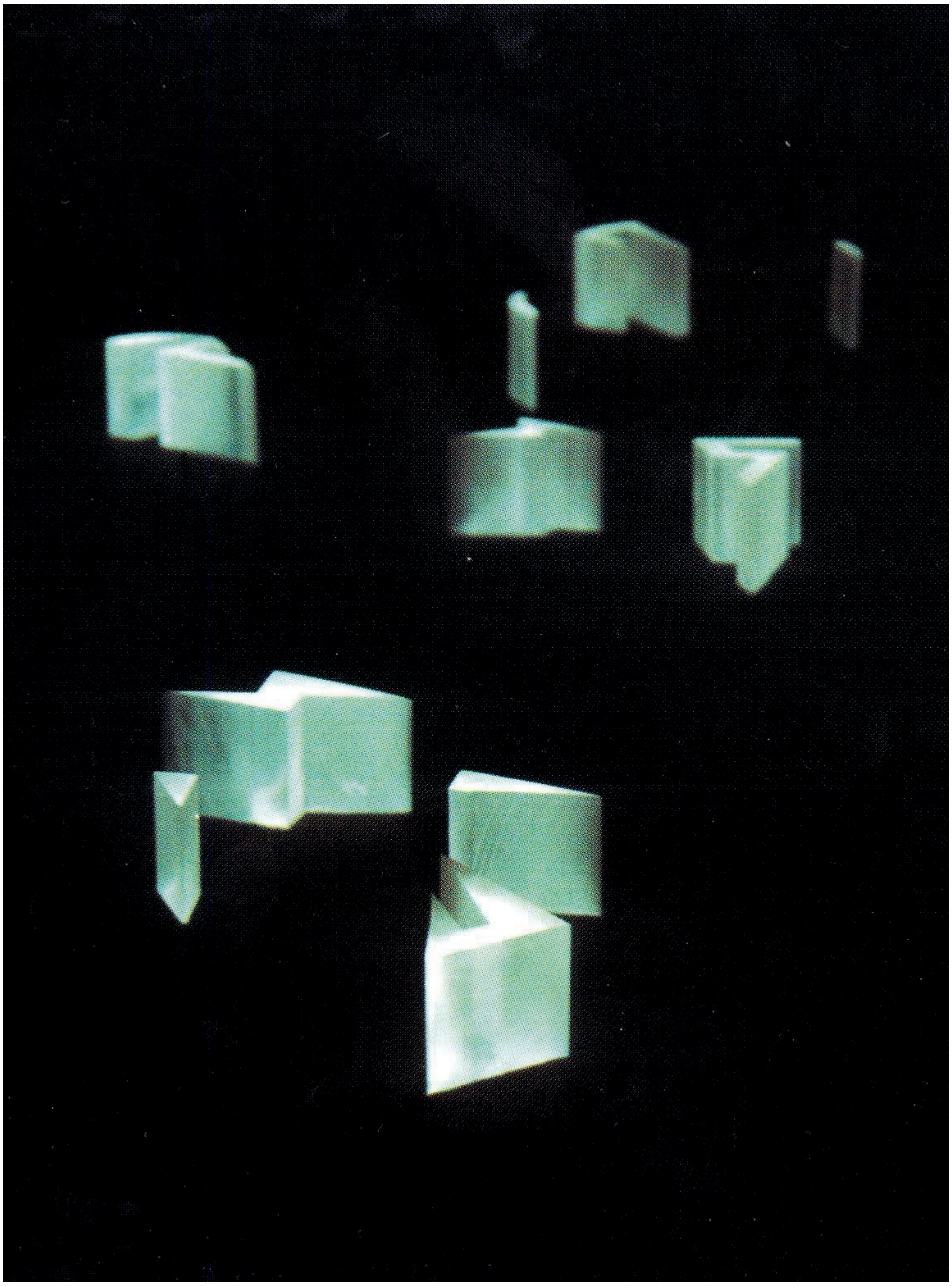

Figure 5: Model for the Architectural competition for Redesigning the West Arc in Thessaloniki. Exploration of transparency of the proposed buildings (architects: V. Trova, Th.Kanarelis, 1997).

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THE MATERIALITY OF MEMORY

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KEYWORDS
Materiality, architectural epistemology, time, place, renewal

Introduction

In the context of the Erasmus + Program "MATERIART / Art and Science of Materiality in Architectural Design Education", considering the umbrella concept of materiality which "*… embraces all the fragments of the whole materialization process, starting from architectural imagination, conceptualization, and design, to the act of construction …*", this essay corresponds to a chapter of a book, organized based on the submissions to the symposium "MATERIART: Architectural Design, Research, and Technology", focusing on the sub-topics "Architectural Practice" and "Heritage and Conservation".

Theoretical Approach

The general theme of the essay is a reflection on the impact of the physical environment or, more specifically, on the impact of the physical architectural and urban fabric and their adaptation to the obvious need of change through time, over people welfare, based on my personal experience as an architect and also as an area resident.

As a statement, I stress the conviction that the personal image of time is crucial to individual welfare and that the physical environment plays an important role in the forging and maintenance of that image.

So, the analysis of the conditions through which people live that image and of those needed to the desirable and necessary change, constitute a major contribution to policies for change, which are in architects' sphere of action.

I prefer a world that evolves progressively, that along with novelty keeps the meaningful signs of the past, what implies the consideration of what for and for whom is preservation destined, a decision with a panoply of possible answers.

These considerations also emerge a set of different strategies that together with the former options or, in other words, selections of the past, define architectural operative scales, which should not prevent the possibility of discarding obsolete buildings.

More than a simple conviction, those ideas are anchored in the theoretical principles of Kevin Lynch expressed in his book "What time is this place?", published in 1972, but actual in most of their philosophical assumptions.

The case study that will be presented is "Santa Cruz de Baixo", a social neighborhood from the fifties of the XX century, in Lisbon, through which the epistemologies are exposed above and their ongoing values, expressed through materiality, confirm their potential and actuality.

"Santa Cruz" Neighborhood

"Santa Cruz" is a contemporary urban area, organized as a morphological unit with a regular layout, located in a broader urban sector, Benfica, actually with 37.000 inhabitants, which constitutes a large part of the western boundary of Lisbon municipality, approximately 8km from the city center – that sector, was a rural area, originally out of the city, with a slow development until the XVIII century when the wealthy classes, attracted by the landscape, started to settle there in "Quintas" (farms) and by the XIX century, with the appearance of the public transport nets, Lisbon grows exponentially and absorbs Benfica.

During this development, a great number of the former important buildings disappeared and the place of the farms have also been occupied. Such is the case of "Quinta da Feteira", wherein 1880 the owner, João Carlos Ulrich, to embellish the property decided to plant a wood of about 5ha – the wood still remains, nowadays named "Parque Silva Porto" or also "Mata de Benfica", belonging since 1911 to the municipality of Lisbon, but the area of the farm around was occupied by a public development for social housing, a big one with 703 houses, actually named "Santa Cruz" neighborhood (Fig. 1).

This kind of scheme for the development of social housing was improved in Portugal from 1933 when through a decree the government establishes the conditions for the partnerships government/municipalities/social solidarity entities on the purpose of the building of "Casas Económicas", independent houses to rent at a controlled cost for the middle class and whose tenants after some years could become the owners – the action of these partnerships included the choice of the sites and the respective urbanization, the approval of the architectural and technical design and their costs, the promotion and supervision of the buildings fabric and the administration and supervision of conservation and improvement works.

"Santa Cruz" neighborhood was planned, designed, and built between 1955 and 1958, somehow inspired in the English Garden Cities movement, being curious that even the distance to the city center is equivalent (≈ 8km) (Fig. 2) – the architect has been Francisco Keil do Amaral.

The neighborhood has two parts, placed around "Mata de Benfica", namely the bigger one "Santa Cruz de Cima" (402 houses), in the east and south of that park and "Santa Cruz de Baixo" (301 houses) at the west. Both are exclusively residential, only with semi-detached houses and townhouses, with a variety of sizes/typologies but presenting a simple and coherent morphology which gives a strong feeling of place to the inhabitants. Inside the perimeter of the neighborhood, the only two buildings that are not houses are a school and a health center; commerce and services are on the periphery at walking distance.

The extensions of the name of "Santa Cruz", namely "de Cima" and "de Baixo", we can translate as High and as Low, which implicitly indicates a hard deployment topography, coming down from the park on the top and mainly south-north – nevertheless, the layout of the streets is more or less regular (not orthogonal).

Those layouts, adapted to the correspondent topography and with distinct perimeter outlines, are different in the respective global morphology, but provide similar historical background and living ambiance which, while the houses remain property of the first generation of tenants, until about the eighties, was that of a quiet suburb (although belonging to the city), with little traffic (Fig. 3), with a hierarchy of streets that one could feel through width and through the kind of pavements (with or without sidewalk), mainly design for people and accompanied by a hierarchy of spaces, namely public, semi-public, semi-private and private, clearly assigned in the design of each house lot (street/public, yard – visually permeable/semi-public, backyard/semi-private, house interior/private); vegetation was everywhere, in the park, in streets, in the lots and contributed for the understanding of that hierarchy – on the whole, a pleasant atmosphere.

Our study will nevertheless focus on "Santa Cruz de Baixo" (Fig. 4).

The houses themselves were also a powerful element to the characterization of the sense of place.

Their plans, as previously said organized as pairs of semi-detached houses or rows of townhouses with different unit numbers and (4-10) corresponding to a variety of sizes/typologies, express the mentality and principles of an era towards the concept of social homing, considering many small compartments, a very small kitchen and only one bathroom (Fig. 5), they were nevertheless well organized and programmed possible expansions (Fig. 6 and 7).

Corresponding to this layout, the exterior of the houses was also simple and some features were determinant for the characterization of the "family" look of the facades:

- the size, proportion, and rhythm of the facades and their openings;
- the light pastel colors, varying from house to house;
- the strong shoulder pads of doors and windows, white-painted, contrasting with the color of the wall and the also strong wooden frames natural color;
- natural color tiles on eaves and roofs.

The interior materials were also simple, but pavements and doors, in natural wood color, controlled the ambiance.

Concrete pillars and beams, lightened joist slabs, brick masonry plastered and painted where the core of the remaining materials and the level of quality of the building was good at that time, although for actual standards, we consider them as poor, especially concerning energy sustainability.

About parking, only the semi-detached and the extreme houses of the rows had private parking, but even like that, as many of the families had no car, the streets, mainly the shared ones without a sidewalk, whereas playgrounds for children.

Memory, place, and time

Inexorably, time runs over the place and the initial adequacy of the urban solution and of the interior layout of houses, besides the already programmed house unit expansions, will require deeper changes that will bring physical transformation to the general image and ambiance of the neighborhood.

That wave of impact start to occur during the eighties, when the first generation of tenants, elderly people were able to become owners of the houses and so able to sell them at the time, what many of them did and so introduced younger generations in the neighborhood – in parallel and implicitly, new ideas and concepts of ways of living were imported into that community, not all adequate/correct, which, materiality speaking, interfered with the hierarchy of spaces of the neighborhood (because of changing visual patterns and because of the number of vehicles increase), as well as interior layouts renewals.

Lisbon municipality has rules to control the changes, with an overall spirit of keeping the general image of a neighborhood that, as an all, is considered municipal patrimony, which should mainly preserve the exterior, nevertheless, in practice, they were not enough.

So, renewals developed, underneath a strong image of the original urbanization and architectural solution, but with distinct sensitivities, some reinforcing the values of the past, others contradicting them.

Although it is forbidden, some of the new owners decided to build high opaque fences, instead of the original low ones, whose height could only be surpassed with vegetal elements, nevertheless allowing some visual permeability, while others decided to comply with the rules, recognizing the value of this solution – the first claim for security, but evidence (many times they are assaulted, on account of that "invisibility" and excessive privacy) demonstrate a fake argument – consequently, sometimes in different parts of the same street, we can have different ambiances, like walking in a narrow channel and pushed out from that boundary (Fig. 8) or, alternatively, feeling the hierarchy of spaces, the sense of a community, confirming the interaction of neighbors (Fig. 9).

Another example of this contradictory attitudes can be seen on the houses themselves, some with complete disregard of the "family" look, without justification, in the volume of a house (Fig. 10) or introducing elements that don't fit (balcony guards, windows, color, …), while others understand the spirit of that "family" look and select what to keep and, even when introducing new elements, they try to go along with that spirit (Fig. 11), sometimes the two opposite kinds of attitude are side by side (Fig. 12).

Considering the interior of the houses, initially, all was standardized (layout, materials, …) and so with a similar appearance. Renewals brought the panoply of possible options, from the complete destruction and different rebuilt, effacing memories, to the tentative of preserving the original, so not using actual potentialities – I prefer the optimization of the layout and the use of actual technologies, respecting and benefiting the from the spirit, values, and materiality of the past in a blend with new opportunities (Fig. 13).

This option, complementing the way of dealing with the exterior (expressed in former Fig. 11) is exemplified through detail proposals for some house, namely in the entrance, taking advantage of the interaction of old and new materials (Fig. 14), in the living-room, where although suffering a radical transformation, looking for a broad space (Fig. 15), the past keeps its presence which one can feel in the distinct pavement coatings, in the organization of new exposed metallic beams, by the impact of original wooden features (windows, doors, stairs), in the interaction of this wood with new elements (Fig. 16), amplifying synergies through color and texture – a creative demolition/enlargement, using temporal collage, reinforcing the value of the past and the flow of time, through personal connections.

We must select the past to make it present, build the future, and, although, the former examples of houses renewal somehow represents individual attitudes, sometimes contradictory, "Santa Cruz de Baixo" as a community with a strong sense of place, benefiting from a huge blend of memories, also gives signs of actual vitality.

That is demonstrated for instance by a global interview on the renewal of the streets and other public spaces (Fig. 17), that will remain the same but that, considering the actual concepts of smart cities, sustainability, mobility, including links to the close environment, bike lanes, parking order, but also of the infra-structures (street lighting, rain sewers, new pavements, …) (Fig. 18) coordinated by the municipality of Lisbon, will upgrade the general ambiance, looking to restore the primary of pedestrians.

For this, the participation of the inhabitants in the process is included (Fig. 19) and it has been very rewarding, more than just participate in technical meetings, to feel the blend of memories of people living in the neighborhood as indeed there were different generations, some still remember the era of the farms, others that had to arrive as original tenants in the fifties, others yet that arrived in the eighties/nineties when the houses start being sold and also some recently arrived, young couples with small children, essential for the revitalization of the place.

All have a common ground, the conviction of the importance, value, and need of conservation of this kind of neighborhood.

Santa Cruz de Baixo, in particular, constitutes a good example of evolution and adaptation of urban physical and special environments, demonstrating that there is no need for the submission for long term terrifying plans but that a rational control of the present acting in short and middle term, avoiding irreversibility, is effective.

A world that can change progressively, where our personal emotions, that are stronger than the remote past, reinforced through the materiality of urban settlements, can be safeguarded, where we feel the past not as a sacrosanct data but as selected inspiration, is crucial for the future welfare.

IMAGES, CHARTS OR GRAPHIC LEGENDS

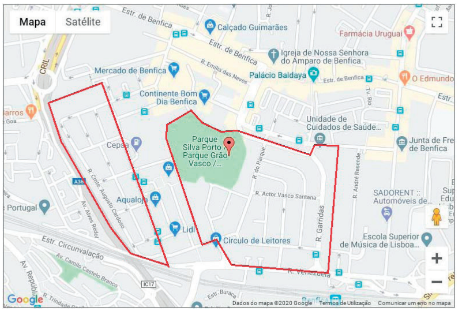
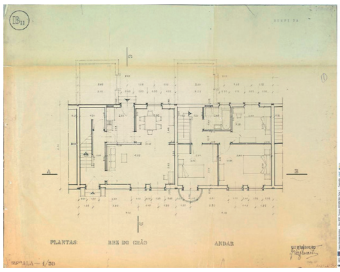


Figure 1: Bairro Santa Cruz + Parque Silva Porto. www.monumentos.gov.pt/Site/APP_PagesUser/SIPA.aspx?id=19840.

Figure 2: Lisbon – Bairro Santa Cruz location. Google Earth.

Figure 3: Original Street view. www.monumentos.gov.pt/Site/APP_PagesUser/SIPA.aspx?id=19840.

Figure 4: Santa Cruz de Baixo. Arquivo Municipal de Lisboa (obra 59904).



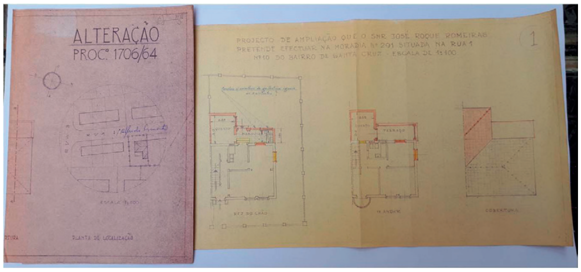


Figure 5: Original standard townhouse plans. Arquivo Municipal de Lisboa (obra 59904).

Figure 6: Original programmed enlargement plans (end of row townhouse). Arquivo Municipal de Lisboa (obra 59904).

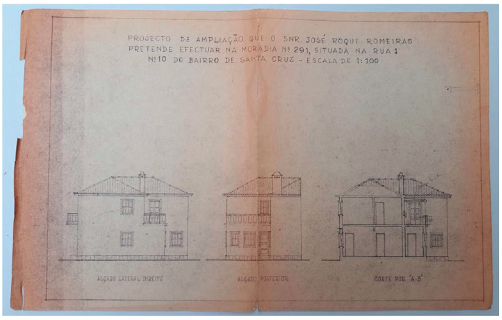


Figure 7: Originally programmed enlargement facades. Arquivo Municipal de Lisboa (obra 59904).

Figure 8: High illegal fences – traffic channel and section (end of row townhouse). Author photos / drawings.

Figure 9: Low "transparent" fences – a sense of community intervention. Author photos / drawings.

Figure 10: Illegal and disruptive. Author photos / drawings.

Figure 11: Renewed spirit of "family" look. Author photos / drawings.

Figure 12: Contrasting renewal options. Author photos / drawings.

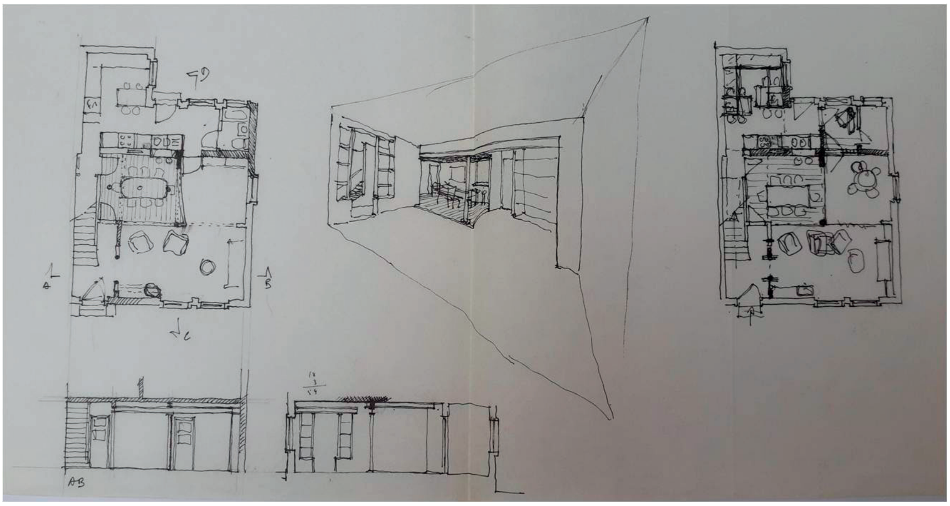


Figure 13: Respectful upgrade – sketch for interior renewal/expansion. Author photos / drawings.

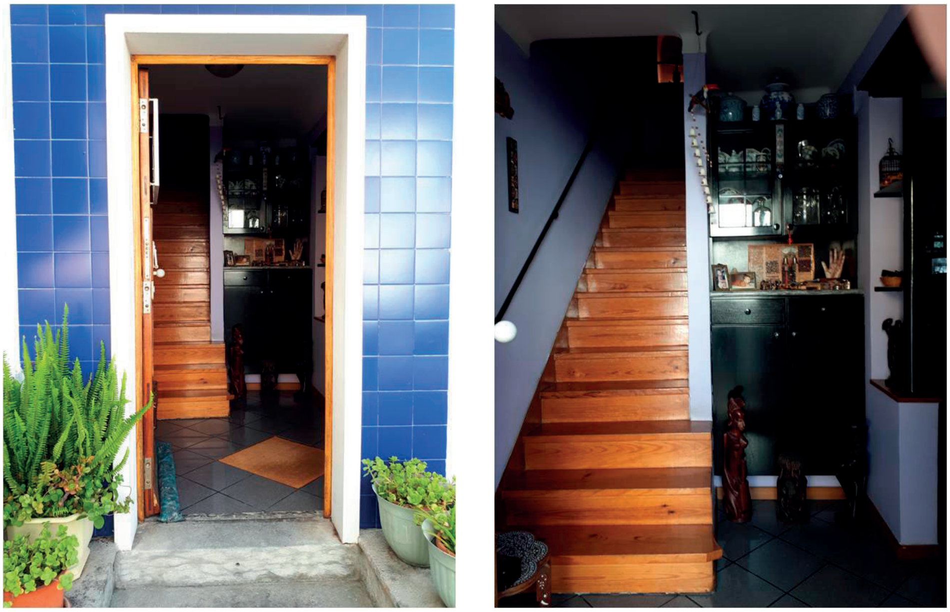


Figure 14: Respectful upgrade – entrance. Author photos / drawings.

Figure 15: Respectful upgrade – living room. Author photos / drawings.

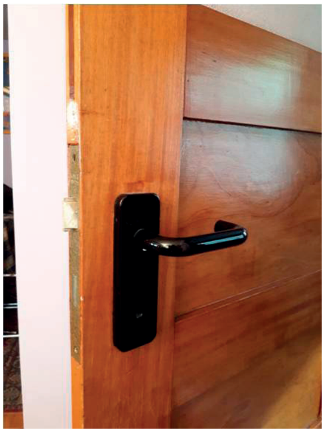


Figure 16: Respectful upgrade – detail. Author photos / drawings.

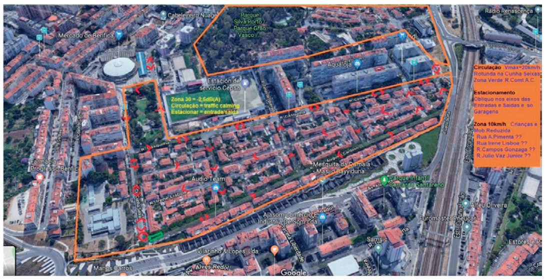


Figure 17: Requalification of public spaces. Câmara Municipal de Lisboa / Unidade de Intervenção Territorial Norte.

Figure 18: Requalification of public spaces. General plan/view, pavements, trees, traffic. Câmara Municipal de Lisboa / Unidade de Intervenção Territorial Norte

Figures 19: Requalification of public spaces public participation. Author photos / drawings.

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DECIPHERING CONSTRUCTION INFORMATION FROM DIGITAL SURVEYS OF UNDERGROUND HISTORICAL STRUCTURES

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ABSTRACT

Preparing digital datasets is essential today for documenting the various phases of heritage structures and facilitating the analyses and interpretation of these as they transform under natural and artificial forces over time. Photogrammetry is a liable light-based survey technique used for capturing coordinates of surface features and for creating mesh models out of thus attained point clouds. These models, made out of images, carry a high level of visual detail but little information on constructional parts that could feed information-rich models. We photographed the interior of the Pişirici Kastel in Gaziantep, a unique underground water structure that presents challenges for accurate digital surveys, and created a three-dimensional model for the purposes of studying the limitations of its conditions in surveying and processing resulting images. Space receives light only from two culverts. Not only is the light insufficient, but it also reflects off of the water pools on the floor resulting in imperfect conditions for a light-based survey. Nevertheless, we were able to achieve new documentation of differently constructed surfaces that are not captured via manual measurement methods. These kinds of documentation, we argue, introduce new tools to researchers working in the protection of cultural heritage.

KEYWORDS

Digital model, photogrammetry, texture

Introduction

Modeling in fields related to design and planning such as architecture, urbanism, landscaping practices, and interior designing applications, as well as construction and restoration, is an essential step in studies on feasibility, of surveying and for preparing source inventories and online virtual spaces (Uzun and Gül, 2017). Recently, digital documentation offers more than just three-dimensional representation (Dore and Murphy, 2012) to analyze the physical changes and to follow the up-to-date status of a structure. Digital surveys capture and facilitate accurate documentation of the existing physical condition of architectural heritage which gets harmed by natural and unnatural elements. Acquired data is used in creating digital twins in order to preserve and pass knowledge on to the next generations of researchers and users.

Photogrammetry is a reliable documentation method used for the digital survey of historical structures. It is a means to measure the visible features of the structure in high resolution based on multiple photographs of it. Photographs are superposed accordingly in relevant software and the result is a three-dimensional point cloud data with coordinates with color information, determined with reflections of light off the surface. The points are usually concentrated and turned into polygon mesh models to create seamless surfaces and solids. These models can be used to determine features of the overall shape, and its parts, their locations, size, and appearance. There is also the potential to determine more in the detailed features of the surface (Mancuso and Pasquali, 2015). High-quality captures acquired with the photogrammetry method can be used to study the micrographic detail of the surface to understand issues of making and transformation of material over time. The surface can reveal information to corroborate theories on the equipment and tools used in making it. Yet there are several issues that need to be overcome case by case due to differences in either the features of the environment or the structure itself.

In order to analyze underground and carved historic structures from digital data and with regards to their constructional features, we survey and study a unique water structure in Gaziantep, Turkey. Pişirici Kasteli is a 13th century underground infrastructure and public facility. We create a three dimensional digital model of the Pişirici Kastel using photogrammetry. Models created as such have high detail levels but, as raw data, lack attributes and meaningful parts. It is necessary to remodel these representations, for instance to 2D images to process for segmentation of attributes and parts relevant for conservation and restoration processes (Taş, 2019). Our approach is to designate the crevices and formations on the surfaces to decipher constructional information from the raw data and to represent it in the model, as information valuable to researchers interested in preserving constructional techniques as much as the existing object.

Surveying Pişirici Kastel comprises of only its interior because its exterior envelope is underground and out of sight. The-task is the acquisition of reliable data for reverse engineering the surface texture, i.e. its construction. This is an underground structure that has both cut stone construction and carved rock surfaces. The interrelation between these parts is essential in understanding the total structure, and the survey can capture that accurately. There are various light conditions that impact photographic capture results. The particular case has unique light conditions. Even though the interior receives daylight via two vents in its ceiling, the interior is artificially lit for the most part. There is also a reflection of the waterpool. A light that reflects unevenly from the surfaces creates noise data and more details to sift through. We investigate how to overcome these underground lighting conditions for accurate photogrammetry and eventual modeling to designate shapes on the surface that are either meaningful as parts of a structure or as traces of tools.

Steps towards Holistic Modeling of Heritage

Excluding reductive approaches, the use of technological advancements and innovative techniques in the documentation of heritage brings advantages of efficient, accurate, consistent, and sustainable procedures. Today, Building Information Models (BIM) link to 2D, 3D, and augmented reality (VR) models of the architectural parts and details of buildings. Digitally documented data can be stored in digital architectural libraries and can be kept as updated, easily accessible objects of queries. Innovative perspectives in preservation and restoration practices call for comprehensive surveys that carry extended information on the historical and cultural significance of heritage objects in digital environments.

Conceptually, BIM is an integrative tool for the design, representation, production, and long-term management of the built environment. BIM software combines multi-dimensional visualization with comprehensive, parametric databases to facilitate collaborative design and facility management among project partners (Russell and Elger, 2008). The intelligent data or information contained in the model can range from geometric and spatial to material, structural, environmental, cultural, and economic. The model is comprised of intelligent objects which represent the elements of a building structure and are organized within a 3D virtual environment (Murphy et al., 2017). BIM can support heritage management processes as well. Cultural heritage research and practice have recently started Building

Information Modeling (BIM) for historic buildings. The historic building information model (HBIM), which emerges as a multidisciplinary work product, creates a model record of existing structures including its past states, as well as accurate minute data on surface texture using techniques such as laser scanners or photogrammetry. Our research is with regard to acquiring and processing this input data of the model, and our case is a unique underground structure termed a "kastel".

Architectural Libraries for Digital Documentation

Historic Building Information Modelling (H-BIM) incorporates a library of parametric objects, based on historic architectural data, and a mapping system for plotting the library objects onto laser scan survey data. BIM authoring platforms are mostly tailored for the modern architecture and their libraries of parametric objects are limited to basic components (Murphy et al., 2017). However, in these models, it is very difficult to find parametric object libraries with architectural details that have more specific and periodical features for historical places and architectural structures. The architectural elements can be coded or graphically produced. The design and detail for the parametric objects are based on architectural manuscripts ranging from Palladio to the architectural pattern books of the 18th century. The architecture of the Renaissance and the detail in architectural pattern books introduced and documented advanced scientific rules for the production of architectural elements, and these rules assist the design of parametric models. The use of historic data introduces the opportunity to develop the details behind the object's surface concerning its methods of construction and material makeup (Murphy et al., 2017).

In this context, it is important that the flexibility and ease provided by architectural libraries in the digital environment can be used to preserve, develop, and transfer our historical-cultural heritage. It is of great importance to transfer the architectural structures and objects that exhibit historical features to various parametric architectural libraries by using various computerized methods such as photogrammetry, laser scanning, thermal scanning, and photography-based modeling programs.

Historical Water Structures in Gaziantep

The historical water transportation system of Gaziantep is via a channel system called "livas" in the local language. The water is used in ganes – a kind of pool in the courtyards of the houses – and wells in residences, and mosques, inns, baths, and structures called “kastel”s in public areas (Uçar, 2016). The geological properties of the area, consisting of limestone, clayey limestone, and chalk allowed the opening of rock carved water channels.

The livas system of Gaziantep is similar to the technology of the water transportation system called “qanat” (dig) in Arabic. The system basically relies on the principle that the groundwater can be transported and extracted to the earth by using only gravity power through slightly inclined tunnels (English, 1968). In this system, the transportation of water is provided by a tunnel that starts from the groundwater level at the upper level of sloping land and reaches the earth where the slope allows. The transported water was used to irrigate agricultural areas and to obtain drinking water. One of the unique aspects of the Gaziantep historical water system is the structure of its kastel. The water, which was carried by livas built under the rocks by carving underground, was made available to communities through kastels built in certain centers in the residential area (Uçar, 2016). Depending on the level of the livas, the kastels are located under the ground level. Instead of making an additional system to carry the water upward in the livas system, which is made entirely by making use of gravity, and without any mechanism, kastels were dug underground to be at the same level as the water. Most kastel structures that have survived to the present day are completely underground except for a few that are above ground due to the level of the livas they connect to (Uçar, 2016).

A kastel is a public structure for serving water to the public. As a type, they contain spatial arrangements for many functions. Inside, there can be water intakes, toilets, bathing areas, resting and ablution areas, laundry and wool washing places, and a masjid. Areas of worship and gathering are organized together with service areas associated with water. People come together, spend time, do their chores, and perform their religious worship, in this important gathering place of the daily social life of the city (Uçar, 2016). Some unique examples of which have already disappeared for various reasons, kastel and livas were included in the UNESCO World Temporary Heritage List in 2018.

Surveying and Modeling the Pişirici Kasteli

Pişirici Kasteli, the oldest in Gaziantep, is located at the intersection of the Pişirici and Müftüoğlu streets in the neighborhood of Suyabatmaz. A central space, with two interconnected reservoir pools of 30 cm depth, can be reached by stairs coming down from the levels above ground. The pools are surrounded by niches for individual use. There is another pool to the south of the two reservoir pools. This pool deepens in two stages and its depth is 65 centimeters. There is also a sitting bench in this area. The toilet and masjid section of the building, which is known to be built in the 13th century, is connected to this central space via a few steps. Some of the masjids are partially rock-carved (Uçar, 2016). A clean water channel passes through the walls of the halls. The water flowing through the canals is collected in a small pool next to the "hela" stones and poured from a mouth and offered for cleaning. There are two bathing niches on the east side of the pool room. There are round lighting and ventilation windows in the mirrored vault covering the pool area. There is a porthole window on the south wall. The first restoration work was done by the General Directorate of Foundations in 2008 who cleaned the livas and opened them for operation. It is thought that the masjid was built between 1282-1283. The inscribed relief on the upper part of the mihrab wall reflects the Mamluk period style (Çam, 2006). This shows that the Pişirici Kastel was built during the Mamluks period in the 13th century. It is the most preserved one among the existing Kastels in Gaziantep (Uçar, 2016).

For the photogrammetric survey of the said building, we used a Nikon D5000 camera with AF-S NIKKOR Lens (f = 18 ~ 55 mm) and 12.3 Megapixel image sensor, Agisoft PhotoScan, and Blender 2.8 computer software on an Asus ROG Strix GL753V computer with a 2.8GHz Intel Core i7-7700HQ processor, 16GB (DDR3) ram capacity and a 4GB RTX The 1050Ti graphics card. Agisoft PhotoScan program has features to use photographs taken with any amateur camera, for modeling materials such as historical buildings, modeling in 3D, and working with hardware of minimum technical specification.

In order to collect photogrammetric data at the Pişirici Kastel, we took photographs of the inner wall surfaces of the kastel in such a way that there was no uncovered surface. While photographs were taken, the inner wall surfaces of the kastel were virtually divided into two as top and bottom. First, the top surfaces were photographed from left to right and then the bottom surfaces were photographed from right to left. While creating the photo data set, no extra light source was used and the existing illumination of the kastel was used.

The shots we used were selected with an overlapping of the images of about 25%, so that we could choose the most appropriate image between the camera in the portrait and the panoramic model, following previously tested methodology (Morganti and Bartolomei, 2018).

A point cloud was created with the photographic data set. The mesh model operation was performed on the selected north side of the interior space. In addition to photogrammetry, PBR (physically-based rendering) materials were used for a more detailed understanding of the surface textures in the created model. Especially the "diffuse map" defining the visible color of the surface, the "normal map" which encodes the surface relief as an RGB image and defines it as normal values, and the "heightmap" which calculates the deviation of the surface points from the average level based on light are used. "Diffuse map" defined as a UV map was exported to the Blender 2.8 program in png format. Using the Diffuse map in Blender 2.8 interface, Height, Normal, and Ambient Occlusion maps were created. These maps are then combined on the model. With the "displace" command, one of the Modifier tools, the joint gaps, deformations, and stone texture on the model were pronounced on the heightmap. The structure and texture maps of the Pişirici Kastel modeled in Blender 2.8 program are given in Figure 3.

Findings and Results

In our study, the model of the interior space is not a complete and seamless one due to the lighting conditions that effected the color in images. Nonetheless, we not only captured the general spatial geometry of the volumes and construction of the kastel in a three-dimensional model but also documented surface textures that represent valuable construction information such as the grooves between cut stone blocks and traces of the carving on the rock. The model of the vaults of the niches is documented more comprehensively than the two-dimensional drawings in the Archives of the General Directorate of Foundations (Altın, 2015). This information is relevant to complete the model and optimize the surface textures with information on the actual material and construction techniques.

We identified a number of critical issues that presented advantages or disadvantages in the creation of an information model for the selected historical environment. The Agisoft PhotoScan program has an easy to use interface and requires minimum training for an initial model. Providing modeling flexibility, the environment allows for transferring models to or from other three-dimensional modeling programs of the field of architecture and urban design. The simulation of real looks is successful as the model is based on high-resolution photographs. The capture of color and location information yields to realistic twins of two-dimensional objects. Textural maps filter the image under various parameters to improve focus on select surface details. Nevertheless, there are also some limitations. The most prominent one we encountered has been the failure to eliminate the dark spots in the photos that had occurred due to the reflected light from the water inside the kastel. These result in distortions in the three-dimensional model.

The lack of light inside was another issue. This is a problem likely to be encountered in most underground structures with less than ideal lighting conditions. In the post-photogrammetry procedures, the color of lit areas or of the light source was chosen as one that distorts the color of the structure, the resulting model was prepared with existing lighting. Since textural maps are affected by light data, it affects the accuracy of the model. It is directly related to the problem of how the real object is translated to the model, *i.e.* the minute details of the surface, including surface features' depth and real texture are crucial in documenting the material aspects of the object.

Conclusion

Digital documentation systems that have been developing for the last few decades bring versatile advantages to protocols of the conservation of cultural heritage. Albeit, given critical assessments of how data is acquired and technically processed, accuracy in the digital model is questionable. Still, it is a worthy discussion to bring in the digital model as a document as it provides great convenience in extracting the current state of a historic building in minute detail. In our broader study, we survey and create information models of the historical water structures in Gaziantep. For this paper, we present our findings from working on the Pişirici Kasteli. We photographed and using digital photogrammetry,

created point cloud and mesh models of the interior space to facilitate a basis for an information model.

Our digital models capture and document more than the conventional orthographic drawing sets. Visible features, as well as any other type of information, are added onto the geometric model. The entire structure of the Pişirici Kastel was surveyed and modeled in a short time compared to manual methods. Because it is fast, the surveying methods can be improved based on the needs of the specific case. In our study, the light conditions called for investigations on how to improve firstly the photography, secondly the images acquired and used for the model. The use of texture maps provided a fast control of the model within the limits of acceptable distortions in the three dimensional model. Future work includes benchmarking the surveying under different light conditions for underground structures and attributing construction information to the surface models already attesting material details.

The digital depiction can hold information on the construction and restoration techniques applied to one piece of architectural heritage over the years. Instead of being a spectator to the demise of cultural heritage, it is possible to create fast and easy surveys and three-dimensional information models for protecting it and its inherent knowledge.

IMAGES, CHARTS OR GRAPHIC LEGENDS

Figure 1: Interior of the main space of the kastel.

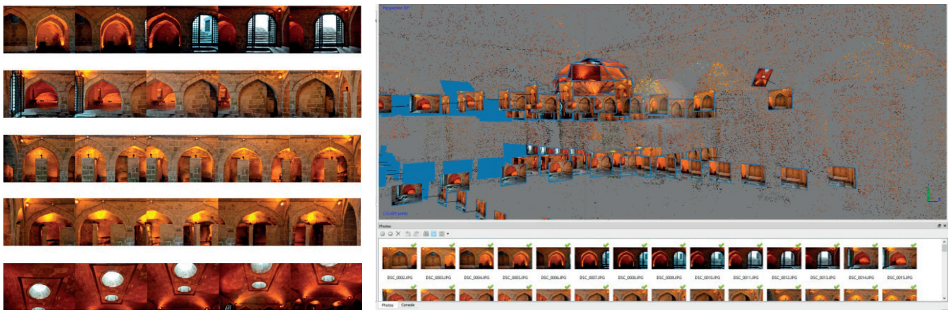

Figure 2: Sample photo data set and its use to create the three-dimensional model

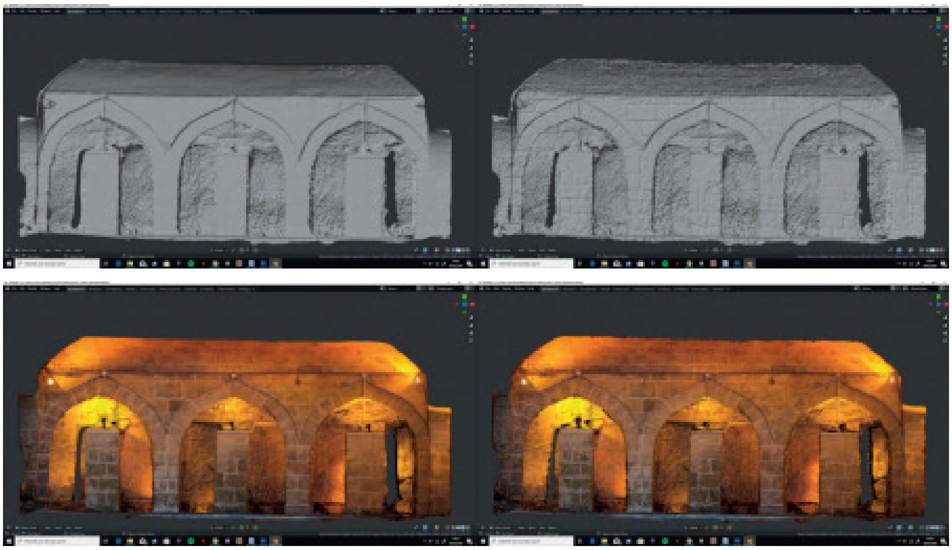

Figure 3: The North side of the main interior space, clockwise from top left: height map, displacement applied on height map, model where all textural maps are applied, and diffuse map.

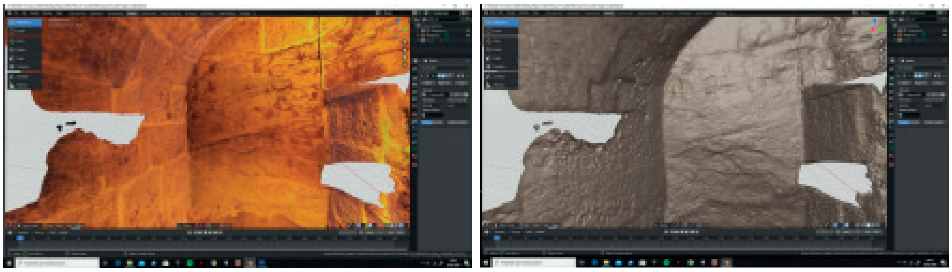

Figure 4: The depths of the surface visible in a three-dimensional model (left) and the model with texture information (right).

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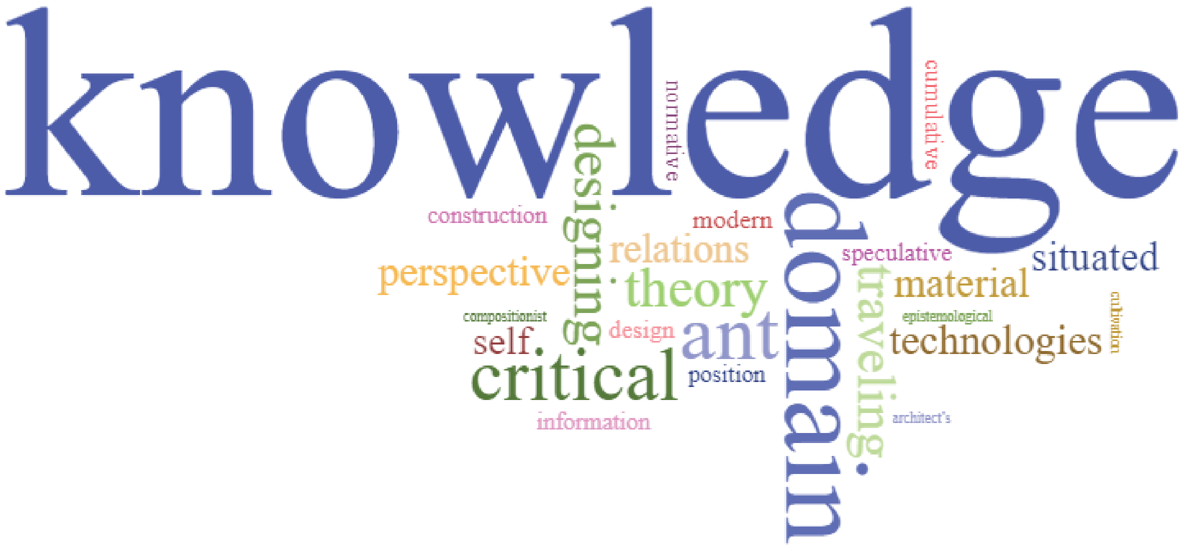
CHAPTER III


knowledge
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self
normative
cumulative
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modern
speculative
design
position
information
compositionist
epistemological
cultivation
architect's

INTRODUCTION: DISCUSSING ARCHITECTURAL KNOWLEDGE IN BROADER CONTEXT FROM DIFFERENT PERSPECTIVES

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Architectural knowledge has always been disseminated in the domain of theoretical and/or practical spheres of the discipline. This broad terrain encompasses many different approaches and discourses bridging the gap between the two. This session aims to discuss the domain of architectural knowledge in a broad perspective and to contribute to the field of architecture by introducing different conceptual arguments dwelling on critical backgrounds.

Considering the epistemological evolution of architectural knowledge there is always a search for common ground between theory and practice. Theoretical knowledge is not only the knowledge of a building or architectural object, it is not only the knowledge of technical issues but also the knowledge of aesthetics, history, sociological and practical processes. In that sense, knowledge of architecture has multi-disciplinary and multi-dimensional relations.

Since Vitruvius, many principles in architectural theory aim to bind the relationship between the aesthetic and the functional as well as practical concerns of architecture. Moreover, there is always a debate on the scientific knowledge of normative values and the critical practice of the discipline. Since architecture as a discipline is about the creation and production of space, it has spatial, social, and cultural bonds. Having these bonds, architecture is a representation of values, meanings, and identities that makes it a unique discipline between design and practice, between the tangible and intangible areas of knowledge.

In that sense, architecture as a discipline dwelling on practical production and theoretical knowledge combines different modes of knowledge and brings together different modes of research. Tanyeli (1999), emphasizes the existence of two different areas of knowledge in the discipline; knowledge of practice which is the knowledge of sophisticated production, and the knowledge of theory which prepares the ground for comprehension of architecture. The theoretical knowledge covers all the areas of intellectual and practical construction. It provides the base for critical and conceptual understanding and it bridges the thoughts between the idea and reality, tangible and intangible.

In this context, the domain of architectural knowledge in its practical sphere is not only an intellectual ground where the boundaries of right and wrong are drawn but a medium that prepares the ground for the development of design practices and the formation of new architectural discourses. This medium requires to be critical, reflexive, and as well as intellectual. Hence, different codes and data enhance its interdisciplinary and transdisciplinary characteristics both on intellectual and practical levels. Rendell (2004:145) explains the difference between theoretical and practical knowledge and focuses on the reflexive nature of the practice. In this context, she puts forward the necessity of the critical theory as a reflective theory which does not aim to prove a hypothesis nor to prescribe a methodology. Instead, it dwells on self-reflexive modes of thought that aim to question and transform knowledge rather than describe and affirm it like the definite laws of scientific knowledge. For her critical theory enhances the interdisciplinarity of architecture and explores the boundaries of disciplinary knowledge. This innovative relationship between theory and practice paves the way for the emergence of new forms of knowledge. From this point of view, we can argue that being reflexive is the critical re-construction of knowledge during the design process. In that sense, architectural design knowledge embraces both the theoretical knowledge and the knowledge of the practice including all intellectual reconstructions for differentiation, change, and diversity. It aims to generate new ideas based on creativity with new approaches that were previously unexplored and unconventional, feeding from the epistemological position of architecture and interdisciplinary fields.

Keeping in mind that the design process covers all intellectual constructions we need to know the effects of sociological knowledge on the concepts of daily life and the actions that it shapes since the design practice cannot be realized apart from our daily life practices, social and individual actions. Changing life practices, social consciousness, and understanding, individual and social relations make it difficult to understand and to explain the modern world. As Giddens (1990) declares; the dynamics of modernity not only refer to the emergence of a new type of social system (like the information society or the consumer society) but also to the institutional changes. The extreme dynamism and globalizing scope of social institutions explain the changing nature of social relationships and the reason of the discontinuities from traditional cultures.

> "The dynamism of modernity derives from the separation of *time and space* and their recombination in forms which permit the precise time-space "zoning" of social life; the *disembedding* of social systems… and the *reflexive ordering and reordering* of social relations in the light of continual effects of knowledge affecting the actions of individuals and groups. (Giddens, 1990:16-17)

These consequences of modernity; the changes in the spatial dimensions of social life, the dislocation of *space* from *place*, the impact of new technologies, innovations in new technical research, and other environmental and cultural changes affected human activities and social life. Architecture as a discipline is concerned with the relationship between human activities and the social contexts within which they arise, and inevitably it has to deal with the sociology of knowledge and the social construction of reality. We have to clarify here that the social construction of reality is a common sense "knowledge" belonging to the members of the society rather than the "theoretical formulations of reality" in general. Although the topics of this session are not directly related to the sociology of knowledge, they introduce different approaches to the re-construction of architectural knowledge from different perspectives.

Giddens (1990) puts forward the concept of *reflexivity* to understand and to explain the changing nature of modernity and the reproduction of reality. For him, (1990:151) modernity is inseparable from the abstract systems that provide for the disembedding of social relations across space and time. To understand the dynamics of modernity the concept of reflexivity helps us to question the reconstruction of reality and the self-establishment of knowledge.

Berger who establishes a sociological interest in questions of "reality" and "knowledge" initially focuses on justifying their social relativity. Social relativity depends on the self-establishment of knowledge due to the differences in human societies. In that sense, there is the need for an adequate sociological analysis of these contexts to reveal the "realities" that are accepted as "known" in these societies. In other words, Berger and Luckmann argue that a "sociology of knowledge" will have to deal not only with the "empirical variety of 'knowledge' in human societies but also with the processes by which any body of knowledge comes to be socially established as "reality" In that sense, they contend that the sociology of knowledge is concerned with the analysis of the social construction of reality" (Berger and Luckmann, 1967:2).

Since Berger and Luckmann wrote this book towards the end of the 1960s, before the forthcoming digital age and its network society we cannot see any discussion on the concept of "reflexivity". Nevertheless, we see a conscious approach to the knowledge of everyday life and the knowledge of personal identity in the dialectic of individual and society. We can see the significance given to the background of an intellectual situation in an empirical inquiry that engenders the idea of "reflexivity" in the following years. After the second half of the twentieth century, the social and cultural dimensions of knowledge began to be discussed in critical perspectives, and this paved way for the transformations in the philosophy of science.

As we stated above architectural knowledge is both the knowledge of theory and the knowledge of the praxis. As a discipline, it is concerned with the relationship of ideal and real, creativity and materiality, human thought, and the social context within which it arises. Within the wide spectrum of different approaches, the domain of architectural knowledge is discussed in this session. The discussions highlight the significance of different perspectives in the production of architectural knowledge, such as its' transforming characteristics, changing formations of design and production processes, changing actors, its travel through geographies, and its blurring boundaries. Within this process, the knowledge of theory/history and practice is discussed in association with different methods and discourses in different approaches.

One of the discussions focuses on the changing domain of architectural knowledge due to the changing dynamics and realities of the modern era. **Güleç** investigates the epistemological change which paves the way for conceptual and formal transformations in architecture. She discusses the change in the domain of architectural knowledge from normative and cumulative to speculative and argues that architecture has been usually discussed as the knowledge of form but actually it is the "form of knowledge" as Tschumi discusses. **Akyol** delves into the act of travel and discusses how architectural knowledge is individually constructed through the architect's travel. This theoretical reading of architect's travel as a self-cultivating process suggests a creative and critical ground for accumulating and constructing knowledge. Additionally, she argues that travel leads to a situated and constructive way of learning; and so, the construction of individual knowledge is possible with a critical mind. **Yılmaz** proposes a wide discussion on re-thinking architectural design knowledge. She addresses "knowledge in designing" as a conceptualization to define a specialized field of discussion regarding the complex structure of knowledge formed within the activity of designing in reference to Gilles Deleuze's philosophy of creation. **Balcı** investigates the changing boundaries of architectural knowledge, in terms of its approach to issues of materiality and process. She aims to put Actor-Network Theory on agenda to understand the relations between people and things, or artefacts and actors involved in the materialization processes. Her article is an attempt to illustrate translations of this theory's compositionist method into the act of composing architectural knowledge.

We hope you enjoy reading these diverse approaches and arguments on architectural knowledge in a broader context.

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DISCUSSING THE CHANGING DOMAIN OF ARCHITECTURAL KNOWLEDGE: FROM NORMATIVE AND CUMULATIVE TO SPECULATIVE KNOWLEDGE IN ARCHITECTURE

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ABSTRACT

The domain of architectural knowledge is in a constant state of change. This domain is mainly based on norms in Pre-modern architecture. These norms promote to use of traditional materials and material technologies. They are used to design traditional forms. The domain of knowledge is also normative in Modern architecture. But it introduces new norms such as universality, functionality, transparency, and simplicity by criticizing historicity and traditionality. It is an important epistemological change, which paves the way for conceptual and formal changes in architecture. So, the domain of architectural knowledge changes as well. It also changes in the Post-Modern architecture due to the fact that the domain of architectural knowledge is already constituted in the past. History again becomes the main source of knowledge. Therefore, the domain of knowledge is cumulative rather than normative in Post-Modern architecture. It is mainly based on the cumulative historical knowledge of architecture. However, the domain of architectural knowledge is recently changed by new dynamics and new realities. It is neither normative nor cumulative; it is speculative. Developments in computer technologies lead the domain of architectural knowledge to be changed by speculations. They also lead new materials and material technologies to be used so as to design speculative architectural forms. It is particularly information and communication technologies, which promote speculations in architecture. Information is replacing knowledge due to these technologies. It is rather an information about architectural form and formation. Thus, it becomes challenging to discuss knowledge; because it is replaced by information, which is generally reduced to form in architecture. The discussion of this paper is based on the changing domain of architectural knowledge from normative and cumulative to speculative. It is discussed in the paper that this domain is not only changed by formal but also conceptual innovations. So it is revealed that the domain of knowledge, even if it is speculative more than ever, cannot be limited or reduced to form in architecture.

KEYWORDS
Architectural knowledge, domain of knowledge, information, speculation, speculative architecture

Introduction

The word of knowledge is defined and discussed in many disciplines including the discipline of architecture. These definitions and discussions go back to ancient times. Knowledge is particularly discussed in the discipline of philosophy as the theory of knowledge since then. It is anciently defined as "episteme" as distinguished from "techne". Episteme refers to theoretical knowledge while techne is practical knowledge. So the distinction between theory and practice is constituted in ancient times. Aristo sees this distinction as the basis of philosophy. However, Socrates and Plato use the words of episteme and techne interchangeably in their philosophies. They discuss that the domain of knowledge is constituted by the collaboration of theory and practice (Parry, 2014). It is actually the basis of Modern philosophy. But knowledge is still a challenging word in the discipline of philosophy as it is in many other disciplines.

As Deleuze cites, Foucault, who focuses on knowledge in his philosophy, claims that it is both theoretical and practical. According to him, knowledge is constituted of visibility and vocabulary. The first is practical (or formal); the second is theoretical (or conceptual). And knowledge is a combination of them (Deleuze, 2019). Besides, Foucault discusses that human sciences are divided into various domains of knowledge such as biology, economy, and philology. These domains have their own epistemology. During the ancient times, they are commonly constituted by the method of taxonomy. It is a common method enabling formal entities to be analyzed in terms of their similarities and differences so as to constitute the domain of knowledge. It is the knowledge of form. However, this domain changes in such a way that subjective knowledge also becomes a part of the epistemology as well as objective knowledge, which is already constituted by the method of taxonomy. Thus, Foucault suggests that knowledge is no longer defined and discussed by the concepts of certainty, constancy, or stability even if these concepts are usually used to define scientific knowledge. It is subjectivity, which leads epistemological changes in philosophy (Foucault, 1999). That means subjective knowledge enhances the domain of knowledge by leading a new point of view to be developed not only in the disciplinary field of philosophy but also in other fields including art, design, and architecture.

Virilio promotes subjective knowledge versus objective knowledge even in the field of science. He discusses that modern science is replaced by techno-science, which leads scientific truths and realities to be criticized. Technology, particularly digital technology, is capable of boosting knowledge. Therefore, science, which is once a rigorous field thriving on an intellectual adventure, is bogged down in technological adventurism that denatures it. So knowledge becomes cybernetic, not encyclopedic by denying all objective reality (Virilio, 2005).

These philosophical discussions lead the definitions of knowledge to change also in architecture. The changes in the domain of architectural knowledge are discussed in this paper. It is discussed that these changes are particularly related to the philosophical definitions of knowledge. Knowledge is profoundly discussed in philosophy, the field in which concepts emerged, defined, applied, and transformed (Foucault, 1999). Furthermore, philosophy is defined as the knowledge of concepts (Deleuze, Guattari, 1992). This definition reasonably reveals the close relationship between conceptual thinking and knowledge.

Knowledge is constituted by concepts. And scientific knowledge is usually defined by the concepts of truth, reality, and certainty. But these are challenging concepts in the domain of knowledge in architecture as well as in art, design, and philosophy. Nevertheless, they are the main norms of Pre-Modern architecture. It is historically and certainly known how to design and construct a column, a wall, or a pediment in the Pre-Modern times. It is thought that the historical knowledge of architecture is true and certain. That's why; it is also real. Subsequently, historical principles and norms generate a normative domain of knowledge in architecture. As such, it could be argued that Modernism leads new norms to be developed such as simplicity, transparency, functionality, and universality. It is discussed as a radical epistemological change in the Modern architecture of the 20th century (Tanyeli, 2017). Indeed, the domain of architectural knowledge changes radically; this change occurs not only in conceptual but also in formal realms of architecture.

However, the concepts of *venustas* (beauty), *firmitas* (solidity), and *utilitas* (utility) defined by Vitruvius many centuries ago are still included in the domain of architectural knowledge. That's why; it is proclaimed that Modern architecture does not break its connections with history. Instead, it is actually a part of it. It is also asserted that the historical roots of Modernism are in the 17th century, even if it is usually dated back to the 20th century. It is supported by the similarities between simple and modern architectures of Boullee, Ledoux, and Le Corbusier (Tanyeli, 1997). Yet, Modern architecture is different in its nature from the architectures of the past. It is not a difference only created by new materials and material technologies. It is also an epistemological difference. It paves the way for modern architects to become new intellectuals (Yürekli, Yürekli, 2000).

Bauman defines intellectualism as being interested in interdisciplinary concerns such as Modernism, Postmodernism, and Globalism. According to him, Modern and Postmodern are totally different periods in which the role of the intellectual is different. He defines this role as determining norms in Modernism, while it is interpreting in Postmodernism (Bauman, 2003). The change in the role of the intellectual from determiner to interpreter leads architects to make interpretations as intellectuals. These interpretations are mainly based on the history of architecture.

Therefore, it is possible to assert that the domain of knowledge becomes cumulative rather than normative in Post-Modern architecture. It is suggested that architecture has cumulative historical knowledge, which is already constituted in the past. It cannot be ignored so as to create a new domain of architectural knowledge (Jencks, 1990). So, cumulative knowledge replaces normative knowledge in architecture. And the domain of knowledge becomes more open to interpretations rather than creations.

The interdisciplinary relations of architecture, particularly with art and philosophy, promote changes in its domain of knowledge. These relations lead new interdisciplinary concepts to be used in architecture. Thus, disciplinary limits are frequently opened to discussion. These discussions reveal that there is an epistemological ambiguity in architecture (Tanyeli, 2002). Ambiguity does not only enable concepts to change, but it also enables their meanings to become blurred. However, it is challenging to discuss stable disciplinary knowledge in architecture because of its interdisciplinary relations (Mennan, 2002). These relations lead the domain of architectural knowledge to change conceptually and formally. It reveals the fact that the domain of knowledge is neither normative nor cumulative in architecture recently. It is rather speculative. Developments in computer technologies, particularly information and communication technologies have an important role in the change from normative and cumulative to speculative knowledge in architecture.

These technologies promote the process of Modernisation discussed by Berman as the process through which all that is solid melts into air (Berman, 2013). It affects knowledge in such a way that it is no more concrete and real; instead, it is abstract and unreal. Developments in computer technologies change the ways of producing, sharing, and consuming knowledge. Architectural knowledge is now produced in a computer-aided environment. This environment enables knowledge to be easily shared with the world. However, this new sharing and experiencing environment leads architectural knowledge to rapid consumption. It also leads speculations in architecture recently. Thus, knowledge is replaced by information. In other words, information becomes more popular than knowledge **(Image 1).** Producing, saving, sharing, and using information is too easy; but managing it is too hard (Yılmaz, 2014). Information is open to speculation; it is even produced by speculations. So, it is different from knowledge, which is thought to be certain, true, and real.

It is information above all that is becoming an essential component of new architecture (Gausa, Guallart, Müller, Soriano, Porras, Morales, 2003). The change from knowledge to information reveals that architectural knowledge is changing as well. But, in this case, it is usually reduced to the knowledge of form in recent architecture. However, architecture is not the knowledge of form; instead, it is the form of knowledge (Tschumi, 1996). Hence, knowledge is a challenging discussion in architecture. This discussion is based on the changing domain of architectural knowledge from normative and cumulative to speculative knowledge in the paper.

The Changing Domain of Architectural Knowledge

The domain of knowledge is mainly constituted by practical knowledge in the Pre-modern architecture. There is a common belief that architecture can only be practiced by construction. So, the knowledge of architecture is based on the knowledge of the practice. However, this belief, which reduced architecture to a mere construction, changes. The knowledge of architecture also changes in such a way that it is no more limited to the knowledge of construction. Thus, the domain of knowledge is enhanced by theoretical knowledge as well as practical knowledge.

Practical knowledge is considered as the real knowledge in the Pre-modern architecture. But theoretical knowledge enhances the domain of knowledge in Modern architecture. This domain is separated into two fields as theoretical and practical knowledge. Therefore, duality is created in the domain of architectural knowledge (Tanyeli, 1999). It is actually dated back to the ancient times in which there is also a duality between episteme (theory) and techne (practice) (Parry, 2014).

This duality is discussed as the double-identity of knowledge in architecture. It is because of the fact that architectural knowledge can both be concrete and abstract, objective, and subjective or generic and specific (Uluoğlu, 2002). That's why; theory and practice are separated from each other. While the theory is defined as abstract, subjective, and specific; practice is concrete, objective, and generic. On the other side, reciprocity of theory and practice leads this duality to be criticized. Thus, a new critical discussion is developed on praxis including theory and practice. It is defined as a theoretical practice (Williams, 2018). So the domain of knowledge should not be reduced to theory or practice; instead, it should be discussed both as theoretical and as practical knowledge in architecture.

This domain is mainly constituted of normative knowledge in Modern architecture as it is in the Pre-modern architecture. However, the domain of knowledge is reconstituted by new norms and principles in Modern architecture. One of them is the famous Modern principle of "Form follows function." defined by Sullivan in 1896. This normative definition suggests a determinative relation between form and function. It is used to suggest that function can determine the form in Modern architecture. In other words, it is a norm to design a specific form for a specific function or vice versa. But, on the other hand, there is actually a dynamic relation between form and function, which cannot be reduced to a determinative or normative definition (Tanyeli, 2017).

Norms or principles such as form follows function is used so as to create an absolutely true, certain, and real architecture. Modern architects have the ideal of creating a mathematical truth, certainty, and reality in their designs. They use the metaphors of problem and solution. However, problem-solving is problematic in architecture. Therefore, Post-Modern architecture is rather based on defining and deciphering the problem. The domain of knowledge is no more enhanced by solving architectural problems through norms, principles, or formulations.

So, the role of the architect changes as well as the domain of knowledge in architecture. It is discussed that the role of the architect changes from being a norm determiner to an interpreter. This discussion is made by referring to Bauman, who points out the change of the role of the intellectual (Bauman, 2003; Tanyeli, 2017). Thus, interpretation becomes the only possible way to (re)produce knowledge in architecture. Architectural knowledge is not normative; rather, it is cumulative. Post-Modernism leads the domain of knowledge to be defined as cumulative, which is already constituted in history, by promoting to use historical and traditional norms and forms in architecture.

Knowledge is an instrument used to decipher the meaning of time and space in which it is defined and designed (Serim, 2016). It is an instrument also in architecture. However, architectural knowledge is constantly changing. It leads architectural concepts to change as well. For instance, the concept of topology is used rather than the concept of geometry in architecture recently (Uluoğlu, 2002). These conceptual changes reveal that not only the ways of conceptualizing but also the ways and the acts of designing change in architecture (Güleç, 2017). It paves the way for another change from product to process. The knowledge of the process is rather discussed than the knowledge of the product in contemporary architecture. Knowledge is generally indexed during the computer-aided design process. Indexical knowledge enables architectural products to be designed conceptually and formally. Form emerges instantly and spontaneously during this process. Hence, it is called as an emergent form (Kolarevic, 2003). It is able to respond to the instant and spontaneous changes created virtually by the computers. It is defined as a living organism, which is animistic rather than dynamic. Therefore, it is also called as an animate form (Lynn, 1999). These conceptual and formal innovations lead the domain of architectural knowledge to change radically.

The domain of architectural knowledge is now based on the process rather than the product. Thus, "Form follows function." is replaced by "Form follows the process." in architecture. It is not based on a specific norm or principle. Because the computer-aided design process is freed from normative principles. It promotes instant and spontaneous formations. It also promotes randomness and accidentalness (Tanyeli, 2017). They are the new architectural design principles. Developments in computer technologies change the domain of knowledge in such a way that the knowledge of the process is discussed rather than the knowledge of the product. It is a spontaneous, random, and even accidental process, which is open to speculations. It is an important epistemological change in recent architecture. However, the process is also discussed in Modern architecture because of the fact that the methods of architectural production are changed. Its focus is mostly on mechanization and mass production. So, not only the product but also the process becomes a part of the domain of architectural knowledge (Uluoğlu, 2002). Nonetheless, there are now new methods of architectural production such as mass customization and digitalization.

Epistemological changes lead the domain of knowledge to change in architecture. These changes are not only in the discipline of architecture; they are in many disciplines such as philosophy, sociology, art, aesthetics, economics, and politics as well. It is a fact that its interdisciplinary relations promote epistemological changes in architecture. Interdisciplinarity enables the domain of architectural knowledge to change by promoting new ways of thinking, conceptualizing, and designing. These are significant changes concerning not only theorists or critics but also designers in the discipline of architecture.

Concluding Remarks

The domain of architectural knowledge is mainly constituted of the knowledge of construction in the Pre-Modern architecture. However, it is not reduced to the knowledge of the constructed product in Modern architecture. The knowledge of the process as well as the knowledge of the product constitutes the domain of architectural knowledge. It is an important epistemological change in architecture. The domain of knowledge in Pre-Modern architecture is based on historical norms and forms. Modern architecture is also normative as Pre-Modern architecture, but it introduces its own norms and principles of simplicity, transparency, functionality, and universality as distinguished from history. Modern materials and material technologies such as steel, concrete, and glass promote these new norms and principles. And they are all promoted by the principle of "Form follows function." particularly. It establishes the basis of normative knowledge in Modern architecture.

Normative knowledge is replaced by cumulative knowledge in the Post-Modern architecture. It is discussed that architecture cannot be distinguished from its history (Jencks, 1990). Hence, the concepts of history, identity, tradition, place, context, and culture are again put on the agenda of architecture. So, the domain of architectural knowledge is reconstituted within this conceptual framework. This framework reveals that the domain of knowledge is cumulative and its main source is the history of architecture. It is the history of traditional forms, materials, and material technologies.

However, the domain of architectural knowledge is today speculative rather than normative or cumulative. Developments in computer technologies, particularly information and communication technologies promote speculations in architecture. Thus, architectural knowledge is constituted by the speculations produced in the computer-aided environment. Besides, architectural products are easily and rapidly shared, liked, and commented in this environment. They are also experienced through their three dimensional, motional, and even emotional images produced by computers. It paves the way for producing speculative knowledge in architecture. Truth, certainty, or reality, they all become irrelevant. Architectural knowledge is no longer constituted by them.

Reality becomes irrelevant; because there is a new reality produced by computers. It is called virtuality. In the virtual environment, there is so much information on forms and materials. The computers index them all. That's why; there is not one single truth in this environment. So, truth and certainty become irrelevant as reality. Therefore, architecture is neither normative nor cumulative; it is rather speculative recently.

In this new computational domain of knowledge, the principle of "Form follows function." is replaced by the principle of "Form follows the process." It is because of the fact that architectural knowledge is now constituted of the process rather than the product. It is the computer-aided design process, which constitutes the new architectural knowledge. Architectural product is instantly, spontaneously, and even accidentally formed in this process by the aid of the computers (Kolarevic, 2003). And consequently, the domain of architectural knowledge is reconstituted by the concepts of indexicality, instantaneity, spontaneity, and accidentality. These concepts reveal the fact that architectural knowledge is formed speculatively **(Image 2).**

Thus, the change in the domain of architectural knowledge from normative and cumulative to speculative is discussed in this paper. It is an important epistemological change in architecture. It is the change from knowledge to information. Information is a new reality; it is a new way of productivity. Information is now produced in architecture. And it promotes speculation. In this speculative environment, form follows form not function. The most speculative forms are constantly (re)produced. But, as it is emphasized through the discussion of the paper, the domain of architectural knowledge is not only constituted of forms; it is also constituted of concepts. This domain is changing conceptually and formally. It concerns designers as well as theorists and critics due to the fact that the domain of knowledge is usually reduced to form in architecture recently.

IMAGES, CHARTS OR GRAPHIC LEGENDS

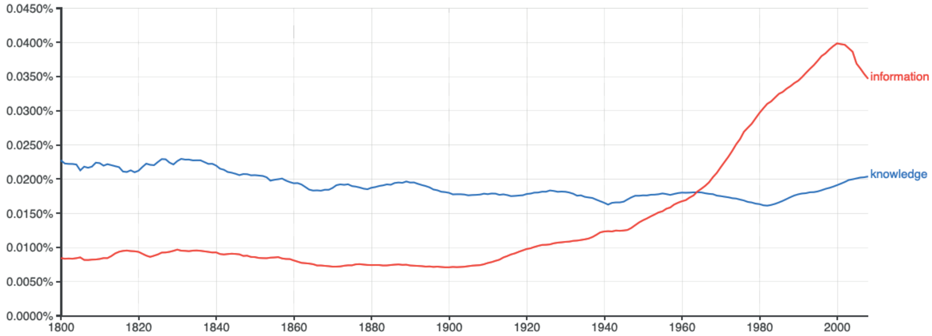

Image 1: Diagram showing the frequency of using the words of knowledge and information between 1800 and 2008. It shows that information is on the rise until 2000. Even if the frequency of using the word of information decreases after 2000, it is still popular than the word of knowledge. Diagram also shows that using the words of knowledge is almost stable between 1800 and 2008. (https://books.google.com/ngrams)

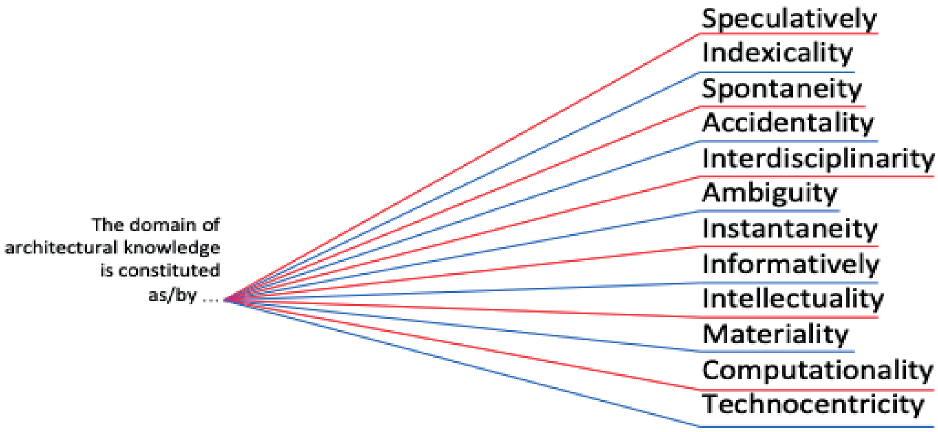

Image 2: Diagram of some of the concepts used to define and discuss the domain of architectural knowledge in 2000s. (Produced by author)

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CONSTRUCTING INDIVIDUAL ARCHITECTURAL KNOWLEDGE THROUGH ARCHITECT'S TRAVEL

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ABSTRACT

This study aims for a theoretical reading on architect's travel as a self-cultivation process that suggests a creative and critical ground for accumulating and constructing knowledge. Travel is an individual experience, where an architect finds self-learning methods and ways of defining what s/he perceives in his/her own specific terms by observing, discovering, and interpreting architectural works. A critical perspective is made possible by traveling in that architectural artefacts are to be studied in their own settings and in multiple dimensions by being inside and around them; in this way, architecture can be taken not only as an object but also a composition of inhabitable spaces. It is argued in this paper that achieving to possess a critical position by traveling as part of self-cultivation leads to a situated and constructive way of learning; and so, the construction of individual knowledge is possible with a critical mind. The critical mind is attained by embracing diverse partial perspectives instead of accepting the transcendent objectivity determined by dominant scientific knowledge. In the scope of this research, Edward Said's "traveling theory" and Donna Haraway's definitions of "situated knowledge" and "partial perspective" are taken as guiding theoretical frames to investigate the role of architect's travel in construction of situated individual knowledge of architecture. Traveling practice is active in the situated and partial construction of knowledge since traveling within knowledge itself stimulates the critical position of the architect to come up with various constructions deriving from the same set of architectural constituents for knowledge. Thus, self-knowledge construction by way of comprehension of the observed reality and self-cultivation will be investigated in parallel with that traveling triggers the architect's critical approach.

KEYWORDS

Construction of knowledge, situated knowledge, architectural knowledge, traveling theory, architect's travel, self-cultivation, critical thinking

Introduction

The constructionist approach diverges from positivist research due to its methods of learning and gaining knowledge. In this study, architecture will be addressed as a discipline that pursuits a constructionist epistemology; because it is contingent upon subjective experience and interpretations apart from its applied nature. Besides its practical aspect adhering to the available mediums and materials for production, architecture's constructionist facet entails architects depend also on their own individual experiences accompanied by their interpretive and critical scrutiny for furthering their knowledge and learning skills.

Keeping in mind that architecture encompasses both practical production and theoretical examination, the constructivist approach in architecture is considered to be most evident in its theoretical domain. While practice leads to tangible construction, the theory provides the base for interpretive and critical construction on an intellectual level. Stanford Anderson (2001: 292) calls attention to that architectural field unites practice of "profession" and theoretical research on "discipline". According to Anderson, the product of the profession is the physical artifact, which is to be performed via a synthesis; whereas the products of the discipline, although emphasizing a particular aspect of architecture, come out in many forms and propose resources for an architectural synthesis to be implemented (295). Anderson puts emphasis on the architectural field as an intersection of profession and discipline, and relatedly, the presence of such an intersection to be available in the educational account. Similar to how practitioners are influential in theoretical development, discourse on architectural discipline, especially examined in schools' degree programs, contributes to the application of practice. So, students by studying the architectural discipline in detail will accomplish "both for an understanding of its past and to revel in imagining a practice that does not yet exist" (298).

Correspondingly, Uğur Tanyeli (1999) dwells on two ways leading to architectural knowledge, where architecture is the subject on the one hand and the object on the other. Tangible knowledge of architectural practice takes architecture as the subject, whereas theoretical architectural knowledge proposes a ground for comprehension of architecture. According to Tanyeli, practical architectural knowledge is constructed upon the ground of architectural discipline itself, where architecture is seen as its own subject; and theoretical architectural knowledge is the re-constructed knowledge depending on architecture as the object of discourse. Tanyeli suggests that theoretical knowledge does not determine architectural practice; rather, it encompasses all intellectual constructions that guide the knowledge of the architectural practice. Architectural discourse, being one of these intellectual constructions, provides the base for constructed and re-constructed theoretical knowledge.

Construction of knowledge in the architectural field can be taken as a way of thinking on a theoretical and intellectual ground in order to make different perceptions and speculations available, and in this sense, as a part of the architect's self-cultivation process including education in schools of architecture. Self-cultivation is a constant learning and improvement process continuing especially after school education; while it also benefits from and contributes to professional practice. Architect's travel will be examined in this study as parallel to the self-cultivation process by offering tools of learning and critical thinking for reaching new forms of knowledge on a theoretical account.

An Epistemological and Theoretical Inquiry for Construction of Knowledge

Among the three major epistemological positions given by Michael Crotty (1998: 5), the objectivist perspective differs from constructionist and subjectivist ones. Crotty draws attention to "the great divide" between objectivist/positivist and constructionist/subjectivist research. These two are claimed to correspond respectively to quantitative and qualitative research. Crotty underlines that qualitative research in the past made use of empiricists, i.e. positivist tools; and non-positivist research did not reject quantitative ways. Hence, Crotty sustains that a researcher can use different tools from qualitative, quantitative, or both according to his/her goal. However, according to Crotty, what is important for a researcher is "to be consistently objectivist or consistently constructionist (15). By being consistently objectivist, one recognizes scientifically specified objective findings as opposed to subjective meanings as interpretations of them. Being consistently constructionist, on the other hand, stimulates to approach all understandings as constructions, including scientific or non-scientific ones. Even if constructionists benefit from quantitative tools, their constructionist interpretations generate different results. According to them, there cannot be any form of knowledge that is regarded as "objective or absolute or truly generalizable" (Crotty, 16).

In line with Crotty's claim that the constructionist perspective does consider meaning (or truth) as neither barely subjective nor barely objective, architectural knowledge appears to embrace a constructionist approach/epistemology with both objectivist and subjectivist considerations (1998: 43). Architectural production is itself a particular subjective act, even though it includes knowledge of construction technology, which follows objective rules on construction such as materials with certain dimensions or load-bearing system. Yet, the construction process involves diverse compositions due to diverse design principles, and it becomes a unique subjective production in the end. For constructionism:

> There is no objective truth waiting for us to discover it. Truth, or meaning, comes into existence in and out of our engagement with the realities in our world. There is no meaning without a mind. Meaning is not discovered but constructed. In this understanding of knowledge, it is clear that different people may construct meaning in different ways, even in relation to the same phenomenon. Isn't this precisely what we find when we move from one era to another or from one culture to another? In this view of things, subject and object emerge as partners in the generation of meaning. (Crotty, M., 1998: 9).

Crotty's argument regarding the movement from one era or culture to another leads the discussion to differences in perception, comprehension, and ideas according to different temporal and spatial contexts as well as that "the generation of meaning" arises from different subjects' comprehension of diverse objects. Subjects do not create meanings, in fact, they construct meanings upon the world and its objects, which already existed (44).

Crotty (1998: 42) correlates constructionism with "making of meaning"; the constructionist view promotes that all meaningful reality as knowledge depends on human practices which are "being constructed in and out of the interaction between human beings and their world and developed and transmitted within an essentially social context". Consciousness is another input to understand the construction of meaning. Human beings have their interpretation of the world they live in and experience, justifying the idea that there should be a mind for meaning to arise. In other words, an object does not carry meaning without a mind; as, for instance, how Merleau-Ponty implies, "actual meaning emerges only when consciousness emerges with them" (43).

Therefore, it should be noted that consciousness is a vital element for the constructionist standpoint. It can be claimed that criticality, which can be considered as another vital component, stems from consciousness. Edward Said (1984: 231) correlates consciousness with critical scrutiny considering Georg Lukács' analysis of reification; for Lukács, that capitalism bases upon a quantitative approach makes humans deviate from their organic connections with life in that their labor power becomes a quantifiable commodity (231). Said suggests a form of an experience he calls "crisis" which stimulates an active and "critical consciousness" as opposed to "contemplative consciousness" caused by passivity caused by reification. Experience of crisis enables the mind to gain awareness of itself as a "subject and not as a lifeless object" (232). That means criticality arises at the point where a subject begins to scrutinize. Accordingly, Said claims that consciousness belongs to the world of theory, not objects; when the consciousness of change in the status quo occurs, it leads consciousness to complete self-realization which can be comprehended as theory or projection (234). Yet, critical consciousness separates from theory, for it is a search for ways to locate or situate theory; including examining theory in the place and time of its commencement, acting in and for it, reacting to it, and evaluating its use in other places and times when it travels. Additionally, critical consciousness offers tools to recognize differences between situations of the emergence and destination of a traveling theory; it investigates, even delivers resistances to theory to make it accessible for interpretation and manifestation of alternating ideas (Said, 1984: 242).

Paul Boghossian (2006), by coining the term "equal validity", draws attention to "many radically different, yet 'equally valid' ways of knowing the world, with science being just one of them" (2). Equal validity calls for an approach that scrutinizes beyond the objective facts, out of the strict boundaries of "science". According to Boghossian, the affinity for equal validity is tied to post-colonial or postmodern thinking, which instead of promoting "superior science and culture of the West" (5), gives importance to "different knowledge, each appropriate to its own particular setting" (6). The acceptance that there are different knowledge has also been embraced in feminist epistemology; Kathleen Lennon states that most of the feminist epistemologists "accept that all knowledge is situated knowledge, reflecting the position of the knowledge producer at a certain historical moment in a given material and cultural context" (Cited by Boghossian, 2006: 6).

The multitude of perspectives promoting and offering a diversity of alternatives in meaning, and thus in knowledge, will be handled within a twofold relation between traveling and situated theories. In a similar way to an idea's or theory's travel, knowledge travels as well. Traveling, it is argued in this study, ensures knowledge to be originated, transformed, and used in and for different settings by holding diverse meanings. Traveling urges a researcher (or an architect, in the scope of this paper) to construct self-knowledge stemming from the context of his/her existence; transform it through traveling within it at different times and domains and transferring it to other contexts independent of its origination place. In this last case, knowledge travels with the subject who constructs it; but when it is confronted by other subjects in their contexts, it starts to be transformed and re-constructed by them. Therefore, knowledge is broadened by means of different meanings offered by a multitude of constructions, which are born out of their contexts and re-constructed as they undergo transformations.

Along with all these considerations, this article attempts to pursue a theoretical investigation on travel and moreover, the critical and transformative ground it provides for construction and re-construction of architectural knowledge. The discussion on the travel of architectural knowledge and of architects to construct and re-construct their individual knowledge will be grounded on a theoretical framework with regard to Edward Said's "traveling theory" along with Donna Haraway's description of "partial" "situated knowledge" in the following part.

Traveling and Situated Knowledge

The term "situated knowledge" has been introduced by Donna Haraway (1988) to manifest her argument related to the decree of objectivity in science and possibilities of partial perspectives against it. Haraway, holding a feminist objectivist standpoint, says that situated knowledge embraces partial perspectives developed by different subjects suggesting objective visions, against transcendent scientific descriptions (583). Put it another way, subject and object are not to be separated; "embodied" partial vision by subjects is of significance for objectivity. As a result, embodied objectivity arises as an expression as opposed to transcendent objectivity. [1]. If not situated and derived from a partial perspective of a subject, knowledge becomes an "unlocatable" or "irresponsible" claim. Haraway also underlines that partial perspectives of the subjugated are not innocent either (584); they are also subject to a critical inquiry as to how it should be in the prevailing scientific–isms. Therefore, according to Haraway, feminist epistemologists expect "transformation of systems of knowledge and ways of seeing" (585). This stance goes parallel with Said's emphasis on resistances to theory provided by the critical mind, which leads to a transformation of theory, as well as the initiation of alternative ways through pondering upon it.

Edward Said (1984) dwells on the four stages of the way theory or idea travels, which consist of "a point of origin", "a distance transversed", "a set of conditions" of acceptance and resistance, and finally "accommodated (or incorporated) idea". Said's choice of using the word "transversed" when defining the distance that theory takes at the second stage of his "traveling theory" implies the interaction between disciplines, conditions, perspectives, or ideas. Said emphasizes that the boundaries of disciplines are uncertain; hence a "local" and "detailed" analysis of the travel of theory from one situation to another is contradictious (227). Many different theories and contexts should be analyzed by taking into account their relations with other theories and contexts. In that way, it will be possible to comprehend each approach with a critical mind by considering the associated and separated parts of each of them and the ways they can be related.

For traveling knowledge there can be identified two tracks: travel of constructed knowledge and the travel of the subject (architect) in the process of constructing knowledge. In the first case, knowledge travels after it is constructed as situated in a particular locale; for the later phases of its circulation, Said's traveling theory can be implemented. Knowledge goes through the same phases of traveling theory. First, situated knowledge is constructed upon a theoretical background which springs from a particular "point of origin"; and second, they are transversing with different disciplines and different conditions of other different contexts. In the third stage, knowledge encounters with different disciplines and/or circumstances and so goes through recognition or rejection processes. Lastly, knowledge is accommodated when it gains validity on a critical ground within the context of its arrival. In all these phases critical consciousness is influential. Once knowledge, after traveling from a specific discipline or context, is put forth within the scope of another discipline and/or context, it will eventually be "accommodated" there. For the accommodation phase of a theory, Said also draws attention to its process of transformation by its new uses in a new time and place. Likewise, knowledge is transformed through its adaptation with its new uses in its new position.

Accordingly, the distinction between situatedness and accommodation simultaneously designates the distinction between the first and the last phases of Said's traveling theory. That is to say, if knowledge is situated in a specific locale it was born from there; while if it is accommodated, it had transformed and adapted itself to the conditions of the context where it arrives at the end of its travel. Said underlines the change in theory when it travels to be researched or interpreted by other subjects, because "the critical change in time and in place" (237) occurs between the writer of theory and another who interprets it. So, it can be deduced that a knowledge accommodated in a new place in a new time gives rise to new interpretations, which culminate in constructions of situated knowledge.

Keeping their distinction in mind, the conditions of situatedness and accommodation seem to maintain each other's continuity within a recurrent loop. At this point, an intermediary phase that links the end (accommodation) and the beginning (origination) phases of knowledge's travel can be proposed. In this intermediary phase, an accommodated knowledge is transformed within a different context when it is used and re-used many times and in many ways by interpretations of different subjects. This transformation leads to the initiation of new situated knowledge upon a transformational ground that arises as a new locale bound to its specific context. Therefore, even when it is derived from accommodated knowledge that is transformed into new interpretations upon its travel, newly constructed knowledge is still regarded as situated; because the knowledge that travels is accommodated in the conditions of the specific locale, in which new situated knowledge originates.

The second track for traveling knowledge holds that it is the subject who travels [within] the knowledge to cultivate and develop it. In this case, the context for traveling practice is the knowledge itself, which can be regarded as the soil; and knowledge is the situated construction resulted from a cultivation process conducted within this specific soil by architect him/herself. Situated knowledge arose from its particular locale; it is dug out of its soil and then cultivated by a subject who constructs reality in two phases: by comprehending and attributing meaning to it. These two phases of reality construction are thought to refer respectively to objective and subjective approaches, which are depicted as essentials of constructionism by Crotty. In this respect, the comprehension phase relies largely on objective account of seeing and learning since existing reality is objective; but it still involves subjectivity, as learning also demands criticality as it includes discovering and interpreting the perceived reality. The subjective part linking to the former is the cultivation phase which is considered as a way to construct situated knowledge along with meaning generation. It should be emphasized that both comprehension and meaning generation are possible on critical ground. The cultivation process includes comprehension of discovered reality and traveling as a way of interpreting that reality so as to generate meaning. A subject discovers the local features or reality of a context and reveals it as a meaningful accumulated knowledge by cultivating it. Cultivation of the context is very much like traveling which is also seen as a state of critical thinking, which will be addressed thereinafter.

Among the two tracks defined in this part, the first one examines travel of knowledge, and the second one examines the travel of architects to construct an individual knowledge by means of self-cultivation process. The cultivation process is intertwined with traveling, where either knowledge travels and reaches to other architects in their contexts to be utilized or continues to be searched by architects to reach various constructions and re-constructions arising out of it. In the field of architecture, traveling and accommodated architectural knowledge or traveling architects gather on a collective construction ground where architects involve in critical understanding, exchanging and associating diverse ideas; and thus, they construct, transform and re-construct various partial knowledge. Furthermore, the unique knowledge generated in this whole process apparently contributes to a comprehensive accumulation of architectural knowledge.

Individual Architectural Knowledge as Constructions through Architect's Travel

This study departs from the idea that architecture is a discipline possessing a constructive nature following Nigel Cross' designation of "design as a discipline, but not design as a science". Cross (2001) refers to objective and rational methods of science to be implemented for design, favored by the Modern Movement of the 1920s and then by the "design methods movement" of the 1960s. However, with the 1970s "design methodologists" wanted to separate methods of design from scientific research.

In order to draw the distinction between methods of architectural discipline and science, it can be helpful to consider their research area, as Cross draws attention to the differences between natural sciences and design in terms of their interests. For the difference in methods, Sydney Gregory's statement is guiding: "science is analytic; design is constructive"; and in this parallel Christopher Alexander sustains that "[s]cientists try to identify the components of existing structures, designers try to shape the components of new structures" (Cited by Cross, 2001). Cristopher Frayling (1993) similarly pointed out that reaching to new perspectives necessitates diverging off from the old; and in this direction, instead of engaging in common knowledge advocated by "scientific" [Frayling also uses "critical rationalist"] way of thinking, new ways should be sought to go beyond the already existing knowledge.

Subsequently, departing from the distinction between the methods and interests of design and science, architecture can be handled as a discipline, finding and using its own constructive and creative methods rather than analytical methods of science. Travel, in this regard, seems to be developed as a method derived from within the discipline of architecture itself. In this case, the construction of architectural knowledge will be approached as a process born out within the scope of the discipline covering its own terms and intellectual boundaries; and traveling as an architect's tool for individual knowledge construction will be treated as an architectural disciplinary method.

As opposed to the transcendental and generalizable objectivity of scientific research, the discipline of architecture departs from a constructionist approach relying both on objective and subjective methods. Architectural knowledge in the frame of constructionist stance depends on its own disciplinary discourse and the architectural artefacts to be congregated and improved. Cross (2001) puts emphasis on that designers work on the artificial world, covering the human-made artefacts; so "design knowledge is of and about the artificial world and how to contribute to the creation and maintenance of that world". He holds that design discipline is to be studied using its own terms and pursuing its own "rigorous" culture; there are special forms of knowledge only available to the use and appreciation of a designer who benefits from the reflective practice of design. By reflectivity, it can be understood that the designer learns from the "techniques of the artificial" not "the sciences of the artificial" (Cross, 2001). Though the techniques may adhere to rational scientific reality, architects (as designers) attempt to re-think the existent technical knowledge to re-compose them in order to reach to new knowledge. It should be underlined at this point that this new knowledge is, as Cross (2001) says, already inherent in the architectural discipline itself via the design activity or artefacts – their forms and configurations, manufacturing processes, or instructions in them. Learning from these inherent techniques does not require a scientific analysis but a reflection of the designer on the use of the artefacts. Put it in an architectural context, the techniques of the artificial are to be interpreted and improved by architects in relation to their experiences upon their specific use for different purposes. Thus, architectural artefact including its design process becomes the object and the context of architectural research. Artefacts are not superior products just to be seen remotely, but they are the learning ground and sources for knowledge formation and transformation.

Going beyond the existing knowledge given by scientific explanations implies also thinking in a critically conscious way on different voices to generate new constructions. Homi Bhabha (1994: 5) defines "beyond" as a "spatial distance" and progress into the future. For Bhabha, thinking beyond, with the postmodern condition, is recognizing the epistemological limits of not only ethnocentric ideas promoting transcendental obeying but also "other" minor voices (6). Epistemological duality determines the distance between major scientific knowledge and the other partial knowledge; this duality sets a potential for critical constructions. Differences sound new in the beginning, but while pondering upon them, new tools and new compositions are revealed. Formation of diverse knowledge constructed on a critical basis becomes possible through new intersections of traveling architects as knowledge constructors and travels of their constructed individual "partial" knowledge.

It is to be noted that, traveling suggests a transformational ground upon which critical perspective is formed; as a result, an architect's creative process is made possible, since creativity is driven by critical thinking. In this regard, travel provides a ground for creative thinking per se, by raising a critical distance from the research focus. Georges Van Den Abbeele (1992) draws attention to thought as travel, because thought as a quest (xii) is a critical act that necessitates a critical distance from an existing place or situation:

> […] the application of travel to thought conjures up the image of an innovative mind that explores new ways of looking at things or which opens up new horizons. That mind is a critical one to the extent that it's moving beyond a given set of preconceptions or values also undermines those assumptions. Indeed, to call an existing order into question by placing oneself "outside" that order, by taking a "critical distance" from it, is implicitly to invoke the metaphor of thought as travel. (Van Den Abbeele, 1992: xiii)

Movement makes sure the required distance and thus engenders "the transgressive or critical possibilities implied in the change of perspective travel provides" (Van Den Abbeele, 1992: xx). Similar to the condition of "thinking beyond" (Bhabha) for appreciating different partial perspectives the change of perspective is made available by traveling which can be considered as a critical act itself.

The creative dimension is rendered possible by the architect's "encounter with newness" in Bhabha's terms (Bhabha, 1994: 10). The encounter with new is thought to lead to the critical construction of new forms of architectural knowledge. "New" also implies "other"; that is, other situated and partial knowledge, their ideas, methods, and terminology. Consequently, traveling is assumed to be the domain of critical juxtaposition involving confrontations with new or other ideas, disciplines, and cultures which are taken as different contexts.

In addition to Cross's debate that architecture is a discipline forming its own knowledge within itself; a critical approach on a juxtaposition ground is required for a broader understanding of architecture to construct the main knowledge base. In the scope of this study, it is sustained that travel ensures to recognize new perspectives and look through them. This will serve the learning from architectural discipline itself by means of interpreting, generating, and intersecting different architectural knowledge. In addition to the "constructive" nature of architecture, the critical-minded architect needs and constitutes critical tools of learning for the construction of individual self-knowledge. Criticality is especially significant for an architect to arrive at new perspectives for constructing new knowledge and re-constructing them through a transformation; and to find his/her own critical tools, as well.

Conclusion

In this paper, architect's travel is theorized both as a tool for and a process of self-cultivation, which consists of architectural knowledge construction through exploring the limits of the critical mind and ways of critical learning. Traveling is an experiential field and process, and it is unique for each architect. It makes an architect's direct experience of architectural works, their environments, and the relationship between them possible. As a result of this kind of unique experience, as I mentioned elsewhere within the definition of the concept "archi-travel", architect unearths "individual and unique ways of accumulating, constructing and transforming (architectural) knowledge" and benefit from travel as "a creative process" in terms of his/her own "path of self-cultivation" (Akyol, 2019); self-cultivation is an essential part of self-education by contributing to the construction of knowledge.

Traveling and situated knowledge both contain criticality. Traveling is a process, while its reciprocal part situatedness can be seen as a consequence. Even though it is a consequence, it is not an absolute end in itself; rather, it is the beginning of another travel of knowledge or architect for critical inquiry. Connotations of the concept of travel, such as self-cultivation, exploration, critical distance, and critical thinking are all derived from its meanings in literary use and applied to the experiential performance of learning by traveling. As Kay Bea Jones (2001) dwells on site-based experience of architect's travel as a means for self-constructed knowledge, this study investigates travel as a tool for architect's individual knowledge construction. This proposition is also buttressed together with the consideration of architecture as a discipline to be cultivated in its own vocabulary and methods in order to enhance architectural knowledge from multiple partial perspectives. Moreover, Jones' remark for the impact of the first-hand experience on altering the dominant visions in order to diversify and expand knowledge coincides with the feminist perspective indicated by Haraway, which sustains that partial objectivities constructed by diverse subjects together comprise the truth. Jones put forth that intuitional and subjective forms of knowledge, which are "conscious, well-informed, and contextualized", arise through confrontation with the authoritarian facts driven by the "object-obsessed" approach. In this kind of knowledge, emphasis shifts from facticity to original insights, which are constructed with critical new thinking upon the knowledge relying on the observation of the architectural environment itself (Jones, 2001: 146). Being conscious, well-informed, and contextualized, this form of knowledge is active, partial, and situated.

The traveling mind and the situated mind chase each other in an endless loop. Critical distance taken during the practice of traveling proposes the duality and juxtaposition of foreign and local vision, owned respectively by traveling and situated mind. The change of perspective implied by the shift of vision from local to foreign and vice versa is observed in the state of traveling, which results in constructions and re-constructions of knowledge through critically conscious investigation. Besides, the shift of vision maintains the transformational account of meaning-making throughout knowledge construction. Such a transformation occurs through an architect's encounter with "unknown" or "foreign" leading to new conceptions of architecture by means of traveling; accordingly, traveling provides a foreign vision in order to alter unknown to known (Akyol, Boyacıoğlu, & Altan; 2019). In the course of traveling, the context is constantly changing and therefore being experienced always as foreign places. In this regard, Mark Wigley outlines the architect as a foreigner who can explain and construct the local architecture (Cited by Akyol et al., 2019). Wigley's analysis implies that architect, by the shift of vision, puts on foreigner's view to unveiling situated knowledge. Likewise, an architect should embrace a foreigner's new, critical, and constructive perspective to recognize and involve in other partial knowledge. As a result of this kind of critical consciousness, other knowledge which was initially foreign turn into familiar alternative knowledge available to be analyzed.

To conclude, architect's travel as a ground for critical learning as well as accumulation and generation of situated knowledge paves the way for enduring research for achieving a broad architectural knowledge. Learning architecture by its own elements and works leads architects to embrace a critical approach for reaching diverse individual constructions of architectural knowledge through their own interpretations. The critical mind of an architect participates in the wider domain of knowledge with his/her individual constructions and appreciates diverse partial knowledge contributing to it.

NOTES

1. Within the architectural discourse, according to Sarah Williams Goldhagen (2000), situated modernists search for reforming the existent political conditions dominated by capitalist democracy and industrial technology for contributing to social progress and for reducing the social injustices, inequities, and conflicts caused by a cultural disorder (305). In the social context, situated modernists both accept the positive aspects and try to eliminate the negative aspects of modern life. Its negative aspects such as "dynamism, mobility, and rational modes of analysis" cause respectively "the disorientation of the self, the sense of dislocation from community and place, and the disregard for the phenomenological and emotive". Consequently, situated modernists attempt "to situate the users of their buildings socially and historically, in place and time" (306), by emphasizing "personal identity" and "site-specificity" (312). Along with these considerations, Goldhagen underlines situated modernists' criticality of the prevailing institutions of modern society, their damaging social effects, and the International Style as an instrument of those institutions. Resulting from this criticality, they carry on creating "a rich, stylistically heterogeneous body of buildings and theories" (320). Goldhagen's understanding of situated modernism seeking pluralism in practice and theory by criticizing the prevailing International Style and supporting particular modernities instead shows similarity to Haraway's situated standpoint.

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ON ARCHITECTURAL DESIGN KNOWLEDGE: REFLECTING UPON THE KNOWLEDGE IN DESIGNING

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ABSTRACT
Some discussions on architectural knowledge question whether architecture is a discipline or not and what its frontiers are. Accordingly how architectural knowledge is produced and what constitutes its basis are handled with regard to architecture's theory and practice and its relations with other disciplines. In this context, design is one of the significant subjects of discussion in respect of the production of architectural knowledge, as it allows both the theoretical and practical fields of architecture to be engaged and complex relations to be built with different disciplines. In this perspective, this paper proposes rethinking on architectural design knowledge. It addresses "knowledge in designing" as a conceptualization to define a specialized field of discussion regarding the complex structure of knowledge formed within the activity of designing. Concerning this conceptualization, the interrelations between the formation and communication of knowledge in the activity of designing is examined. To hold such an examination in terms of the unpredictable, intricated relationships between thinking and doing, a perspective is opened in the framework of the experimentality of designing. With this regard, the content created by Gilles Deleuze regarding experimentalism in context of his philosophy of creation is used to create an understanding of the structural characteristics and transmission potential of the" knowledge in designing". In the light of this understanding, going beyond the epistemological or the doxological frameworks of knowledge, the validity of the "knowledge in designing" is discussed based on basis of its own dynamics of genesis.

KEYWORDS
Architectural design knowledge, knowledge in designing, knowledge formation, knowledge communication

Introduction

Some discussions on architectural knowledge question whether architecture is a discipline or not and what its frontiers are. Accordingly how architectural knowledge is produced and what constitutes its basis are handled with regard to architecture's theory and practice and its relations with other disciplines. In this context, design is one of the significant subjects of discussion in respect of the production of architectural knowledge, as it allows both the theoretical and practical fields of architecture to be engaged and complex relations to be built with different disciplines. In this perspective, this paper proposes rethinking on architectural design knowledge in order to open up a specialized discussion on architectural knowledge. Accordingly, it addresses "knowledge in designing" to build up a discussion on the formation and communication of knowledge within the activity of designing and it inquires the validity of this knowledge.

Architectural design knowledge has complex scape of knowledge patterns that extend along different domains comprising various categories of knowledge. In relation to its complexity and extensiveness, it is discussed in terms of both epistemological and doxological components it embodies. In context of architectural design knowledge, the form, communicability and validity of the knowledge produced within the activity of designing is a subject of discussion that is addressed through different research frameworks. As Nigel Cross expresses through his concept of "designerly ways of knowing", knowing in designing refers to a kind of unique cognition that cannot be confined to the scope of the natural sciences or the social sciences. Furthermore, designerly knowing through the complex volution of thinking and doing provides access to a widespread knowledge field that is far complex to be expressed neither by design theories nor by design objects alone[1]. It is built into an intricate scape of knowledge in which many types of knowledge (explicit knowledge, tacit knowledge, intuitive knowledge etc.) are intertwined. Respectively, knowledge in designing is partially externalized via compound patterns of subjects, objects and mediums which leads to verbal, imaginary and structural expressions specific to the design[2]. In this sense, this paper addresses and discusses "knowledge in designing" as a complex, dispersed, specific kind of knowledge internalized through designerly ways of thinking to some extent and externalized through designerly ways of doing to a certain extent.

On the point that Donald Schön discusses via his concept of "reflection in action", it is not possible to consider any knowledge that is transferred, formed or transformed in designing, independently of the intricate, convoluted processes of

1. Cross, N. (2001) Designerly ways of knowing: Design discipline versus design science, *Design issues*, 17(3), 49-55.
2. Yılmaz, İ. (2018) *Rethinking Design Space in Architecture,* Phd Thesis, Gazi University, 65-94.

reflection and action[3]. In this sense, designerly thinking and doing are integral to each other in terms of the stratifying dynamic loopings between them. Considering the integrity of thinking and doing in knowing through the activity of designing, this paper is structured to open a discussion on the "knowledge in designing". Accordingly, "knowledge in designing" is pointed out as a conceptualization to define a specialized field of discussion regarding the complex structure of knowledge formed within the activity of designing. Concerning this conceptualization, the interrelations between the formation and communication of knowledge in the activity of designing is examined. To hold such an examination in terms of the unpredictable, intricated relationships between thinking and doing, a perspective is opened in the framework of the experimentality of designing. With regard to this, the content created by Gilles Deleuze-concerning experimentalism in context of his philosophy of creation is used to generate an understanding of the structural characteristics and transmission potential of the "knowledge in designing". In the light of this understanding, going beyond the epistemological or the doxological frameworks of knowledge, the validity of the "knowledge in designing" is discussed based on basis of its own dynamics of genesis.

Knowledge in Designing

Design knowledge that is mostly dealt in context of design research or design inquiry, expresses a challenging, complex knowledge structure due to the expansive nature of design. As Richard Buchanan[4] expresses, the subject matter of design has a peculiar indeterminacy and in relation to this indeterminacy, design is far beyond being an instance of subject matter for different disciplines or an applied version of knowledge that belongs to other disciplines. Accordingly, it is impossible to draw rigid boundaries between different design disciplines and to rely

3. Schön, D., (1983) *Reflective Practitioner: How Professionals Think in Action*, United States of America: Basic Books, 128-130.
4. Richard Buchanan refers to Horst Rittel's conception of "wicked problems that he created in 1967. He refers Rittel's idea that wicked problems are a "class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing." And he cites ten properties of wicked problems that Rittel defined in 1972 as "1) Wicked problems have no definitive formulation, but every formulation of a wickedproblem corresponds to the formulation of a solution. (2) Wicked problems have no stopping rules. (3) Solutions to wicked problems cannot be true or false, only good or bad. (4) In solving wicked problems there is no exhaustive list of admissible operations. (5) For every wicked problem there is always more than one possible explanation, with explanations depending on the Weltanschauung of the designer.39 (6) Every wicked problem is a symptom of another, "higher level," problem." (7) No formulation and solution of a wicked problem has a definitive test. (8) Solving a wicked problem is a "one shot" operation, with no room for trial and error. 1 (9) Every wicked problem is unique. (10) The wicked problem solver has no right to be wrong-they are fully responsible for their actions" to discuss the indeterminacy and determinacy in design thinking.
   See Buchanan, R. (1992) Wicked Problems in Design Thinking, *Design issues*, 8(2), 5-21.

on any one of the sciences for adequate solution to design's wicked problems. Furthermore, due to that design spreads over stratified looping of design thinking and doing, design knowledge carries references from both theory and practice. It contains both explicit and tacit knowledge structures. Thusly, it gains access to diverse domains of knowledge depending on the context of the wicked problems it handles. Considering ramification of design knowledge in accordance with its expansiveness, diversifying taxonomies are made to define it better[5]. Within this expansive field of design knowledge, without getting stuck inside the boundaries of any of the domains, the conceptualization of the "knowledge in designing" is proposed to frame an inner core field that can be associated with all the design domains in different ways. This conceptualization focuses on the knowledge that comes into being within the activity of designing. It is a framework to speculate on the partially-cognisable knowledge structures that comes out of the unpredictable interaction within the compound patterns of subjects, objects and mediums through the activity of designing. It focuses on the reformation of the knowledge processed in the activity of designing as something else, rather than the whole set of the knowledge included in the activity or the speculated knowledge produced by interpretations afterwards on the activity itself or on what it produced.

In line with Nigel Cross's concept of "designerly ways of knowing", "knowledge in designing" is discussed as a designer-specific knowledge structure that can be conceived via "designerly knowing". To understand what is "designerly knowing", Salu Ylirisku and Petra Falin's article that constructs a debate on knowing in situated action is noteworthy. With reference to Nigel Cross, Ylirisku and Falin handle "designerly knowing" with its differentiating aspects from design knowledge. They assert that, "design knowing" comprises the interactive properties of knowing in designing. Putting focus on situations in the activity of designing, they claim that all design knowledge (theoretical, practical, phenomenological or any other) can play a role in "design knowing", if it is placed into and having effect in a situation. With this point of view, they define characteristics of "design knowing" as follows: they assert that "design knowing" is driven by value, grounded in expectation, guided by orientation, embodied, both social and material, continuously produced in situation, divergent, context-shaped and context-renewing. Thusly, they move beyond the traditional conception of knowledge as something abstract,

5. Nigel Cross defines design knowledge in terms of people, processes and products which correspond to three design knowledge domains: design epistemology, design praxeology, design phenomenology. On the other hand Ken Friedman defines four domains of knowledge as skills for learning and leading, the human world, the artifact, the environment.
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disembodied, individual, and formal[6]. Considering the explanations of Ylirisku and Falin, knowledge in the activity of designing is conceived as the knowledge produced in context of interactions that take place at the social, material and contextual levels that are constituted in design situation. In line with this understanding, the production of knowledge in practice and the nature of this knowledge constitute a key discussion topic.

In the related publications, knowledge produced within the activity of designing typically dealt in context of practice-led research and the activity of designing is taken as a research methodology. However, as Fredrik Nilsson mentions when he deals with the formation of design knowledge, handling the activity of designing as scientific and critical research activity has problems in itself. Due to the reason that designing is about constructing rather than describing, understanding or explaining, the activity becomes a tool to produce something new within the existing rather than trying to understand something that exists. It works towards creation beyond exploration. In line with this, the activity of designing deals with the local by virtue of the specific, indeterminant subject matter of designing in contradistinction to the activity of researching that seeks for determinations to generalize[7]. In this sense, as Nilsson gives reference to, Eric Stolterman's definition of two ways as "dismantling" and "assembling " to deal with the reality shed light on the subject. Stolterman explains "dismantling" as following the procedure of science to learn how reality functions. On the other hand he expresses "assembling" as creating a changed reality basing on design effort. Accordingly while the first one is about creating knowledge of how thing function, the second one is about creating something that not yet exists[8]. With this point of view, as it is understood from the different ways that the activities of researching and designing use to deal with the reality, these activities work with different modes of thought[9]. While a mode of thought bring knowledge into being tacitly, the other cause it to appear explicitly. Considering tacit and explicit existence of design knowledge, Ken

6. Ylirisku, S. and Falin, P. (2008) Knowing in Situated Design Action, *Design Connections – Knowledge, Value And Involvement Through Design*, Turkka Keinonen (editor), University of Art and Design Helsinki, Working Papers – Työpaperit Publication Series, F 34, 8-17.
7. Nilsson, F. (2007) Forming Knowledge – On Architectural Knowledge and the Practice of its Production, *The Unthinkable Doctorate: Proceedings of the Colloquium "The Unthinkable Doctorate"*, St. Lucas Architectuur, Press Point, 241-250.
8. Nilsson, F. (2007) Design, rhetoric, knowledge– Some notes on grasping, influencing and constructing the world, *Design Inquiries*. The Second Nordic Design Conference.
   See also Stolterman, E. (2004), "Att sätta ihop och plocka isär", M. Koblanck & L. Åberg (eds.) *Designmedvetenskap*, Stockholm: Vetenskapsrådet.
9. Gilles Deleuze and Felix Guattari handle philosophy, science and art as three main forms of thought working with different strategies. In line with this, discussing ways of philosophy, science and art to deal with reality, they mention that philosophy works with concepts, science works with functions and art works with composite emotion . In this sense the activity of researching mostly use the way of science, while the activity of designing can use all the ways in relation to each other according to the design situation it handles. In the light of this understanding, when questioning the relationship between the activities of researching and designing , revealing the ways of thinking they use can provide a reference to connect these activities and what they produce.
   See also Deleuze, G. and Guattari, F. (1994). What is Philoshopy?, Columbia University Press.

Friedman asserts that thinking practice-based research as theory construction creates categorical confusion on knowledge. He affirms that practice-based knowledge grounds on tacit knowledge which arises from behavioural patterns and embodied practice embedded in personal action. Unlike explicit knowledge that enables shared communication and reflection, tacit knowledge is not completely transferable and expressive. Therefore, it is not possible to use tacit knowledge in theory construction without a conversion that turns it into explicit knowledge. According to Friedman, considering design knowledge identical to tacit knowledge and handling practice as a research method cause confusion. He asserts that tacit knowledge and reflective practice in which tacit knowledge is produced cannot be considered as basis of theorizing or researching. According to him, linking the reflective practice of design to design knowledge is a misguided effort[10]. On the other hand, Halina Dunin-Woyseth and Fredrik Nilsson admit that until recently there was a gap between research and practice, and knowledge transfer was problematic. However, they assert that new opportunities have been arising for providing the permeability of various practices such as researching, designing, etc. within architecture and design. Accordingly they put emphasis on ways of navigation in complex knowledge scapes to effectuate a continuum from creative practice to scientific research[11]. Similarly, Salu Ylirisku and Petra Falin mentions about a new understanding of design knowing. In line with this they bring forward the need of focus shift "from domains and types of design knowledge towards systems through which designers achieve or create their knowing in interaction and towards processes which enable and generate knowledgeability in design"[12]. Therefore, beyond considering designing and researching as separate activities, to grasp the activity of researching that shapes up within the activity of designing with its specific nature and to evaluate the knowledge formed within the activity of designing with this point of view allow going beyond problems of direct transduction. In this way, the opportunity arises to explore the levels of formation and communication of knowledge within the activity designing and to discover the characteristics of the "knowledge in designing".

10. Friedman, K. (2008) Research into, by and for design, *Journal of Visual Arts Practice*, 7(2), 153-160.
11. Dunin-Woyseth, H and Nilsson, F. (2014). Design Education, Practice, and Research: on building a field of inquiry, *Studies In Material Thinking*, 11, paper 01.
12. Opcit. Ylirisku, S. and Falin, P. (2008).

Formation and Communication of Knowledge through Designing

Before establishing the discussion on the formation and communication of knowledge, there is a need to explain the existence of knowledge as a form. Although knowledge comes into being in different ways, as Michael Foucault and Gilles Deleuze say, it emerges in a form in every existence whether it is made of matter, words or signs. In Foucault's description, knowledge can be thought as an open system of visible and utterable, in other words material and discursive. According to Deleuze, it is shaped in the mutually complex relationship of the visible and the utterable[13]. To understand knowledge in terms of visibilities and utterabilities it conveys, Deleuze's conceptions of concrete machine and abstract machine are noteworthy. According to him, it is possible to grasp form, in which knowledge is exposed, as a concrete machine associated with domain of physical objects. He discusses concrete machine in terms of the level of the actual over forms of expression and forms of content with reference to his work with Felix Guattari. In this context, forms of expression and forms of content refers to material and meaning that a concrete machine conveys. However, Deleuze and Guattari's discussion goes beyond traditional conception of form and content. Instead of this, they handle the form itself in relation to the transformation of expression and content one to each other. At this point, to explain the transformation and the interaction between expression and content, they bring forward the conception of abstract machine in relation to the level of the virtual and the potential. In this sense, constructing a different type of reality, abstract machine contains the possibilities of many concrete machines. In this way, abstract machines provide many possible directions of metamorphosis consisting of diagrams of force. And due to that they are constituted by diagrams of force, there is no assignable distinction between expression and content in the unformed reality of abstract machines[14]. In this conception, the transduction and connectivity between the tacit knowledge in the material formed by the expression and the explicit knowledge in the discursive formed by the content are explained via the conceptualization of abstract machine. Thereby, in order to understand formations of knowledge tacitly or explicitly within the activity of designing, there is a need to discuss the conception of abstract machine in context of designing.

Abstract machine occupies and traces the plane of consistency as a diagrammatic being of forces. In this respect, Deleuze and Guattari define the 'plane of consistency', as a space of creativity and experimentation which is non-formed,

13. Nilsson, F. (2007) Forming Knowledge – On Architectural Knowledge and the Practice of its Production, *The Unthinkable Doctorate: Proceedings of the Colloquium "The Unthinkable Doctorate*", St. Lucas Architectuur, Press Point, 241-250. See also, Deleuze, G., (2006) Foucault, New York: Continuum, 41-59.
14. Bogue, R. (1989) Deleuze and Guattari, London: Routhledge, 125-163. See also Deleuze, G. and Guattari, F. (2004) A Thousand Plateus, New York: Continuum, 44-83.

non-organized and deterritorialized as being in a state of constant flux. Defining a level beyond the actualized, the plane of consistency is shaped by spreading to virtualities. On the plane of consistency, abstract machine makes new connections between virtualities to actualize them as concrete machines[15]. With this understanding, it is possible to conceive abstract machine as the machine that creates a space of possibilities and potentialities for another machine to come into being that is concrete machine. Keeping this in mind, looking again at Philip Boudon's distinction of design space and design allows for interpreting abstract and concrete machines in terms of designing. According to Boudon design space and design constitutes two distinct levels. When the design move towards the design space that produces it, it has access to a knowledge field that exceeds it[16]. In this sense, design space[17] can be considered as a dynamic space of creation similar to abstract machine in terms of the potentialities it carries. On the other hand design can be considered as a actualized potentiality similar to concrete machine. In that case, the design space creates an interactive, stratified network of connections that provides medium for formation of knowledge. The knowledge that is not formed yet in design space, interacts in the level of virtualities. But when it is actualized into design forms, it becomes tangible and communicable. In this sense, the actualization of design variations as forms within the activity of designing until the design object is created makes the knowledge potential of the design space to some extent accessible and communicable[18].

It is not possible to think of formation and communication of knowledge in designing separately from each other. The formation of knowledge also creates a being that enables the communication of knowledge. Due to that the activity of designing is an activity where design problems and design solutions take place together,

15. Parr, A. (editor). (2010) *The Deleuze Dictionary: Revised Edition*, Edinburgh: Edinburgh University Press, 18-19, 33-35, 37-39, 59-61.
16. Boudon, P. (2015). *Mimari Mekan Üzerine: Mimarlık Epistemolojisi Üzerine Deneme*. İstanbul: Janus Yayıncılık, 15-17.
17. In the thesis "Rethinking Design Space in Architecture", design space, which has been redefined in context of its relationship with architectural space, is defined as a dynamic creation created within the activity of designing and existed only within this activity. Design space, which is defined as a formation that contains creation possibilities of many architectural spaces, is conceptualized through its relationship with architectural space and its differentiating qualities. In this sense, design space, which is widely conceived far beyond all the elements and contents that make up the architectural space, is discussed in terms of its dynamic, versatile and multi-dimensional existence that expands towards the disciplinary fields and is examined in terms of the compound networks of design actors, design objects and design mediums..
    Opcit. Yılmaz, İ. (2018)
18. As Fredrik Nilsson argued referring to Sanford Kwinter, design forms and design object are distinct entities from each other. According to Kwinter form is ordering action, a deployed logic while the object is merely a resulting image of that process.
    Opcit. Nilsson, F. (2007) Forming Knowledge – On Architectural Knowledge and the Practice of its Production
    See also Kwinter, S. (2003) 'Who's Afraid of Formalism?, *Phylogenesis. FOA's ark*, Michael Kubo (editor), Barcelona,:Actar.

design forms are essentially argumentative[19]. Thereby the formation of knowledge in designing also creates a rhetoric that plays an argumentative role in the communication of that knowledge. Discussing the rhetoric in the context of architectural design, Elisabeth Tostrup argues the rhetorical material through both visual and verbal forms[20]. In this sense, the forms of expression and content created within the design space processes the possibilities of transduction of language by establishing rhetoric, besides creating material and discursive languages that allow to communicate. Therefore, the formations of knowledge made within the activity of designing, become determinant in the effectiveness of communication depending on the rhetoric it creates. Opportunities to communicate creatively are also expanded through these formations.

Material and discursive formation of knowledge in the activity of designing makes the transduction between tacit and explicit knowledge forms controversial. However, it is beyond a simple translation problem to make the tacit knowledge explicitly revealed. This creates a conversion problem that shifts that form of knowledge back into the design space and creates it as a new form of knowledge. Therefore, there is no one-to-one transduction between material and discursive. During the transduction of knowledge, the formation that creates it is resolved and shifted to the design space. The information that re-interacts virtually in the design space is reformed by the re-actualization of virtualities. However, the forces that were actualized in the previous form of knowledge differ in their re-actualization[21]. Therefore, the knowledge formed within the design space is a variable knowledge. The transduction and reprocessing of the knowledge in the cycles of thinking and doing makes the knowledge experimental because of the unpredictability of these cycles. With this understanding, it is difficult for the knowledge formed within the activity of designing to establish a consistency that ensures an adaptable framework that can be valid for situations other than the one in which it is formed. Understanding "knowledge in designing" with its variability and evaluating endless forming potentials of being variable can be considered as a unique way of using this knowledge in its own nature. From this perspective, using non-settled "knowledge

19. Nigel Cross and Kees Dorst discuss design space upon the duality of problem space and solution space. With reference to Maher's model of the co-evolution of problem space and solution space, they handle the creativity of designing in terms of the constant iteration of analysis, synthesis and evaluation processes between these two notational spaces. Referencing to Schön's notion of "surprise" that keeps designer away from the routine behavior, leading to framing and reframing through the design processes
    Cross, N. and Dorst, K. (2001) *Creativity in the design process: co-evolution of problem–solution, Design Studies, 22, 425-437*.
20. Tostrup , E. (2009) Tracing competition rhetoric, *Nordic Journal of Architectural Research*, 21 (2/3,2009), 23-36.
21. According to Deleuze actual object and virtual images are the parts of an integral whole that are constantly in interaction. As Deleuze explains it, everything that is actualised is surrounded by a fog of virtual images, and it spreads or swallows virtuals of different levels. Because just like the virtual surrounding the actual, there are other virtualities surrounding the virtual. In this sense, the virtuality circles that surround the actualised object are conceived as a multi-layered structure consisting of virtualities spread over different levels. In this sense, the virtalization of the actualised object via detteritorialization and its reactualization via retterritorialization leads to differentiated forms due to the dynamism of the virtuals.

in designing" in the cumulative production of settled knowledge as a source of change that creates different lines of evolution supports the evolutionary processes of architecture and design knowledge.

Discussion

"Knowledge in designing" expresses the complex structure of knowledge formed and communicated within the activity of designing. It is a nebulated knowledge that is formed of the complex interaction within the compound patterns of subjects, objects and mediums through the unpredictable, intricated, dynamic loopings between designerly thinking and designerly doing. It is partially-cognisable knowledge that is communicated to some extent being externalized via verbal, imaginary and structural expressions of design. It is not the knowledge that the design object or the design process forms but the design space forms. It is formed and communicated in material and discursive forms of design prioritizing the design object. It is the knowledge that is in constant being. Due to the indeterminacy and creativity it hosts, it is experimental. Thereby, the validity of such an experimental knowledge form in the fields of architecture and design is problematic. On one hand, it is not possible consider it as an epistemological entity as it is, due to the variability of its form and the incompetence of the truth it reveals. On the other, considering it as just a doxological entity, causes to ignore the epistemological expansions it can provide. Therefore, beyond questioning the validity of "knowledge in designing" or situating it into frameworks of knowledge, discussing the ways to access and to process its essence can contribute to the issue of producing knowledge specific to design and architecture.

"Knowledge in designing" is an integrative knowledge provided by the activity of designing, which can provide access to the segmented fields of knowledge within architecture, design and beyond. In the course of designing, all design knowledge (theoretical, practical, phenomenological or any other) have the potentiality of having effect in a specified design situation. Complex connections established in a specific design situation arises from multi-levelled interaction that take place at the social, material and contextual levels depending on the multiplicity and variability of subjects, objects and mediums in the activity of designing. As it is expressed in relation to Deleuze's philosophy of creation, the connections established between different categories of knowledge within interaction, dissolve the interacting knowledge and shift them to a level where their expressions and contents are formed that is design space. The knowledge reshaped in design space exists as something other than the knowledge that created it. For this reason, it is not possible to pursue directly the traces of the source of the knowledge formed within the design. However, it is possible to argue that "knowledge in designing" indicates a state of unification that the knowledge of different qualities within and beyond disciplinary fields can integrate. In this sense, the fused, self-referenced essence of this knowledge can be grasped within the design space in which this essence is shaped. Accordingly, design space becomes the essential being of specific time, space and data to create "knowledge in designing".

To question further what forms "knowledge in designing" and how it is formed; to speculate on how to activate "knowledge in designing" for producing knowledge specific to the fields of architecture and design; and to research on communication of "knowledge in designing" in terms of generating knowledgeability in design and architecture, design space constitutes the main research field. With this understanding, to grasp the design space as an interactive creation field built by designers to build their own designerly knowing, and to evaluate the spontaneity and originality of the design processes upon the self-referenced states of knowledge creation provides an insight into the formation of "knowledge in designing". Thus, instead of comparing this knowledge with the existing knowledge structures and questioning its validity, it becomes possible to evaluate the value of the knowledge through its own formation context. Furhermore this kind of insight also provides a basis for discussing the transmission potentials of "knowledge in designing" as a self-referenced, specific knowledge, in the participation in architectural knowledge.

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ACTOR-NETWORK "THEORY": COMPOSING ARCHITECTURAL KNOWLEDGE

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ABSTRACT

This paper aims to put Actor-Network Theory (ANT) on agenda for an insight on the formation of architectural knowledge and investigates how ANT performs in changing boundaries of architectural knowledge, in terms of its approach to issues of materiality and process. Since its outset in the 80s in the sociology of science and technology, having its roots both in the science and technology studies and social studies, ANT has had an important impact on many fields of research, including architectural research. ANT formulates a methodological framework that acknowledges that technology and society are mutually constitutive, thus refuses to accept the material and the social as distinct categories. In architectural terms, ANT perspective would see architecture as a socio-material entity in which the building (as a technological artefact), its author (architect) /user (society) /interpreter (such as architectural theorist) and the socially-constructed relations between them, have no supremacy over other. ANT problematizes the disciplinary boundaries of architecture while redefining architecture as a "socio-technical network" comprised of distributive relations between people and things, or artefacts and actors involved in the material processes, which may be situated beyond the field of architecture. Even though ANT has been called a theory by name, it has been defined by its spokesmen Bruno Latour and John Law more as a set of thinking, or a method of research. In this sense, this paper aims to illustrate how encounters between ANT and architecture problematizes "Theory" of architectural knowledge while suspending conventional distinctions between theory, history, and criticism of architecture. It suggests a "compositionist" way of knowing architecture (with reference to Latour's Compositionist Manifesto) in relation with the shift from "matters of facts" to "matters of concern" in representative Compositionism as a manifesto declared by Latour, is a position with a critical distance from both the modernist and postmodernist ways of knowing, replacing the binary oppositions with the multiplicity of the relations. By virtue of an epistemological position in the "expanded field" of architectural knowledge, this study attempts to illustrate translations of ANT's compositionist method into the architectural theorist's act of composing architectural knowledge.

KEYWORDS

Materiality, actor-network theory, architectural theory, architectural knowledge, compositionism

Introduction

In the past three decades, traditional practices of architecture have been challenged by "other ways of doing architecture", which decentered spatial agency through practices cross-cutting different disciplines. Hence, the field of architectural knowledge expanded, in need of hybrid modes of research entailing interdisciplinary research in the academic world, and transdisciplinary research extensive for non-academic practices as well.

Yet, "other ways of knowing architecture" by means of spatial design, distributed architectural "knowing" outside disciplinary boundaries, altering conventional definitions and hierarchical orders of the objects and subjects of architecture. Material turn in social science, assigning agency to things, fostered relative and speculative production of knowledge, also had reflections in architecture since spatiality of material and social relations between things and people become one shared concern.

In need of a theory convenient to its expanded field of architectural knowledge, actor-network theory as one significant mode of material-semiotic thinking is considered in this paper as an "other way of knowing by doing" for architecture in which theory is performed in/through practice. Since space is regarded as a network constituted by the complex interactions of people and things as act-ants in ANT, architecture as a verb of building and its spatial concepts as metaphors for the structural features of the theoretical and methodological network model, are of great interest for ANT scholars. Taking account of ANT and architecture's mutual interest in each other, this paper proposes to revisit premises of ANT and its translations to architecture, in order to speculate on an ANT-driven architectural theory that will illustrate "new modality of making" in architecture today.

First, this inquiry recalls ANT by placing theory in inverted commas in order to illuminate how ANT registers "theory" and position itself on a relational field having its references in the "material-semiotic method" and the concepts of materiality and, rhizome elaborated by Gilles Deleuze and Felix Guattari.

Secondly, this paper defines the object of architecture as a dynamic socio-technical network and goes through the scholarly works that account for the encounters between ANT and architecture, in terms of how their methodology operates on the production of architectural knowledge. Works of Bruno Latour and Alberta Yaneva are of great importance in terms of translations of ANT to architecture. Yaneva's ethnographic method of writing architecture, by the act of tracking and tracing net-that-works (buildings) unfolds the spatial narrations; ascribing architectural theory a line of "storytelling".

Lastly, referring to Latour's Compositionist Manifesto, compositionism will be brought up for discussion as a way of knowing architecture and in return for the "Theory" of architecture. Bruno Latour's compositionist practices as aesthetical and political stances of bringing things together are overviewed briefly with an intent to propose alternative positions for the architectural theorist.

Actor-Network "Theory": Not a Theory, but a Method

Material Turn, Materiality and the Rhizome

Materiality, as a theoretical concept built upon the work of nineteenth-century phenomenology constituted by Husserl and Hegel. Heidegger's "ontology of being", Bergson's philosophical works on time and memory, Merleau-Ponty's thoughts on perception, and many others also contributed to shaping the theoretical framework. Materialism was developed in reaction to the classical humanist Western thought of an asymmetrical human-centered world-view which resulted in the dominance of the human rationale over nature (also has an impact on global crises today), and brought direct criticism on the hegemonic and destructive of so-called humanism by assigning a new ontological way of looking at the "material". Materiality or the new materialism" also differs from the historical materialism of Marx in terms of its definition of the "material". While historical materialism defines matter as "hard physical stuff occupying a discernable point in space and time" and eliminates everything in the universe that does not fit the materialist model (Graham, 2017, 135), new materialism suggests a "flat ontology" with a broader view of the material, on which all material, social and abstract entities are present in relation to each other. (DeLanda 2004, 58). The concept of materiality gave rise to new ways of thinking and writing about things –bringing fore the "thingness" of things in Heideggerian terms, and "proposes we question critically how material, physical, and formal qualities of things—manmade or natural, visible or textual, representational or non-linguistic—solicit, organize, and participate in our historical, cultural, and existential realities" (Vranic, 2017).

Materiality cannot be reduced to a single approach or idea but can be a traced back to different theoretical approaches, such as time-geography, space syntax and socio-materiality in the 1970s and 1980s; material semiotics and actor-network theory (ANT) in 1980s and 1990s; object-oriented philosophy and vibrant materiality in 2000s. (Kärrholm, 2014, 65). Sociology, anthropology, and literature were among the pioneering disciplines taking materiality into consideration and acknowledging the agency of things, such as objects of everyday life, documents, works of art or architectural artefacts in evidencing for/contribute to the immaterial things through their connections and relations with human or other non-human existential realities. As a biological term given a philosophical twist by French philosophers Deleuze and Guattari (1976;1983;1986), "rhizome" has been of great importance as a theoretical concept that portrays the decentered-structure generated by the multiple, entangled and unpredictable connections and relations between things, people and places; in relation to materiality which tries to explain how they are assembled.

Actor-network theory, this paper intends to revisit, is considered influential and remarkable for its approach to materiality. ANT owes much to philosophical assemblage thinking of Deleuze and Guattari while its notable concept of "network" makes reference to "rhizome". In A Thousand Plateaus, Deleuze and Guattari manifest the principal characteristics of the rhizome as such:

> It is composed not of units but of dimensions, or rather directions in motion. It has neither beginning nor end, but always a middle (milieu) from which it grows and which it overspills. It constitutes linear multiplicities with n dimensions having neither subject nor object…Unlike a structure, which is defined by a set of points and positions, with binary relations between the points and biunivocal relationships between positions, the rhizome is made of only of lines: lines of segmentarity and stratifications its dimensions, and the line of flight or deterritorialization… (Deleuze and Guattari, 1988; 2004, 23).

Like assemblages of rhizome, connections of infinite productions and reproductions of connections, ANT is also interested in the processual nature of assembling the social and the material, and the decentralized forms of socio-material networks "[t]here is no social order. Rather there are endless attempts at ordering (Law 1994, 101). With reference to Deleuze and Guattari's post-structuralist world-view that suspends the dichotomies of traditional Western philosophy, Bruno Latour enhances the issue of materiality by adopting a semiotic approach towards things (from the realms of science and technology particularly), defining them as "hybrids of objects and subjects".

Clarifications on Actor-Network "Theory"

Actor-Network Theory, which was developed by Bruno Latour with Michel Callon and John Law, is entitled in relation to material-semiotic method, which maps the "material relations between things" and "semiotic relations between concepts" simultaneously. In material-semiotics, "things/non-human" or "materiality" is relationally operative, as are "subjects". In other words, as relational consequences or reasons of situated practices, both the subject/human and the materiality/non-human are active in the construction of actor-networks (Beetz, 2016: 109). Having made its appearance in Science and Technology Studies (STS), ANT share many concerns with Deleuze and Guattari's assemblage thinking but its references reach out for various fields of knowledge: sociology, philosophy and semiotics and their relational positions taken by sociologist Gabriel Tarde, philosopher Michael Serres and semiotician Algirdas Greimas, all of who suggested an order without hierarchies, of heterogeneities and associations. In Latour's material-semiotic approach, "[t]here is nothing outside associations, and to become capable of action, entities need to form aggregates and find allies to produce an actor-network" (Müller, 2016, 30-31).

Two decades after he developed ANT, Latour recalls ANT and questions the very substantial terminology that constructs the name of his thought: network. He draws attention to the ambiguity that the word network brings along due to its two common use; first, as a technical metaphor having its connotations for energy, transportation, and communication, latter as a human-centric representation of sociology of organization that calls for the assemblage of human agents rather than markets or states. In the book Networks, Larsen argues that, long before its associations with the technological terminology, the network was a concept proper to post-industrial society of the twentieth century. Larsen points out the word's sociological connotations: First, 18th-century economist and philosopher Adam Smith who is also known as the father of capitalism, used network for the supply chain; later Jürgen Habermas defined his conceptualization of the public sphere as a network, which he introduced as a domain of social life where public opinion can be formed (Habermas, 1991, 398); further in media theory "discourse network" was defined as "the network of technologies and institutions that allow a given culture to select, store, and process relevant data:"

> Networks offer a unique perspective on structures and fault lines where the fact based and the speculative, the historical, and the non-human encroach on one another. Cosmologies are embedded in networks (Larsen, in Networks, 12).

Latour dates back further the word "network" on Diderot's use the word *réseau* "to describe matter and bodies in order to avoid the Cartesian divide between matter and spirit." (Latour, 1996, 370) In order to make clarifications on how "network" operates in ANT, he offers simply putting together the elementary properties of "nets" and actors that work. Latour states that:

> There is not a net and an actor laying down the net, but there is an actor whose definition of the world outlines, traces, delineate, limn, describe, shadow forth, inscroll, file, list, record, mark, or tag a trajectory that is called a network. No net exists independently of the very act of tracing it,

and no tracing is done by an actor exterior to the net. A network is not a thing but the recorded movement of a thing. (Latour, 1996, 370)

In his emphasis on the processual nature of the network, Latour puts emphasis on the "net-that-works" indicating the actions taken by the act-ors (be human or non-human) and addresses how a "theory" of a network would operate. In order to clarify the theoretical performance of ANT and state the advantages of thinking in networks, Latour re-articulate the characteristics common to all the networks by raising three conditions of which three spatial dimensions are suspended: far/close, small scale/large scale and inside-outside. In the first case, a network eliminates the notions of distance or proximity since the conditions of connection or disconnection designates how far or close the elements are: "[e]lements which are close when disconnected may be infinitely remote if their connections are analyzed; conversely, elements which would appear as infinitely distant may be close when their connections are brought back into the picture" (Latour, 1996, 371). Secondly, the notion of network (Latour's reference to Tarde) is freed from the macro/micro dichotomy (Latour's critique of classical social theory which implies a top and a bottom for societal orders) and the scale of it is a consequence of the connectedness of the actors. Latour draws upon the compromising position of network thinking as such: "Instead of having to chose between the local and the global view, the notion of network allows us to think of a global entity -a highly connected one- which remains nevertheless continuously local..." (Latour, 1996, 371). The third spatial dimension suspended in the network is the inside and outside; yet "a network is all boundary without inside and outside…it is not a foreground over a background" (Latour, 1996, 372). These clarifications of Latour on the "topological outline" and of the network and the above-mentioned spatial metaphors are of great importance for this paper in its aim to reclaim the relevance of this particular model to architectural theory today.

In the same way with the term "network", Latour tries to clarify the term "actor because of its association with the human intentionality in the Anglo-Saxon tradition. If conditioned with this meaning, an actor would imply human individual who takes on the might of building a network for himself and make it powerful with the act of "networking"(Latour, 1996, 372). However, as it is used in ANT, an actor is defined in semiotic terms and also appear in the vocabulary of the theory as "actant" that gets into the action, the action of whom is designated by other actants (a term that is symmetrical in terms of capturing all entities that exist.) The social world, rather than being merely the Social, is a complex world of "time, space and dynamic network of relationships" reproduced and maintained through the unsettled interactions of people, things (Latour, 1997).

In the title of this subchapter, "Theory" is put into inverted commas, in order to hint at the still ongoing controversies on the ANT's status as a theory in the academic realm which was elucidated by the ANT scholars Latour and Law as well. As declared by Latour (2005) and Law (2007), ANT is not a theory but a method; not a thing to apply but the tenets of which we follow. ANT as a method, as "a different mode of social inquiry" (Latour, 2005), allows the researcher to follow the actors of research interest and traverse in the network by tracing the ordinary interactions between connected actors while also collecting records of these interactions that show the researcher how actors mediate through the connections they make (Wessels, 2016, 352). Since ANT operates on practice, on empirical case studies of networks (Law, 2007), it cannot be portrayed solely in abstract but also in the "fieldwork." In this respect, Latour calls himself an ethnographer (in Laboratory Life, Latour and Woolgar, 1986), which tells a lot about his tendency to favor method and enquiry over theory (Latour, 1988). He defines his method "a fusion of philosophical ideas with empirical, ethnographic fieldwork…the best way of testing lots of skills and lots of arguments. Learnings form the people involved in the field…" (Latour, Perspecta 44, 65). Law also ascribes ANT a methodological status in terms of its descriptive nature rather than being foundational. He claims that ANT "is a toolkit for telling interesting stories…about how relations assemble" (Law 2007 in Yaneva, 2013, 4). With regards to the network's in-betweenness in terms of scale, each assemblage "locally" builds its narration on its own scale and when the researcher reassembles them, she is exposed to different narrations rather than one univocal theory. As Alberta Yaneva states:

> As those 'interesting stories' unfold, we find implicit theories that come right from the actors' worlds and are told with their native words. So, the use of an ANT methodology does not lead to the generation of one foundational Theory, but inevitably generates many new implicit theories that are better suited to explain the actors' world-building activities (Yaneva, 2013, 4-5).

Fieldwork, as in Latour's modes of investigation (as in Laboratory Life or in Aramis), in line with the method of tracking and tracing "complex arrangements to reveal the implicate, unforeseen elements and practices that constitute them", followed by the constant assembling and reassembling performance of the "ethnographer", leads to "the production of new knowledge – knowledge which, almost by definition, has a sense of surprise or unpredictability" since (Austrin, 2005, 148).

Actor-network theory, without designating disciplinary boundaries since there is no inside or outside for the complex networks of knowledge; without asserting a meta-theory but local-theories since there is none settled scale; or without assigning the actors or actants a pre-defined position since the distance between them is relative in terms of their indeterminate connections; could be considered "a way to travel from one spot to the next, from one field site to the next" (Latour, 1999:21 in Austrin, 2005, 150).

Encounters between ANT and Architecture: Building" as a World-Making, Theory as a Storytelling

Since architecture is both a profession and a discipline, having entangled relations with the world, it is inevitably engaged with different forms of knowledge produced by/through theories and practices of various disciplines. Following the tenets of ANT and its theoretical and methodological model network, "architectural theory" becomes a performative act cross-cutting disciplinary and non-disciplinary fields of knowledge. A more "relational" knowledge in an "expanded field" needs to be acquired, where both the architectural and not-architectural objects are considered as networks with no inside and outside, their assemblages become that field of lines, a boundary itself, where the "theory" wanders about.

Latour expresses his disbelief in the field; although he has been actively engaged with his works on "questions of modernity, anthropology, social theory, geography, and architecture recently, he positions himself somewhere in the middle of all those disciplines, having no field. According to Latour, acknowledging architecture is "building" in its literal terms, the practice of making buildings has always been in between different fields, despite architecture's claim for a field-specific to it. Latour considers social theory as metaphors about the idea of building, however, finds them those metaphors to weak in comparison with the actual building (Latour, 2011, 65). In this sense, Latour's statement implies a turn to the actual objects of architecture, buildings, and the material relations that constitutes it; also a turn to the act of architecture, building, in which "agency is distributed across a whole set of practices" (Latour, 2011, 66) This paper follows the traces of how "object" of architecture is redefined through the ANT perspective, and in which ways alter the production of architectural knowledge; while reassessing architectural theory over the self-reassessed theory of actor-network.

In their essay "Give me a gun and I will make all buildings move": an ANT's view of architecture" Latour and Yaneva (2008) problematizes the static view of artefacts, by relating to the nature of the Euclidian space of architectural representation. Recalling the "gun" called by the authors in the title of their remarkable article refers to the French scientist Etienne Jules Marey's chronophotographic method -or the photo-graphic-gun in Latour and Yaneva's terms- with which Marey captured multiple phases of a continuous flow of movement in one single format. The authors make reference to Marey's chrono-photography (Image 1) in need for a device capable of depicting a building as "a moving project and that even once it has been built, it ages, it is transformed by its users, modified by all of what happens inside and outside, and that it will pass or be renovated, adulterated and transformed beyond recognition". (Latour and Yaneva, 2008, 80) Since, both the Euclidian space of drawing and the photograph fail to capture the flow of transformations of buildings and bypass too many dimensions, Latour and Yaneva calls for "an artificial device" in order to transform the fixed view of artefacts, a "theory" that would not reduce them to what they are and what they mean as in the case of traditional architectural theory, but would infer how they act in which material relations, in a more complex ecology where human and non-human entities coexist.

In this regard, ANT view of architecture brings "object" and "theory" of architecture into question and suggest that "architectural theory" should be "tracing pluralities of concrete entities in the specific spaces and times of their co-existence, instead of referring to abstract theoretical frameworks outside architecture" (Latour and Yaneva, 2008, 88). Thus, it would be a field itself germane to multiple materiality and agencies and define a field of knowledge with multiple boundaries.

Architecture is concerned with buildings and the materiality of the environment, which encompasses not only the material relations that constitute buildings and urban constructs but also the connections with the people who inhabit those spaces (Nilsson, 2007, 247). Since architecture is both a discipline and a profession, it is engaged with broader concerns on the social world. "It, therefore, seems obvious that hybrid modes of inquiry are part of the knowledge landscape…" (Douchet and Janssens, 2011, 4). In the questioning of modernist thought (since his seminal book We Have Never Been Modern, Latour suggests a methodology that considers space as a series of coexistence and cohabitations:

> I made the argument that we are moving from the time of time to the time of space. So, in the time of time, which was really the modernist dream, you destroy the past and then you have something else... But now we are in the time of space in the sense that cohabitation of all of the things that were supposed to be past are now simultaneously present (emphasis made by the author) (Latour with Ghosn, Jazairy, and Ramos, 2008, 124).

In order to illustrate this simultaneous presence of "things", in the time of space, Latour proposes the notion of "matters of concern". His methodology calls for a move from "matters of fact" as a scientific category of things, to "matters of concern" that overarches the material, social, political, and ethical dimensions of things; a move that he calls "controversies." According to Latour, "[a]rchitecture is now about building as a contentious object", (Latour with Ghosn, Jazairy and Ramos, 2008, 125) as a space of controversies, therefore the field of architectural knowledge has become more contentious as it is "coextensive to whole fields of practices." (Latour with Ghosn, Jazairy and Ramos, 2008, 128-129) In this sense, an ANT-driven architectural "theory" would be a method of writing or visualizing those controversies.

Alberta Yaneva, notable for her scholarship on the translations of ANT in architecture and her pragmatic perspective to the material environment, approaches buildings and design objects as "socio-technical devices that mediate our actions" and illustrates the ways "ANT shows how every single technical feature of an object accounts for accounts for a social, psychological and economical world" (Yaneva, 2009, 276). Referring to Madeline Akrich and her socio-technical analysis of objects, Yaneva redefines the technical object as a world itself in which each technical feature works in the socio-material "net" he has partaken. Referring to his scholar work on materiality in terms of architectural and urban design, architect Mattias Karrhölm's elaboration and appropriation of ANT is visible through his focus on spatial artefacts' role both as networks and as actants. Namely, in Karlhölm's case, a wall as a spatial artefact and a network itself can generate different effects of territoriality as an actant in relation to its associations with other actants. Architectural theorist Sanford Kwinter, with an object-oriented perspective, defines buildings as a practice in terms of "particular clusters of action, affectivity and matter" together. Each definition of the architectural object challenges the static and reductionist view of it while implying a world-making process, together with the production of a more complex ecology of knowledge.

To speculate on an architectural theory that learns from ANT as a method of inquiry, it is important to refer back to Latour and Yaneva's essay on architecture in which they address the challenging act of documenting a building as a "flow of transformations." What the authors seek is "not to represent but to document a building as having its own line of flight through its controversies, its prior and ongoing constructions, its cohabitants, and its abundant written descriptions." (Boyle, 202) Yaneva, as previously mentioned, appropriates method of ANT by means of writing the "interesting stories" that the building unfolds, through her fieldwork where is positioned as her self-observer, tracing and describing the ways others' and her own daily practices and the design objects/spaces interacts and mediates. (Yaneva, 2013, 4-5) This is how Yaneva theorizes architecture, as an ethnographer who engages in a day-to-day ethnography of the building, and as a storyteller on the network that makes the building work. (Yaneva, 2013, 10) Latour is deeply concerned with not only writing but also visualizing the space of "controversies" or "matters of concern", that tells a lot about his engagement with architecture and interaction with the architects recently. He states that "Architect know how to visualize…We live in controversies and yet we do not know how to spatialize them." (Latour with Ghosn, Jazairy and Ramos, 2008, 125) In this way, both Latour and Yaneva is calling for a theory of architecture –as a dynamic composition of actions and mediations, which they perform by means of the act of writing, in visual or literary forms of it.

Compositionist Ways of Knowing Architecture: Theory Performed

Regarding the meaning of composition as a method of writing, it is possible to set up a relation between the writer of the composition and the architectural theorist. Building upon the re-definitions of the architectural object and the field with an ANT view, and considering ANT as a performative method in which theory and practice are merged –traversing networks as a practice of theory-, compositionism is represented as a way of knowing architecture and its object as a complex world itself, a composition already. As previously portrayed, the method of ANT is related to the act of storytelling and giving forth theories from those "interesting stories"; curating and mapping what is known to architectural space can be ANT driven compositionist modes of storytelling.

In "Some Experiments in Art and Politics", Latour re-reads the installation work of Thomas Saraceno, which was exhibited in 2009 at the Venice Biennale (Image 2). Latour uses the work that is made of elastic ties that form nets and spheres, as a metaphor for his methodological model. According to Latour "[w]hat Saraceno's work of art and engineering reveals is that multiplying the connections and assembling them closely enough will shift slowly from a network (which you can see through) to a sphere (difficult to see through). By means of this model as a metaphor, Latour introduces "composition" as a solution to the binary of modernism/postmodernism. For the purpose of avoiding modernism in which hierarchy moves from larger parts to smaller parts with a centralistic approach, as well as postmodernism where neither local hierarchies nor homogeneous principles exist, Latour draws attention to the necessity of a prevailing language for the whole model. At this point, he chooses the word "composition" to reassemble all these spheres, networks, and connecting pieces. Latour notes that:

> This concept plays the same role as Saraceno's percept of elastic tensors. It allows us to move from spheres to networks with enough of a common vocabulary, but without a settled hierarchy. It is my solution to the modern/postmodern divide. Composition may become a plausible alternative to modernization. What can no longer be modernized, what has been postmodernized to bits and pieces, can still be composed (Latour, 2010).

Hallsall (2016), in Actor-Network Aesthetics, defines Latour as a contemporary artist. According to the author, a contemporary artist as an actor interacting with other heterogeneous actors is a part of a network, where she collects and re-assembles pieces convenient to her way of making to translate them into a form of artistic production. Hallsall draws attention to the resemblance of Latour's method and of the contemporary artist. Most importantly, Hallsall claims that Latour blurs the disciplinary boundaries and puts into practice a "theory performance", hence reassembling different divergent grounds in compositions (Hallsall, 2016).

In his article An Attempt to a Compositionist Manifesto, Latour asserts that the "composition" is a nice word since "it underlines that things have to be put together (Latin *componere*) while retaining their heterogeneity" and he explains his preference for his use of composition with an –ism, in line with his intent to give his argument a manifesto character. Apart from the word's etymological origins, Latour draws attention to other relatives the word such as; "composure" having correspondences in art, architecture, theatre, music, and dance; or "compromise" that calls for a deal between different parties. Compositionism –as a manifesto declared by Latour, is associated with a simultaneous act of searching for and constructing a universality, without any belief in the availability of it waiting to be unveiled and discovered. Therefore, composition constructs a common ground while asserting that this ground will never be a univocal one in terms of its heterogeneous parts, producing a form of composed knowledge.

Accordingly, it is important to emphasize Latour's compositionist theory performances concerning space, and his recent curiosity and engagement in operating in different media. Mapping is one theory performance of Latour, which he demonstrated in his Paris: Invisible City (2006) by means of the "web" as a medium: "In the virtual book I did on Paris, I have been trying to be innovative in the way one experiences a city", notes Latour on his work, in which he worked in collaboration with the photographer Emilie Hermant to construct a visual narration of Paris and the latent networks of its spatial controversies. By his statement"[i] was interested in doing an experiment of printing an impossible-to-read book, and then doing an impossible-to-read web site, to frustrate traditional ways of vision" (Latour with Ghosn, Jazairy and Ramos, 2008, 125), Latour calls attention to the impracticability of seeing the city as a whole, while visually telling different stories about temporal materiality that constitutes spaces and bringing them together would compose matters of concern in a different representational way.

Curating is another theory performance of Latour, which could be traced in his composing of the exhibition Making Things Public (2005) in collaboration with the artist and the art theorist Peter Weibel (who is also the director of Zentrum für Kunst und Medientechnologie (ZKM) where the exhibition took place). Regarding Latour's argument that politics is about things and "making things public" is the way to translate thing into "matters of concern" This curatorial project is an "assembling" of "more than hundred writers, artists and philosophers rethink what politics is about" by means of multiple media (Latour and Weibel, 2005) The exhibition is itself a public space, which is composed of "things" and the public coexist and cohabitate. Latour and Weibel as compositionist curators, spatially brings together matters of concern uttered by multiple storytellers, that exhibits their form of composed knowledge.

Compositionist practices of Latour briefly mentioned above and of Yaneva's compositionism as a writing act referred previously, give an insight on compositionist ways of knowing architecture, expanding positions and methods of the architectural theorist that would associate thinking on architecture with the thinking on socio-material networks. Architectural theorist, as a compositionist, "makes knowledge by describing and assembling", a "…knowledge…always common but also always provisional…a-truth-for-now" (Birkhead, 2012, 141 in Cooper, 2015, 185). Yet, "knowing, itself, is a doing. By practice" (Boyle, 2015, 203).

Concluding Remarks

Architectural design is concerned with the design of spaces of cohabitation and coexistence; spaces of different contexts and scales, from conventional modes of practices as buildings and infrastructures, to recently-accepted-conventional modes of spatial practices as temporary structures and interventions in architectural or urban scale, and exhibition-making, spaces of which are symmetrically inhabited by architectural structures, natural phenomena, and people and constantly evolving through organized/disorganized inter-actions. Such complexity of socio-material relations, infinite stories written with the lines of complex networks, thereby, calls for new research methods as a watchful eye capable of unraveling the networks of connections that are not visible at the first glance. "Making visible, or representing and making public are one fundamental challenge of architecture, to shape a new aesthetic of matters of concern, to devise new ways to problematize and be interested and to represent and being re-presented" as ANT scholar Cristiano Storni (2015, 168) discusses, implies the essential status of the architectural theory as a performative method, as a mode of re-presentation (literary or visual narrations), as criticism, as politics of things or matters of concern in Latour's terms.

In terms of method, Latour's compositionist work with ANT points out that tracking, tracing, writing, assembling, mapping to make things and associations visible or invisible, curating to assemble and reassemble relatively far things and spaces together, are all diverse compositionist ways of knowing and well convenient to the call of architecture for a method, a theory. Since Latour's methods also share grounds with methodologies and practices of other disciplines and fields, such as ethnography, anthropology, literature, geography, or art, a method proper to architecture would only be different to its matters of concern. This paper argues that despite being an almost forty-year-old “theory”, actor-network theory is still the most prevailing and inspiring one for architecture, promises outright methods as the worlds they illuminate change.

IMAGES, CHARTS OR GRAPHIC LEGENDS

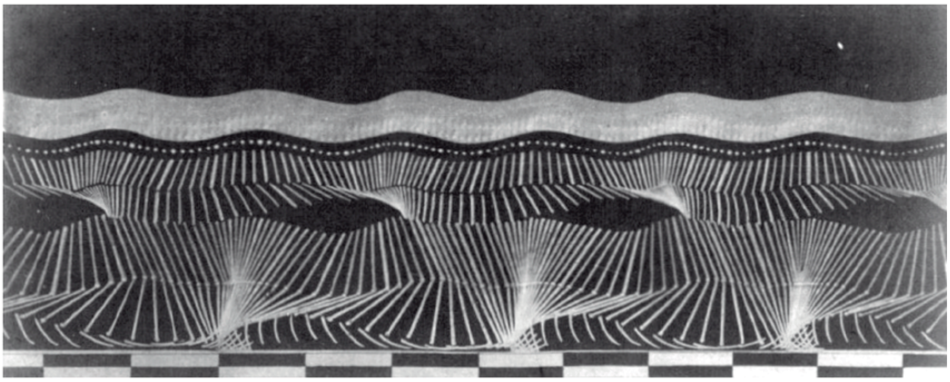

Image 1: Étienne-Jules Marey, Walking Man, chronophotography, 1884. Body of a person walking added reflective markers on.

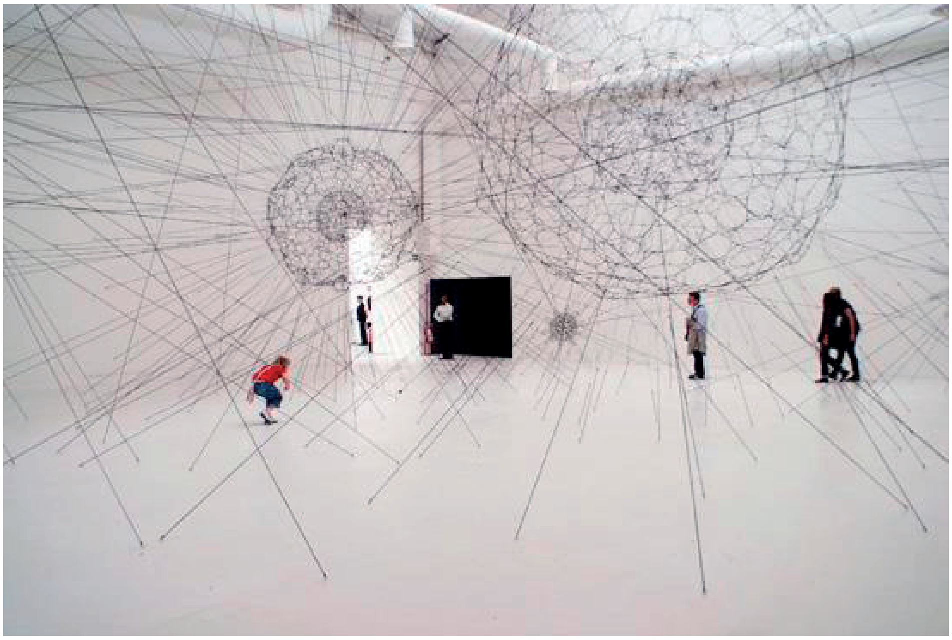

Image 2: Tomas Saraceno, Galaxies Forming along Filaments, Like Droplets along the Strands of a Spider's Web (Saraceno, 2009)

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CHAPTER IV


learning
course
workshop
domain
concept
embodying
space
collective
environment
students
device
emotional
basic
temporary
alternative
experience
visual
trade
critical
bodies
process
creative
narrative
studio
stage

INTRODUCTION

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Architecture is capable of realizing ideas. It does not exclude the most common way of doing architecture for representation, illustration, symbolization, or just building. Architecture brings ideas into existence as solids and voids in their own materiality. As a part of genius loci, this kind of materiality accumulates and makes sense without explicit exposition of immaterial content. It is the philosophers' stone for architects in their quest to develop their technical knowledge and previous learnings about the history of other architects, buildings, and currents, to a possibility of phenomenological experience.

Architectural education formally and/or informally amplifies the "idea" of architecture through reflecting upon, exploring, inventing, grasping, feeling, or experiencing space, thinking spatially, and acting spatially.

The following three studies will introduce inspiring experiments in their quest to "an" architectural knowledge. They present various experiments investigating or encouraging the students to investigate and reflect on the spatial design via their bodily, sensory, and mental interaction with/in space. They are, in a sense, exploring the direct reflection on and of design learners. The authors endeavor to reveal, depict, and reflect on how to realize their theoretical constructs. Their constructs are multi-layered. They unfold precious ideas about architectural learning, architectural teaching, body, space, phenomenology, and production of space in different scales and modes.

The authors present how their initial conceptual constructs or semi-structured experiential learning environments motivated the participants to elaborate and digest that "an" architectural knowledge in/to new forms of knowledge of participants. They invite us to share their journey. I suggest readers let their creative imagination to expand what had been shared here, rather than a critical investigation of student works or ideas realized through architectural production in various modes and forms.

A PHENOMENOLOGICAL STUDY ON ARCHITECTURAL EXPERIENCE AND DESIGN

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ABSTRACT

This study is a discussion on the experience of the architecture in order to have a critical look at today's understanding of visual narrative based architecture. The visually oriented culture of today imposes an understanding that the visuals tell the main story. The visual narrative of architecture starts with the first sketches of the concept design, continues with the renderings, and ends with the first photographs of the newly constructed building. On the contrary, even after this, architecture continues to exist and more importantly becomes an important part of human life. The architecture that is dependent on human experience and life is somehow allocated within the visual narrative.

While the architecture is inseparable from the lives of humans, architects are no exception. The experience of architecture merging into everyday life is becoming a part of the architects, and possibly their designs later. Within this context, the aim of the study is to observe the experience of architecture, and its possible relation to the design of architecture through the critique of visual narrative. In order to question the qualities involved in the experience of architecture, and their possible effects on the design process, a two-stage workshop has been carried out with the participation of Istanbul Technical University architecture design students. In the first stage, the students experience Taşkışla architecture faculty building and prepared representative works of their experience. In the second stage, they design an architectural experience based on their experience from the first stage. The results of the workshop will be discussed parallel to the theories on the phenomenology of architecture and a comparative analysis of the case study will be represented.

KEYWORDS

Architecture, phenomenology, experience

Introduction

The visual narrative dependency of architecture is very much parallel to the conditions of today that the visuality is accepted as the equivalent of existence. Kelley (2005) suggests that after the agricultural, the manufacturing, and the information community, now came the "era of images". He claims that the images could be an effective way for the busy people of today. According to how this era of images is shaped, it can be helpful and time-saving or ineffective and useless (Kelley, 2005).

In the case of architecture Naegele claims, "In the current age of hyperreality, an architecture that represents representation might be seen to serve as a cultural continuum, for it embodies the very essence of the age" (Naegele, 2005, p. 111). Whereas, Pallasmaa (2005) criticizes the current mass production of visual imagery in architecture as it takes away the experience element and turns into a false perception. These images tell a false story of architecture that is driven further away from the everyday experience of architecture that human involves. This creates an image of architecture that is devoted to watching. Debord (1994) explains this contagious way as: "Everything that appears is good; whatever is good will appear" (p. 15). The reflection of this understanding can easily be observed through the representations of the architectural designs. The renders, photographs, and one-liner conceptual mottos used in these representations encourage the same understanding (Loerakker, 2013). According to Debord these "images detached from every aspect of life merge into a common stream, and the former unity of life is lost forever" (Debord, 1994, p. 12). In a world of these contextless images, we are forced to be the viewers rather than engaging in the experience, the creation, the production.

Within this context, Boer asks the question: "What the actual life of a building might look like" (Boer, 2018). This visual narrative of architecture emerging from the initial conceptual design sketches, continuing through the renders on the construction stage, and finalizing at the building's opening day with the photographs taken is not representing an important part of the lifetime of architecture (Boer, 2018).

Zumthor says, the home we grow up, the school that we go to every day, the city and its architecture shape us and become a part of us (Zumthor, 1999) While architects are shaping the architecture through design, the existence of architecture that is lost on this visuality keeps shaping us. It is a continuous interaction happens in time. It is a dialogue between human and architecture through the experience. On the other hand, in this age of images, architecture becomes an object to look and to appreciate but not to get involved.

Pallasmaa (2005) explains the vision as a sense of distance. While putting the distance as the viewers, we do not only disassociate the images of architecture, but we also cut ourselves from the experience of architecture. While Rasmussen (2010) tells the work of an architect is like the work of a theatre producer. They create a stage for their actors, involving in many different scenarios of life. On the contrary, today is a world where the actors only watch. Then, they do not need a stage, but an image to look at. The lack of interaction and mutuality creates a monologue of visuality, while humans are the viewers rather than the actors. This contradicts the essence of architecture that is to be experienced.

Context of the Study

The experience of architecture has been a topic of the phenomenology of architecture for a while. Seamon (1979) explains phenomenology as a descriptive discipline. He says: "It attempts to question radically the taken-for-grantedness of life-world and theories developed" (Seamon, 1979, p. 21). This approach of phenomenology is very critical in the case of today as not taking the visual narrative as a fact but questioning the experience of architecture.

Rasmussen (2010) suggests that architecture creates a frame for human life, just like the stage of a theatre. While Pallasmaa (2005) explains that within the experience of architecture: "space, matter and time fuse one singular dimension, into the basic substance of being, that penetrates our consciousness" (p. 72). This architectural experience definition penetrating through life has been also associated with the design process of architecture. Zumthor (1999) suggests that one's understanding of architecture relies on their "biography" that is beginning from their childhood without even knowing the term architecture. Pallasmaa (2005) discusses that an architect designs with their senses and perception of self. He says through the design process of architecture: "a powerful identification and projection take place" (p. 12).

This overlapping interplay in between implies that the architectural experience affects the design process of architecture. It suggests a relationship between the experience and the design of architecture. Therefore, not only architects shape architecture with their design, but also architecture shapes the architect with its real-life existence. In this study, not only the experience of architecture but also its effect on the design process will be forming the main context.

Firstly, while working on these two main topics as the experience of architecture and its interplay with the design process as the main context, the discussions will be brought within the literature review on phenomenology and phenomenology of architecture. The phenomena of architecture will be discussed.

Secondly, it will be analyzed through the architectural experience itself. A workshop study of architectural experience will be presented to observe the architectural experience of today as well as its relationship with the architectural design. A two-stage workshop study corresponding to the architectural experience and design process has been planned. Within this context, the experience of architecture and its effect on the design process will be discussed through the participation of ITU architecture students in the workshop.

Grounded Theory method will be used, through this process. It is described as a flexible methodology: "when little is known about a phenomenon; the aim being to produce or construct an explanatory theory that uncovers a process inherent to the substantive area of inquiry" (Birks et al, 2019). This methodology will allow learning from real-life architectural experience. The experience data of the workshop will be used in a comparative analysis among data of the participants and the theories brought through the literature review.

Literature Review

Phenomenology has been defined as: "the study of structures of consciousness as experienced from the first-person point of view" (Smith, 2018). In the early 1900s, Edmund Husserl who is accepted as the founder of phenomenology worked on the consciousness in experience. He stated that consciousness is intentional since it is directed towards something. While he takes the intentionality as the central structure of the consciousness, the something that the consciousness is directed is the phenomena as the "appearances" (Smith, 2018). Husserl's approach involves the idea of "bracketing" as suspending the pre-judgments and assumptions about the world to focus on the analysis of consciousness of the experience. This method is called the "epoché" that is not questioning the existing world but focusing on the conscious experience (Behnke, n.d.). Later, Heidegger as a former student of Husserl claims that there is no possibility of bracketing. The experience cannot be separated from being in this world "dasein", so one can only interpret. He states: "to let that which shows itself be seen from itself in the very way in which it shows itself from itself" (Heidegger, 1962) His statement is that the experience is biased, and bound to being as "dasein", thus through experience a constant revision of a pre-understanding happens. This is called as "hermeneutic circle", while hermeneut meaning interpretation in Greek, the term refers to the constant movement from the object to be understood, to the person understanding then back to the object. It is a constant revision of the interpretation.

Then in the 1940s, Merleau-Ponty discusses the phenomenology of perception, offering an ontology of perception. He focuses on the role of the body, while he is resisting the mind-body dualism of the cartesian approach. He states the embodiment is a given (Smith, 2018). He creates an innovative vision of phenomenology. He stands against the idea of intentionality and develops operative intentionality, which is announcing oneself to the world. He states the perception goes beyond the subjectivity and get an optimal grip of reality. Like Aristotle's claims keeping acting, experiencing, and making mistakes will let one the person of practical wisdom eventually (Smith, 2018). "Inside and outside are inseparable. The world is wholly inside, and I am wholly outside myself" (Merleau-Ponty, 2005, p. 363). Merleau-Ponty suggests his idea of "chiasm" that is objecting to the traditional mind-body, subject-object, or self-other dualism. He says when someone presses two hands together the roles are interchangeable, the touched and the touching can be either of them.

This vague emergence forms a new setting as his "chiasm" idea where the perceived and the perceiving are not two separate things (Merleau-Ponty, 2005).

Reynolds explains the chiasm suggested by Merleau-Ponty as: "Rather than involving a simple dualism, this divergence between touching and being touched, or between the sentient and the sensible, also allows for the possibility of overlapping and encroachment between these two terms" (Reynolds, n.d.).

Phenomenology has been discussed by many more philosophers till this day, like Sartre, Frege, Russell, Kripke, Putnam… Many theories have been developed; the Encyclopaedia of Britannica describes seven types of phenomenology. It is still a fascinating concern; the consciousness is still confusing to this day.

On the other hand, the phenomenology in architecture has been investigated starting from the 1950s. Rasmussen wrote his book Experiencing Architecture in 1959. He explains his study is about how we perceive things that surround us. He describes architecture as a "functional art" that "confines space so we can dwell in it, creates a framework around our lives" (Rasmussen, 2010, p. 10). Then, he associates the work of an architect with a theatrical producer in a way they create the stage for lives. He says the design of this stage is not easy. The actors of this theatre are the ordinary people and the architect must know these people and their natural way of acting very well to design a natural environment for them. He explains one design fitting for one culture and generation can make no sense for another one within the changing habits and tastes (Rasmussen, 2010).

Pallasmaa (2005) takes the phenomenological approach from Merleau-Ponty into the architectural experience and explores the phenomenology in architecture in his book The Eyes of the Skin, he includes the consciousness as well as the sensational involvements within architecture. He associates the meaning of architecture with the consciousness of being in this world, as he points out architecture creates a measure for human understanding above eternal time and space. He takes the body into the center of the experience, as he explains the interaction with the environment happens through the sensory system of the body. It is our window opening to a multi sensory experience. He says: "Our contact with the world takes place at the boundary line of the self through specialized parts of our enveloping membrane" (p. 10).

He also points out that the architect works with their body, senses, and sense of self. He explains the design process as a measuring and projection process from the architect's body scheme through the context and functional requirements. He eventually says that: "Architecture is a communication from the body of the architect directly to the body of the person who encounters the work, perhaps centuries later" (Pallasmaa, 2005, p. 67). He defines a projection of self onto other people through architecture.

This self-projection idea is also expressed with the work of Zumthor (1999). In his book Thinking Architecture, he explains that architecture has its own realm relying on the experience of life. He describes architecture as an "envelope and background for life" that contains "the rhythm of footsteps on the floor, for the concentration of work, for the silence of sleep" (Zumthor, 1999, p. 13). Then he explains his feelings during the design process as a flooding new light consisting of everything he knew before (Zumthor, 1999).

While Pallasmaa was suggesting a bodily projection onto the design, Zumthor implies the thoughts and feelings projecting. It becomes clearer when he explains the base for good design relies on the perception of the world with emotions and reasoning. He says: "The roots of architectural understanding lie in our architectural experience: our room, our house, our street, our village, our town, our landscape" (p. 57). He suggests one's architecture understanding relies on their own biography.

This projection theory that suggests that the architectural experience affects the design process. While the design as architecture affects the experience. This interplay between the experience and the design seems to be close to the idea of the chiasm in Merleau-Ponty's philosophy. He suggested an overlapping situation between the perceiving and the perceived, an inseparable osmotic relation in-between when he said: "The world is wholly inside, and I am wholly outside myself" (Merleau-Ponty, 2005, p. 363).

In the case of architecture interplay of the perceiving -human- and the perceived - architecture- proceeds through the design process. The suggested inseparable nature of experience between humans and architecture flows through another inseparable process between humans and architecture as the design emerges. This theory forms one of the main questions of this study. How the interplay between the experience of architecture and the design of architecture happens?

Sense of Architecture Workshop

"Sense of Architecture" workshop has been conducted in February 2019, with the voluntary participation of 4th-year architectural design students of Istanbul Technical University. The participants were 12 design students, which 9 of them have been students of Istanbul Technical University for years, while 3 of them were exchange students coming from different universities, and this was their first time visiting the school.

The aim of the workshop is to gather the data on the experience of architecture as well as its possible relation to the design process. This aim led to two main questions:

- Which qualities does the experience of architecture contain? What is the role of visuality in this experience?
- Does the experience of architecture affect the design process? If so, which qualities of the architectural experience play a role during the design process of the architect?

As a reflection of these two main sets of questions, a two-stage workshop has been prepared. The first stage to inspect the experience of architecture, while the second to inspect its possible relation to architectural design.

First Stage: Experience Mapping

In the first stage, the participants are asked to experience the Taşkışla faculty of architecture building of ITU. They are asked to pay attention to their journey through the building – the senses, emotions, memories, thoughts, etc. The first handouts are handed over to participants to give a framework of the workshop (see Image 1). On the handouts, they are asked to define their routes consisting of at least two storeys and two wings of the building. The result of this stage is mapping this experience. They are encouraged to use any media in the mapping process.

Participant A

"Taşkışla Experience" (see Image 3), has an emphasis on the day and night contrast. Her experience contains the contrasting sounds of architecture in between day and night-time, within smells accompanying at certain points.

It is possible to point out that her perception of "Taşkışla" affects her experience significantly. Throughout her experience, she talks about some insights, like how some particular smells make her feel and how the light impresses her, but she finalizes her experience description with her impression on Taşkışla. She describes: "It is impossible to think about Taşkışla without the stairs, the vaults, the floor stones, and the footsteps echoes touching these stones" (see Image 5). This finding of an existing perception settled from an ITU student, can be compared to the exchange students to answer if the experience over time and experience for the first time involve different qualities.

Participant B

"My Taşkışla Route" (see Image 6), contains many different qualities as sensible stimuli, the feelings, the memories, etc. around her route. While Participant A clearly draws her route on the plan and marked her nods, together with the focused qualities through this route, Participant B's map is shaped by all the qualities and does not have special focus points. She sees the seagulls and wonders, then notices the perspective through the corridor that seems endless, then she remembers a memory from her first year at school… On the other hand, an existing Taşkışla perception is common in between them. While participant A was expressing this through characteristics of Taşkışla, participant B expresses this as her memories. They both bring some lived experiences as memories and some settled ideas as the perceptions to their experience of now, as the title suggests: "Mapping: Taşkışla Experience".

Participant C

The experience of Participant C (see Image 9) contains the voices, smells, the visuals, the material, the colors, the classrooms, the students, and his perceptions like the memories or the feelings they evoked. The representation looks a little like participant A, where the icons are put around the route of the experience, but also not following a simple legend and marking all the qualities came across is like

Participant B. Collages seem to be an effective way for this participant like the glass classrooms shown as blue squares on the second experience map, described as "like an obstacle in my way, but not interrupting the view" are also depicted 3D within a collage. Participant C uses this method through the experience many times, as he comes across different colors, materials, or light and shadows.

Participant D

The experience maps (see Image 12) have a simple style very similar to the handout graphic (see image 1). However, when he describes the intensity on the first floor, he develops something that's his own (see Image 12). He pushes the boundaries of the corridor and creates a squeeze on the corridor representing the feeling of being watched. The participant developed a unique representation when he comes across something striking. The lack of privacy of the glass: "I felt stuck with the glass studios squeezed into the hallway", "I felt that I was being watched through the corridor where the glass studios were intense" (see Image 14). This also brings the chiasm idea by Merleau-Ponty: "Inside and outside are inseparable" (Merleau-Ponty, 2005, p. 363). Touching and being touched, seeing and being seen are inseparable according to Merleau-Ponty. The transparency of the glass brings a very important manifestation of this.

Participant E

This is the first experience map from the exchange students (see Image 15). She begins her journey from the outside, almost reflecting the fact that this is her first time there, and she is coming from outside.

Another important point to mention about the experience is when she finalizes her journal she talks about the cats and the students, which give relief after the confusion the building evokes. She says: "They made the building look like an architectural university." An understanding of "an architectural university" exists before this experience. This situation can be considered as a manifestation of what Heidegger suggested as "dasein" that the experience is biased and bound to being as the continuous interpretation of a pre-understanding. Even when the participant is experiencing the architecture for the first time, this pre-understanding still exists.

Participant F

As another exchange student, participant F does not only talk about being lost in space but also in time, which then she links to the broken, fragmented rhythm that she feels (see Image 18). While some of the ITU students expressed the repetition of architectural elements, none of them expressed the confusion or feeling lost. The first encounter with Taşkışla creates confusion for the exchange students with its repeating elements and symmetry.

Another important quality is the "new spirit in old". She explains in the journal how the new generations and the new people inside bring a new spirit into the old "grandeur" structure. This is very similar to the time-architecture relation Pallasmaa (1998) is mentioning as "the art of permanence" (p. 56). As his idea as the architecture bringing the matter, space, and time, a participant says that the "grandeur" structure of the past meets the people of today.

Participant G

Participant G as the third exchange student mentions the expectations about the first encounter with the building: "Before you come into a certain space you have some expectations after you can be surprised positively or negatively, or it can be exactly what you expected" (see Image 21). She explains her expectations and feelings are mixed followed by surprise and confusion.

The first maps showed that the ITU students have a personal history with the building - memories and friendships, which make them feel safe and relaxed which they settled an image of Taşkışla. On the other hand, the exchange students have expectations about how this building could be inside, how an architecture faculty and its students could be... These expectations all meet reality and lead to surprise, confusion, or relaxation. In the end, even both groups experience the same architecture, they did not have the same experience of architecture.

Second Stage: Experience Designing

In the second stage, participants are asked to design an architectural experience. They are asked to choose a place on their experience map and design something reflecting on their experience. Through the handouts of the second stage (see Image 2), they are specifically asked to reflect on their experience from the first stage while designing and then create a representation of their design on their experience map through different media, as well as a conceptual model.

Participant A

The participant describes "… sharp light that leaks within the huge windows of the short wing of Taşkışla which as the most beautiful feature of the building" (see Image 4) as she designs on the light.

Another important point is that the participant depends on her perception of Taşkışla while she says, "The design will let people enjoy a characteristic feature of Taşkışla to me is the aim of the study" (see Image 5). She has a perception of the building; she enjoys a particular feature of it and wants to share this through her design. This is again her perception that she builds her design upon. She explains her purpose for this design to let people enjoy "a characteristic feature of Taşkışla" which she says: "… to me is the aim of the study."

Participant B

Participant B focuses on the three-dimensionality of the sound. The three-dimensionality that is usually considered a visual aspect of space, is being approached from the audial side. The black and white presentation of the design seems to be reflecting on this also (see Image 7).

Ong (2005) has a theory about the rise of secondary oral culture with developing communication technology. Hearing and seeing are two dominant senses in culture as well as in the communication of humans. Blocking the visuality and isolating the hearing created a certain solitude. This solitude may be the major aspect that design is offering. This way, the participant did not only design hearing-oriented installations but also some escaping points within the space that can be considered as the black holes. May (1994) was suggesting that in today's world where the individuals are overly stimulated, a need for distance arises.

Participant C

Participant C creates a variety of shadow objects as physical models. The participant describes the spatial quality of the architecture and the shadows together: "It was empty, spacious and wide space, but the shadows seemed to fill the area." His description tells that the contrast between the light and shadows seems to be affecting the spatial perception of the architecture (see Image 10).

The design seems to be focusing on the spatiality, as the participant sees the shadows as an element of the space. Space, the materiality, time, and place all qualities come together and form a unique breathing identity that moves the human when they experience the architecture. While the identity of the space is described as "atmosphere" by Zumthor (2006) rather than a void among the bigger void. This is a case showing how these qualities of architecture come together and form a unique entity as the architecture and it is perceived by the individual. While one sees the shadows on the floor of the hall filling the space, another sees the emptiness of the hall.

Participant D

Participant D creates an exhibition structure that seems to be functional and based on the analysis of the people density (see Image 13).

During the first stage, the participant remarked a "quiet corridor" where the silence in contrast to the other places in the building, creates a "nervous atmosphere. The participant explains that this place is making him tense. Then, he mentions the darkness and the echoes caused by the emptiness in the hall increasing the tense atmosphere, and how he wants to break this with his design.

The uneasiness caused by the "tense" hall provokes the idea of another possibility for the participant. Even though the participant seems to be presenting his idea as depending on the pure analysis, there is no doubt about the self-reflection process, after inspecting the journal.

Participant E

The design of Participant E is a navigation tool focused on the confusion of an unfamiliar experience of the architecture (see Image 16). This be a manifestation of self-reflection. As it is observed through the other participants, ITU students who attended school three years do not have this unfamiliarity and did not notice the lack of signs. They focus through other things the lights, the shadows, the sounds, the people.

While the first-time experience of the unfamiliar environment created confusion and anxiety for the exchange students. Then, instead of approaching from other angles to the architecture, the participant is building her perception upon this confusion, as well as her design.

Also, this is the second time that the participants are focusing their designs on an inconvenience which they came across while experiencing the architecture. Participant D was focusing on the uncomfortable quietness and the emptiness of a hall, while Participant E is focusing on the confusion she experienced.

Participant F

Participant F is also focused on the feeling of confusion through the design as well (see Image 19). The different part of the design from Participant E's design is the depiction of the confusion. Participant F designs a purely sculptural kind of object. Instead of showing the way around, or build something upon the existing architecture to differentiate, she builds a self-standing object of her perception.

This direct representation of the experience be another manifestation of the self-reflection discussed as the "communication from the body of the architect directly to the body of the person" many years later (Pallasmaa, 2005, p. 67).

Participant G

Participant G's design is focusing on the confusion just like the other exchange students. The participant even draws a sketch of a labyrinth depicting her feelings and writes underneath: "… seems like you are always at the same place…" The sketches of the halls appear to be empty - the absence of windows or doors, nor the time indicating shadows or lights, or the people.

Here the expectations, the mood, the feelings, and the thoughts of the participant affect her, and her consciousness to turn a blind eye to the landmarks and differences between the halls. This perception and the feeling of confusion is so strong, it reflects on her design. As had been discussed before, the architect is using a "reverse perspective" with their existential experience (Pallasmaa, 2005, p. 12). In this situation the reverse perspective of the lost and confused feelings makes the participant think that people always lose their way inside the building, while the regular students of the faculty participated in the experience never mentioned this characteristic.

Discussion

This research is aimed to study architectural phenomenology as a critique of visual narrative. The workshop and its discussions have been presented as an analysis of the experience of architecture, as well as its effects on the design process. The qualities involved in the case of the experience of Taşkışla and the qualities involved during the architectural design process have been discussed with a workshop.

Throughout the study, the purpose was to be able to reach an analysis of the experience of architecture and its relation to the design process. The discussions were dependent on the literature review and the data of the workshop. The workshop was planned with a limited number of participants and only one case of architectural experience that is Taşkışla. The overall conclusions can be drawn as such:

Taşkışla experience contained the smells, the sounds, light and shadows, the repetition, rhythm, and the monumental spatiality. Through the students' experiences of architecture, the architecture and the human exchange was very strong that the two were melting into each other through the sensibles, time, and space as well as the feelings, thoughts, expectations, memories, and the established perspectives. This be a manifestation of the chiasm theory of Merleau-Ponty. As he claimed, perceiving and being perceived roles were interchangeable. A lot of qualities moved one from another and overlapped frequently while these overlapping qualities proved to be requiring a multi-dimensional look. Some qualities that appear to be visual, have been associated with spatiality and time. Some qualities related to smell have also been associated with memories. Some of these relations were settled through the literature review, but some of them were proved to be requiring a wider perspective.

Whereas, the design process analysis showed that not all the qualities involved in the architectural experience affect the design process. It appears that the stronger their effects on the participants the more they are involved in the design process. Some of the qualities with weaker impacts have been completely ignored, through the design stage by the participants.

Unpleasant, or disturbing qualities -such as the nervous quietness, feeling lost, being watched- through the experience of architecture seem to be having stronger effects on participants in a way that they want to change this unpleasantness. Repetition, rhythm, and symmetry seem to create a certain strong image of the architecture of Taşkışla. These characteristics are also one of the main effective experience qualities involved in the design process. In order to reach more definitive conclusions on how this process works, more cases are needed. Then it can be possible to discuss which of these qualities are not considered through design. On the other hand, it is possible to point out a certain relation with the experience and the design of the participants. Their designs reflect on their personal experiences, the memories, the sounds, the light, the confusion, the expectations, etc. All the participants used a part of their experience in their designs.

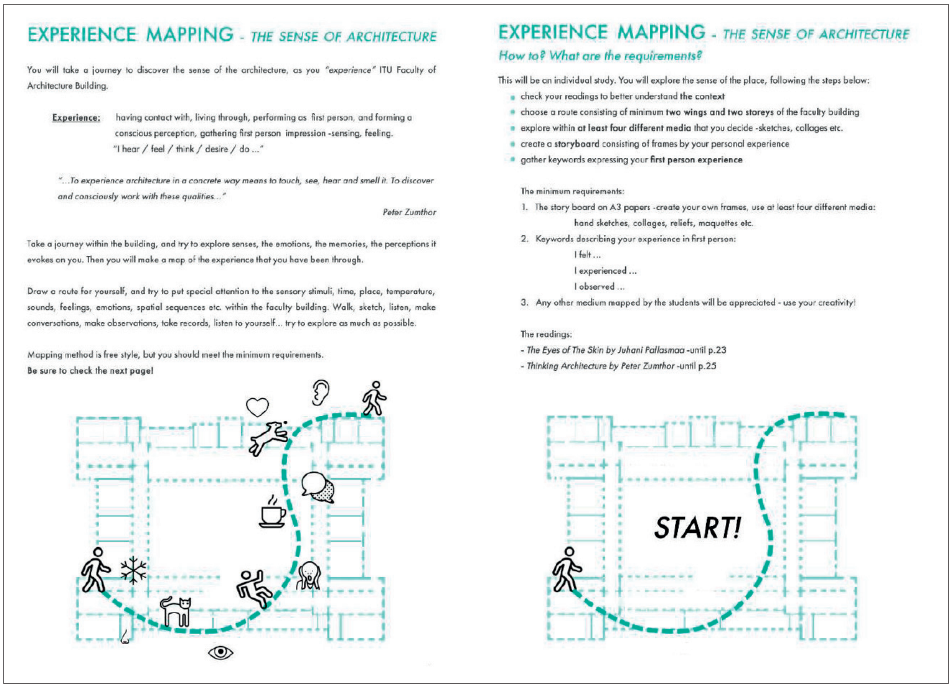
The analysis of both groups of students -ITU students and exchange students- showed that the experience of architecture does not start with an unaffected, unbiased individual encountering the architecture. ITU students had the memories, feelings, thoughts, established images, and characteristics of the building that had been built over the years. These all became a part of their experience and shared by them. While the characteristic image of Taşkışla had proved to be the most impactful quality among these, as the ITU students also used this on the design stage.

On the other hand, the exchange students had expectations about the first encounter, as well as certain images and understandings of an architecture school and architecture students that were coming from their previous experiences. he architectural experience had involved all these biases, and this confirmed the "dasein" statement from Heidegger. A pre-understanding based on being in this world keeps being revised to the current experience and understanding. Even the first time encounter from the exchange students showed this quality of bias. However, a more detailed study on how these two groups involved their biases, and which qualities were more impactful can be done.

These questions and the conclusions reached as answers showed that this study was only covering a small vague part of very complex and bigger phenomena in architecture. Human architecture relation, through the experience and design processes, is a very fluid and complex phenomenon. It requires not only one experience study but many more to reach more answers. The data gathered, and the discussions made here upon the experience of Taskisla reached many confirmations about the statements made by philosophers and architects.

However, it is certain that further studies with more specific questions can be handled. Comparative analysis with more participant groups or different cases of architectural experiences would create more data and would lead to more answers as well as further questions. One important conclusion that has been reached through this study is that the more data, and analysis made on the experience of architecture, the more questions and curiosity will arise. The continuously evolving nature of the human experience and its fluid relation to the architecture will lead to many more questions.

IMAGES, CHARTS OR GRAPHIC LEGENDS


EXPERIENCE MAPPING - *THE SENSE OF ARCHITECTURE*

You will take a journey to discover the sense of the architecture, as you *"experience"* ITU Faculty of Architecture Building.

Experience: having contact with, living through, performing as first person, and forming a conscious perception, gathering first person impression -sensing, feeling.
"I hear / feel / think / desire / do ..."

"...To experience architecture in a concrete way means to touch, see, hear and smell it. To discover and consciously work with these qualities..."

Peter Zumthor

Take a journey within the building, and try to explore senses, the emotions, the memories, the perceptions it evokes on you. Then you will make a map of the experience that you have been through.

Draw a route for yourself, and try to put special attention to the sensory stimuli, time, place, temperature, sounds, feelings, emotions, spatial sequences etc. within the faculty building. Walk, sketch, listen, make conversations, make observations, take records, listen to yourself... try to explore as much as possible.

Mapping method is free style, but you should meet the minimum requirements.
Be sure to check the next page!

EXPERIENCE MAPPING - *THE SENSE OF ARCHITECTURE*

How to? What are the requirements?

This will be an individual study. You will explore the sense of the place, following the steps below:

- check your readings to better understand **the context**
- choose a route consisting of minimum **two wings and two storeys** of the faculty building
- explore within **at least four different media** that you decide -sketches, collages etc.
- create a **storyboard** consisting of frames by your personal experience
- gather keywords expressing your **first person experience**

The minimum requirements:

1. The story board on A3 papers -create your own frames, use at least four different media:
   hand sketches, collages, reliefs, maquettes etc.
2. Keywords describing your experience in first person:
   I felt ...
   I experienced ...
   I observed ...
3. Any other medium mapped by the students will be appreciated - use your creativity!

The readings:
- *The Eyes of The Skin by Juhani Pallasmaa* -until p.23
- *Thinking Architecture by Peter Zumthor* -until p.25

Image 1: First Stage Handouts.

EXPERIENCE DESIGNING - *THE SENSE OF ARCHITECTURE*

You will design an architetcural "experience" within the ITU Faculty of Architecture building based on your experience map from the previous study.

> *"Architecture is deemed complete only upon the intervention of the human that experiences it. In other words, architectural space becomes alive only in correspondence with the human presence that perceives it in..."*
>
> *Tadao Ando*

Choose a place where you will design the experince you want to create. You will use the map you prepared as a base, and design an experience reflecting on your own experience.

Think about the human intervention on your design, and their impression, awareness and perception that you want to create. Use your previous study as a source. You may want to emphasize certain senses, impressions, qualities, or you can create a certain defamiliarization by making the familiar strange.

How to? What are the requirements?

- choose a place on your experience map -consider **the spatial sequences** of the faculty building
- try to **self-reflect** on your first-person experience from the first study
- create a **conceptual model** of the design expressing the experience you want to create
- write a **self-reflective journal**- covering both experience mapping and experience designing process

The minimum requirements:

1. The conceptual model -you can use any material that corresponds to your design the best:
   cardboards, papers, ceramics, lego, scraps...
2. Your self-reflective arguments placed on your story board, together with defining sketches:
   I felt ... I designed...
   I experienced ... I created...
   I observed ... I shaped...
3. A self-reflective journal describing the whole process of experiencing architecture and designing an experience within architecture - min 500 words.

The reading:
- *The Eyes of The Skin by Juhani Pallasmaa* -from p.51 until p.72

Image 2: Second Stage Handout.

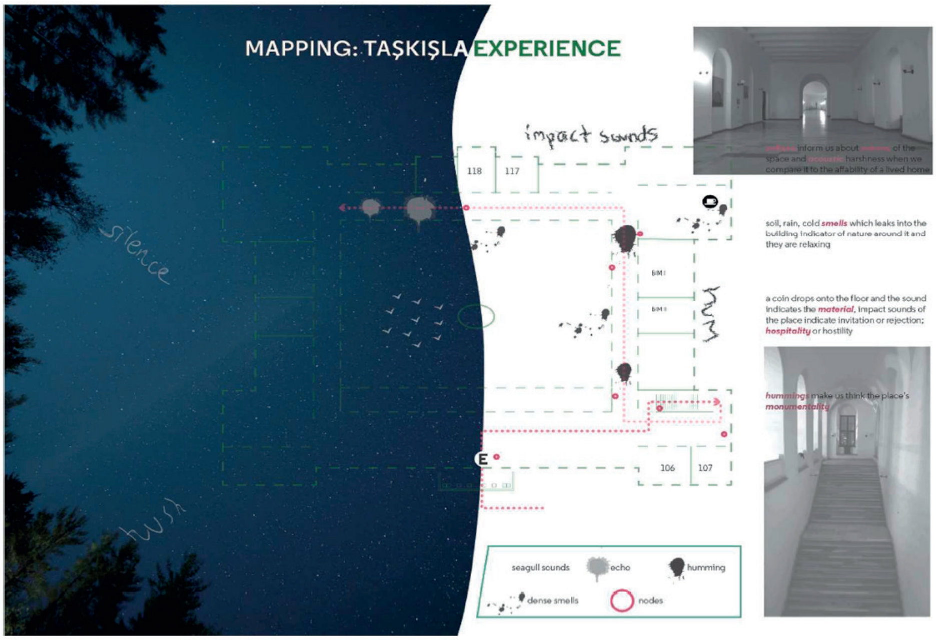


Image 3: Participant A – First Stage.

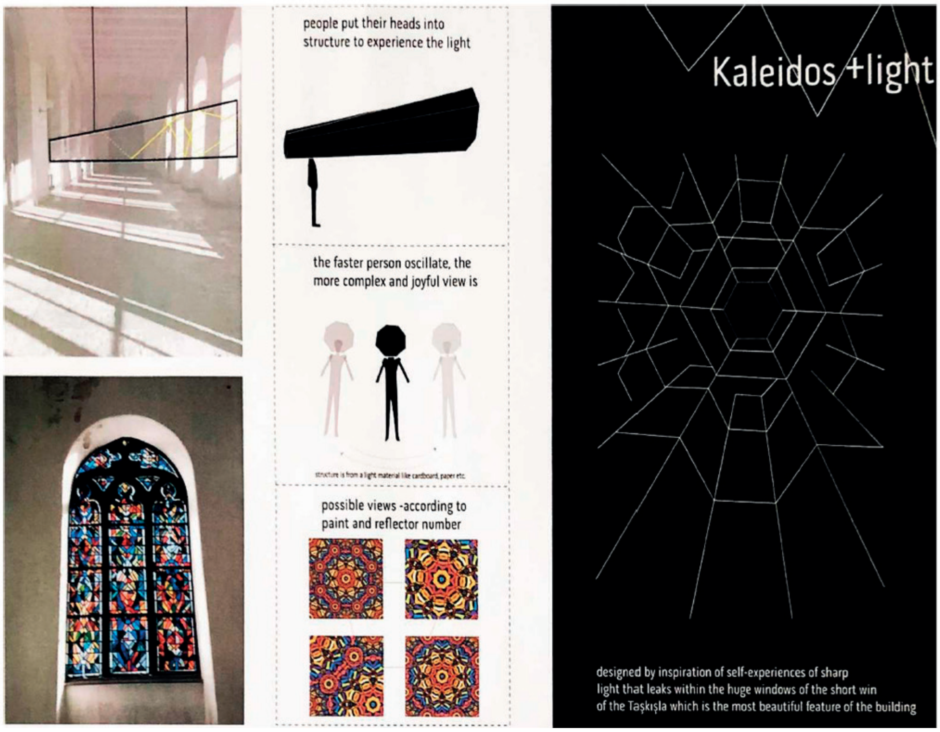
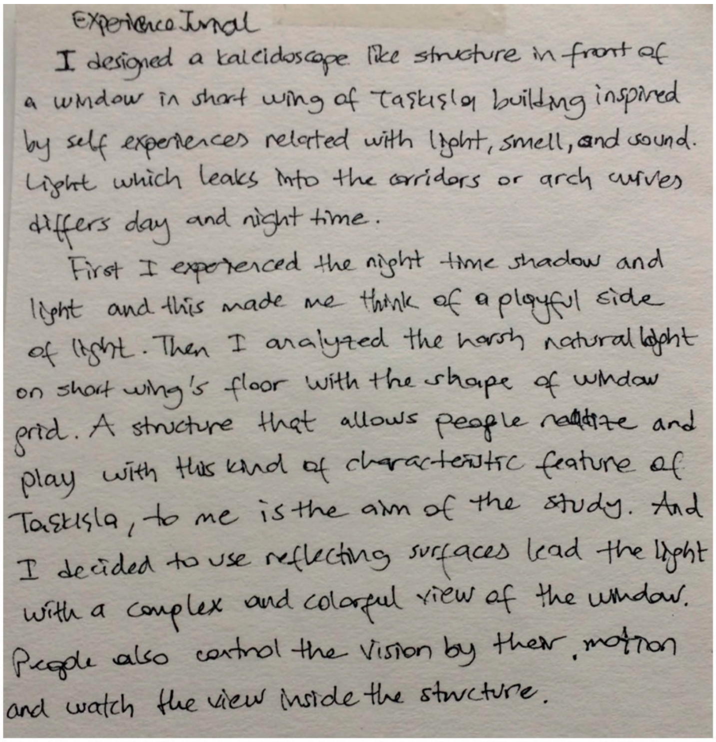


Image 4: Participant A – Second Stage.



Experience Jurnal

I designed a kaleidoscope like structure in front of a window in short wing of Taskisla building inspired by self experiences related with light, smell, and sound. Light which leaks into the corridors or arch curves differs day and night time.

First I experienced the night time shadow and light and this made me think of a playful side of light. Then I analyzed the harsh natural light on short wing's floor with the shape of window grid. A structure that allows people realize and play with this kind of characteristic feature of Taskisla, to me is the aim of the study. And I decided to use reflecting surfaces lead the light with a complex and colorful view of the window. People also control the vision by their motion and watch the view inside the structure.

Image 5: Participant A –Journal.

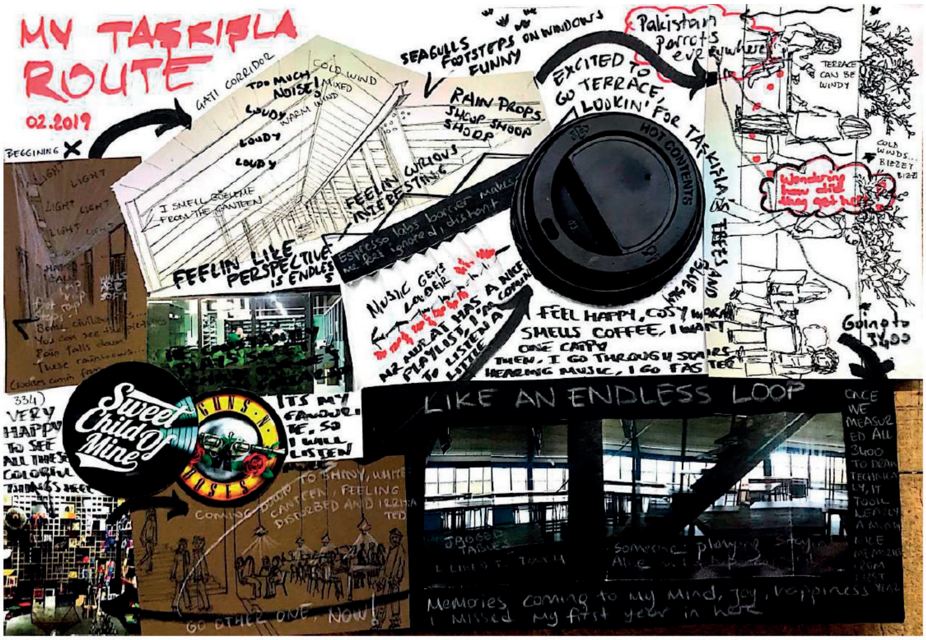


Image 6: Participant B – First Stage.

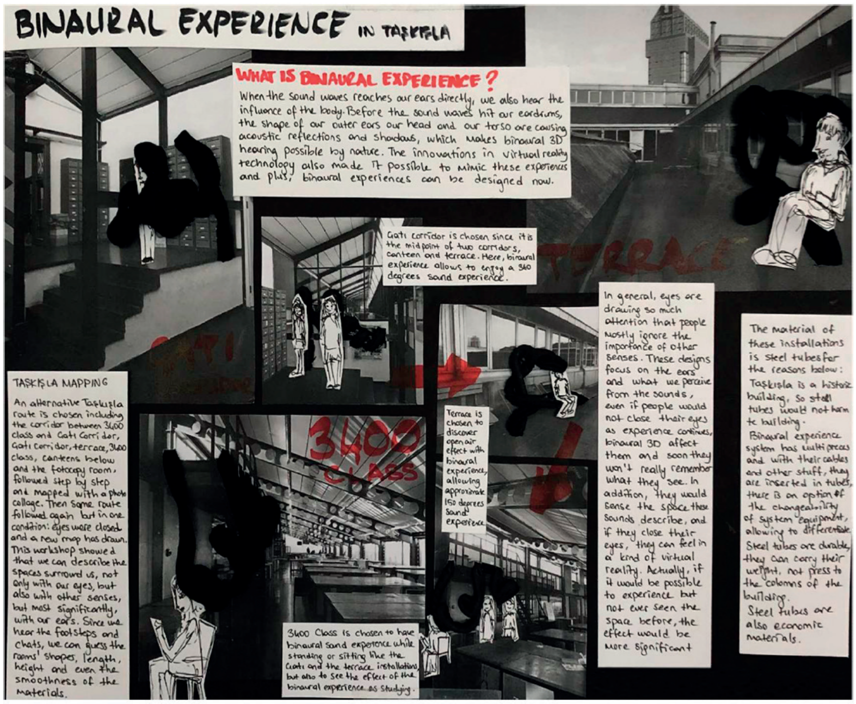
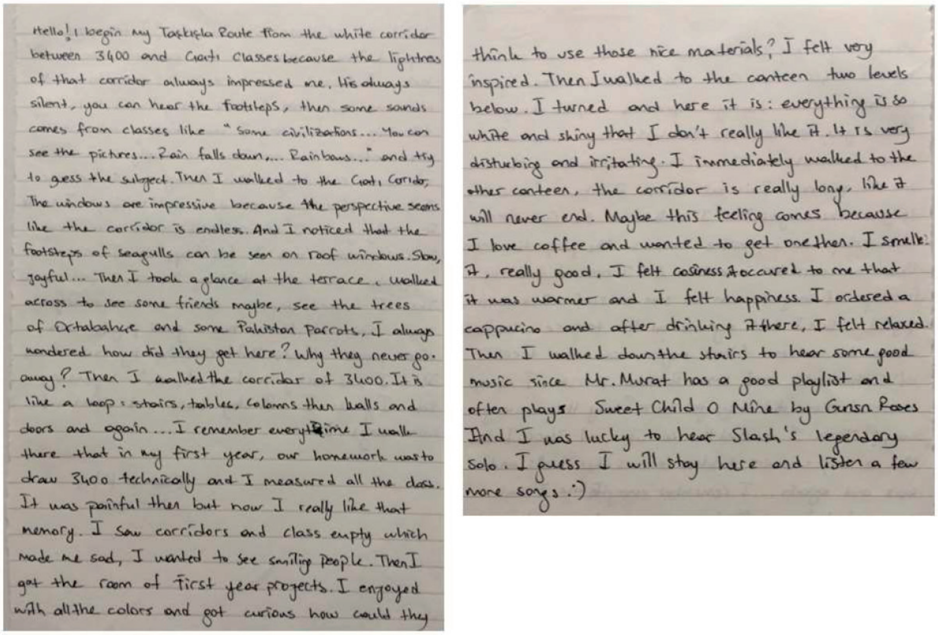


Image 7: Participant B – Second Stage.



Hello! I begin my Taşkışla Route from the white corridor between 3400 and Gati Classes because the lightness of that corridor always impressed me. It's always silent, you can hear the footsteps, then some sounds comes from classes like "Some civilizations... You can see the pictures... Rain falls down,... Rainbows..." and try to guess the subject. Then I walked to the Gati Corridor; The windows are impressive because the perspective seems like the corridor is endless. And I noticed that the footsteps of seagulls can be seen on roof windows. Slow, joyful... Then I took a glance at the terrace, walked across to see some friends maybe, see the trees of Ortabahçe and some Pakistan Parrots, I always wondered how did they get here? Why they never go away? Then I walked the corridor of 3400. It is like a loop: stairs, tables, colomns then walls and doors and again... I remember everytime I walk there that in my first year, our homework was to draw 3400 technically and I measured all the class. It was painful then but now I really like that memory. I saw corridors and class empty which made me sad, I wanted to see smiling people. Then I got the room of first year projects. I enjoyed with all the colors and got curious how could they think to use those nice materials? I felt very inspired. Then I walked to the canteen two levels below. I turned and here it is: everything is so white and shiny that I don't really like it. It is very disturbing and irritating. I immediately walked to the other canteen, the corridor is really long, like it will never end. Maybe this feeling comes because I love coffee and wanted to get one then. I smelled it, really good. I felt cosiness it occured to me that it was warmer and I felt happiness. I ordered a cappucino and after drinking it there, I felt relaxed. Then I walked down the stairs to hear some good music since Mr. Murat has a good playlist and often plays Sweet Child O Mine by Guns n Roses And I was lucky to hear Slash's legendary solo. I guess I will stay here and listen a few more songs :)

Image 8: Participant B –Journal.

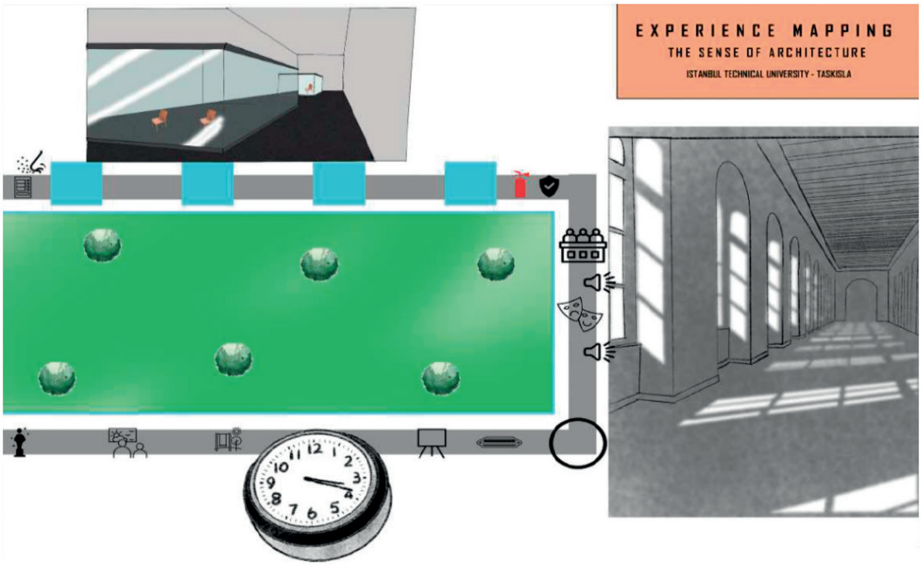
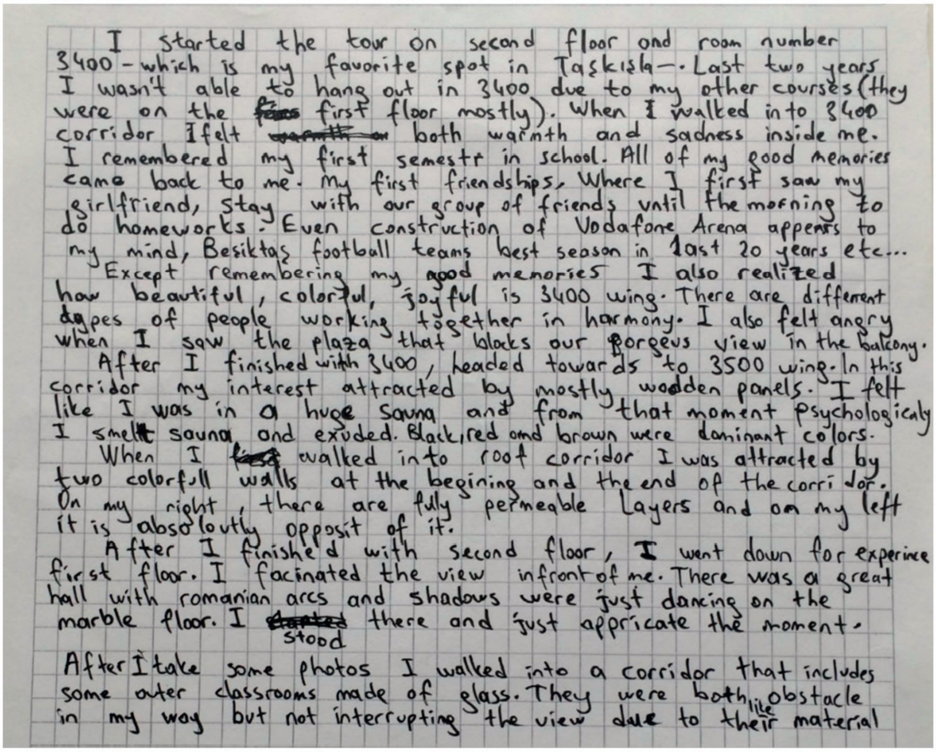


Image 9: Participant C – First Stage.

Image 10: Participant C – Second Stage.



I started the tour on second floor and room number 3400 - which is my favorite spot in Taşkışla -. Last two years I wasn't able to hang out in 3400 due to my other courses (they were on the ~~first~~ first floor mostly). When I walked into 3400 corridor I felt ~~warmth on~~ both warmth and sadness inside me. I remembered my first semestr in school. All of my good memories came back to me. My first friendships, Where I first saw my girlfriend, stay with our group of friends until the morning to do homeworks. Even construction of Vodafone Arena appears to my mind, Besiktas football teams best season in last 20 years etc...

Except remembering my good memories I also realized how beautiful, colorful, joyful is 3400 wing. There are different types of people working together in harmony. I also felt angry when I saw the plaza that blocks our gorgeus view in the balcony.

After I finished with 3400, headed towards to 3500 wing. In this corridor my interest attracted by mostly wodden panels. I felt like I was in a huge sauna and from that moment psychologicaly I smelt sauna, and exuded. Black, red and brown were dominant colors.

When I ~~first~~ walked into roof corridor I was attracted by two colorfull walls at the begining and the end of the corridor. On my right, there are fully permeable layers and on my left it is absoloutly opposit of it.

After I finished with second floor, I went down for experince first floor. I facinated the view infront of me. There was a great hall with romanian arcs and shadows were just dancing on the marble floor. I ~~standed~~ stood there and just appricate the moment.

After I take some photos I walked into a corridor that includes some outer classrooms made of glass. They were both like obstacle in my way but not interrupting the view due to their material

Image 11: Participant C –Journal.

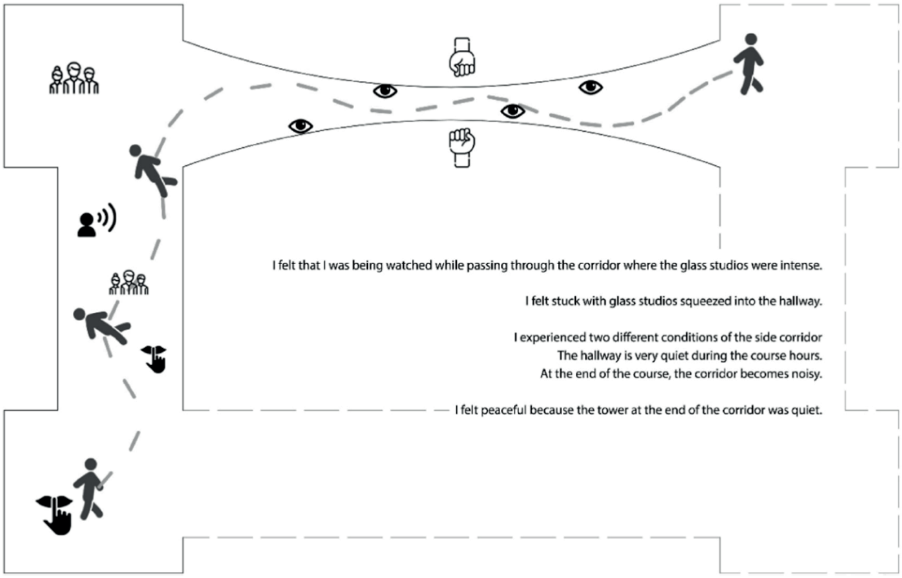


Image 12: Participant D – First Stage.

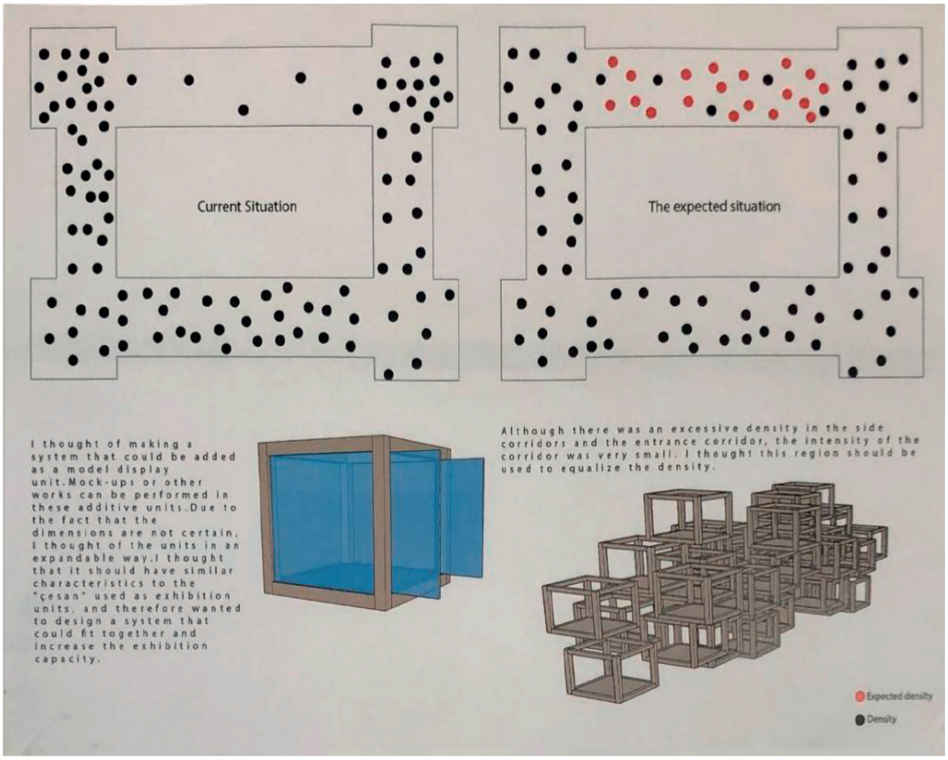


Image 13: Participant D – Second Stage.

Taşkışla had the behaviors and orientations that did not consist of the first elements I observed in my first journey. The corridors after the entrance were more noisy and cold. They were going somewhere. Density was high for the entrance, but the exhibition narrowed down the corridor and both the newcomers to the school and the center of the exhibition center were increased in intensity. This situation was disturbing. The first thing that stands out from the corridor is the sunlight coming into the corridor and the cigarette smell coming from the garden cover while working a little. There is noise in this hallway, but now there is no rush and there is a source of noise in the air. The fact that people are looking at the exhibitions creates a desire to look at the projects in the corridor and to look at the exhibitions. It makes us think that stationery should be in this corridor and you should have any requests. At the end of the corridor you will find a canteen on the left and a dark, quiet and very quiet hall on the right. There are more teaching buildings and graduate class classes in this corridor. There is a general encounter with a teacher in the hallway and this causes me to feel nervous. There is a canteen at both ends of the corridor and the corridor is echoing from here. The higher the ceiling, the higher the sound, and the voices do not reach an uncomfortable level. Because there is nothing in the corridor and the intensity is low, it creates a longer sense of space. I went upstairs to the upper floor with a lift in a small space, which continued in the corridor and compressed on the left. The floor where the upper floor workshops and classes are concentrated. When we get off the elevator and continue through the right corridor, we are going through a narrow space with glass workshops and main workshops. The corridor was noisy because my tour time coincided with the course hours. The fact that the doors of the workshops are open and the glass workshops are not reaching the ceiling and the ceiling is not the ceiling is the main reason for this noise. The corridor is narrow down the corridors downstairs, creating a stifling space. At the same time, the habitats are glass, which inevitably leads to eye-to-eye with people inside and creates a monitoring-viewing situation. Although the viewing situation is a bit disturbing, it feels pleasant to watch the workshop. When we turn left at the end of the corridor, it connects to a corridor with classes. The low density of this space and the absence of anything in the corridor make it easy to observe the flow of sunlight inside. When we pass through this corridor during class hours, there is only a slight hum of noise coming from the stairwells but it is a very quiet place.

The corridor is the dark and quiet corridor which I found for the design. The main reason I choose this corridor is that I feel so tense every time I go through there and the intensity is low. This corridor is a corridor that is used only for passage when required by students. to break the tense atmosphere in this corridor and to reduce the density in this corridor also revive another corridor where I wanted to create an exhibition environment. In the other exhibition areas, only the drawings of the projects are displayed and the models are not exhibited. I wanted to turn it into a corridor which displays this corridor model for what I thought was important exhibition of Models. Used in our school, '' fountain who 'thought it easy to carry and a structure that can be upgraded as needed when requested and therefore that will form the exhibition product friable can and sizes of can be changed when necessary to do a system in this manner. I created thanks to the exhibition area will increase the intensity of the corridor and I think the intensity will decrease found in other corridors.

Image 14: Participant D –Journal.

Image 15: Participant E – First Stage.

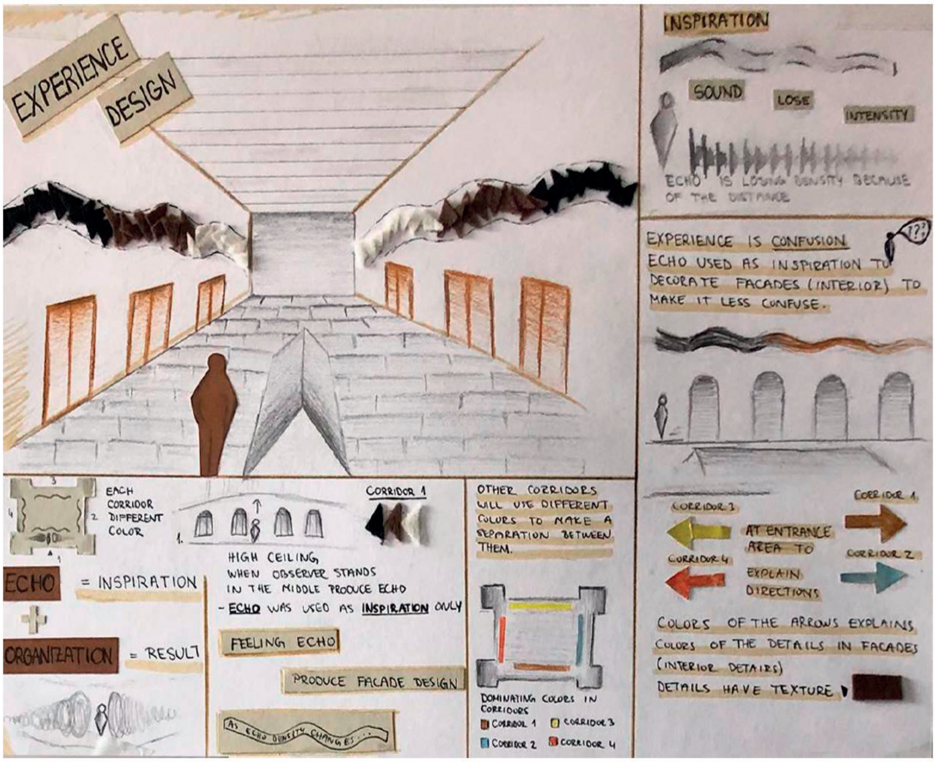


Image 16: Participant E – Second Stage.

Echo traveling as inspiration for better organization produced with coloring

The building itself consist of very high ceilings and long corridors (4 of them) without any barriers that allow the echo to travel constantly. Depending at which point of the building observer stands the travel of echo will be different, at some points it will going to both sides while at another it will only go to one side. In both cases the echo lose its intensity. This was mine inspiration, for creating interior design of facades, in order to respond to mine experience of confusion. Traveling in space will destroy the continuity of the coloring, by having each corridor of different colors. Since all the doors of the offices and classrooms are the same, that made confusion in my head. So I decided to make each corridor decorated with kind of waved line (simulating echo traveling) of different color, in order to have better understanding of the building („That office is in yellow corridor"). At the entrance area, explanations and directions of the colors will be represented. The continious line with no end of same objects will be broken by having a differentiation between decoration (colors and texture). The beggings point depending on the side (left or right) will have strongest color, and the shadow will change while going to the end of that specific color. This will serve for better understanding and approach to the spaces of the building. Each corridor will have different color that is complementar to the previous one and to have different color shading. The color shading and differentiations will create a rhythm of the floors whose plans and organizations are very similar to each other. This rhythm will be followed at all building (in each floor) in order to broke continuity that already exist and to provide overall completence of existing space with additional improvements. Some corridors at the buildin are very quite that provide better echo, so the volume is better, but still the sound lose its clearance with distance. The facade decoration of the building inside is created with waved lines above the openings, with directions at the entrance of the building or corners of it. The corners are diveded with numbers, entrance corner is CORNER 1, and the others are following it. This coloring and texture will define each corner and emphasize it. It will give a touch of modernity in this old building. The building will corespond to its function, and the plan of four corners will be easier to understand. Since the building is explained with plans at almost each corner, they are hard to understand and find, if it is your first visit. The color is what attract humans, it gives impression to them, it make them to remember the place. People remember it easier with having some emphasized parts, such as some important landmarks at the building. My goal was to provide kind of differention and barrier (separation) between the corridors. Coloring will provide separation while tecture and shading will improve the decoration of the white walls. The color of the doors will create a sense of continuity, while waved lines above them will create a differentiation. The echo was mine inspiration, to create this kind of interior design of the facades, to solve experince of confusion that I felt at my first time in the building.

Image 17: Participant E –Journal.

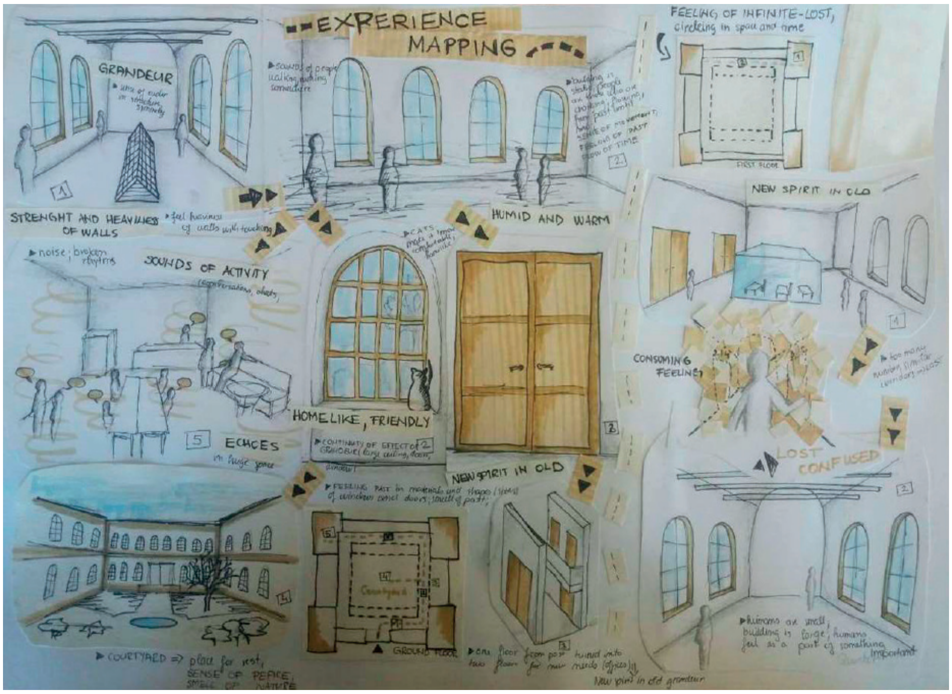


Image 18: Participant F – First Stage.

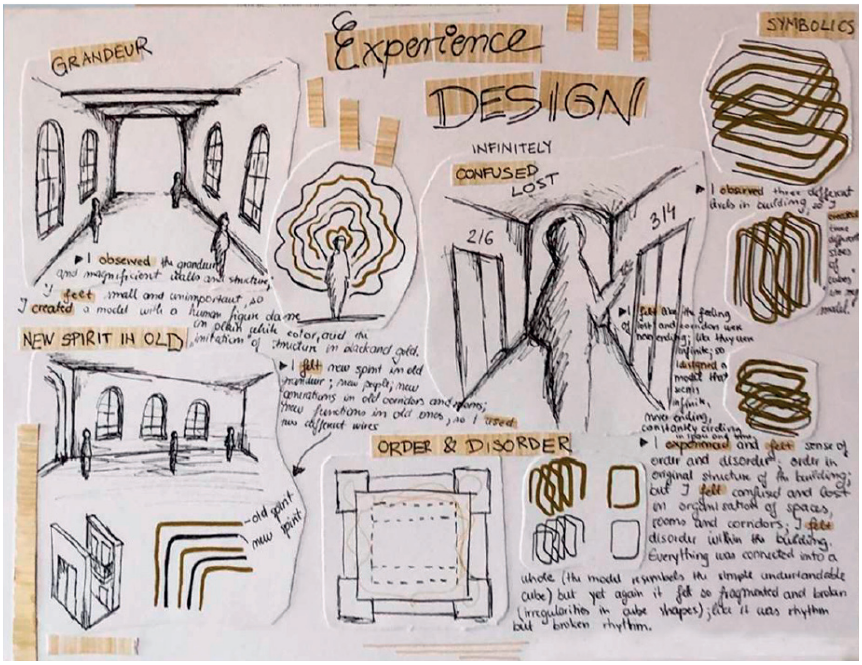


Image 19: Participant F – Second Stage.

When entering into any new, unknown place, you will feel lost for a few moments until you find your course of movement and purpose. Completely contradictory to what I was expecting and what I learned to expect; when entering to ITU Taskisla campus; the experience of being lost, confused and caught into endless continuity, made me experience some things I've never vitnessed before. Approaching the ITU Taskisla building, seeing the columns and pediments done in ancient styles, magnificent windows and doors; made me think that same style and detailing was awaiting me within the building.

Entering the building; it seemed like there was no more signs of ancient style decorations, however; the white plain walls and spaces seemed to be breathing out more history and past spirits than the earler seen facade. I could feel the grandeur and order in the structure, I could touch the heaviness and strenght of walls. I was amazed by the size of the ceiling and how small that made me feel. Being so small I still felt as a part of something important.

As being so amazed in my first impression, so I began to feel confused and lost. Continuing to the different sides and conftontnig the plain white walls in every corridor, I felt like I was circleing in space and time; like I am being caught in an endless rythm. The rythm that I felt was broken, fragmented, but yet it managed to create or to give an impression of a whole. The order that I felt within the structure, was affected by apparent disorder in organisation and my navigation.

Closing my eyes I focused on sounds; people walking, talking, laughing, rushing to somewhere. I could smell the coffee, the meals, I could smell the oldness and grandeur of building again. I was able to feel the old spirit of the building, occupied by new spirit, new people, new generations, new designs in old ones. I saw a lot of cats, a lot of people being glad to see them and feeling like they are a part of a very friendly and comfortable environrment just like me.

Yet, what mostly impacted me was the complexity I felt in my confusion with the building, which was mostyl affected by the fact that it is my first time in it, being a foreigner in its country and not knowing its native language. I treid to represent this experience and feeling that I had, within the experience design/design of model.

I experienced and felt sense of order in original structure of the builidng; but I felt confusion and lost in organisation, rooms and corridors. Just like represented in my experience design; everything seemed to be connected into a whole (the entire model resembles the shape of a simple cube) but again it all felt so fragmented and broken(the cube shapes within the model are not we defined and are confusing). As I felt the feeling of lost and corridors was never going to end; as I was feeling it as it was infinite; my experience design model seems to not have and end or even beginning; it seems like it's constantly circleing in space and time.

When I felt the new spirit in the old grandeur of the building, I searched for a way to represent it, and I took gold color to represenr the grandeur and uniqueness of old time and spirit, and black color to represent the new spirit and designs within the builidng. The grandeur of the building and how it made humans feel smaller in relation to the building, made me create a model where human is smaller, plain, white and seems irrelevant when commpared to the black and gold wires around it.

Image 20: Participant F –Journal.

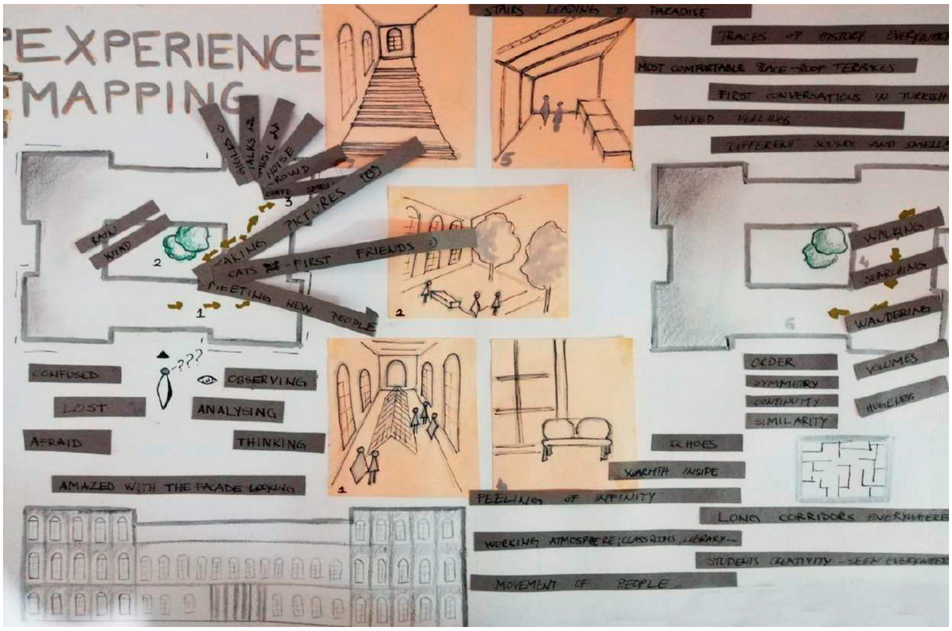


Image 21: Participant G – First Stage.

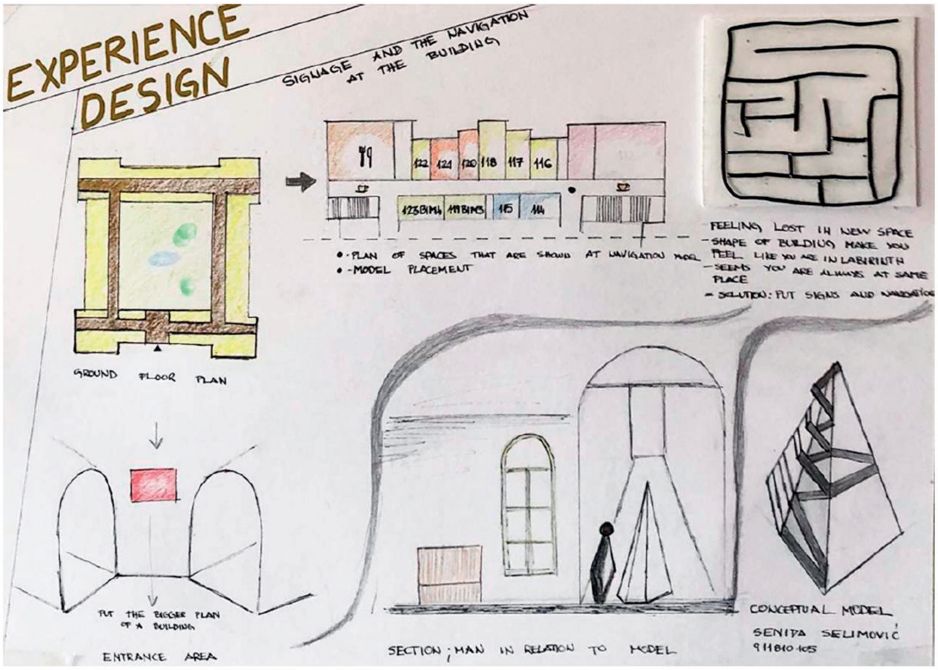


Image 22: Participant G – Second Stage.

EXPERIENCE DESIGNING

Coming into new space or place is always special experinece, full of different feelings, meetings, new things. Before you come into certain space you have some expectations, after you can be suprised positively or negatively or just it can be exactly what you expected.This time all my feelings and expectations were mixed.

Building of ITU Faculty of architecture from the outside looks like old Roman or Greek temple with that colmns at the entrance, colour and material at facade and the shape and height of the windows are totally different from those that we see in modern buildings. When you enter inside it is totally opposite; there are blank walls decorated by students architectural drawings, floors made of stone without any other floor material, long corridors, high storeys. Whole building give you sense of structure that existing many years; typical historical building with enermous and wide staircases, huge spaces, wide corridors, arches, big openings. Although it is a historical building it has some elements of modern architecture, such as: added floors, wooden stairs, steel structures, use of glass and roof structures.

What is really intersting is inner courtyard that gives more life to the building and that means people are always close to open space, greenary, fresh air.

Next step, after observing the building, was to find classrooms, offices or any other social spaces. For a person that first time comes into that building it is really hard; you don't know where is what, from where to start, are all corridors same-how to differentiate them??? A lot of questions come to your mind, and you are starting to be afraid and confused. You realize that you are lost and just spinning, always coming at the same place. Temperature rises, there are different sounds; music, noise, people's laugh, talks, student's movement through corridors. Only comfortable space, that day, was courtyard; go out, take some fresh air, listen to sound of the rain and wind, become a friend to some of the cats, take a coffe and start from the beginning.

As my first experience was as I'm in labirinth, always coming into same place, usally at the corners of the building; I decided to design some signs and navigation model that could be helpfull for new studens or any other people coming for the first time.Firstly, I think that it would be a good idea for having some bigger plan at the entrance area for better orientation and direction of a people.The other, very important thing is to put some kind of navigation model that would be located at the critical corners (that almost all looks similar), and like that will show what is at left or right side. I felt lost in this square building with all similar corridors and I chose to design that model to be helpfull to many other people, to direct them to places they want to go, to preserve their time and make them feel comfortable.

Model looks like a pyramid in order to correspond to some existing shapes at the building such as the shape of elements located across the middle of corridors where student's drawings are exhibited. Beside that it looks very simple and understanable for everyone.

Image 23: Participant G –Journal.

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NEW MATERIALITY IN THE PROJECT OF SMALL ARCHITECTURAL DEVICE FOR EXHIBITION SET-UP: A RESEARCH EXPERIENCE BETWEEN CONCEPTION, LANGUAGE, PERCEPTION AND CONSTRUCTION

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ABSTRACT

The space set up in a trade show becomes a domain of consideration of the project as linked to the new way of relating to the art of exposing objects and to the ability to transmit the company's brand through an expressive language that could reveal the emotional value of a certain concept. This domain of intervention, which has its origins in the interior design and in the temporary exhibition set up sectors, represents a peculiar field of experimentation and research where the designer is called to rethink the project for the new forms of trade exhibition market. The point is thinking about a project that, for a temporary event, should be carried out as a performance; a theatrical representation offering the opportunity to occupy the scene in an engaging way while interpreting the current 'mood' (Bramston, 2010).

New ways of setting up are therefore possible, and they can generate different ways of relating to space with an original project approach in the 'exhibiting', interpreting an expression 'moodboard' in an active, creative, empathic, emotional, flexible, and changing environment adapting to the possible formal implications linked to the various needs of a company and market demands. This last sector is always more interested in an ever growing need for optimization of the economic resources and it requires new outfitting expressivity aiming to obtain the most with the least resources available, for a rapid temporary event.

The set-up project is then featured as a small architectural 'device' marked by a strong chameleonic concept feature, able to adapt to the possible shapes of spaces and rooms in the trade show pavilions and express a constituent and versatile language with a strong communicative feature (Vitta, 2001). A device that becomes a 'display' of alternative languages to reproduce multiple meanings, often perceived as personal communications for those who make use of it.

The configurations of the outfitted spaces are the result of unconventional project strategies which express, through a collage of highly aesthetic figurative/constructive solutions, a simple language which is also evanescent, surprising, persuasive, seducing, and engaging so as to establish an empathic link between the users and the installation (Norman, 2004). Therefore, this is about simple constituent bricolage exercises that follow the collage principles, in which different images/solutions are put in contrast and can be clearly identified. Through constituent processes of addition, integration, and insert, it is possible to obtain various light expositive devices through the repetition of simple and cheap building solutions (Maeda, 2006). Most of the time, the innovative feature of the expositive stands does not reside in the detail designed for each project nor in the use of performing materials, but in the designer's creative ability of simply and freely combining standardized systems, semi-finished materials, and industrialized components available on the market.
The possibility to combine the expositive stands drags the visitor's attention to the way's materials are produced and the products are 'described' and 'narrated'.
The outfitting structures want to generate a new modality of fruition/exposition/perception by the users. This modality should not be confusing, but reassuring, trying to set up a univocal vision of the exposed objects, shaping a flexible expositive path that can be personalized and adapted to the different modalities of 'discovering' the objects. The exhibition modalities, conceived to produce interest, awaken curiosity, and create empathy in the users can trigger an interaction between the work and the observer in order to define an interactive path/visit.
The paper wants to bring back the research activity with the aim of experimenting a new expositive/project/communicative modality as an instrument of knowledge and experimentation, able to
generate a figurative/formal/constructive new language expressing the ability to communicate/show/expose in the rapidity of a temporary event, where everything must be carried out in a specific context[1]. (1)

KEYWORDS
Exhibit design, instant experience, construction device

1. The contribution reports the outcome of the university research activity (SAP.E.RI & CO - Enhances Research Innovation & Coworking, Sapienza University of Rome, 2016/2017), of the didactic experimentation activity (activated in the domain of trade show set-ups, developed by the author as a teacher of 'Exhibit and Public Design' and 'Trade show outfittings' in the Product Design course and Master of 'Exhibit and Public Design' at Sapienza University of Rome between 2017 and 2019) and of the project experimentation applied in three different stand project created by the author.

The exhibition set-up: an instant experience

> *"The set-up is the conception of a space designed to catch the Monstrum, that particular detachment in the systemic organisation of knowledge, or the anomaly that is made remarkable by a slight displacement of meaning or because it is crystallized in shape, an appearance, that wouldn't otherwise be visualised, an artifice prepared to decode the scientific criteria of the exhibition inside a labyrinthic voyage, the allusive tale, the invention. (…) Intercepting the Monstrum means to operate through a set-up architecture able to evoke the silence rather than the noises of an ostensive and destabilising formalism (showing its cumbersome presence). Therefore, a cautious 'absence' available for the display of accurate artifices, allusions, and inventions which turn the exhibition object into something relative."*
>
> (Cerri, 2000).

The set-up of the exhibition spaces has become a domain of consideration linked to the new way of relating with the exhibiting art and with the ability to communicate the company brand, through an expressive language revealing the emotional value of a certain concept. Such an intervention domain, which has its origins in the interior furnishing and temporary exhibitions sectors, represents a particular field of experimentation and research where the designer is called to rethink the project for new transitory forms of the fair market.

The set-up, as it is considered by Andrea Branzi is "(…) *a sort of minor category of architecture, a project activity without any particular attribute of durability and stability, and this way it is close to the world of temporary installations and environmental fiction, absolutely over structural and transitory.*" (Branzi, 2002). In the fair market sector, the set-up defines the ceremonial temporariness of the 'display', which takes the expositive, didactic, and demonstrative connotations of a product, in the frame of a transient temporal domain.

The temporary set-up does have a 'demonstrative' disposition because of its temporary nature: it gathers different codes in its expositive devices, it overlaps meanings, and becomes an exercise of formal comprehension and symbolic tension.

Regarding the temporary nature of the expositive event, in relation with the actual display of the object, Franco Albini states that the set-up has a resemblance with the performing arts thanks to the visual language "(…) *and in the same way that the performance needs a clear, defined, enclosed topic with an orientation that can create a balance between the different parts, that freezes and finishes them, just like a director does with a theatre play.*"

The topic of the space set-up for fair events expresses the concepts of staging, exposing, and showing with the intention of triggering the visitor's interest and communicating the value and meaning of the exhibited work, not only in an explicit sense but also in an evocative and allusive one. The task of set-up is to transmit and transfer the meaning of the exhibited work in a short time.

In the exhibiting culture, a quick action represents the "moment of truth" of the project in relation to the product that is exposed.

The temporary space that should be set up, is often of small dimensions, most of the time it is located in a dense chessboard of stands organized in the big pavilions of the fair structures. The stand has the function of presenting new products and services to test the market and advertise the company brand through an effective and immediate communicative message.

The set-up becomes a temporary installation, fitted for the visitor who walks through the expositive space in a particularly short time, and it has to convey the quality of the product and the brand philosophy. A structure is able to engage the visitors and make them relate in a unique and subjective way with the displayed product through a narrative path and an experiential program made of initiatives and organized events inside the exhibition space in the short time of the fair.

The itinerary inside the pavilions actually unfolds like a 'film' where the visitors/users are not passive subjects, but they interact with the expositive dynamic, they seize the solicitations that are proposed and grasp new correlations and references.

In the visitor's fleeting vision, the set-up space is characterized by a play of colors/backgrounds/indirect and hidden lights, which create a constant diffused light. This space has the task to enhance the object instead of hiding it with the set-up.

In this sense, the expositive structures must be conceived to bring the visitor's attention back to the ways of 'describing' and 'recounting' the object. The fair stands must create a new way for the use/exposition/perception of the visitor, reassuring and not disorienting, aiming to a univocal vision of the exposed objects, shaping a flexible expositive path which can be personalized and adapted to the different modalities of the discovery of the exhibited objects.

Once again, according to Franco Albini, the atmosphere of the set-up spaces *"(…) shouldn't be still, static, but vibrant and the audience should find themselves immersed and stimulated, without realising it."*

The expositive modalities, conceived to produce interest, awake curiosity, and create empathy in the user, can actually start interaction between the work and the observer, so as to define an interactive path/visit similar to storytelling. A narrating expositive space where the visitor's sensorial perceptions are involved through polychromy of the lit surfaces, background sounds, and noises, scents, and aromas are diffused. A place where the sensorial dimension can impress, upset, engage, excite, and at the same time convey the brand idea and a commercial message of the exhibited products. Such a space is intended to outline diversified experiences, able to remain in the occasional visitor's memory.

Therefore, new modalities of set-up are shaping to be able to generate different ways of relating to space with an original projectual approach of the 'exhibition' interpreting a 'moodboard' through the expression of an active, empathic, emotional, sensorial, flexible, and changeable environment according to the possible formal connotations regarding the different needs of the company and the market's requests. This last sector has been interested by the growing necessity of the optimization of economic resources. It requires a new expositive expressiveness in order to obtain the most with the least resources available in the rapidity of the event.

This is about considering the project as something that has to finish in performance; a theatrical play offering the opportunity to occupy the scene in an engaging way and interpreting the current 'mood' (Bramston, 2010).

In order to meet the different set-up needs, which have to change according to the different situations, to different products and exhibiting companies, space has to mediate the relation between the visitor and the exhibited objects creating a new value to the set-up, a suggestive element for the visitor. With the aim of reaching this result, rather than defining volumetric compositions for the achievement of evocative formal and sculptural articulations, it is necessary to find space solutions where the atmosphere recalling concepts of void and light emotionally engage the audience in an 'instant experience'.

According to Franco Purini, the search for something immediate, short, and provisional belongs to the precarious and temporary nature innate of the set-up space (Purini, 2002).

Being part of a system created for quick consumption, the set-up requires features of futuristic lightness in its language, expressed through the use of materials supposed to communicate the transitional and experiential substance of an event/installation which finds most of its meaning for the visitor in its short existence. The exhibition consists of a real 'display' of alternative languages acting to reproduce multiple meanings, often perceived as personal communications for the visitors who benefit from it.

The set-up, defined by an equipped path, built on a repertoire of symbols, materials, and spatial models, becomes an intermission, an autonomous no man's land, one thing between space and matter, between function and shape, product communication and marketing.

The aspects linked to the topic of fair set-up are necessarily connected to the stand's project modalities by stimulating the designer to combine the spaces of the expositive microstructures with the materials and the constructive systems that are employed, the graphic design, the visual merchandising, its multimedia features which are all typical aspects of retail design expressed through the key concepts such as retail environment and shopping experience.

Small-architectural-device: light set-up solutions

> *"Today architecture does not need original works, instead it has to produce 'devices' to be inserted in the right places so as to continue working in the space and produce social effects."* (Stefano Boeri).

Fair stands are light 'devices' with a transitional character conceived to have a short life. They are small infrastructures that, most of the time, are made of different materials with experimental standardized modular structures that can be combined, and quickly assembled or disassembled.

The set-up structures are capable of defining the 'liquid' space of the fair by dividing the micro-architectures and creating conditions that are strongly characterized by high social sustainability. These structures define a flexible expositive path for the visitor, allowing a diversified 'display' of the products and, at the same time, the creation of a visit path which each visitor can personalize.

The fair stand can be labeled with the term of 'small-architectural-device' and it is distinguished by a concept with a strong chameleonic feature, able to adapt to the possible spatial and environmental morphologies, rather consolidated in the big fair pavilions, and to express a constituent and versatile language with a strong communicative feature (Vitta, 2001).

The simple language of the expositive spaces is temporarily adapted to different configurations and it produces social effects.

The configurations of the set-up spaces are the results of unconventional design strategies which, through a collage of highly aesthetic figurative/constructive solutions, express a simple and transient language, at the same time surprising, persuasive, seducing, and engaging so as to create an empathic bond between the users and the installation (Norman, 2004).

The small scale of the small-architectural-devices represents a concrete occasion for research and experimentation to test a new language as well as the materials and the building techniques used on a larger scale (Bianchi, 2012).

The most innovative feature which is sometimes part of the small-architectural-devices is not in the drawings of specific detail, one for each case, or in the use of performing materials, but it lies in the creative ability to freely and simply combine the standardized systems, semifinished materials and industrialized components available on the market. In most cases, the project derives from an examination on the catalog of the range of products which are accessible: the choice of materials and technologies is made through a careful reading of the data sheets describing the most suitable performing ability of both products and applications patented by a specific company (Bianchi, 2017).

The choice of minimizing details, of using standardized detail solutions, of adopting low-cost building solutions by skillfully or creatively selecting on a catalog industrialized products and systems, all of different dimensions and shapes is the insurance of good and quick solutions for the fair stand.

The serial production guarantees the availability of components, the simplicity of assemblage of the single elements, standardized measures, spare parts reversibility for multiple uses, product's warranty, waste product management, and the optimization of storage and transportation steps during the fair.

This approach, which requires specific knowledge of the performing details of the standardized product, and its possible conventional applications, becomes a field of experimentation for the designer who can re-interpret new uses of the materials and the assembly systems of industrialized components, without turning to specialized craftsmanship for the set-up assembly.

New set-up modalities are therefore defined, trying to obtain the maximum with the least resources available, creating new ways of relating to the material, and allowing an original project approach of the 'exhibition', to be considered as a tool of knowledge and research.

These simple constituent DIY exercises follow the collage principle, where different images/ solutions are in contrast still remaining clearly identifiable. This combining principle produces hybrid constructive solutions, able to provide new space configurations, extremely flexible and personalized, for fair stands and all the forms of communication and set-up.

Through the constituent processes of addition, integration, extension, and insertion, various light devices are obtained thanks to the replicable, repetitive, simple, and cheap building solutions of a single module/ basic element (Maeda, 2006). These devices have small dimensions, as a result of a 'dry' design strategy which takes care of the assembly and disassembly of the adopted industrial components.

The design strategies which have been developed by the designer bricoleur are realized, most of the time, with low profile solutions that intend to keep the costs down by using semifinished or low-cost materials, industrialized and low-tech components that use simple constructive systems for a lighter working site.

The low-cost of the set-up projects, determined by the initial limited budgets, allows a confrontation with light technologies, reconsidered and applied in an original and unusual way for the expositive sector. The necessity to realize light expositive devices has actually led the designers to the creative use of the materials and industrialized low-cost systems such as polycarbonate, metal fabrics. pallets, plastic crates, pvc, cardboard pipes, standard aluminum profiles, and metal frames are chosen from a catalog, creating a competition in the research for the most suitable and aesthetically more convincing solution.

Besides, in the last few years, several fair set-ups have been built or assembled by employing 3D metallic systems, like industrial prefabricated containers. The container's structure is completely autonomous and flexible and it allows rapid set-up, with inexpensive furniture and lighting systems.

Among the bidimensional metal structural systems that are particularly popular in the fair set-up sector, we can find the scaffoldings. These light frame systems are particularly used in this domain due to their structural reliability, lightness, their simplicity in dry assembly, their ease in storage, reduced costs, and their flexibility when it comes to combining them with wooden or metal prefab panels.

The stand can therefore be considered as a simple and flexible constructive device realized thanks to a 'soft' technology able to offer the designer new and stimulating possibilities to try and satisfy the fair market needs and expectations.

Tiny devices: the convertibility of the furnishing elements

> *"Just as the study of movement and its practical use is one of the foundations of our era, so the mobility is the most important key to understand furniture."* (Sigfried Giedion).

The space configurations in the fair sites express a common behavior of study and research on a particularly light and transformable furnishing project.

According to Edoardo Persico, the furnishing objects in the set-up spaces *"(…) offer themselves as moments of experimentation and fine-tuning of an architectural language of materials and technologies. They are constituent exercises where the architect's vocation to a total project finds an achievement, 'from the spoon to the city'."*

The temporary pavilion's projects express great freedom of use in the set-up spaces through furnishing elements. The architect enjoys the freedom to use the space as a 'malleable' matter to be molded, modified, transformed according to the experiences and the performances which are supposed to take place inside the stand during the entire fair. This way, the spaces become the stage of a continuum, where the furniture and objects that are part of it are the main actors of any possible modification. In the relation between the user and the temporary space, the objects are laid out as a unique core of possible meanings. Tables and chairs that can be extended, folded, overturned; container boxes can be expanded or reduced like an 'accordion', 'inhabited' walls which open like a book to contain any type of exhibited object. Each furnishing complement is perfectly integrated with the expositive structure and with the lighting systems, it develops a common core in different and personal modalities. This core is where the movement, the transformation, the reduction to the minimum superficial space, and the transport vocation can be found. All these elements define a conception of minimal furniture and moving space that can be light, transformable, turning, extensible, combinable, foldable, overturned, and reconducted to a clear, simple, and essential shape referring to the relevant company brand.

The furnishing elements represent a 'tiny device' inside the context of a 'small-architectural device' containing an idea of temporariness, transformability, and modernity described clearly and intuitively, where solutions are born from the formal invention in relation to its function rather than from an elaborated response in terms of mechanic complexity. The temporariness of the installation is expressed through furnishing elements made from signs, shapes, images belonging to simple and immediate functioning models. Given its temporariness and transient aspect of the fair event, the objects are integrated in the stand structure and require simple gestures to be activated, or actions which do not need complicated learning efforts. The tiny devices, that allow the space to be inhabited in all its part, express an essentialist attitude producing solid, simple, and clear elements, ready to trigger new behaviors and meanings of usage in the temporary and flexible space. The logic intrinsic to the idea of the tiny devices is to convey a certain expressive and formal clarity of the furnishing object in relation to the exhibition, where the configuration of its constituent parts expresses episodes of transformation during its functioning while displaying the concept of the exhibited objects. The movement principle implies a specific work of conceptual simplification on the object that can be translated in a clear shape of "shapes that the eyes can see clearly, that the mind can measure". The set-up space is analyzed in all the possible variations of usage and perception, through the creases of its infinite directions ductile and open objects move, ready to take different shapes and dimensions, to welcome unpredicted phenomena, unimaginable uses.

In the domain of possible space articulations of the expositive sites, it is possible to identify two possible types of tiny devices operating on a small (S) and extra small (Xs) scale. The two different configurations of the furnishing elements act on the concept of a simple and cheap structural design, with the intention of representing an operational strategy aiming to enhance new ways of relating to the material and the productive industry. The exposed materials and prototypes can be organized in a different way, both articulated and disarticulated, in relation to the product typology, the expositive concept, and the ways of using the fair space.

The first typology calls for the use of modular small (S) structures, either bidimensional or tridimensional. The intervention is done through furnishing solutions made of few 'pieces' that, dislocated in the expositive environment, configure different ways of using the set-up space and defining a flexible equipped space that can be personalized by the visitor. the furnishing elements are made of light, resistant, cheap, materials that are easy to transport, assemble, and store. The sizes of the basic module are usually the same as those of a door: 1-mt wide by 2-mt high. This basic modular element mainly made of a single piece is fitted to be combined with other parts/panels or combinable floors according to the needs and necessities of the exhibited objects.

The second type of furnishing objects employs extra small (Xs) modular elements and, just as the first typology, it is defined by the use of bidimensional and tridimensional structures. It is possible to act in the realization of artifacts with structures that were built from only one basic cell/ module/matrix that is light, foldable, self-sustained, and replicable in infinite configurations where the single elements simply wedge in without any major effort during the assembly and without screws and bolts. The measurements of the basic 'piece' are usually the same as those of a file/drawer: 40-cm wide by about 30-cm high. This minimal self-sustaining double-face element once added to the others, is able to contain vertical and horizontal displays with different layouts, to create a diverse, rich, and sinuous fair path.

Conclusion

The research experiences in the domain of fair set-ups show new paths and recurrent design strategies in the productive sector and the market fair, defining a new rigorous method, adaptable to each case according to the requests of the different markets.

The sector of market fair set-ups offers the designers the possibility to confront themselves on a micro-architecture scale that, due to its technical, technological, and functional flexibility, is able to adapt each time to the context where it is inserted.

The constructive simplicity of the small intervention scale, a common feature of most of the fair stand projects, allows to:

- simply read and understand the issues connected to the ability to expose in a fleeting temporal dimension;

- communicate and perceive the message and philosophy of the product and the brand concept;
- engage the visitor in a narrative, experiential, sensorial, emotional, and empathic performance;
- enhance the 'display', in a simultaneous exceptional case of space and matter, spatial solutions defined by their alternative figurative languages, extremely meaningful; - know the DIY/bricolage modalities of addition, integration, extension, insertion, composition and decomposition, replicability, and repetitiveness of a single/basic element of the light device;
- understand the technical issues of the semifinished low-cost materials, of the low tech standardized constructive systems, and the industrialized components available on catalogs of already existing products;
- investigate possible configurations linked to the minimal furnishing and mobile space to a small and an extra small scale.

New spaces for the shared 'making' are therefore created, fitted with light spatial elements, composed by small-architectural-devices and by tiny devices at the same time modular, experimental, changeable, and adaptable to the different expositive configurations of fair markets.

The new dimension of the fair spaces is a result of commercial and economic situations. It represents new modernity characterized by architectural microsystems and subsystems, at the same time flexible and temporary, provisional, and interstitial. The stands set-up represents the staging of work on the productive market becoming today an important activity in the phenomenology of the liquefaction of solid bodies in the public space." (Branzi, 2002).

Thus, new materiality is expressed in the project of 'small' and 'tiny' constructive devices aiming to experiment a renewed expositive/projectual/communicative modality, to be seen as an instrument of knowledge and experimentation, able to generate a figurative/formal/constructive new language finalized to the expression of the ability to communicate/display/expose in the rapidity of a temporary event, where everything has to be consumed in a specific context.

The project labs working on creative research and craftsmanship become places of knowledge, comprehension, manipulation, project, and idea production on a technical-productive level and on that of creative, emotional, empathic, and temporary experimentation of the fair set ups.

IMAGES, CHARTS OR GRAPHIC LEGENDS

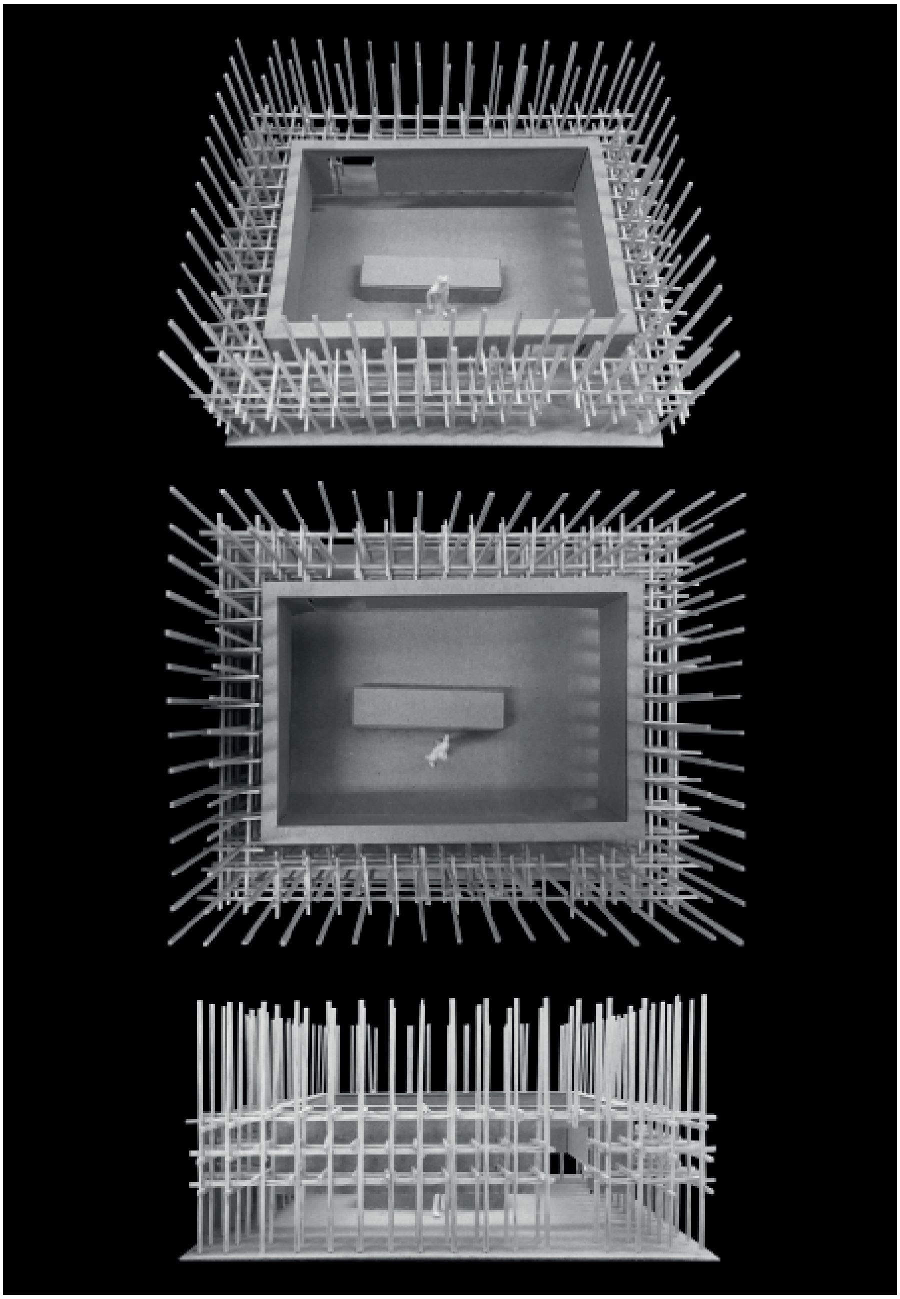

Image 1: Developed by the author as a teacher of 'Trade show outfittings' in the Master of 'Exhibit and Public Design' at Sapienza University of Rome, 2017/2019 (student Alfonso Rodriquez). Images of study model.

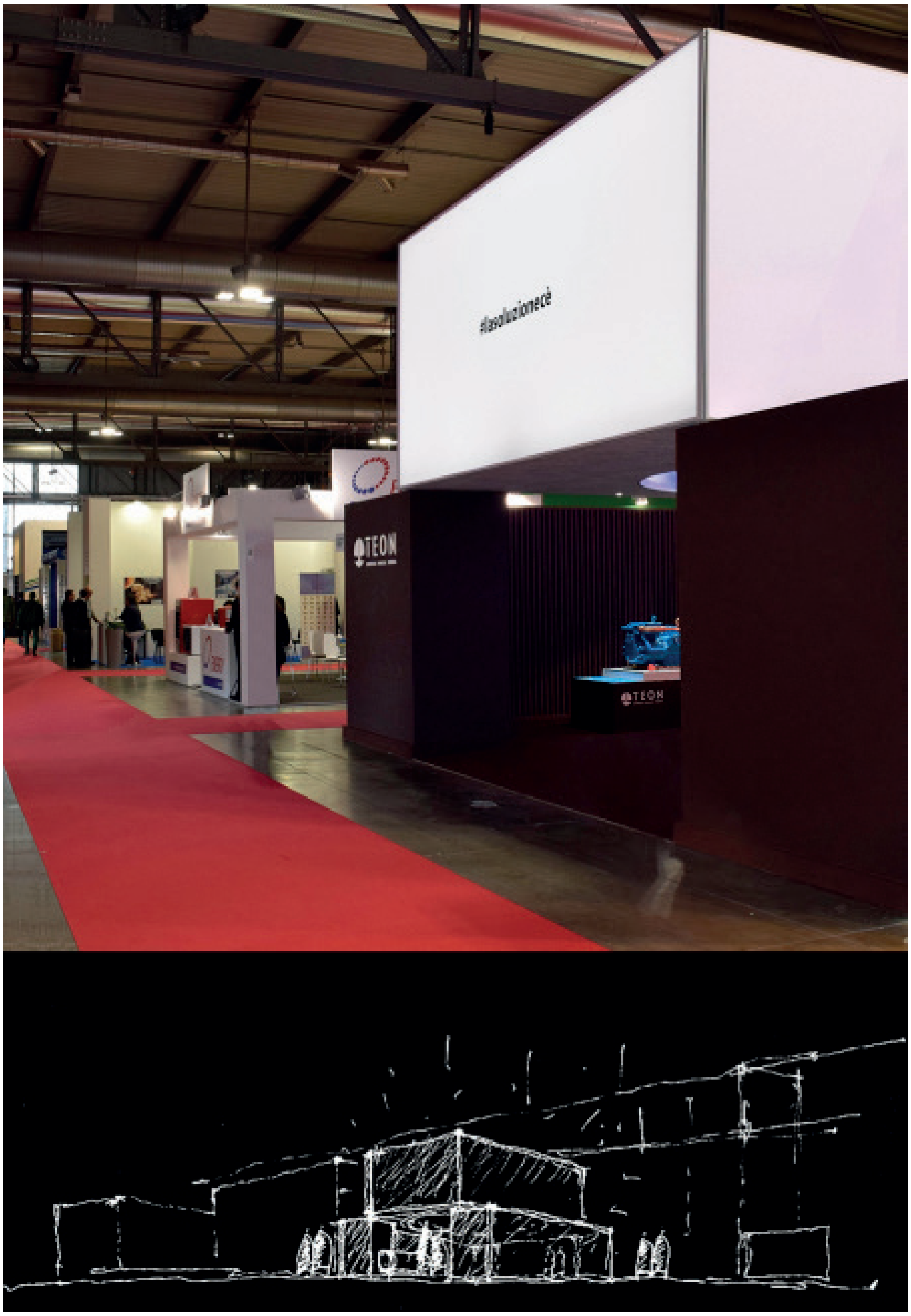

Image 2: The project experimentation applied in MCE Exhibition design, TEON Temporary pavilion, Milan, 2018 by the author with bianchivenetoarchitetti office. Images of the temporary pavilion and the sketch of study.

Image 3: The project experimentation applied in MCE Exhibition design, TEON Temporary pavilion, Milan, 2018 by the author with bianchivenetoarchitetti office. Images of the temporary pavilion.

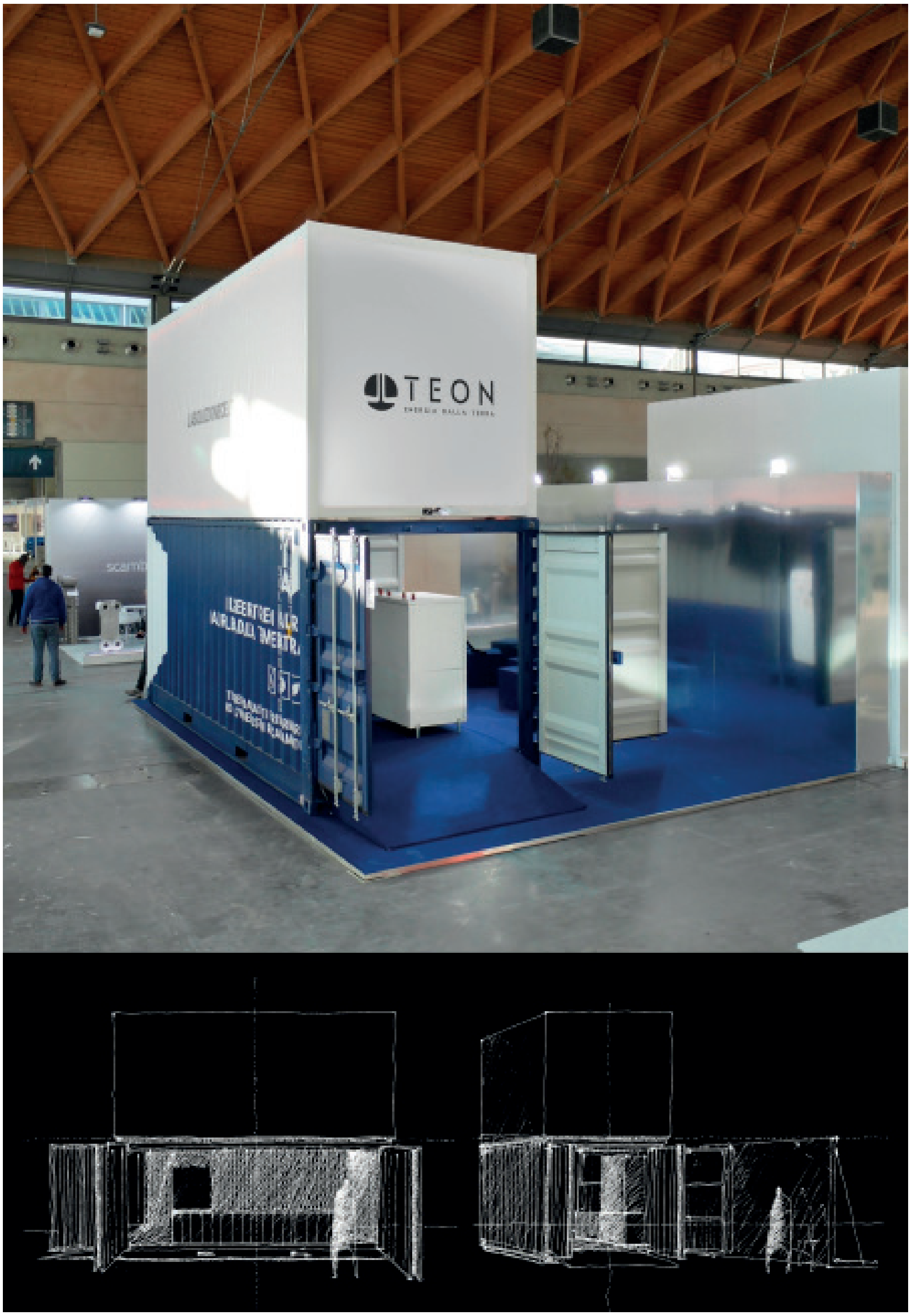

Image 4: The project experimentation applied in Key Energy Exhibition design, TEON Temporary pavilion, Rimini, 2019 by the author with bianchivenetoarchitetti studio office. Images of the temporary pavilion and the sketch of study.

Image 5: The project experimentation applied in Key Energy Exhibition design, TEON Temporary pavilion, Rimini, 2019 by the author with bianchivenetoarchitetti studio office. Images of the temporary pavilion.

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LEARNING BY EMBODYING

Body as a Basic Design Studio Material

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ABSTRACT

This study is a critical inquiry into approaches of teaching methods adopted in the basic design studio. The basic design course provides an initial learning environment introducing the essentials of design for junior architecture students. In this course, students are enabled to question already established situations, concepts, and norms, and are encouraged to be engaged with critical thinking and creative practice. In this study, we underline that the basic design course stimulates both cognitive and intuitive aspects to trigger students deeply into design education. Accordingly, we are concerned about how embodiment can be incorporated in the learning process to enable students' individual and collective attachment to the studio. We claim that basic design exercises stimulating 'learning by embodying' may increase students' creativity and develop their designing skills, paving the way for students to engage both their bodies and the mindsets with the whole design process.

In this respect, 'learning by embodying' as a basic design teaching method was experimented through an alternative syllabus of the Basic Design course at Başkent University, Department of Architecture. The goal was to offer an overarching studio environment which allowed students to challenge their bodily engagements and reveal their individual and collective experiences throughout the learning process. Thus, with the studio project entitled as 'Metamorphosis within the Space', we aimed to encourage students to delve into complex relations of body and space and to experience learning by researching their own 'bodies', its materiality and tectonics, and by discovering their bodies' spatial, structural and relational potentials. Hence, the project comprised a series of exercises leading from a yoga practice workshop to spatial design construction. Consequently, based on this particular case, in this paper, we attempted to draw attention to the contribution and significance of 'learning by embodying' in the learning process and discuss the possibilities, ways, and outcomes to integrate into the basic design studio.

KEYWORDS

Basic design course, learning by embodying, body, materiality, space

Introduction

This study is a critical inquiry into approaches and ways of teaching methods adopted in the basic design course. As accepted for decades, the basic design course provides an initial learning environment introducing the essentials of design for junior architecture students. By triggering first-year architecture students to question already established situations, concepts, and norms, the basic design studio encourages them to be engaged with critical thinking and creative practice equipped with adequate knowledge, skills, and competences. Therefore, the basic design course itself presents a particular transition between high school education and architecture education. It is for this reason that in many architecture schools and related scholarship, the basic design course has been also referred to as 'preliminary course', 'introductory course' or "foundation course"[1].

Having in mind that basic design course constructs not only cognitive but also embodied links which help junior architecture students to further orient themselves into design education, this study aims to initiate a critical discussion on how a pedagogy for embodiment can enable students' individual and collective attachment to the studio. It argues that basic design exercises encouraging 'learning by embodying' may lead to emancipation in opening new spacing of creativity, where students can engage their bodies as well as their mindsets with the whole design process. Thus, this study propounds that basic design teaching methods which are inspired by embodied pedagogical registers can develop student's design making skills by internalizing the given design problem and creating more individual and deeply processed works. Accordingly, the significant role of embodiment in learning is discussed through a particular practice realized in Basic Design Studio during the 2017-2018 Spring Semester at the Department of Architecture at Başkent University as an exemplary case.

In doing so, initially, concise evaluation on the introduction and development of the Basic Design Course in architectural education is presented. Next, the contribution of Bauhaus to design education and its teaching-learning model based on 'learning by doing' is underscored. Then, from a critical stance to the Bauhaus method both in terms of its epistemological foundation and of its subsequent transformation and continuation in later architecture schools, 'learning by embodying' is highlighted to replace 'learning by doing'. Learning by embodying, a teaching method based on a phenomenological approach is considered to integrate and complement the learning process by including other forms of knowledge acquired through intuition and experience. Accordingly, the particular project practiced in the basic design studio is assessed to experiment the role of embodiment in learning. Finally, it is shown that teaching approaches based on learning by doing not

1. In the Bauhaus, the basic design course was named as Vorkurs which corresponds to the foundation course.

only affected the way students engage with the design problem and process but also how they attach themselves to the studio.

A Quick History of the Basic Design Course

The history of basic design course has its roots in the early 20th century when the industrial mode of production triggered the formation of modern design education as a contemporary demand against existing craft traditions and apprenticeship processes (Ranjan, 2005). In 1919, the Bauhaus was established as the realization of the ideals towards modern design education. Following 19th century scientism, at the Bauhaus, the notion of design was considered as an artistic or aesthetic theory applied to practice (Findeli, 2001) and, accordingly, the learning process was based on phases such as 'experience with the senses' to enhance sensory stimulation, 'objectivizing at an intellectual level' to develop logic towards understanding explaining concepts and relations and 'realizing through synthetic means' to be able to produce with quality (Ranjan, 2005).

Under the influence of modernist universalism, the tradition of basic design education started in two distinguished and contemporary modernist schools; the Bauhaus in Weimar and the Vkhutemas in Moscow. By the foundation of these classical schools of avant-garde art and design, the basic design teaching thrived and became the core of the curriculum from the beginning of the 20th century (Boucharenc, 2008). However, the changing paradigms in architecture, design, and education, triggered by paradigm shifts in meta-disciplines, have impeded the positive rise of the 'traditional' way of basic design teaching and have threatened the popularity of such traditional rationales. The pioneer teaching methods, therefore, become questioned particularly after the 1970s and new teaching approaches have been inquired and then experienced, which will be discussed later.

Thrilled by child educators Johann H. Pestalozzi and Friedrich Froebel (Özkar, 2004), Johannes Itten set up the basic design course at Bauhaus as a preliminary course, *Vorkurs*, to prepare fresh students to "acquire knowledge through experimenting, creating and discovering" (Boucharenc, 2008). On the other hand, at Vkhutemas, Nikolai Ladovsky organized basic design courses focusing more on sensory experience to analyze factors such as "attention", "memory", "perception measurements" and "spatial and motor abilities" (Özkar, 2004) As examples of modernist architecture and design schools, both the Bauhaus and the Vkhutemas promote a positivist and logical thought to initiate and accompany a design process which reflects timeless and universal intellectualism. The first basic design courses, within such a context, appear as a modernist program encouraging the development of universal design skills through constructing abstract relations among concepts, forms, and materials.

The Bauhaus Method: a teaching model upon learning by doing

As the curriculum of the Bauhaus combines arts, craft, and design, the adopted teaching methods within *Vorkurs* also present an approach embracing craftsmanly inclination (Banham, 1980). In his seminal book "Theory and Design in the First Machine Age"**,** Reyner Banham discusses the Bauhaus method of education:

> Handicraft, as a teaching discipline, implies 'learning by doing' rather than reading or listening to lectures, …, and this became the 'Bauhaus Method' and ultimately the norm for advanced architectural training all over the world. (Banham, 1980).

Within this prominent teaching method, for Banham, a great innovation of the Bauhaus Method was the decision by Itten to cleanse the fresh student's mind of all existing preconceptions, aiming at obtaining minds back into kindergarten. These fresh minds then become ready to discover potentials of creativity within *Vorkurs,* which has been still regarded as the essence of the Bauhaus Method.

The liberation of creativity within the Bauhaus Method has been provided by adopting a student-centered approach, as propounded by John Dewey (1938), through which the learning environment -in our case, the basic design studio- becomes a social setting where students can build social relations during their learning processes. The studio, therefore, becomes a social space where students practice 'learning by doing' and solve the given problems through hands-on approaches. According to Roger Schank (1995), learning by doing is an active constructive process through which theories meet practices, and, therefore, learning becomes easier while learning processes are seen, felt, and done as in real life.

By injecting learning by doing into teaching approaches, the Bauhaus Method itself presented a revolutionary pedagogy when appreciated within its own context, as a method criticizing the classical formalism of the 'Beaux-Arts System'. The Bauhaus challenged the Beaux-Arts System of transferring knowledge and experience from master to apprentice, through enabling students to intervene in the design process by putting their personal insights and releasing their inner creativity. On one hand, its methods have been made use of for decades and studied still as a favored topic in design education research. On the other hand, particularly after the closure of the Bauhaus, the 'traditional' way of basic design teaching became to be questioned and criticized for several reasons.

Christian Boucharenc (2008) assembles the reasons behind the decline in popularity of the traditional way of basic design teaching after the 1970s. The main criticisms over the Bauhaus Method argue that became repetitive and dogmatic; since, the follower schools of the Bauhaus had reproduced its schemes of learning without applying any update (Sausmarez, 1964). For Boucharenc (2008), in many architecture schools, the Bauhaus Method "degenerated into an inflexible form of teaching" and, so, it was mainly adopted without any revision in its content or rationale (Boucharenc, 2008). This was interpreted also by Anna Rowland (1990) as "a frozen a piece of dogma as the academic courses it sought to replace". Another main reason for a critical approach to the Bauhaus Method was that its adopted learning model became apparently formalist especially during the 1970s, which had a negative effect on creativity (Boucharenc, 2008). Following such criticisms, after the 1980s, the traditional teaching methods of the basic design was reviewed by contemporary design instructors and more emancipatory approaches have been quested since these instructors still believed that basic design education is necessary for two major reasons: Constructing a link between design specializations and even among science and creative disciplines and providing students with the first encounter on ethics of design profession (Boucharenc, 2008).

Learning by Embodying: a phenomenological teaching approach

The paradigmatic shift in the pedagogical approaches adopted for basic design teaching has brought more phenomenological registers into the curriculum. It should be noted here that this is due to the intentions of contemporary design instructors for reconsidering individuality and cultural identity in design thinking and practice (Boucharenc, 2008). The phenomenological tendencies in basic design teaching, appeared in 1980, are analog to the postmodern turn pointing to the epistemological shift from modern to postmodern thought. This shift thus triggered a reconsideration of established binaries such as "truth vs. perspective, certainty vs. uncertainty and universality vs. particularity" (Susen, 2015), all of which affected the ways how learning is approached. On the other hand, following this turn, the production of knowledge and reality has been then embraced as contextual, relational, and historical, rather than being considered as results of scientific tests and observations (Susen, 2015).

As a reflection of that shift, the entry of phenomenological registers into the basic design curriculum has forced an update in teaching methods and, therefore, in the curriculum of the studio. As the Bauhaus Method based mainly on 'learning by doing' was criticized because of its positivist approaches towards learning, the revisions have been suggested to encompass a more flexible structure. The formalist model of the Bauhaus Method limited instructors' freedom in adapting their own programs to the studio. Defining the design process merely as a problem-solving exercise where students have been expected to solve the given abstract design problems, it also inhibits the inclusion of individual experiences and intentions through the design process. Beyond so-called dogmatic schemes of teaching and learning at the Bauhaus, what phenomenological approaches into basic design teaching recall is the "structure of various types of experience ranging from perception, thought, memory, imagination, emotion, desire, and volition to bodily awareness, embodied action, and social activity" (Smith, 2018).

At that point, this study aims to initiate a critical discussion on the entry of phenomenological, or more particularly the embodied, pedagogical approaches into basic design teaching. The study, therefore, propounds the concept of 'learning by embodying' as an updated basic design teaching method beyond 'learning by doing'. In order to further elaborate historical and theoretical debates discussed so far, by linking them with practice, the study exhibits a basic design studio project entitled 'Metamorphosis within the Space' which is a part of the alternative syllabus created in the Spring Semester of the Academic Year 2017-2018, for the Basic Design Studio at Başkent University Department of Architecture. The intention behind suggesting an alternative syllabus lies in the idea of providing a studio environment based on experiential learning processes accompanied by embodied pedagogies. The exercise applied during the second phase of the syllabus will be analyzed within this study, as it offered an overarching studio environment where students challenged their bodily engagements and revealed their individual and collective experiences throughout the learning process.

Questioning the complex relations among body and space and thus triggering students to discover the social potentials as well as the physical limits of their bodies in providing a reference for the production of space, the basic design studio project 'Metamorphosis within the Space' enables us to propound and elaborate an inspiring concept in basic design teaching; 'learning by embodying'. The concept points a critical pedagogy based on an embodied approach which challenges the Cartesian dualism dictating our minds and bodies as separate entities. For decades, it was believed the body had no contribution to cognitive processes, and therefore, into the development of knowledge (Ollis, 2008). This disjuncture between mind and body has been influenced the dominant pedagogical approaches in Global North and West, where "the highest status is reserved for abstract and immaterial learning" while "the lowest status is accorded to material learning, … the embodied actions" (Morris and Beckett, 2004). As Edward Casey puts,

> Human embodiment was among the first victims of the Cartesian revolution in philosophy. This embodiment… had no place to go: still worse, no place of its own. But like any good ghost, it has returned to haunt its exorcizer. (Casey, 1998 as cited in Dall'Alba and Sandberg, 2020) .

However, thanks to feminist and postcolonial attempts in the academy during the past few decades, 'the body' has become to be taken into consideration for researches conducted in many disciplines. Feminists have disparaged the dominant Northern/Western epistemological tradition privileging "mental detachment, the observation and calculation of the world from disembodied and abstract rationality" (Lelwica, 2009). Feminist scholars, therefore, argued that the priority to mind and reason in accounts of claiming what the knowledge systematically denies the body and, thus, the necessary dependence on embodiment (Barnacle, 2009). Therefore, the embodied aspects such as experiences, emotions, personal narratives, and intuitions have long been regarded unreliable in the production of knowledge, therefore, in the learning processes.

Appreciation for both mind and body in learning processes have challenged the objectivist and positivist approaches in education and instead have suggested more phenomenological ways encompassing both mind and body as interrelated "mediational tools" (Wertsch, 1991 as cited in Cheville, 2005) of learning. As Sharon Todd points, bodily sensibilities cannot be "contained, directed or enforced by tightly defined procedures and institutional arrangements" and, therefore, she questions the assumption that "the 'right' kind of teaching will produce the 'right' learning outcomes" based on the role of embodiment in learning (Todd, 2016). This also shows how embodied aspects throughout a learning process have been ignored in teaching (Dall'Alba and Sandberg, 2020). However, it has been proved by many scholars[2] in different fields that learning is not limited to the intellect, or 'doing' things. Then again embodied practices integrated into the learning process enable students to acquire different forms of knowledge and develop further skills even for the same learning situation (Dall'Alba and Sandberg, 2020).

At that point, it should be noted that compared to teaching methods based on 'learning by doing' which privileged problem solving and thus the cognitive operations by the mind, 'learning by embodying' exhibits an overarching model which covers "knowing, acting and being" (Dall'Alba and Sandberg, 2020). Robyn Barnacle addresses how mind-body collaboration significantly affected learning processes:

2. See, Barnacle, R. (2009). Gut Instinct: The body and learning. Educational Philosophy and Theory, 41(1), 22-33; Dall'Alba, G. & Sandberg, J. (2020). Bodily grounds of learning: embodying professional practice in biotechnology, Studies in Higher Education; Ivinson, G. (2012). The Body and Pedagogy: Beyond Absent, Moving Bodies in Pedagogic Practice. British Journal of Sociology of Education, 33(4), 489-506; Wagner, A. E., and R. A. Shajhahan. (2015). Centering Embodied Learning in Anti-Oppressive Pedagogy. Teaching in Higher Education, 20 (3), 244-254.

> How mind-body relations are understood will have a considerable impact on the way in which such a notion is conceived as well if education is to address, engage, and transform the whole person, of relevance is the question of how the subject is constituted: whether vertically, through the dominance of the brain, central nervous system, and intellect, or in a more distributed fashion. (Barnacle, 2009).

As such, in addition to addressing, engaging, and transforming the whole person, it can also be noted that the Basic Design course triggers junior architecture students to broaden their vision in understanding the world or being-in-the-world. At that point, teaching methods propounding approaches on learning by embodying encourage students to investigate into material and interactional aspects of their bodily being throughout the design process. Noticing the presence and effect of the body in the design process, therefore, leads to new possibilities of creativity, where students put their individual experiences and intuitions forward. In other words, through learning by embodying, the students can attribute a particular meaning to the entire design process, which provides them to attach themselves better to the studio and to be more creative. Exploring the ways in which the body is mind, in his seminal book "The Body in Mind: The Bodily Basis of Meaning, Imagination, and Reason", Mark Johnson discusses how our embodiment relates with our creativity:

> …as animals we have bodies connected to the natural world, such that our consciousness and rationality are tied to our bodily orientations and interactions in and with our environment. Our embodiment is essential to who we are, to what meaning is, and to our ability to draw rational inferences and to be creative. (Johnson, 1987).

Including embodied practices in basic design studio provides exciting opportunities to notice the body as one of the 'materials' of the design process. As embodiment applies to "anatomical, emotional and psychological experience" (Foucault, 1984), in learning by embodying, the body manifests a presence accompanied with its intertwined qualities, therefore, both tectonic and phenomenological materiality of bodies become revealed. During the design project 'Metamorphosis within the Space', the students were expected to discover both physical and relational qualities of their bodily engagements to the studio and thus to transfer this embodied knowledge to a spatial experience leading the development of the design process.

The Studio Project: 'Metamorphosis within the Space'

In the Spring Semester of the Academic Year 2017-2018, the Basic Design II Course at Başkent University Department of Architecture adopted embodied learning approaches. The studio was conducted by Çağla Caner Yüksel, Tevfik Gürsu, and Burcu Ateş. In our department, Basic Design II is designed as an intermediate course that prepares students and lays conceptual, theoretical, and process-based foundations for architectural design. In this course, students are introduced to the concept of 'space'. The aim of the course is to develop and associate students' skills of designing in two- and three-dimensional media particularly in making spatial designs.

It is among the objectives of the course that the students are expected not only to have basic knowledge of anthropometrics and ergonomics related to the human body and scale but also to develop awareness on the relation of body with/in space and improve skills in creating solutions to design problems involving body-space interaction. As such, each semester we determine the main theme, under which the spatial and space-related concepts have been studied and practiced. 'Metamorphosis' was the semester's theme, which was discussed in three phases as 'metamorphosis with(in) volume', 'metamorphosis with(in) space', and 'metamorphosis with(in) place' through a series of exercises realized with a variety of representational media. The second phase, which is the very focus of this paper, involved exploration of reciprocal relations of body and space; definition, production, and creation of space through bodily poses and movements, and thus encouraged embodied experiences in the studio.

This phase was articulated to include students' own 'bodies' to reflect on during design thinking and making. In this particular case, the students were encouraged to experience learning by researching their own 'bodies', its materiality and tectonics, and by playing with their bodies' spatial, structural, and relational potentials. It is thus aimed to uncover the intuitive creativity of the students during the bodily research and design process. During this phase of the semester, therefore, the body, as a physical and phenomenological entity, was considered as the main 'material' of the design project, where students can intuitively learn from it while discovering its complex materiality; its anatomic qualities, structural principles and tectonic characteristics. Ultimately, students were oriented to experiment learning by embodying.

In order to complete learning through bodily experience and enable students to deeply internalize acquisitions aimed at, intuitive learning was supported with traditional modes of learning by doing such sharing of trained, acquired knowledge through research, analysis, and alike. In this sense, this second phase consisted of a series of exercises starting with research on the concepts of 'scale and proportion' as well as discussion on 'body, movement and space'. Based on their own research and through a list of assigned short readings and movies[33], students reflected on the relation and interaction of body and space (Image 1). This preliminary exercise enabled them to think deeply on the body and space relations and prepared them for the subsequent bodily experience, or put learning differently by embodying.

To materialize learning through real-life experience, a workshop (Image 2) was organized for students to practice yoga poses through a flow under the direction of expert yoga instructors Burcu Ateş and Gözde Yorulmaz. The yoga practice paved the way for each student to develop an awareness on his/her body and realize its material and structural properties and potentials by experiencing its changing balance in different poses. Subsequent to individual practices, the students were divided into groups of 4-5, where one of them performed a particular yoga pose and the others explored and documented the characteristics of the body in that particular pose through free-hand sketches, diagrams, taking photographs, etc (Image 3). They tried to figure out the structural, formal, and tectonic qualities of the body in pose and its spatial potentials.

Then, they transformed their embodied knowledge into a three-dimensional medium, namely into 1/1 scaled abstract body models (Image 4, Image 5, Image 6, Image 7). Tectonics of the body formed the basis of the tectonic language necessary for the construction of structural models. They were free to choose any kind of material to construct their 1/1 scale, body models. Structural components, constituent parts, joints, how these relate to each other, come together, and organize the whole in the pose was concretized through wooden sticks, folded cardboard, wire or mesh-wire accompanied with wooden plates, sponges, metal plates, etc. according to students' preferences. As such, the students were enabled not only to experience the structure and materiality of their own bodies through the yoga workshop but also they experimented with a variety of materials during body models construction. They decided and designed their structural units and put them together according to the characteristics of the materials they preferred.

This exercise of constructing body models synchronically developed with another one, where each group of students was also asked to experiment on structural systems (post and lintel, cantilever, truss and space truss, tension and compression structures, folded plates, arch, vault and dome and geodesic dome). By

3. Short readings on body and space relations through performance arts, particularly modern dance:
Özge Can Balaban, Çağdaş Dans Üzerinden Beden-Mekan Birlikteliği- Bölüm 1 https://www.inploid.com/post/mekan-dans-hibritlesmesi/26958/ ve Bölüm 2 https://www.inploid.com/post/mekan-dans-hibritlesmesi-2/29487/ ; Orkun Aziz Aksoy, Performans Sanatında Beden - Mekan İlişkisi, https://www.artfulliving.com.tr/sanat/performans-sanatinda-beden-mekan-iliskisi-i-1133 . Videos on performance arts which reflect on body and space interaction, and definition and production of space by the moving bodies: Pleiadesenra: https://www.youtube.com/watch?v=0813gcZ1Uw8; Cloud Cluster-enra: https://www.youtube.com/watch?v=XrNKrV9ydUA; Ballet-rotoscope: https://www.youtube.com/watch?v=yzJk6ww3LD0; Colloque Rudolf Laban 01: https://www.youtube.com/watch?v=hTtC1j9GoCQ

this way, they would support their grown awareness on the structural properties and behaviors of their own bodies through lived experience with designing experimental models which simulate basic structural systems. It was also aimed that the students would find out potentials of materials relevant to each construction system and structure. This practice added acquired knowledge to intuitive awareness on structures and hence helped the students both to articulate their body models and prepared them for the final outcome of this phase in creating three-dimensional designs that are structurally stable and steady.

The final step of this phase required relational design making for the body. The students were asked to focus more on the spatial potential of the bodies and therefore to discover the very space defined by, derived from, and related to the body. Constituent parts, their joints, and relations in the body, its structural balance, orientation, levels, and locational specifics of the pose and alike were the criteria to figure out the space and its sub-spaces in relation to the body and its parts. At this point, the way the body models were represented – the potential of applied material, design of structural units, geometric order of construction, etc.- were also significant to guide the process of the final design. Each group of students proposed solutions specific to each body model, deriving from its representational modes and techniques, which at the same time considered its unique spatial features. Based on the tectonics of the body in the pose, the body model was articulated, hence, the tectonics of the body model led to the final spatial design (Image 8, Image 9, Image 10). The end products were displayed in an exhibition which included a mobile jury to evaluate and give feedback on each spatial model (Image 11, Image 12, Image 13).

Conclusion

The entire project process was experimental and educative for both instructors and students. The design of the syllabus and the project required integration of interdisciplinary approaches in the basic design studio where junior architecture students encountered different media and materials. They were triggered to find ways to transform knowledge from one medium and material to another. The body itself throughout the phase was considered both as a medium and as a material. It is a medium since, through an investigation into their own bodies, students embodied themselves in the studio both in a physical and interactional way. The bodies became a medium for provoking the design process and social relations. The body is material since the students discovered its anatomic qualities as a structure while they also searched for its spatial potentials, how the body itself created a space. To this end, attention to embodied practices helped students to achieve transformations of knowledge from the body to structure or body to space.

It was also observed during the project entitled 'Metamorphosis within the Space' that the bodily commitment of students to the design problem affected their way of engagement with the studio, in other words, how they attached themselves to the creative and social processes. Throughout the project, it became even more apparent how the studio itself turned to be an experiential learning environment where 'knowledge' and 'space' are constructed by means of acollaborative production through 'learning by embodying'. During the colloquium held at the end of the semester, almost all of the students conveyed how they felt themselves really 'attached' to the studio during this second phase. We understand from their feedback that their presence and being-in-the-studio developed in a way that they found their own embodied practice both for conducting a design process and also for developing social relations in the studio.

IMAGES, CHARTS OR GRAPHIC LEGENDS

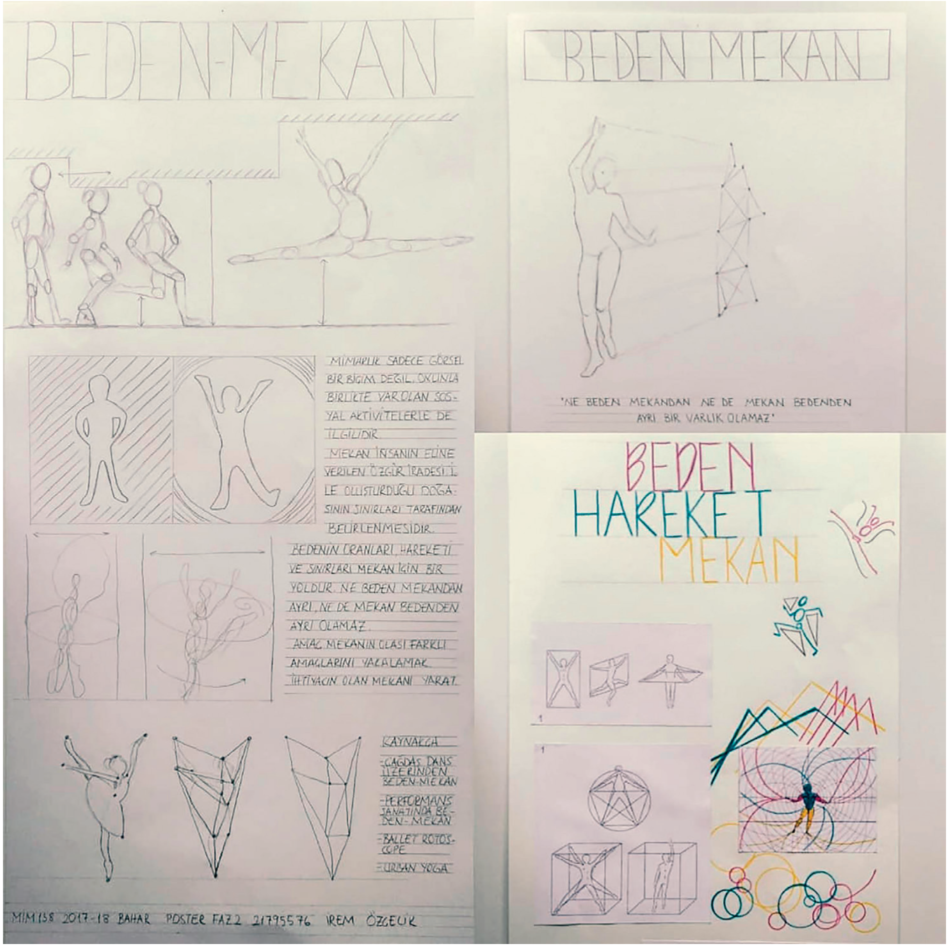

Image 1: Preliminary exercise on the body, movement, and space.

Image 2: Yoga workshop, a practice on body.

Image 3: Yoga workshop, exploration of the body in groups.

Image 4: A body model by Ayhan Çağan, Eylül Melis Kara, Asena Kartal, Erkin Kurtoğlu, Pelin Nur Kuşçu, Mevlüt Furkan Sarı.

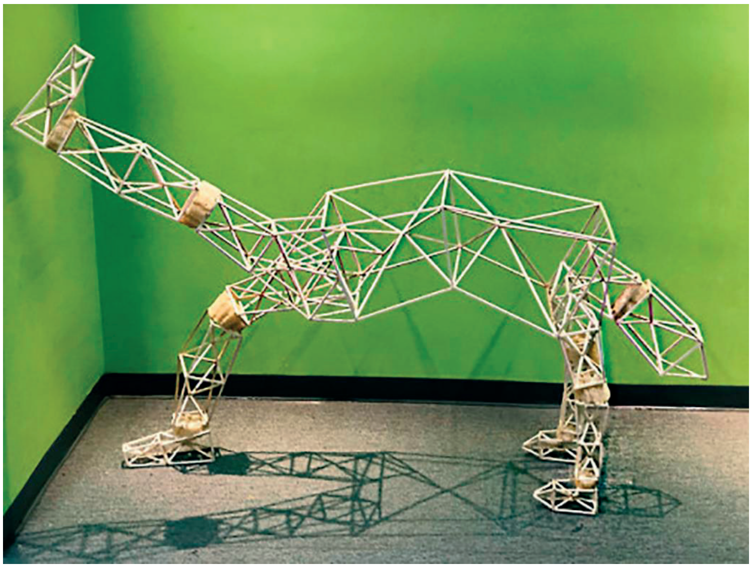

Image 5: A body model by Alp Eren Başhan, idil Berktaş, Dilara Güneş, İlayda Güzelküçük, Eylül Olmuş, Sinem Durdu Önal.

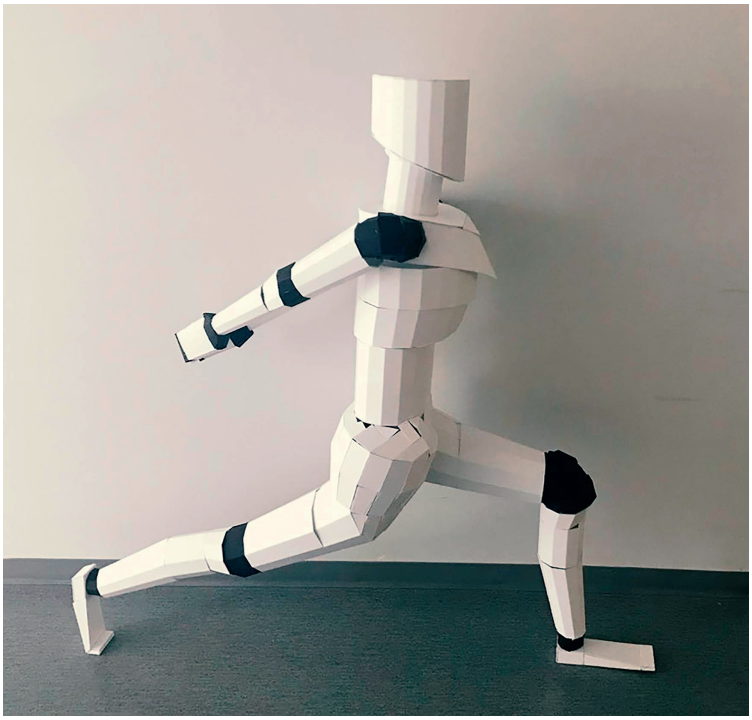

Image 6: A body model by Ülkü Canbaz, Ahmet Berkay Fazlıoğlu, Onur İlgöz, Onur Deniz Kayalar, Çetin Berke Korkmaz, Berkay Oruç Yıldız.

Image 7: A body model by Beyza Akman, Ecem Hamurcu, ELİF Sultan Kaya, Ecehan Kendirli, Selin Kızıl, Esengül Ünlü.

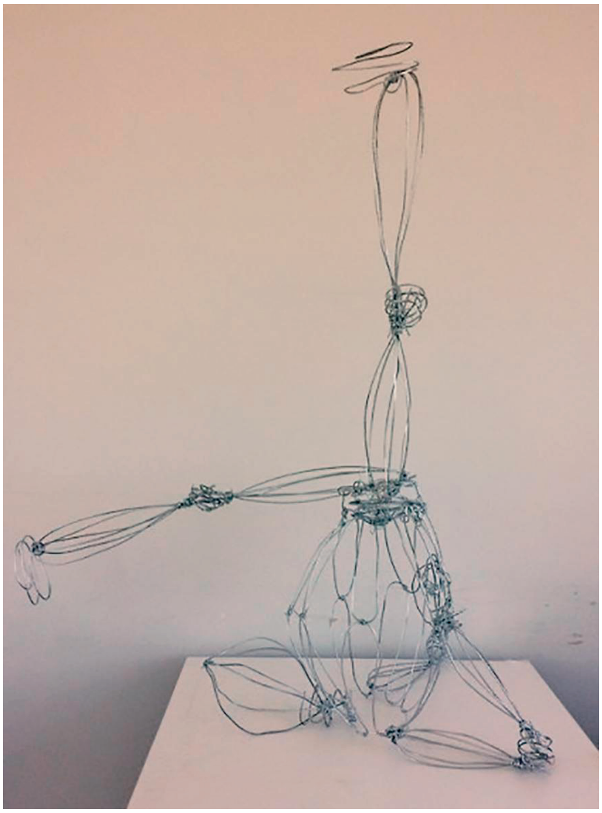

Image 8: Final model by İncinur Ateş, Berf Barkın Çömelekoğlu, Selensu Demir, Bertan Demirçelik, Zümrete Demirel, İrem Özçelik.

Image 9: Final model by Busenaz Beştepe, Elif Dicle Büyükbay, Zümrüt İlbey, Gizem Ören, Dersu Tatar, Merve Yıldırım.

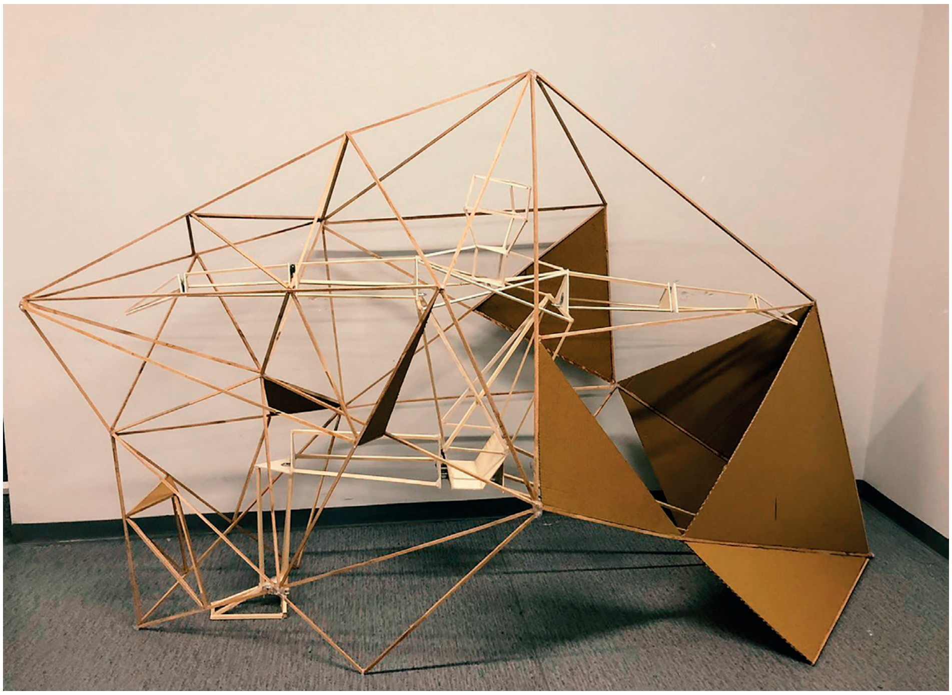

Image 10: Final model by Ayhan Çağan, Eylül Melis Kara, Asena Kartal, Erkin Kurtoğlu, Pelin Nur Kuşçu, Mevlüt Furkan Sarı.

Image 11: Mobile jury by Gülsün İlke Bilgili, Kübra Gül, Sevilay Karakuş, İpek Keskinkılıç, Onat Köse, Mert Soylu.

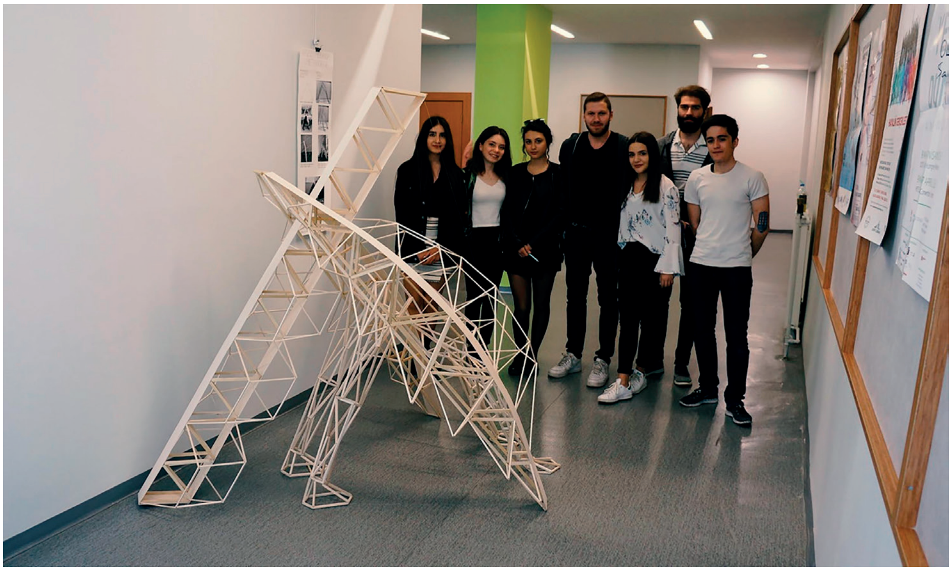

Image 12: Mobile jury by Yiğit Bayrak, Mert Gündüz, İrem Kçş, Müge Şenkal, Ahmet Can Topçu, Ezgi Ece Tozkoparan, Selen Yüksek

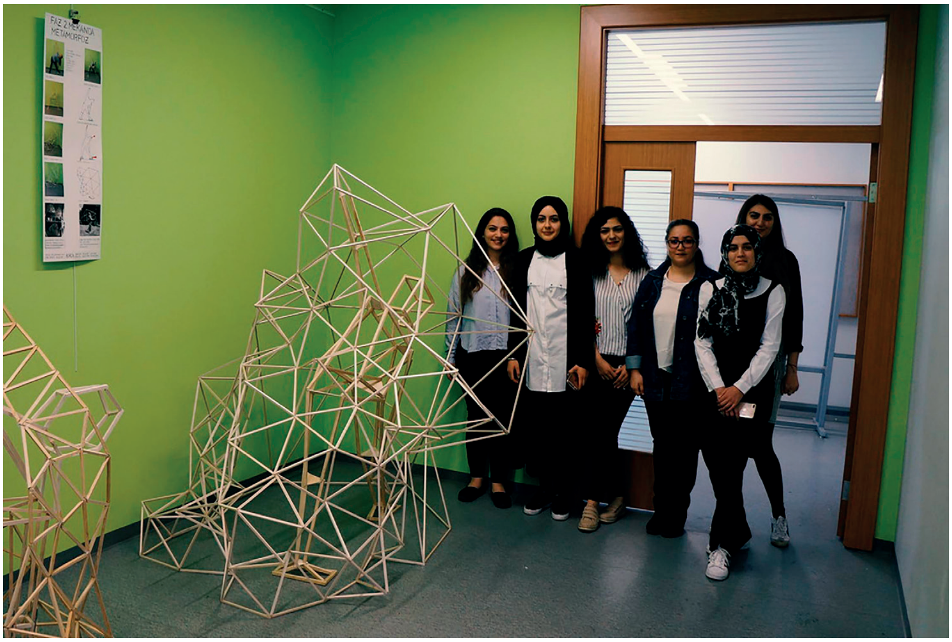

Image 13: Mobile jury by Merve Aras, Birce Güngör, Selin Turhan, Büşra Ün, Gülsüm Yaman, İhya Yağmur Yavuz.

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SECTION III

ARCHITECTURAL MEDIA AND URBAN DESIGN

CHAPTER I


urban
photography
process
reading
space
materiality
context
ideas
media
city
form
inflatable
produced
cultural
soft
portuguese
turkey
shift
principles
1960s
communicating
avant
conjectural
approach
communication

INTRODUCTION: SIGNIFIERS IN ARCHITECTURE AND FOR ARCHITECTURE

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Signified and signifier

The terms "signified" and "signifier" are mainly related to semiotics, which is the discipline that studies the use and interpretation of signs and symbols. Ferdinand de Saussure introduced them as the two inseparable sides of a sign or a symbol (fig. 1). The "signified" is the content, meaning the concept or idea to be expressed by the sender. The "signifier" is the means, that is to say, what can be perceived by any sensory modality of the receiver.

The desire of transferring information has been present in the history of human beings throughout their history. Therefore, the creation and use of many and convenient signifiers can be accepted as one of the most relevant achievements of civilization. Signifiers can be found in a vast range of typologies. But, certainly, those closer to the discipline of architecture are physical means, which is to say, those signifiers which can be seen and even touched. One of the most curious and ancient examples of objectified concepts is the manmade piles of stones which can be found in many ancient cultures with a variety of forms and names but always with a similar purpose. Known as "apacheta" in the Andes mountain range area (fig. 2a), "inuksuk" in the Arctic region of North America (fig. 2b), "cairn" mainly in the British Isles but also in other countries such as Switzerland (fig. 2c), "moledro" in Portugal, or "gromila" in the Western Balkans region, are used as points of reference or markers for places of veneration, burial monuments, travel routes, hunting grounds, fishing places, and many more. Stacking stones in such a way that the result irrefutably could not have been done by nature but by human beings, constituted for our ancestors a powerful communication manner which is still alive in different regions all over the world. Closer to sculpture than to architecture these stony piles are, however, a remarkable precedent of the role which architecture will undertake throughout the centuries as a signifier for many signifieds.

Signifiers in architecture

Architecture is a fertile discipline when it comes to producing signifiers. History of architecture books goes over the different periods not only detailing the characteristics of their most remarkable buildings, and the materials and techniques employed for erecting them, but also explaining the ideas and aspirations of the society of the corresponding time. That duality is especially indissoluble in certain architectural styles such as Gothic architecture, or in the works of certain masters such as Mies van der Rohe. When detailing the beam and column junctions for the Farnsworth House (fig. 3), the German-American architect, pioneer of the Modernist architecture, placed the beam, not on the top of the column, but tangent to it, expressing the independence of the elements and strengthening the concept of the building understood as an assembly of industrial pieces which participate in the whole but preserve their own individuality and identity.

Connecting the column and beam in this particular way is not simply a detailing casual choice. It is a whole manifesto announcing that a new time where industrialization is going to have an undeniable prominence has arrived. Two simple steel structural members being assembled in this unprecedented manner is the signifier of a much larger signified whose consequences would definitely exceed the boundaries of that idyllic property in Plano, Illinois.

Even before then specific detailing, the choice of materials might frequently constitute a relevant signifier in architecture. The chapter is entitled "Materiality meaning as a project concept. The case of the Camí d'Onda Air-raid Shelter in the historic center of Borriana, Spain" by Ivan Cabrera, Ernesto Fenollosa, Begoña Serrano and Verónica Llopis, describes the process of selection of materials for the restoration of an ancient defense infrastructure from the Spanish Civil War. The authors discuss how the project met the challenge of updating a complex whose underground galleries were quite well preserved and required a minimal intervention, but whose street-level access had completely disappeared and a new one was to be designed in a recently refurbished street dominated by the main façade of a Gothic Revival church (fig. 4). The choice of materials to be employed in this project was not casual at all. On the contrary, the selection was made following a set of criteria aimed to preserve the authenticity of the cultural asset, constituting the main concept of the project.

The meaning of selecting one material over another might entail a message which clearly exceeds the scope of the specific project and aspires to create a precedent that clearly defines the sign of the times. The chapter entitled "Soft spaces. Towards new materiality in architecture" by Burcu Eryılmaz and Ayşen Savaş deals with the inflatable architecture of the 1960s and early 1970s and its role as a pioneer of soft architectural practices. In that period some architecture practitioners aimed to become an emergent and radical avant-garde against the still dominant principles of Modernism. They understood that their time was linked to the idea of freedom and that was completely incompatible with the rigidity of spaces designed following the principles of Modernisms and using the materials akin to this architectural style such as steel, concrete, and glass. The choice of textiles and the design of pneumatic architecture was not only a signifier of each specific project. It was framed within a much larger discourse that ambitioned to set the society as much free as possible from any convention of previous times.

Architecture as a signifier

Architecture is an extremely versatile actor. When it comes to expressing meanings, it displays an enormous palette that serves not only the architect but frequently the client. Over the course of a thorough analysis, a cultured eye will be able to unravel a large list of ideas encrypted in the different elements and assemblies which constitute a building or an urban space. However, not all signifieds were implemented on purpose. Many attend with no specific invitation but provide information which is interesting as well. Thus, cities can be understood as more or less cryptic books ready to be read, ready to tell us their history and the history of their inhabitants. This learning process can be performed in many different scales, from observing the smallest detail in the archivolt of a Romanesque portal, to analyzing the overwhelming amount of information contained in a good city map. When Catalan architect Ildefons Cerdà drew his proposal for the expansion of Barcelona (fig. 5), whether consciously or unconsciously he encodes in the blueprint a vast set of ideas of that time regarding the social hygiene movement, sun exposure, prevailing winds, public transport, walkability, social order, population projection and many more.

The chapter entitled "Analogy: architecture, city, and territory. Towards an operative reading on urban morphology" by Sergio Fernandes and Rui Justo invites us to deduce the principles behind the shape of the fabric of historical cities, focusing in the case of Lisbon. For the Portuguese authors, the built city, when displaying before our eyes its streets, intersections, and blocks, becomes a repository of knowledge of the essential characteristics of the time when each neighborhood appeared or was renovated. But this knowledge is neither restricted to human will nor static in time. Frequently, the characteristics of the physical environment leave a print as powerful as the one left by architects, customers, and their ambitions. Likewise, daily life throughout the centuries continuously reshapes the city to a greater or lesser extent, adding new layers to the past ones.

The scope of this kind of analysis can be easily tuned. It can be, for example, narrowed for a specific moment in time but widened for a whole region or country. In doing so, we will discover many examples of how leaders have attempted to employ architecture to convey their message to society and to future generations. And occasionally politics has trusted architecture previously established signifiers for modernity as the best way for demonstrating its own alleged modernity. A good example of this feedback process can be found in the works of Italian architect Giuseppe Terragni for the Fascist government in the region of Como. His most famous building, la Casa del Fascio (fig. 6) displays a sense of modernity and renovation which the political regime of the time aspired to represent.

A similar strategy was followed by other much more successful examples in modern European history. The chapter entitled "Architecture and media: materializing ideas in early Republican Turkey" by Selda Bancı, focuses on the relationship between architecture and the principles of the newly established republic and how this relationship was portrayed and disseminated. The author explains how during the establishment of that new social order, leaders used architecture as the means and Modernism as the message. In order to widely disseminate the incipient but good architectural works increasingly designed by Turkish architects, many instruments such as exhibitions, competitions, journals, books, pictures, and films were implemented and created an architectural culture in the country which enabled architecture to communicate with its own practitioners and with the general population.

Signifiers for architecture

The depiction of architecture in the aforementioned pictures, journals, books, or movies constitutes, in turn, a reobjectifying of meanings previously objectified by means of architecture. These print and graphic media become the second generation of signifiers capable not only of transporting the original meanings to those who cannot visit the architecture on site, but also, capable of coming back to architecture, to make it reflect on its own results in the light of how it is perceived by the lens. This round-trip relationship is analyzed by Sibel Acar in the chapter entitled "As you see: photographic constructions of architecture". The author focuses on how since its invention, photography has developed a symbiotic relationship with architecture. It was initially and immediately employed for documenting relevant buildings and public spaces, enabling as well the recording of the progression of new constructions. Architectural photographs became a frequent source for those who have the ambition to increase their knowledge in the discipline. Progressively, architects got acquainted with the potentiality of photography for representing and disseminating their work. Photography's undisputed influence on architecture has reached our time and has been absolutely boosted by the irruption of social media with results that have to be handled carefully by architecture students and practitioners.

IMAGES, CHARTS OR GRAPHIC LEGENDS

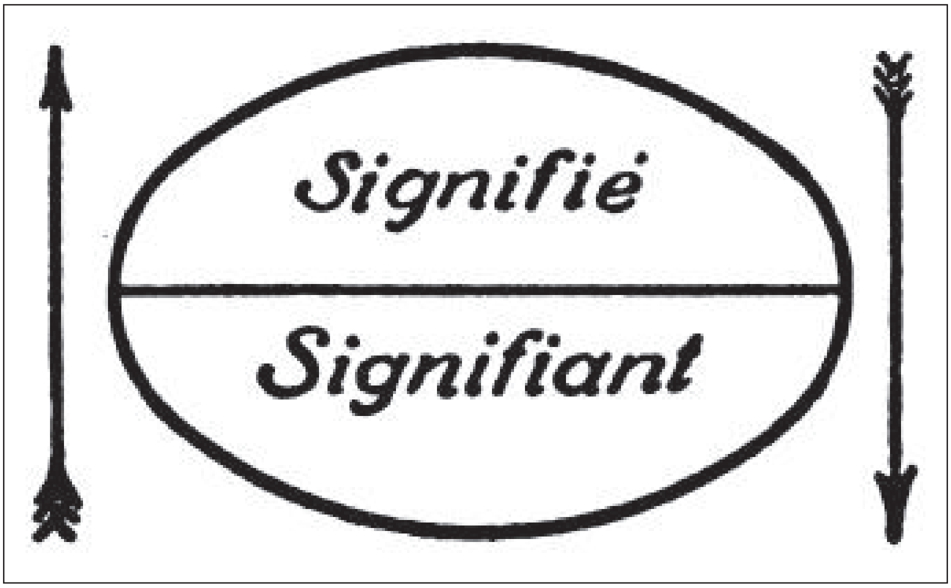

Figure 1: Diagram depicting the relationship between signified and signifier, drawing by Ferdinand Saussure for Course in General Linguistics.

Figure 2: a) Apacheta, picture by Roberto Pampa; b) Inuksuk, picture from Pikist; c) Cairn, picture by Tinelot Wittermans.

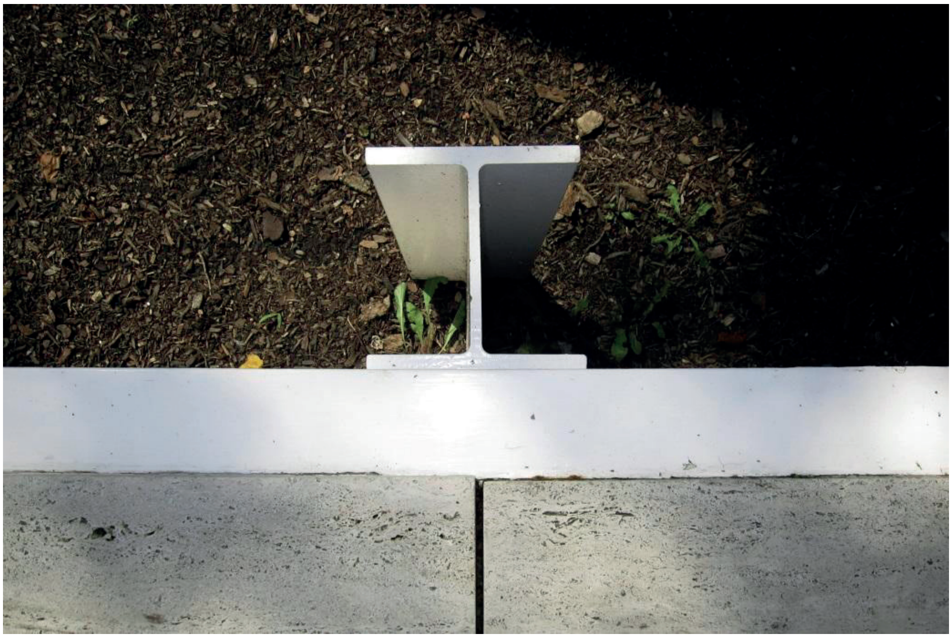

Figure 3: Beam and column junction detail in the terrace of the Farnsworth House, United States, picture by Eduardo Soler.

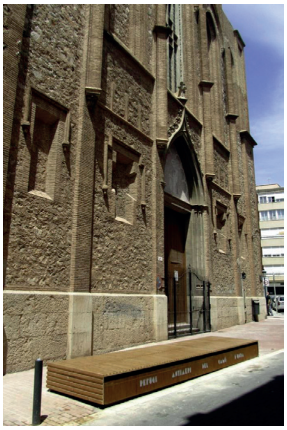

Figure 4: New entrance to the Camí d'Onda Air-raid Shelter in Borriana, Spain, picture by Ivan Cabrera.

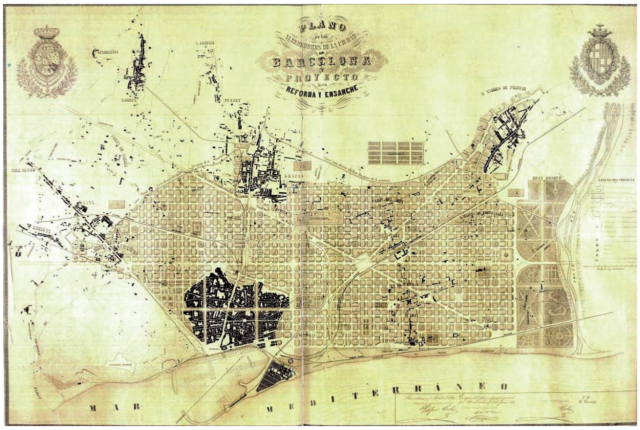

Figure 5: Drawing of the Eixample of Barcelona, Spain, by Ildefons Cerdà, from Museu d'Història de Barcelona

Figure 6: Casa del Fascio of Como, Italy, picture by Ivan Cabrera.

MATERIALITY MEANING AS A PROJECT CONCEPT. THE CASE OF THE CAMI D'ONDA AIR-RAID SHELTER IN THE HISTORIC CENTER OF BORRIANA, SPAIN

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ABSTRACT

Materiality plays a fundamental role in architectural projects and the subsequent appreciation of the built result. Many factors endorse the choice of materials and building techniques including sensory and pragmatic aspects. But materiality can also entail meaning. This semiotic feature reveals as a critical one in projects framed within difficult contexts such as those with relevant urban and historical backgrounds. The project for the conditioning of the Camí d'Onda Air-raid Shelter is a good example of this kind of delicate commissions. Located in the town of Borriana, on the Spanish Mediterranean coast, combines the need of placing value on the remains while designing brand new access. The project concept chosen by the architect was meaningfully supported by the respect to the sensory, pragmatic, and semiotic properties of the pre-existent materials and the new ones to be placed in this relevant heritage element from the Spanish Civil War.

KEYWORDS

Air-raid shelter, architecture, Borriana, ceramic, materiality, rehabilitation Spanish Civil War

The use of materiality within an architect's palette

Architecture is a discipline whose understanding is not fully complete without a physical and sensory appreciation. Architecture learning and daily practice deal mainly with its graphical representation, which has become frequently an object of worship. But a physical encounter still remains indispensable for an adequate inspirational experience. Architecture can be seen and can be touched. It can also be heard, smelled, and maybe tasted. Its materiality fully conditions our perception and the same abstract volumetric composition can lead to very different results depending on the choice of materials. Therefore, an architect's daily practice constantly implies thorough reflections on adequate selection. This decision must consider many different aspects such as how these materials will be perceived, their adequate building techniques, coexistence, sustainability, price, aging, and many more.

The learning of such essential and fascinating ability begins at the schools of architecture. Students must develop the foundations of their critical thinking about architecture's materiality (Carlson-Reddig, 1997). And the guidance provided must not be reduced to specific courses on building materials. On the contrary, it must flood as many courses as possible, also meaning docents reflecting on their actual professional practice and personal experiences. After all, this perceptive quality of architecture conditions substantially our daily lives and is consequently the key to successful projects.

Materiality in difficult contexts

Materiality in over-stimulated contexts

Urban spaces in Western towns and cities are too usually good examples of over-stimulated contexts. The different layers left by the variety of cultures and societies who have inhabited these settlements provide rather often a dense scenario. This rich but not always peacefully displayed historical inheritance is substantially complemented by the overwhelming amount of visual and auditory stimuli typical of capitalist economies. The resulting noise, not just aural, damages to a greater or lesser degree our daily environment, worsening our quality of life.

The neighborhood which hosts our study case is a good example of the previously explained circumstances. Borriana is a Mediterranean medium-sized coastal town north of Valencia in Spain. The Camí d'Onda neighborhood lies on the west border of its medieval historical center. It hosts the promenade to the train station and is one of the attractive Eclectic and Art Nouveau quarters in town. Its more relevant public building is the Church of Saint Joseph, a Gothic Revival temple distinctive for its brick and rammed walls (fig. 1). The urban spaces around this religious construction are filled with medium-sized buildings with colorful façades, flashy signs, assorted urban furniture from different periods, vehicles, and vividly dressed citizens. Any new actor on that stage would really need to make a meaningful effort to catch the audience's attention. Certainly, the Camí d'Onda area would be much better with much less.

Materiality in historical contexts

Historical contexts owe to their materiality a meaningful percentage of their interest. It is impossible to detach any relevant architectural heritage element from its shape, mass, color, or texture. Their preservation, rehabilitation, or restoration requires architects to study carefully these sensory attributes in order to properly distinguish what is essential from what is superfluous, what is authentic from what is fake, and consequently dispensable.

Therefore, this professional field demands a triple approach to materiality. The first stage involves apprehending the qualities and spirit of the pre-existence. A second stage entails reflecting on the properties and meaning of the materials to be employed in the intervention. This is especially relevant if they are not intended for repairing or reconstructing existing elements but employed in brand new pieces that complement or make possible the use of already existing ones. Finally, the third and possibly more important stage demands a joint analysis of the old and the new so as to safe a proper coexistence, not necessarily mimetic but always harmonious.

Materiality in controversial contexts

Just as a signifier is always connected to a signified in semiotics, materials and building techniques frequently have widely accepted certain meanings in architecture. When traditionally employed in specific contexts, these meanings transcend to the objects and spaces themselves and to the historic moment when they were erected. This is a two-way phenomenon since occasionally the meaning of the architectural element or the spirit of a certain moment in time is transferred to the material establishing then a subconsciously generally accepted one-to-one correspondence. When this relationship brings a positive message, such as the case of glass and modernity in the nineteenth century, there is no additional forethought required. But evocation does not always lead to optimism.

The Civil War is still a bothersome and painful topic of discussion in Spain. Living testimonies of one of the most terrifying European military conflicts and the following dictatorship are still a noticeable percentage of Spanish society. Conversations about this topic are not comfortable for everybody and it is rather easy to raise a bitter controversy whenever any public issue is lightly connected to that period. The Spanish Civil War was the first warlike confrontation where air-raids were used not just against the war front and military supply centers but also against the civilian population (Contel, 2008). The Italian military airplanes were responsible for most of the attacks which terrified the Republican Mediterranean coast (Lozano-Olivares and Lumbreras-Voigt, 2015). Many Catalonian, Valencian, Murcian, and Andalusian municipalities funded and supervised the construction of underground air-raid shelters aiming to protect the citizenry (Besolí and Peinado-Cucarella, 2008).

Despite its unavoidable and aforementioned controversial side, currently, in Spain, there is an increasing awareness about the importance of remains related to our Civil War. They are now understood as a legacy to be preserved and socialized as part of our heritage. When conveniently conditioned and occasionally rehabilitated, these spaces become part of the cultural offer and commonly display exhibits focusing on the war horrors and the importance of peace. In 2017 the Valencian Regional Government enacted the Democratic Memory and Coexistence Law, explicitly mentioning the vestiges of the Civil War. Simultaneously public subsidies for their preservation were established (Moreno and Sapena, 2017). Two years before, in 2015, the municipality of Borriana had decided to reopen its most remarkable air-raid shelter from the Civil War, the one located in the Camí d'Onda neighborhood (fig. 2) and planned to make it suitable for visits. The initiative had at the very first moment an uneven reception. The meaning attached to the shelter, to its bricks, to its stones, was not pleasant for everybody. An old and perhaps uncomfortable actor would reappear in a public space which is still a key meeting place in Mediterranean societies.

The Camí d'Onda Air-raid Shelter

Background

The Camí d'Onda Air-raid Shelter was placed in the nearby Church of Saint Joseph (fig. 3). The inhabitants of the neighborhood stayed safe in there during the bombings which destroyed the town and the port in 1937 and 1938.

It remained open after the war since the Spanish dictatorship feared an invasion of the Allies. During these years large amounts of mud were dragged inside the galleries every time it rained over the neighboring non-paved streets until the shelter was finally closed in the 1950s. Thirty years later sudden ground subsidence during the works of the refurbishment of the above public space favored its reopening and trap door access for occasional maintenance was installed next to the front door of the Church of Saint Joseph.

Located next to the temple as well, the original access was presumably a ramp. Having descended three meters led into a small antechamber previous to two zigzag walls which protected the tunnels behind from the blast, shrapnel, and rubbles (fig. 2). Behind these walls, the first gallery with a remarkable slope took users to a depth of twelve meters below the level of the upper streets (fig. 4). A second flat gallery hosted the neighbors during the air raids (Melchor et al., 2009). The length of this second tunnel is still uncertain since the previously mentioned accumulation of dragged mud was worsened by some partial upper ground sinking caused by the absence of rib vaults in three points. So far more than thirty meters have been discovered.

The technical services of the municipality of Borriana soon understood that any future project for rehabilitating the air-raid shelter would require a previous study on the safety of its ancient brick structure. That encouraged the local government to hire an architect whose expertise was on structural analysis and design both for the structural safety study and the subsequent conditioning project. The commission included several needs and ambitions in order to make the site suitable and attractive for visitors. Lighting and ventilation were a must. Drainage preventing indoor floods caused by filtrations or street runoffs, and a pavement avoiding visitors standing on the slippery mud floor were recommendable. Finally, it was obvious that the trap door and the manhole built in the 1980s should be substituted by more comfortable and appealing access to be placed ideally in Sant Joan de la Creu Street as well. So many aspects involving so many different materials were in need of a clear strategy regarding materiality so as to safe a congruent, decent, and worthy result.

Intervention criteria

Respect

The works to be undertaken could be classified according to different criteria. The project strategy is considered mainly two: physical and chronological.

Physically the future air-raid shelter would be divided into two clearly different areas: the street level and the new access, and the underground galleries. Chronologically the complex resulting from the works would encompass pre-existent elements and brand new ones. A first rough approach might lead us to think that both criteria would divide the components into the same two groups, finding a full correspondence between underground and ancient, and street-level and new. But it was slightly more complicated than this. The subterranean tunnels needed some conditioning which would be unavoidably added such as the lighting, the ventilation, the drainage, and the possible pavement. Simultaneously the street was an existing one. It had been recently repaved with interesting red ceramic bricks (fig. 5). Respect for the spirit of the materials employed in the pre-existences and the character that they had transferred to the build elements and spaces was the strategy chosen for the project.

In the undersoil the quiet, solemn, almost tense, stony, and earthy atmosphere should be preserved as much as possible. The intervention could not damage any pre-existent element and new ones should be reduced. Grooves for power lines, pipes, and drains on the walls or vaults were inconceivable. Fortunately, the arrangement of the mud floor had no historical value and it could be manipulated and later replaced without noticeable changes. A central trench was excavated in both galleries and all necessary conduits were placed in it. Having reconstructed the floor level, a pavement composed of thick red clay tiles without any enamel and a similar tonality to the existing earth was simply laid without any mortar. Thick grouts were filled with the same existing earth in an attempt to blur the line between the newly arrived tiles and the ancient mud, and to ease future repairs of the conditioning elements below.

Any other element necessary for conditioning was intentionally made in plastic in an attempt to clearly distinguish the old patrimonial elements from the new accessory ones. Dark grey beacons were placed on the floor on both sides of the galleries following the rhythm of the pavement and intentionally pointing to the walls. Mesh strainers and ventilation intakes were made of dark grey plastic as well. Finally, necessary switches and sockets were chosen in light grey, placed on the walls but as close to the floor as possible so as not to interfere in the perception of the brickwork surface.

The street-level appeared like the right place for riskier choices. But a substantial range of constraints conditioned the elements to be built and the materials to be chosen as well. First of all, it is important to mention that Sant Joan de la Creu Street is a narrow place with roughly seven meters wide in the nearby location where the new access would be placed. Daily life should not be interfered with by any bulky construction which presumably could be used by visitors once a week, and whose materiality could add visual noise to the urban space. Likewise, comfortable access to the neighboring Church of Saint Joseph should be kept. Secondly, the street had been recently renovated. The new red ceramic pavement had respected the trap door installed in the 1980s for accessing the shelter next to the temple entrance (fig. 5). New bollards had also been pinned. It didn't seem very sustainable and respectful to remove substantially such a recent intervention. Finally, the outer part of the access would unavoidably be an obvious reminder of the infrastructure below. Having learnt how sensitive is the topic of the Spanish Civil War for the locals, an adequate choice should keep the balance between being remarkable enough so as to pay a fair tribute to the war victims and to attract the interest of visitors, and being discrete enough so as not to arise unnecessary controversies about the warlike episode.

Most of the accesses to other air-raid shelters dug in the underground along the Mediterranean coast have been materialized with stalls preventing falls to the necessary stairwell or non-authorized access after opening hours. The final design for the Camí d'Onda Air-raid shelter consisted of a transformable low-profile artifact. When closed it would be simply a bench for sitting and propitiating urban life and social interaction (fig. 6). When open it would reveal the entrance to the complex, providing the necessary railings in order to remove any risk of falling from the street level (fig. 7).

Materiality as a code

The underground galleries should be kept as the realm of strength, serenity, and timelessness. The earthy, stony, and ceramic qualities of the materials employed during its construction in the 1930s clearly propitiate these features in the atmosphere and are one of its most important values (fig. 8). On the contrary, the street level just required certain respect for the recently arrived new pavement and the unexpected visual austerity in such a garish quarter. But it appeared as the right place for lighter and more dynamic and modern solutions.

The choice of materials to be employed should conveniently respect this set of duplicities lower-upper and old-new in order to formalize an appropriate and worthy result. Figure 9 displays all the materials involved in the project, considering both the existing and the new ones.

They have been classified according to the two criteria previously mentioned: physical and chronological. For both street level and underground categories, materials for projected elements have been also divided into two different groups: those for restitution of pre-existing elements and those for conditioning.

The materiality of the underground pre-existence is characterized by its heavy nature and reddish color. Clay soil can be found in the tamped floor or the galleries, in the unfinished back of the niches of the second tunnel, and in the rammed walls properly combined with the limestone of the shire. Retaining walls and vaults are materialized with a double layer of bricks with a thickness of half feet each one and laid on a lime mortar. As previously referred, the masons who built the shelter never finished three rib vaults in the intersections of the second gallery and three of the niches. Moreover, during the works, a sudden and heavy storm caused the collapse of one of the rammed walls bearing the timbrel vault over the antechamber of the complex. These four elements required their reconstruction. Their design and choice of materials constituted one of the most delicate moments in the project. They belonged to the underground historical and calm side of the project, but they would be built in the twenty-first century. The balance between both features was found by choosing similar materials and building techniques, but not identical. Ceramic bricks were chosen with a slightly different color and with half of the thickness so as to ease the building process employing changeable falseworks. The mortar was made with cement so as to improve its properties. Finally, the brick bonding was modified as well. The existing double layer bonding (fig. 10) was reinterpreted with a single layer bonding with the same thickness by placing the bricks orthogonally (fig. 11).

While providing a much more resistant solution, these chosen materials and redesigned bonding provide a unified aspect at first sight but a revealing second reading for eagle-eyed visitors. The ceramic tiles chosen for the floor of both galleries are related to both the pre-existent walls and vaults and the floor by means of its ceramic character but muddy appearance.

The inventory of materials employed in the underground levels is completed by some others also displayed in figure 9. It is the case of the reinforced concrete employed in the retaining walls shaping the staircase of the new access. It is also the case of the timber panels placed at the back of the niches of the second tunnel. With the goal of preventing the fall of the earth to the gallery, they have been thoroughly perforated in order to ease the transpiration and to make possible a view of the earth behind due to the dramatic lights placed at the back of these panels. Finally, it is also important to mention the dark and light grey plastic elements of the conditioning visible accessories such as beacons, mesh strainers, ventilation intakes, switches, and sockets.

The materiality of the street level elements is completely different. Just the ceramic bricks chosen for restoring the neighboring sidewalk and covering the stairs remind us of the past. The mutant bench is materialized with a steel structure composed of rectangular structural hollow sections and thin plates (fig. 12).

This structure is wrapped with weathering steel in the case of the east and west long laterals. The upper horizontal surface, considering both the liftable and the fix parts, the north fix short lateral, and the south small gates receive first the mentioned steel plate with a thickness of 1mm and then are wrapped with weatherproof timber. These wooden boards with a thickness of 20mm are completed by a series of wooden ridges with a thickness of 20mm as well aiming to improve the performance of the bench after rain episodes and to prevent vandalism or, at least, to minimize its consequences. Finally, the long laterals host a back-lighted sign materialized with white translucent polycarbonate with the name of the shelter employing a font widely used in the 1930s.

Conclusion

This theoretical reflection and this exposed case study make possible to draw several conclusions.

Regarding the role of materiality within the previous elaboration of the architectural project and the posterior appreciation of the built result, an adequate choice of materials and building techniques constitute a deciding milestone on the way to a successful experience. The acquisition of such a relevant skill must begin in architecture schools, involving all courses and demanding professors to share their personal experiences in professional practice. A proper selection of materials and their arrangement considers sensory aspects such as color, texture, thermal sensation, strength or aging behavior, and pragmatic aspects such as availability, sustainability, price, thermal and acoustic properties, or fire performance. But it must also take into consideration the semiotics of materiality since within specific contexts certain materials and building techniques have specific and clear meanings.

Regarding the role of materiality within the project of conditioning for the Camí d'Onda Air-Raid Shelter in Borriana, Spain, a meaningful set of initial determinants and constraints led to choose respect for the pre-existent materiality and a careful selection of new materials and building techniques as the project main concept. Historical elements were completed with similar but not fully identical materials and arrangements in an attempt to keep the underground atmosphere but subtly displaying the difference between the old and the new. Conditioning elements were hidden and when not possible were materialized in grey plastic and placed at a discrete low height. Finally, elements located at a street-level such as the transformable bench which protects the staircase in the access have provided chances for modern materials such as steel, weathering steel, weathering timber, and polycarbonate. However, any single material in the project is placed within the shades of grey or brown and exhibits the course texture whose objective is to preserve the historical and calm atmosphere of this relevant exponent of the Spanish recent history.

Technical details of the project

Project: Structural study and conditioning project of the Cami d'Onda Air-raid Shelter (Borriana)

Location: Carrer de Sant Joan de la Creu, Borriana, Spain

Client: Magníﬁc Ajuntament de Borriana

Architect: Ivan Cabrera i Fausto

Building engineer: María Tarancón Franch

Chronology: Projected in 2019 and finished in 2020

IMAGES, CHARTS OR GRAPHIC LEGENDS

Figure 1: Camí d'Onda urban space with the Church of Saint Joseph and the bandstand, photo by Ivan Cabrera i Fausto.

Figure 2: Zig zag walls in the access to the Camí d'Onda Air-raid Shelter, photo by Ivan Cabrera i Fausto.

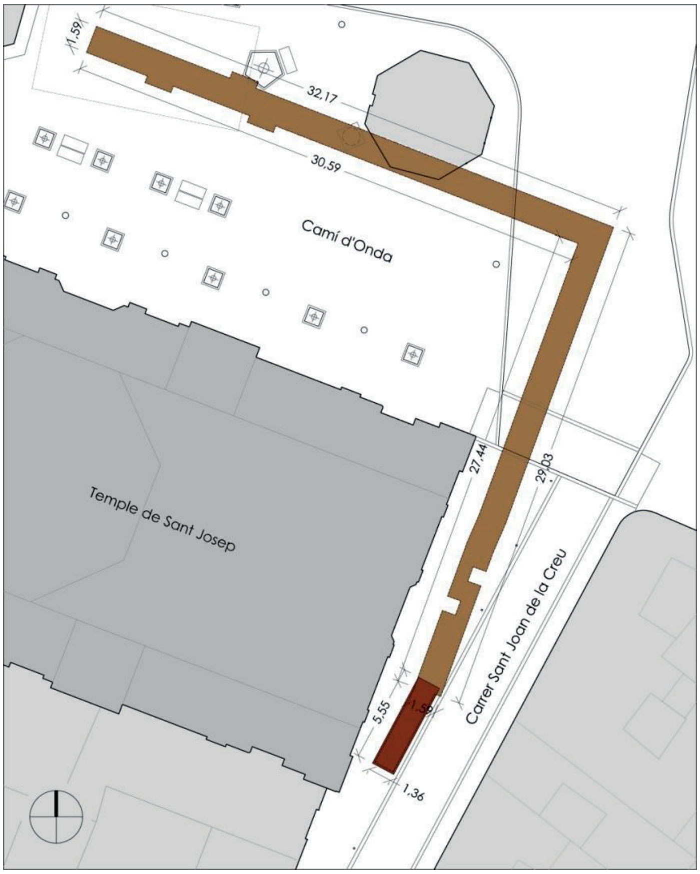

Figure 3: Location of the Camí d'Onda Air-raid Shelter in Borriana, Spain, drawing by Ivan Cabrera i Fausto.

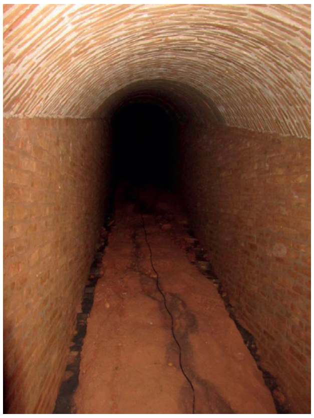

Figure 4: View of the first gallery of the Camí d'Onda Air-raid Shelter in Borriana, Spain, before the rehabilitation, picture by Ivan Cabrera i Fausto.

Figure 5: View of the pavement and manhole in Sant Joan de la Creu Street before the rehabilitation of the air-raid shelter, picture by Ivan Cabrera i Fausto.

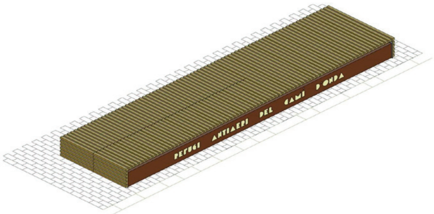

Figure 6: Bench covering the access to the Camí d'Onda Air-raid Shelter when closed, drawing by Ivan Cabrera i Fausto.

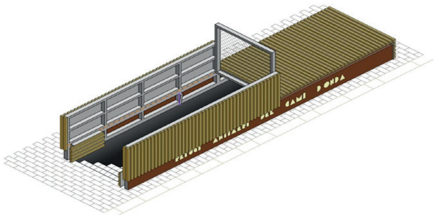

Figure 7: Bench covering the access to the Camí d'Onda Air-raid Shelter when open, drawing by Ivan Cabrera i Fausto.

Figure 8: Rammed wall and timbrel vault in the antechamber of the Camí d'Onda Air-raid Shelter in Borriana, Spain, picture by Ivan Cabrera i Fausto.

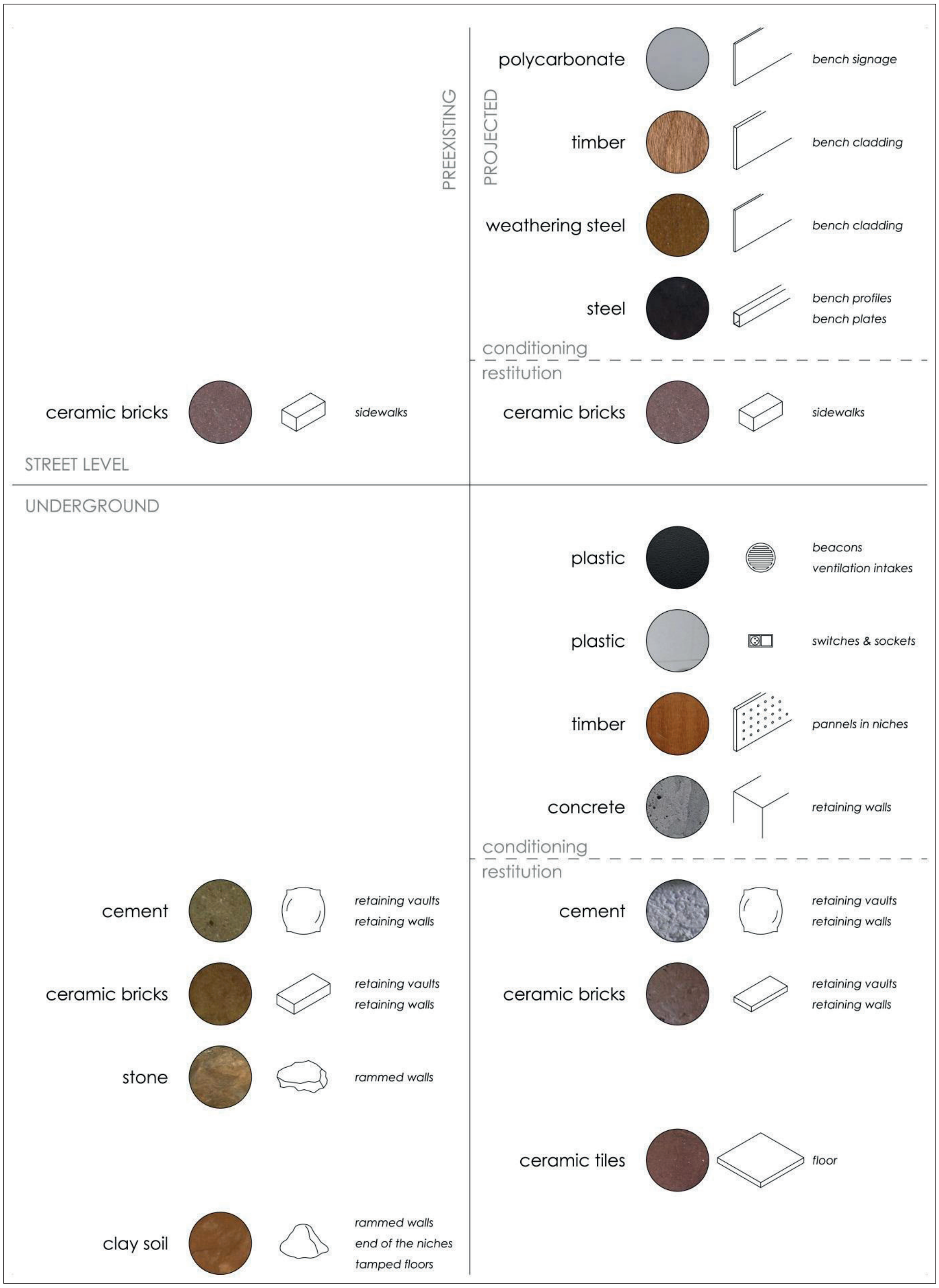

Figure 9: Catalog of materials existing and employed in the project of conditioning of the Camí d'Onda Air-raid Shelter in Borriana, Spain, drawing by Ivan Cabrera i Fausto.

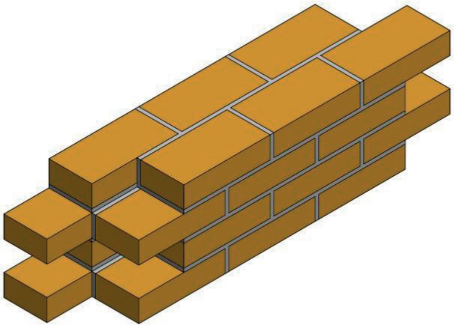

Figure 10: Brick bonding of the existing walls and vaults of the Camí d’Onda Air-raid Shelter in Borriana, Spain, drawing by Ivan Cabrera i Fausto.

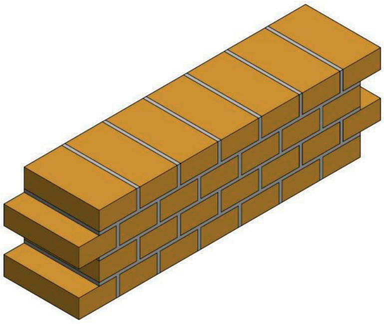

Figure 11: Brick bonding of the new walls and vaults of the Camí d’Onda Air-raid Shelter in Borriana, Spain, drawing by Ivan Cabrera i Fausto.

Figure 12: Constructive process of the steel structure of the transformable bench for the access of the Camí d’Onda Air-raid Shelter in Borriana, Spain, picture by Ivan Cabrera i Fausto.

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SOFT SPACES

Towards a New Materiality in Architecture

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ABSTRACT

The end of the 1960s signifies a shift regarding the materiality of architecture, facilitated by both the technological advances imported into the architectural scene and the emancipatory atmosphere of the 1960s marked with political and cultural upheavals. This shift represents a move away from the dominant modes of space production to the more flexible alternatives, and it is most visible in the experiments of counter-culture architects. During the late 1960s and the early 1970s, this new generation of architects characterized by their radical ideas had been searching for new materiality to liberate the architectural space from conventional restrictions. Accordingly, the avant-garde architects of this period had started to explore alternative ways towards a "softer" architecture as a challenge to the hard connotations of modernist space. To materialize the shift from hard to soft definitions in architecture, this paper proposes an inquiry into the inflatable architecture idealized by the avant-gardes as the foremost technique for producing soft spaces. In this regard, this paper traces the origins and earlier practices of soft architecture, and thus it focuses on inflatable spaces that had been produced during this period. Consequently, it aims at conceptualizing the softness of architecture by discussing how the material characteristics of inflatable structures contributed to the "softening" of architectural space in terms of both technical and cultural spheres.

KEYWORDS

Soft architecture, new materiality, inflatable space, responsive architecture

Introduction

"Soft" is an ambiguous word that holds varied meanings and interpretations in architectural discourse as it not only associates with the physical materiality of architecture but also appears in many different contexts such as soft-tech architecture, software of architecture, or soft urbanism through the expansion of its meaning. Noting that it denotes multiple meanings, in this paper, the term "softness" will be used to hold two interrelated meanings within the boundaries of the discipline of architecture. The first is the softness as a physical characteristic of the building material. It is used for defining the behavior of the material under an applied force, and this behavior is inherent in the nature of the material itself. The second refers to the ability of architectural spaces to respond to human presence. These spaces are characterized by their responsiveness, which allows the inhabitants to interact with the physical environments. In this regard, the latter conception of "softness" could be derived from the former one, and therefore, it has a broader sense. From this point forward, this paper discusses these two forms of softness in architecture and the indispensable relationship between them. In order to make this relation visible, it addresses the inflatable/pneumatic architecture of the late 1960s and early 1970s as a pioneer of soft architectural practices and thus points out the emergence of a radical avant-garde generation consisting of such seminal architectural collectives as Archigram, Utopie, Coop Himmelb(l)au, Haus-Rucker-Co, and Antfarm, who had experimented with inflatables during this period. Accordingly, the objective of this research is to examine the role of inflatable technology in the production of soft spaces and to discuss how the material characteristics of inflatable structures contributed to the "softening" of architectural spaces in terms of both technical and cultural spheres.

In brief, this study introduces the aforementioned architectural collectives as the members of a radical design generation in the quest for new architectural materiality starting from the end of the 1960s. Departing from the concept of "firmitas" as one pillar of the famous Vitruvian triad, these architects had started to explore alternative methods and techniques for a more flexible understanding of space. Among these possibilities, inflatable practices stand out as ambitious attempts to liberate the architectural space from conventional restrictions. In this context, the use of inflatable membrane as an innovative building material represents a shift from hard to soft architecture as well as from the conventional ways of the production of space to the alternative ones. Accordingly, this paper traces the origins and earlier practices of "soft architecture" in the architectural scene, and it focuses on inflatable spaces that had been produced during the period between the late 1960s and early 1970s.

Experimentality and the 1960s

In his seminal book *Experimental Architecture*, Peter Cook (1970) states that the 1960s architecture marked “a central shift towards the comprehension of inventions which are not architectural in origin” (p. 65) and he exemplifies this shift by referring to pneumatic structures of the avant-garde group Utopie (Figure 1). In this regard, it could be inferred that pneumatic technology has been adopted by the counter-culture architects since the end of the 1960s, even though it was initially developed for the U.S. Air Force to protect radar antennas by the engineer Walter Bird in 1946 (Dessauce, 1999) (Figure 2). After its transfer into the material explorations in architecture, inflatable membrane as an invention imported from military applications had started to be widely used by the counter-culture architects in the architectural experiments and pervaded architectural culture during this period (Figure 3-4).

As was stated earlier, this avant-garde generation characterized by its experimentality was searching for the ideas that could liberate architectural space from conventional restrictions. In this context, it could be explicitly said that the freeing atmosphere of this period in the political, economic, and cultural spheres necessitated changes in the production of architectural spaces. This atmosphere was also accompanied with emerging technological advancements accelerated by the Cold War competition. Through catalyzing by the emancipatory environment and creative nature of the late 1960s, architectural experiments of the avant-gardes were driven by their desire to express criticism towards the conventional forms of space and to explore new modes of thinking/practicing architecture. Considering the avant-gardes’ motive for experimenting, Hejduk (2006) refers to their engagement with “the culture of liberation and the hope of technology to create an architectural image of this philosophy/ideology” (p. 232). At this point, it is essential to note that this paradigm was fascinated by pneumatic technology not only because of the enhancement of technical possibilities enabled by an invention in the construction industry but also because that it directly matched with the avant-gardes’ ideas/ideals regarding their new conceptualization of spatial practices. In that sense, the inflatable experiments are served as tools to illustrate radical ideas of the avant-garde paradigm. Thus they enable to identify the contours of the emerging shift in the architectural discourse during this period.

By positioning their radical ideas at the periphery of architectural discourse at that time, the abovementioned collectives had taken a stand against the established frame of architecture, and they had started to a series of experiments to challenge dominant modes of spatial practices. This counter movement in architecture had directed harsh criticism at modernism and its values; accordingly, it has emerged as “a reaction against hyperfunctionalism of the post-war years” (Brayer, 2012). The avant garde opposition is formed around those who accused modernism of not fulfilling its potential and thus missing opportunity regarding technology’s emancipatory power on society as modernism failed functionalism (Hejduk, 2006). Within this context, *the rejection of modernism* was a hallmark of this avant-garde community, which structured their arguments against the modernist conception of space. Rather than adopting orthodox ways of space production by following strict tenets of modernism, the avant-gardes opened up new possibilities outside the pre-existing boundaries of architecture. In that sense, the notion of “experiment” pushed the disciplinary boundaries of architecture towards new expansions, and it occupied a position at the intersection of architecture, technology, and culture during the late 1960s and early 1970s in the avant-garde production of space.

From Hard Spaces to Soft Spaces

As an alternative to the dominant modes of space production, the avant garde conceptualization of architectural space signifies a break from the authoritative modernist doctrines. The construction of such a conceptualization was primarily based on the counter arguments made by the avant-gardes against the hegemony of modernism in architectural discourse. In this context, their arguments were structured around such dualities as *mobile versus fixed, fluid versus solid, light versus heavy, flexible versus rigid, dynamic versus static, or soft versus hard*. These “binary oppositions” regarding the characteristics of spaces constituted a basis for the avant-garde opposition of the established space conception, and thus they help this new generation of architects strengthening their position in the discussions on the materiality of architecture.

The material experiments of this avant-garde circle held during the late 1960s and early 1970s, therefore, can be regarded as acts that were driven by the need for change, oriented to the mainstream architectural practices. Herzog (1976) refers to the domination of “plane, mostly

orthogonal forms with hard, cold, machine-produced surfaces” in architecture for some decades, arising from “the increasing mechanization of the building process” (p. 7). Questioning post-war modernism considered as the most prevalent and institutional way of producing space at that time, the experiments of avant-gardes were aimed at achieving a new mode of materiality and thus enhancing the possibilities for the built environment with the aid of technology. In this context, this new mode is characterized by its contrast with modernism's strict materiality. Rather than adopting "hard, 'hygienic,' strong, unyielding materials – notably concrete, steel and glass" (Melhuish, 2007, p. 205) as modernists did, the avant-gardes formed its materiality towards a smooth, flexible architecture. Arata Isozaki (1970) states as follows:

> "The excitement of the coming decade will derive from change, mobility, stimulation, and all the technology that makes that possible. Architecture has become a medium in itself determining an environment for its inhabitants. In addition to space, it must take time into account. Architecture must now take on multiple meanings: its presence can no longer be determined by form; rather it must be flexible and responsive to the flow of time and the needs of a succession of occasions. I call such an architecture soft architecture." (as cited in Pawley, p. 293)

According to Isozaki's definition of soft architecture, in this new idea of materiality, the architectural form is proposed to be dynamic and able to change rather than static and rigid. In this regard, the formal indeterminacy associated with the soft practices of architecture results from a never-ending transformation process applied through architectural formation. As expressed by Kallipoliti (2010), pneumatics is one of the soft tactics that generate indeterminacy in the material experiments of the 1960s and 1970s as the term soft indicates "a procedural, evolving logic of transfusion" (p. 38). Accordingly, the terms used to describe the softness of pneumatic architecture such as fluid, dynamic, or flexible evoke a material behavior, which allows changes in the architectural form. This behavior arises from the shift occurred in the conception of *air,* moving beyond *from the conventional role of providing a comfortable space for living* following the hygienist rhetoric of Modernity *to a new position as the formal building material* due to its use as an atmospheric tool in pneumatic structures (Corbo, 2016). Consequently, the inflatable idea stood out among other methods and techniques that were introduced into the architectural scene during this period since it "so simple and subverts everything about modernism" (Hale, 2017, as cited in Budds, para. 4).

Inflatables as Responsive/Performative Structures

As simple structures, inflatables are composed of two materials: *the inflatable membrane* and *air* that are integral to each other in defining form. Therefore, pneumatic structures act like organisms, with Reyner Banham's words "an inflatable… in its state of active homeostasis" (Banham, 1968, as cited in Dessauce, p. 33). In that sense, the balanced state of the pneumatic structure is maintained through its membrane cover, which is functioned as an adaptable layer between the interior and exterior. The adaptability of the inflatable membrane provides the ability to respond to the changes that occurred in their environment. Consequently, this process of constant change leads to the dynamicity of form and render the inflatable structures as evolving organisms that are always in a stage of adaptation, rather than finished objects (Steiner, 2009). For this reason, Banham (1968) points that there is a reciprocal relationship of the adaptable layer with the external force applied to the inflatable structures, which is "quite unlike the relationship with the static shell of a traditional building where you can beat your fists on the walls and scream and get no more than an echo for a response" (as reprinted in Dessauce, p.33). Emphasizing the responsive nature of the inflatable structures that he called "wind-bags," he continues as follows:

> "The beauty of that simple wind-bag was the directness and continuity of its response. Every slight change of state inside or out—even a heated conversation—brought compensating movement in the skin, not through the expensive intervention of a computer, but by direct variation of curvature under balance of pressures." (as reprinted in Dessauce, p.33)

Hence, the relationship between the skin and the external forces makes inflatable structures one of the earliest examples of responsive spaces, which result from the soft behavior of inflatables based on the material characteristics. Through the plasticity and malleability of soft spaces in terms of both material and thus formal aspects, inflatables are referred to the responsive structures to human behavior and gain performativity that allows the users to participate in the formation of space. In that sense, Isozaki's emphasis on the responsiveness of soft spaces through the flexibility of architectural form portrays a clear distinction between the definitions of hard and soft architecture. Along the same lines, hard and soft spaces are addressed as opposite concepts in Robert Sommer's seminal book *Tight Spaces: Hard Architecture and How to Humanize It* (1974). Sommer (1974) states that hard spaces are "designed to be strong and resistant to human imprint" while soft spaces "welcome and reflect the presence of human beings" (pp. 2-12). Therefore, soft architecture is also differentiated from hard architecture by the involvement of the inhabitants in the transformation processes of space. This involvement is fed by sensorial experiences, which are based on the altered perceptions of space evoked by the reciprocal relationship between the inhabitants and their habitat. Corbo (2016) points out the departure from the Modernist idea of "a machine for living in" put by Le Corbusier, as follows: "…a new machine has been produced. Not an industrial machine, as propagandized by Modern Movement, instead, a sensorial machine, able to produce, alter and stimulate perception" (p. 67).

The relationship between the human and its environment makes inflatable spaces open to interaction and participation. Banham (1968) states that inflatables encourage “the kind of direct participation, real-space, real-time involvement-aesthetic” and thus they advocate for sensitive environments (as reprinted in Dessauce, p. 33). Besides, transparency of these plastic surfaces, not only achieves what modern architecture was striving for but also questions the established public private space distinctions. In this regard, performative processes were central in the formation of inflatable spaces. Considering Banham’s approach to inflatables, this performativity rooted in the ability to respond makes architecture “less like an object, and more like a happening” (Moon, 2018). And consequently, inflatable spaces became inclusive environments that could communicate with the users through its materiality, and thus, they help to improve the dialogue between space and its inhabitants. In this context, these spaces could be also regarded as tools that transform subjects into active agents involving in the processes of the formation of space during the late 1960s and early 1970s. As could be observed in the most of the earlier works of Coop Himmelb(l)au such as the “Restless Sphere – Basel Contact” and the works of Ant Farm such as “Clean Air Pod,” inflatables were utilized by the avant-gardes in the public acts categorized as “performative installations and actions involving the spectators as participants” (Awan, Schneider, & Till, 2011, p. 130) (Figure 5-6).

Conclusion

During the late 1960s and early 1970s, inflatable plastics had been one of the most natural materials for responsive architecture through their capability to reflect spontaneous acts of the users, as asserted in the book *Soft Architecture Machines* by Negroponte (1975). This responsive nature rooted in material characteristics of the inflatables signifies the emergence of a sensibility towards generating more inclusive spaces in the avant-garde paradigm. Within this context, its pervading use at this period is explained not only by the utilization of an innovation that introduces new ways of producing spaces but also by the adoption of a technology that served as a tool for illustrating the avant-gardes’ ideas on the materiality of architecture. Hence, the inflatables emerged as a model for experimental architecture through “their ability to perform—both technically and culturally—“ (Moon, 2014, p. 362). As Jungmann (1999), one of the members of the group Utopie, points that the virtue of their research is being “certainly experimental but controlled and within the possibilities of a technology” (p. 67). That experimentality paved the way of reprocessing this otherwise low value material into a more expedient architectural product. Consequently, the inflatable idea of the avant-gardes challenged dominant modes of space production by enhancing the alternatives and thus contributed to the softening of architecture through its bond with architectural experimentation.

IMAGES, CHARTS OR GRAPHIC LEGENDS

Image 1: Utopie, Exhibition: "Structures Gonflables" at the Musee d'Art Moderne, Paris, 1968. Source: Official Website of Jean-Paul Jungmann. 26 Jan. 2020. < http://www.jeanpauljungmann.fr/expo_structures.htm>

Image 2: Walter Bird, Erection Phases of the Prototype of the Radome, Cornell Aeronautical Laboratory (USA), 1948. Source: Marc Dessauce, The Inflatable Moment: Pneumatics and Protest in '68 New York: Princeton Architectural Press, 1999: 130.

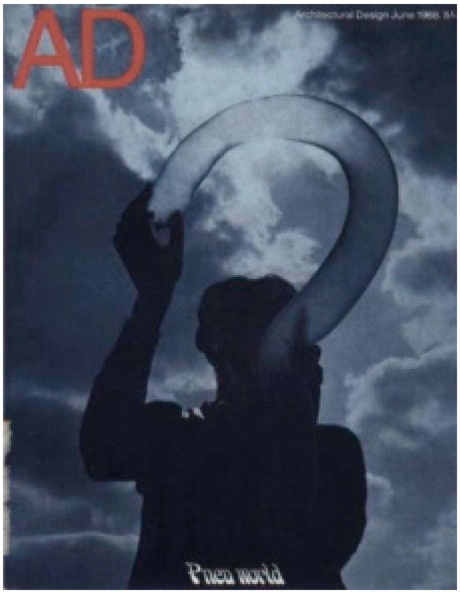

Image 3: AD's cover of June 1968's issue on inflatables. Source: Steve Parnell, Architectural design, 1954-1972 Ph.D., University of Sheffield, 2012: 218.

Image 4: Adrian George, Cedric Price inflating himself, AD's Cover of October 1970's issue. Source: Steve Parnell, Architectural design, 1954-1972 Ph.D., University of Sheffield, 2012: 226.

Image 5 - Photographs from Coop Himmelb(l)au's performance: "Restless Sphere," Basel, 1971. Source: Official Website of Coop Himmelb(l)au. 26 Jan. 2020. <http://www.coop-himmelblau.at/architecture/projects/restless-sphere>

Image 6: Ant Farm, "Clean Air Pod" project from the performance "Breathing – That's your Bag," 1970. Source: Spatial Agency. 26 Jan. 2020. <http://www.spatialagency.net/database/ant.farm>

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ANALOGY: ARCHITECTURE, CITY AND TERRITORY

Towards an operative reading on urban morphology

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ABSTRACT

The paper uses the Portuguese cultural context as a case study to address an operative reading of the city and explores the transfer of its principles to the urban design process. The objective, under the topic of urban form and materiality, aims to discuss the themes of design, urban and architectural, with the research process. It focuses on the ordinary built forms to learn from the tradition and establish an analogous relationship between reading and the designing of the city. Starting from the subject of the urban fabric composition, particularly in regard to the reading of "samples", i.e. urban fragments with urban elements – buildings and streets – serial repeated, the aim is to deduce the laws or design principles behind the shape of historical cities. The proposed approach is based in a form of dialectics attempting to bridge a conceptual relation between the urban fabrics produced throughout the time with the conjectural process of its design. Using drawing as an interpretation tool, together with delayering and elementarism as methodological procedures of decomposition, allowed for the exercise of progressive abstraction and consequent simplification of the complexity of the urban form. The purpose is understanding the whole through the knowledge of its components. From the conjectural point of view, we reconstituted the code of design principles based on a theoretical framework that defines the built typologies structural interference within the city built-fabric. With the comparison of some paradigmatic case studies, it is explored the legacy of notions as context and tradition in the Portuguese building typologies and its current influence in Portuguese urban form. In addition, this interpretative approach proposes an interference between the reading process and the design of an urban-architecture. It means that operative reading should be understood as a transfer from the built-city and from the history to the city design process.

KEYWORDS

Urban layout, territory, building typology, urban morphology, Portuguese city

Architects, like Cattaneo, Haring, Soleri and others perceive the human body as a Gestalt which is analogous to their plans either for buildings or cities.

The analogy is something indispensable to extend knowledge[1].

Oswald Mathias Ungers

Reading the city

The paper uses the Portuguese cultural context as a case study to address an operative reading of the city exploring the transfer of its principles to the urban design process. The work aims to relate the subject of urban and architectural design with the research process, under the topic of urban form and materiality. It focuses on the ordinary built forms to learn from the tradition and to establish an analogous relationship between reading and the designing of the city[2].

If we understand the built city form as a repository of knowledge, the urban layout or the analytical stratum of the public space concentrates the essential characteristics of the city, both the identity of its shape and the timelessness matrices that support its evolution. In this sense, the urban layout can be understood as a powerful element of analysis. It is a structural element of the city because it connects the territory and its form with an idea of order or space organization. Moreover, the urban layout gives a nexus to link the public and the private components of the urban fabric.

The paper intends to reconstruct conjecturally the design principles that define the built typologies structural interference within the city built-fabric. By comparing some paradigmatic case studies from the Portuguese urban fabric it is explored an operative reading of the city according to the role of the building typologies as an element of the urban composition.

In addition, this methodology proposes interferences between the analytical and design procedures, both with urban and architectural approaches. It means that operative reading should be understood as a transfer from the built-city and from history to establish an analogous relationship between the interpretative reading and designing of the city.

1. Ungers, O. M. (1982) Morphologie: City Metaphors. (Köln: Walther König), p. 4.
2. The paper is part of the ongoing research project "Building Typology – morphological inventory of the Portuguese city, funded by FCT ref. PTDC/ART-DAQ/30110/2017.

On methods

Starting from the subject of the urban fabric composition, particularly by the reading of "samples", i.e. urban fragments with urban elements – buildings and streets – serial repeated, the aim is to deduce the laws or design principles behind the shape of historical cities.

The proposed approach is based on dialectics attempting to bridge a conceptual relation between the urban fabrics produced throughout the time with the conjectural process of its design.

By using drawing as an interpretation tool, together with delayering and elementarism as methodological procedures of decomposition, the approach allowed an exercise of progressive abstraction and consequent simplification of the complexity of the urban form. The purpose is understanding the whole through the knowledge of its components.

Methodologically, the reading is based on the analogue relations in architecture, understanding that the analogy can be defined as the similarity between things, or in its Greek origin, the similarity related with a sense of proportion. The transposition of the analogy to the field of creativity means a powerful operation that works as a process to convert images from memory into architecture (Ungers, 2011). In this sense, the analogy emerges as a form of dialectics attempting to bridge a conceptual relation between the Portuguese way of building typologies, the territory and the city, and mainly exploring the structural relation of buildings with the system of places for public use. (image 1.1 and image 1.2)

In a broad sense, the reading process of the urban fabric is based on a theoretical exercise of deconstruction of the built reality, where segmentation means dividing the city by parts and decomposition means delayering systems and selecting the representative elements within the urban fabric. The book of O. M. Ungers about "city metaphors" is one important theoretical reference to understand the city as a complex system made by sub-systems. The comparison of Manhattan "street structure" with the "bone structure" of a human body and also with a "frame structure" of a car brought to the definition of the city a powerful analogy with a very clear meaning, where the city is represented as something in-between the organism and the machine, an entity a half organic and a half mechanic (Ungers, 1982).

Besides that, the fragments that represent the pediment of the Greek temple of Aphaia on Aegina, which we can find in München Glyptothek, give us the notion that an element can be seen as a fragment or even as a member of an entire body. In this current exhibition of the Aphaia pediment, we understand the shape of the object only through the recognition of its fragments. (image 2.1)

Furthermore, we must remind Ernesto Nathan Rogers and his quotes that said that the “Element is the part that contains everything of which it is part” (Rogers, 1981). When we look at a city as Lisbon through a set of samples of the urban layout, we acknowledge through its elements the shape of the city in a similar way as we do with the fragments to recognize the pediment of Aphaia temple. In fact, urban samples largely hide the urban complexity of Lisbon, however, it gives us a clear idea of the homogeneous parts that compose Lisbon urban fabric, and also the idea of the city as a body made by different members.

Composition

For the reading of the city layout, it is methodologically necessary to acknowledge the homogenous parts that compose the shape of the city. For this, it is needed to identify within the city. This task follows the steps of M.R.G. Conzen and its theory on morphological regions (Conzen, 1960) but also the notion of neighborhood established by Kevin Lynch in the classic book about the Image of the City (Lynch, 1960). In this sense and regarding the built city as a case study, the analysis proposes the theoretical deconstruction of the urban fabric and the decomposition of the urban layout into a set of parts, which are homogeneous urban layouts or urban fragments composed by similar urban elements.

Each recognized homogeneous urban layout has its own structure. The delayering of each one shows a set of morphological strata, namely the limit, the theoretical grid, and also an internal structure. The small town of Caminha, in the north of Portugal, is here a clear example where the

the medieval wall defines the limit of the urban layout. Besides that, the Rua Direita or the Portuguese straight street is here the linear system of public spaces that structure and hierarchies the grid, which theoretically is the matrix of the urban fabric formation.

As noted, when the focus is on the shape of Lisbon by reading samples of the urban layout, we hide the structure of the city urban shape and mainly its complexity, according to the specificities of each context and the formal composition of each neighborhood. (image2.1 and image 2.2)

Thus, and regarding the morphological region of Baixa, the urban layout is also structured by the main street, similar to Rua Direita of Caminha. The Augusta Street, in Baixa, is the axis which connects some of the most important squares of Lisbon, Praça do Comércio and Rossio. (image 3)

Regarding the samples as an abstract fragment of the urban fabric, we carefully observe the ordinary elements of composition that allow us to find the type of elements of the urban form namely: streets, intersections, and urban-blocks. The interpretation of this urban layout sample is based on the decomposition of the urban fabric by gradual simplification. By decomposing the urban sample, it is possible to obtain an explanation of the built city, but, more than that, it provides a theoretical model of the city making that is behind its design process. Through methodical decomposition we turn simpler the identification of the ordinary elements and, by simplification, we become evident the elements of composition behind the design urban form.

Looking for the sample of Baixa, the urban-layout composition is based on the gradual staggering of the street profile. The different width of the streets further accentuates the orthogonal grid hierarchy, determined by the dominant orientation of rectangular blocks. Thus, three types of street or three different sections are combined with an ordered axes system to define the urban layout: the main streets with 12.2 meters (55 spans), the transversal streets with 9.5 meters (43 spans) and the secondary streets or less important streets. Those having a narrower profile are arranged alternately with the main streets and have 7.3 meters (33 feet).

The integral composition process of this urban ensemble establishes the correspondence between different street widths, hierarchized sections-type, and the respective height regulation through the design of façades. The emphasis of the hierarchy underlying the urban axes combination is also reflected in the distinct valuation of the building public expression, mainly through façades-type that varies according to the streets nature and, in a way, also varies with the block-type fronts.

Also, as the street, the urban block is a fundamental composition element of this urban layout whose modular nature is inseparable from the hierarchy of the streets. The street façade type is supported by common regulation parameters that define three levels: a commercial basement, a body of windows corresponding to the dwelling floors, and a cover with attic waters framed in the composition of the whole.

Regarding the urban-block type previously identified in Baixa urban fabric, its floor-type plan is characterized by buildings with a similar typology. However, the different dimension of each plot and the variety of the buildings is characterized by the modularity of the theoretical grid of composition (Figure - 3). The grid is here a powerful element of composition that codifies the regularity, but also the variety of the plots and buildings.

The representative building that we can find in Baixa, or in the other words its ordinary building has the ground-floor for commercial use, strictly connected with the public space of the street, and a floor-type plan characterized by a sequence of modular rooms and a structure of spaces that allow the flexibility of use for different housing programs (Figure - 4). The building typology in Baixa varies according to dimension and position. The dimension in terms of footprint varies according to the width of the buildings, which depends on the number of windows. Each building has around 12m deep which means the increase of area varies according to the width of the building façade. On the other hand, the position of the building varies within the urban-block, facing the street in a regular position or in the corner which defines the intersection of the streets.

Formation

When we look at the sedimented city, the objective is to decode the morphological genesis of its urban layout to exploratorily constitute a conceptual framework that, from a theoretical point of view, connects mental mechanisms of design and composition with the casualness and uncertainty of the urban production process. Therefore, it is understood the formation process as something inherent to the original act of urban settlement that combines matrix schemes with their evolutionary derivations. In this process, the progressive increase in the complexity of the urban ensemble is based on the notion of time and the dynamic relationship of urban form production.

The relationship between the route and the territory constitutes the genetic matrix for the urban space organization. The nexus is conceived from the link between the strategic axis of circulation and the symbolic place of permanence and centrality. A concept that is expressed in the link between the main street and the square[3]. This system can be understood as a rule if we understand it as an intellectual method of composition that supports the formulation of the urban layout and its notion of order, by incorporating the traditional characteristics of the forms of linear settlement[4] in the process that implies the construction of a city or simply part of it.

The combination of the main street and the square constitutes a logic of organization that can be morphologically understood as the most elementary expression of the urban layout with linear genesis. (image 4)

Its conceptualization is based on the existence of a composition axis, i.e., a linear system that is at the origin of the layout and simultaneously is the structure of the urban form, which both assumes the hierarchy of urban space and relates a set of elements that are not independent of each other - streets, squares, building

3. The square is here understood as the fundamental element for creating the urbanity of the linear settlement. The square is the most important urban element inside the process of transformation of elementary urban layouts, structuring and hierarchizing the urban space.
4. "The structure of the settlements at the base of the Pre-Arrábida is conditioned by the means of communication that cross it: the main street is the road itself and the dwellings have either side..." *In* RIBEIRO, O. (2004) *A Arrábida, esboço geográfico.* Câmara Municipal de Sesimbra: Fundação Oriente. (94).

typologies and plots. This axis is theoretically constituted by a linear system of public spaces where the segments of the main street are articulated with squares or other exceptional public spaces that concentrate unique events and features within an urban context. In summary, this axial composition simultaneously concentrates on a movement system and a design structure[5].

In this sense, if the combination of the communication route with the place where is located an exceptional building typology constitutes the matrix of the composition system that links the main street with the square. It means that the urban layout making process depends on a progressive adaptation of elements and their consequent incorporation into the urban space, specifically, the route configuration and the topography of the site.

Thus, it can be inferred that the same matrix can generate substantially different urban structures, whose variation depends on the combination of a system of spatial organization with time, with the individual evolutionary process of each urban element.

Context

With the famous "line made by walking" Richard Long proposed that the primitive act of walking should be equated with an art form. This work of art established the reciprocity between the movement of Men walking on Earth and the shape of the itinerary as a consequence or record of that same action. The historical reference of the British sculptor and, similarly, also the production of urban forms tend to establish a system of reciprocal relations between the shape of the territory and the shape of the city, especially when this process corresponds to the sedimentation of the layout of human movements. This alliance - urban layout and context - results in an effect of harmony of the whole, a cohesion, or a nexus in which the territory and its specificities become variables that determine the identity of the city and its shape.

Context permanently acts as a shaping factor of urban layouts and its values should truly be related to the notion of an element that generates urban shapes. However, if in the act of designing, that is, if in the exercise of composition, there is no idea for the city, this will never be found in the place, or as noted by one of Portugal's most influential contemporary architects "the idea is in the 'site' more than

5. "Movement Systems and Design Structure"*In* BACON, E. N. (1974) *Design of Cities*, Revised Edition. New York: The Viking Press. (136) [6] SIZA, Álvaro – «Um arquitecto foi chamado» *in* AA. VV. – *Obras e Projectos,* Electa, Lisboa: CGAC, CCB, 1996, p. 60.

in the mind of each individual, but solely for those that know how to see it..."[6]. It is, therefore, possible to transport context into urban composition variables when the place and its physical characteristics are understood not as a constraint, but as stimulating elements for imagination and for the creation of the city.

In Portugal, the identity of the urban layout is largely determined by the characteristics of the context in which they are inserted, by the geography of each site as topography, orientation or climate, but above all, an "economy principle" is present, rooted in the compositional rationality that articulates the level of necessity with the level of sensitivity. It is this balance that regulates the efficiency and convenience in the production of urban forms.

This evidence assumes in Lisbon a synthesis that illustrates the central importance of the context where the city is built and its essential role in the production process of the layout of this city.

In Lisbon, there is an admirable diversity of urban forms. These have an underlying complexity of interrelations between the shape of urban space and its support. In a way, the individuality of the shape of this city and even its own originality was determined by this correspondence.

This harmony is the result of man's continuous interaction with the territory over time. In this sense, the complexity of the Lisbon layout can also be understood as a result of the interaction of the human imagination with the memory of places and with what each has the most essential. In a way, the variety of forms in this city and its own beauty are rooted in the organic relationship of its members, and of these with the site. This confirms that the production process of the urban layout attributed to the context - to the "soul of the place" - a structural meaning that came to be translated in the deepest soul of the Architecture of this city.

Lisbon will really be one of the most extraordinary examples, where the sedimentation of the shape of the city incorporated the physical characteristics of the territory, but also the vicissitudes of its historical process.

An illuminating example of this is the formation of the city that is most directly associated with the transformation of the two great valleys that characterize the Lisbon site. In these contexts, the gradual overlap of strata over time gradually accentuated the role of this geographical condition in the morphological structure of the urban layout. The process that culminated with the opening of the avenues of Liberdade and Almirante Reis and the constitution of the two urban axes of composition sedimented the valley bottom lines in the urban layout. Through these axes, the growth of the city was guided until the mid-twentieth century, and with them, a harmony was established between the various routes implanted along the slopes and the flow of displacements genetically associated with the topography. (image 5)

Mainly, these operations reveal that the valley line remains eternal in the memory of the territory. Furthermore, this reciprocity between the valley lines and the structure of the city can be generalized to the genetic role that other lines in the territory, such as the ridges or even the banks of the Tagus, still have in the Lisbon layout. In this sense, the transformation of the territory corresponds to the formation of the city itself or, to put it another way, it is an organic project process guided by intuition and sensitivity as well as necessity and ingenuity. Actually, these characteristics are found in most cities, towns, and villages found in Portugal.

The phenomenon of reciprocity is easily revealed when the territory lines - the valley lines or the ridges - become urban axes or streets, or even when the production of the urban layout literally follows the shape of the territory. However, the modeling effect of the topography is less clear when the production of urban layout arises from the urge to overcome the half-slope. Therefore, the form of the territory acts as a catalyst for creativity, to design streets that combine requirements such as brevity and convenience associated with the human movements.

On the slopes of Douro, where Port wine is cultivated, the zig-zag paths allowed to walk through the slopes and terraces that were carved in the topography to plant the vineyard. This landscape, or rather, this structure composed of diagonal paths, support walls, and platforms, translates a very strong image of agreement and conciliation between the human will and the shape of the territory. Interestingly, the construction elements that were used in the Douro valley to transform steep slopes into cultivated areas are the same as those that characterize urban layouts in analogous topographical situations such as in the village of Piodão, in the Serra do Açor, in the neighborhood of Ferreiros in Vila Real, or even on the slopes of the main hill of Lisbon. Any of these urban layouts are actually derived from identical matrices. However, they are currently in different evolutionary stages and, as such, they also reflect different levels of complexity.

Harmony

If we understand harmony as a principle that is based on the balance between the members of a body, this notion is expressed in the urban layout through the relationship of coexistence between the city layout and the territory as support for its establishment, as well as in the agreement between parts and the whole in the urban production of an articulated set. Yet, the reading of these few examples of urban layouts has made it clear that the specific position, that is, the placement of the building typologies on the territory, the relative position in space as well as their arrangement around the geography of the place, corresponds to an operation at the level of poetics and human imagination that is based upon intuition and consequently on a notion of order for the display of elements and to attain group harmony.

In morphological terms, the decomposition of the strata allowed for the identification of matrix structures and evolutionary processes, as well as theoretical models of composition and identified principles of adjustment and adaptation. When comparing complex layouts of sedimented cities with elementary layouts of proto-urban settlements, similar phenomena were found to be intervening in the production process of the layouts, and analogous morphological matrices were also uncovered, albeit at very different evolutionary stages (image 6).

Manifesto

The proposed methodology advises analogies between analytical and designing procedures. It is possible to admit that the knowledge extracted from the reading of the existing city may be transferred to the development of new concepts, as well as to the creation of new urban realities or even to design the urban fabric, whereby it may inform a position on the way of thinking the production of the form of the city.

In this sense, the "Città Analoga" presented by Aldo Rossi in 1976 Biennale di Venezia still seems actual today. The legacy from the past means, more than ever, collecting references and autobiographical memories from the history of the city that can serve as guidelines to imagine a parallel reality in the future. According to that, also Colin Rowe and Fred Koetter give us the same message in its book published in 1978 under the title City Collage. In both manifestos, the same notion of modernity is expressed: the idea of continuity that is based on the acceptance of the built city as legacy and repository of its memory; and also, the city as an unfinished work and the urban design as a possibility of reinterpreting the forms of the inherited city by overlapping new meanings to the layers of the past.

IMAGES, CHARTS OR GRAPHIC LEGENDS

Image 1.1: Lisbon, topography.

Image 1.2: Lisbon, urban layout.

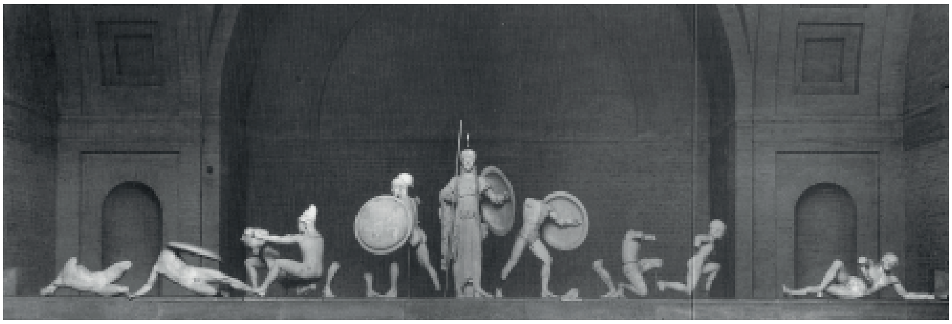

Image 2.1: Aphaia Temple in Muchen Glyptothek.

Image 2.2: Lisbon, urban layout samples.

Image 3: Urban layout interpretation. Baixa in Lisbon.

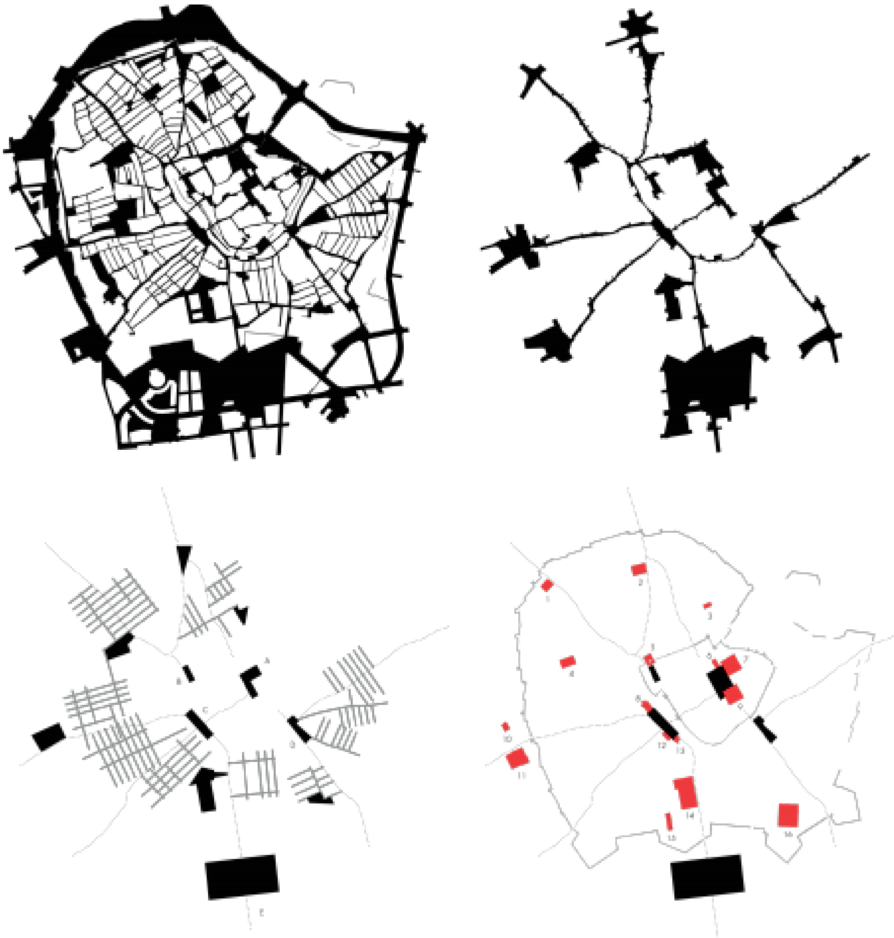

Image 4: Elementary matrix of the urban layout formation process.
Urban layout; Linear systems of public spaces; Matrix routes and grids; Matrix routes and singular buildings.

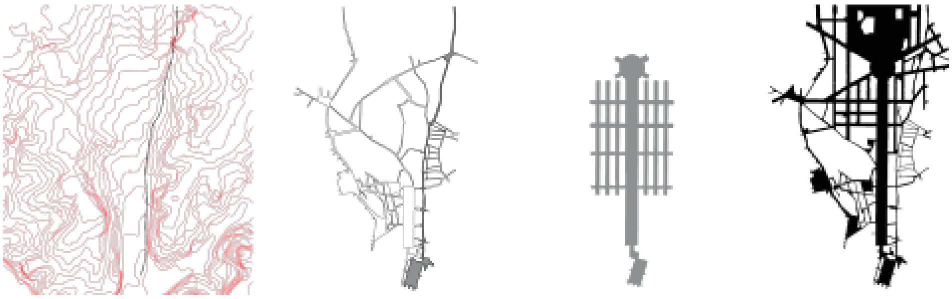

Image 5: Valley.
Valley line; preliminary occupation phase; theoretical grid juxtaposition; urban layout.

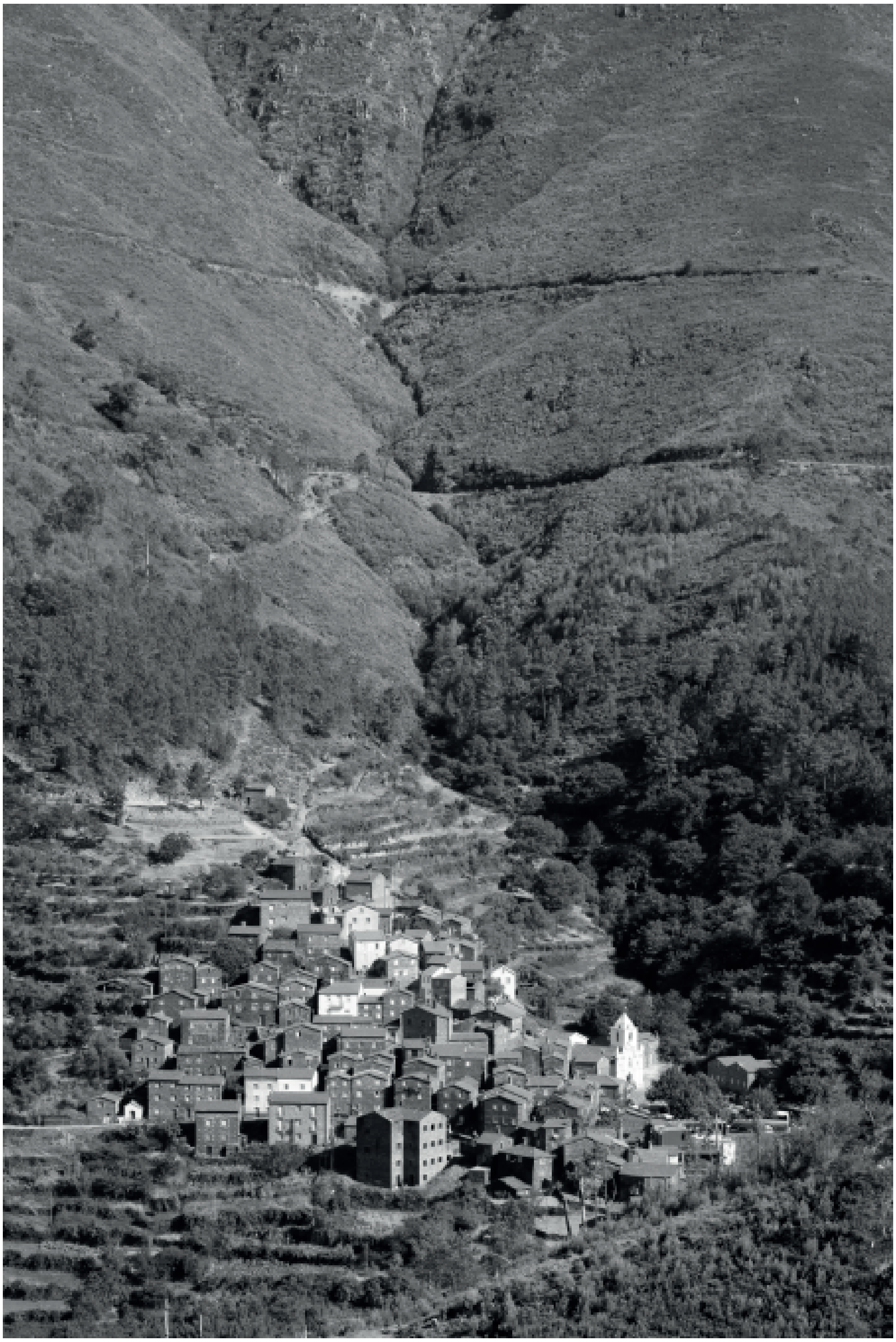

Image 6: View from Piodão. Photo by Nuno Soares/formaurbis LAB.

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ARCHITECTURE AND MEDIA

Materialising ideas in early republican turkey

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ABSTRACT

The modernization process of the Republic of Turkey in the early 1930s is one of the finest examples among various others, illustrating the role of communication media in the formation of modern societies. As is well known, new social orders require a systematic means of communicating ideas to achieve their goals. In this context, architecture and the built environment take on a new meaning as an enduring means of a new way of living to be realized, and correspondingly, turning into communication tools. Similarly, during the same era in Turkey, the republican reforms and policies attempted to communicate with the public through architecture. Subsequently, architecture, which also began the process of modernization, created its media. Thus, architectural and political thought did not seem to exist without being embodied in the media, because communicating ideas must be almost entirely mediated and mediatized. In this sense, this chapter is concerned with the issue of the complex relationships between architecture and media in the context of materializing ideas in early republican Turkey. To portray the issue, the instrumentality of mediums, such as architectural exhibitions, competitions, journals, books, photography, and film, in the materialization of ideas during the formative years of the country is addressed.

KEYWORDS

Architecture, media, modern architecture, twentieth-century Turkish architecture

Introduction

There can be no doubt that an event of primary importance in the twentieth-century history of Turkey is the foundation of the Republic in 1923.[1] As "one of the most successful models of a universally defined modernization process" (Bozdoğan & Kasaba, 1998, p. 2), the Republic of Turkey needed to develop a communication network to be capable of pursuing its goals during these formative years when significant transformations occurring across the country. Communication media, as Thompson argues, is an essential part of the rise of modern societies (Thompson, 1995). Focusing on the experience of Turkey, the same is true. Hence, the development of communication media played an extremely central role in the formation of a modern society in Turkey. Especially in the early republican era, the will to construct a new (modern) social order, as Altan Ergut suggests, was in need of a variety of symbolic mediums that were expected to have an effect upon the masses (Altan Ergut, 2007). Architecture, along with fine arts and other institutional bodies,[2] was one of the considerable tools employed by the young republic because politics would take its shape in such settings that were established through architecture for the formation of a new country consisting of modern citizens with modern lifestyles. During the process of establishing a new social order, politics and ideologies utilized architecture to communicate with the masses, similarly, architecture would also create its own communication media. That is, architecture takes advantage of mediums as much as architecture itself also being seen as a communication tool. Therefore, there has been a complex and dynamic relationship between architecture and media in the context of materializing ideas. The media provides the architectural idea with a physical form, at the same time as architecture embodies political thought. As such, introducing the following cases from republican architecture in early 1930s Turkey, the discussion in this chapter will point to this reciprocal relationship of architecture with media in view of the materiality of ideas. This chapter is an attempt to address the issue of the overall influence of politics upon architecture and architectural media through exhibitions, competitions, journals, books, photography, and film.

1. This chapter has been developed from a research paper prepared by the author at Middle East Technical University, PhD Program in Architectural History.
2. Such as People's Houses (*Halkevleri*), municipal services, the National Economy and Savings Society (*Milli İktisat ve Tasarruf Cemiyeti*), the Turkish Language Society (*Türk Dil Kurumu*) and the Turkish Historical Society (*Türk Tarih Kurumu*).

Exhibitions

During the Great Depression of the 1930s, the National Economy and Savings Society ("the Society") was founded in Turkey at the end of 1929. Its main objective was to encourage savings and to raise awareness of the use of domestic commodities in the country. To realize its aims, the Society opened branches, issued publications and organized events such as exhibitions of domestic goods, and planned Turkish participation in international exhibitions and fairs. The Society's chief contribution in the context of exhibitions was to initiate a modern understanding of exhibitions "which, in the 1930s, became showcases for modern architecture and the republican public space" (Bozdoğan, 2001, p. 137). For many instances, the booths designed by prominent artists and architects of the period differed widely from the traditional ones that had common characteristics with the stores at the Grand Bazaar in Istanbul (*Kapalıçarşı*). The architects in early republican Turkey did not distance themselves from the exhibitions that were organized by the Society. The journal *Arkitekt* (*Mimar* until 1935) spoke highly of the pavilions that successfully reflected characteristics of modern art being simple and economic ('Yerli Mallar Sergisi', 1935). Therefore, the exhibitions designed in particular for state agencies undertook a mediatory position to introduce modernism to the masses (Turan & Ödekan, 2009, p. 19). (Image 1)

Besides national exhibitions, the Society also coordinated the participation program of Turkey in international events. The Turkish pavilion in the Budapest International Exposition of 1930 is an example of this. Unlike the pavilion in the 1925 Paris Exposition, which had been designed by a foreign national architect, it was designed by Turkish architect Sedad Hakkı [Eldem]. According to Sedad Hakkı, the pavilion in Budapest, which was different from the former pavilion in Paris that misinterpreted a Turkish mosque, is "a success for new Turkey." The Turkish pavilion in Paris, its interior, and collections on display had undermined the idea about a new Turkey that should have properly be given to the international audience of the fair. Accordingly, an architectural style for the exhibition building in the Budapest Exposition had been explored in order to better represent Turkey in those days ([Eldem], 1931). One of the commentators of the time noted that "the Turkish pavilion in the Budapest Fair can be considered as the most successful one… There was no hint of the orient or the Grand Bazaar (*Kapalıçarşı*) in the Turkish pavilion. The architecture, decorations, and organization of the displays all were European" (Zelef, 2003, p. 72). Hence, the success of the European architectural style finding a presence in the new Turkey is the result of the choice to represent the nation-state with a modernist aesthetic at international fairs. (Image 2) Thus, both exhibitions and fairs were among the major agents of mass communication that contributed to the birth and diffusion of early republican architecture in Turkey. It can be suggested that there appears to be space-mediated communications offering new ways of seeing oneself and in relating to others and having new ways of interaction between them. The media of exhibitions and fairs can impact the masses at home and abroad, as well as influence the ways people experience the built environment and architecture.

Competitions

During the 1930s, the first international competition was also staged by the Society for the design of the Exhibition Hall in Ankara. *Arkitekt* was appreciative of the Society for its choice to organize a contest instead of tendering the project to a foreign architect ('Sergi Binası Müsabakası', 1933). In fact, foreign architects dominated the Turkish architectural scene throughout the period. Having been invited to work on buildings, planning, and teaching in the country, foreign architects were also expected to design administrative buildings of the Republic. Hence, the state, the main employer of architects at that time, almost always commissioned foreign architects to manage public building projects. In this sense, the competition was seen by the architectural community of 1930s Turkey as a medium for balancing the disparate rights between domestic and foreign architects. Furthermore, architectural competitions facilitated to form an appropriate atmosphere for providing professional legitimacy in Turkey, since the role of an architect both in the eyes of Turkish society and that of the state was not intelligible in the early republican era (Altan Ergut, 2007; Sayar, 2004). The competition instructions of the Exhibition Hall given to architects clearly articulated that "the building should be in the modern architectural style" ('Sergi Binası Müsabakası', 1933, p. 133). Advocating "the modern architectural style" not only portrays intelligentsia's determining role in the formation of the built environment but also verbalizes the state's tendency towards architectural modernization in Turkey (Sayar, 2004). It is worth noting here that Turkish architects supported the dominant ideology in concert with the modernization efforts of the new Republic (Altan Ergut, 2007). The winning project by Turkish architect Şevki Eşref [Balmumcu][3] confirms that it was "the work perhaps most representative of a European modernist aesthetic" among the twenty-six entries (Bozdoğan, 2001, p. 138). (Image 3) Indeed, the Exhibition Hall is one of the turning points of twentieth-century architecture in Turkey. As İmamoğlu points

3. Şevki Balmumcu (1905-1982) also won one of the first Turkish national competitions in the early 1930s, namely *Elâziz Belediyesi*, the project for a movie house in 1931 (Altan Ergut, 2007; F. Galip, 1931; 'Proje Müsabakası', 1931).

out, it "was a source of pride for the 1930s, as it was the first prestigious building to be designed by a Turkish architect by means of winning an international competition. The design's clear modernist lines were seen as proof for the competence of Turkish architects of the time" (İmamoğlu, 2010, p. 50). Here, as one of the mediums through which architecture communicates, the architectural competition has a profound impact on the practice of architecture itself and on the evolution of the profession during the early years of the republic in Turkey.[4] Subsequently, the Exhibition Hall becomes a physically materialized artefact that hosts political and architectural thoughts.

Print Media

Together with the organization of architecture competitions, the first cases of architecture appearing in the Turkish print media was also in the 1930s. For Turkish architects, the process of architectural modernization did not only emphasize the formal and stylistic changes in architecture in the country but also emphasizes the conceptual interpretation of the profession (Altan Ergut, 2007). It was in 1931 that the country's first architectural journal, *Arkitekt* (*Mimar* until 1935), was published by architects Zeki Sayar, Abidin Mortaş, and Abdullah Ziya Kozanoğlu.[5] The journal was the only architectural periodical at that time and continued its publication life until 1980. As such, together with its fifty-year publication history, the journal is doubtlessly one of the primary source materials for the analysis of republican architecture in Turkey. In the first issue of *Arkitekt*, Faruk Galip, then the secretary of the Architecture Branch of the Association of Fine Arts, stressed that the journal was the property of all Turkish architects (Ö. F. Galip, 1931). Architects in Turkey who had been deprived of communication tools for a long time, finally reached the printed media, which also provided an avenue to reveal their architectural ideas. The journal in this sense became a place around which Turkish architects gathered and tried to transform architecture in Turkey into a profession. In other words, *Arkitekt* became a medium in which the architecture profession manifested itself. As Özdel suggests; "for the architects of the early republican period, *Mimar* [*Arkitekt*] was not only an agent of communication but also

4. The early republican period also witnessed certain developments in the formation of the architectural profession in Turkey. For instance, the Association of Turkish Architects (*Türk Yüksek Mimarlar Derneği*) was established in 1927 and the Engineering and Architectural Services Act No. 1035 (*1035 sayılı Mühendislik ve Mimarlık hakkında Kanun*) was enacted in 1928.
5. The journal *Mimar* was renamed *Arkitekt* in 1935, and Sayar continued to publish the journal alone after Kozanoğlu and Mortaş left.

a medium of professional unification to discuss and react against common problems" (Özdel, 1999, p. 39). (Image 4)

Arkitekt took a very central role in constituting the basis for the period-specific understanding of architecture (Altan Ergut, 2001). Most of the projects, texts, and translations published in the journal portrayed the "new architecture" of the period in its modernist aesthetic. The works of well-known modern architects such as Le Corbusier, Mies van der Rohe, and Walter Gropius took their place on the pages of *Arkitekt* for the education of young architects in the country. Furthermore, contemporary practices of Turkish architects were presented under the name of "new architecture." In addition to architectural practice, theoretical issues on contemporary architectural movements were discussed in the journal. In 1931, a book on this new architectural philosophy was published by Celal Esad (*Yeni Mimari*). In the same year, a study on "Architect Sinan" (*Mimar Sinan*) by Ahmet Refik ([Arseven], 1931; Refik, 1931) was also released. Although Celal Esad's work intended to introduce contemporary (European) developments of modern architecture to Turkey (Altan Ergut, 2008), Ahmet Refik's book wanted to give Turkish architects a historical persona, through "Architect Sinan", with his fictional life scenario (Tanyeli, 1996). These two books, together with the journal *Arkitekt*, aside from their primary intentions, seem to also be compatible with the modernization project underway in the new Turkish Republic. More importantly, these early examples of the print media started to create an architectural culture in the country that enabled architecture to communicate with itself and with the public.

Photography and Film

The Republic wanted to reveal Turkish modernism in the 1930s to the rest of the world by way of official programs. Bozdoğan demonstrates in her book on Turkish architectural culture that "they wanted to show the world how the country was succeeding in shaking off its 'oriental malaise' and beginning to participate in contemporary civilization" (Bozdoğan, 2001, pp. 57–58). In this sense, the General Directorate of Press under the Ministry of Interior issued several publications as a part of the official program including magazines, photographic-albums, and city-guides, which were intended to provide publicity material for foreign audiences and were distributed abroad. As important parts of these official propaganda publications, the paradigmatic examples of modern architecture of the 1930s and the newly built urban texture, especially of republican Ankara, were circulated widely, as can be seen in the magazine, *La Turquie Kemaliste*, which began publication in 1934. Photography was given particular attention in the publications of the Directorate. Bozdoğan notes; "what was unique to the Kemalist program in the 1930s was … the official production, supervision, and dissemination of a distinctly republican *visual* culture of modernity" (Bozdoğan, 2001, p. 59). For instance, 16,000 photographs were taken in two years by Othmar Pferschy, the specialist photographer of the Directorate, providing an enormous visual repertoire about the period and offers a methodology for documenting the architecture in early republican Turkey.[6] Hence, the making of modern Turkey would be pursued by means of architecture and the built environment, together through visual representations and reproductions.

A documentary film, *Ankara: The Heart of Turkey* [*Ankara: Türkiye'nin Kalbi*], which was made by Soviet film-makers Sergei Yutkevich and Lev Oskarovich Arnshtam in 1934, portrays the modernization project of the nation besides the ceremonial occasions for the tenth anniversary of the Republic. The republican project for the capital city Ankara, i.e. the making of a modern nation by building a modern city, is clearly supported by the film. In *Ankara: the Heart of Turkey*, the city of Ankara became an enduring icon of cinematography and historiography because the development of Ankara as a modern city has generally been identified with the success of the republican regime (Yavuz & Özkan, 1984). The Republic of Turkey, a young nation, was praised for its major reforms, which transformed the whole country and Ankara, in merely ten years. However, the documentary simultaneously draws attention to "the old Ankara" whose walls preserve the memories of highly developed cultures and civilizations. Accordingly, how a modern city, the capital city of the Republic, was built on the foundations of this venerable past was stressed. (Image 5) While depicting the city of Ankara through the old and new urban landscapes together with the modern way of life, as well as recording the tenth-anniversary parade, the film enhances its technique of narration utilizing the new artistic medium of the time, film. The documentary tells the story of modernity for the rest of the world, documents, and historicizes the built environment and architecture.

Conclusion

To conclude, the present study aims to discuss the impact of the media on the realization of political thought and on the formation of early republican architecture

6. For more information about Othmar Pferschy and analyses on his photography please see: (Batuman, 2006; Mamboury, 1933; Nicolai, 2007).

in Turkey during the 1930s when architectural practice and discourse underwent remarkable and fundamental transformations. To be more precise, the paper's aim here is to demonstrate how architecture and media have a complex and dynamic relationship in the context of the materialization of architectural and political ideas. In general, architecture and media studies have two dimensions; the first deals with architecture as a social communication system and the second focuses on the media by which architecture communicates. This chapter provides a concise account of numerous cases that simultaneously point to these two dimensions. While doing this, the analysis does not concentrate on a specific case but rather proposes to collectively draw attention to various mediums of communication throughout the period, and to the architectures produced or reproduced by them. This has led to a brief overview of the cases such as architectural exhibitions, competitions, journals, books, together with photography and film that were selected from the formative years of the Republic. Indeed, there has been a rapidly growing body of literature on architecture in early republican Turkey. However, it is worth ascertaining what the interaction is among architecture, media, and materiality of ideas, and how they can collectively enhance our view about modern architecture in Turkey.

As has been noted in this study, architecture is both the subject and the object of the built environment in early 1930s Turkey. Architecture seems to be a powerful communicative medium for changing and shaping "the world." Architectural exhibitions, competitions, journals, books, photography, and film provide visibility to architectural ideas. Moreover, such mediums become repositories for architectural meanings and thoughts being collected and preserved. Similarly, republican policies appear with the help of architecture. What is claimed here is that the production carried out through media, is, in fact, mass production. That is, what is produced or reproduced through the media is received and consumed by a mass of people. The public then turns out to be one of the users, audiences, or actors within architecture through these mediums of communication and interaction. In the social world, the use of media, as Thompson remarks, also involves new ways of building relationships (Thompson, 1995). As such, an architectural competition, for instance, offers a new kind of relationship between architects and their clients, as well as, between architects themselves. In addition to establishing new forms of relationships between the masses, the state, and architects, architecture encountered through the media begins to define new experiences. Therefore, there is no doubt that the media changes how the architecture of 1930s Turkey and the built environment were conceived, received, and circulated. McLuhan develops the claim that "the 'content' of any medium is always another medium" (McLuhan, 1994). The underlying argument in favor of McLuhan is that the history of Turkish modernization can be read through architecture; similarly, the history of modern architecture in Turkey can be analyzed through the media. These characteristics of all media may give rise to further research in this area.

IMAGES, CHARTS, AND GRAPHICAL LEGENDS

Image 1: a) Traditional display at The Fifth Domestic Products Exhibition, Istanbul, 1933 (Turan & Ödekan, 2009, p. 19).
b) The Pavilion of Süngercilik TAŞ., designed by Arif Dino, 1935 ('Yerli Mallar Sergisi', 1935, p. 201).
c)The Pavilion of Zingal TAŞ. (interior), designed by Sedad Emin and Suat Nazım, 1933 (Emin & Nazım, 1933, p. 280).

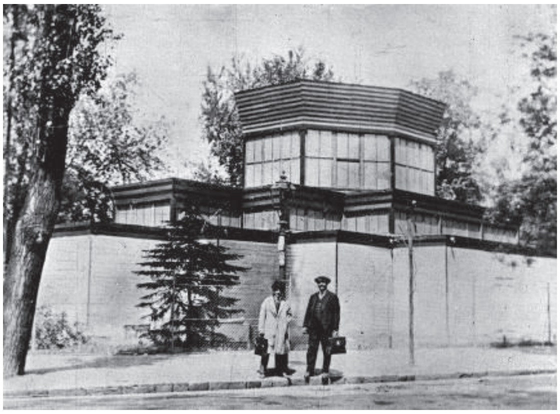

Image 2: The Turkish Pavilion in the 1930 Budapest Exhibition, by Sedad Hakkı Eldem ([Eldem], 1931, p. 189).

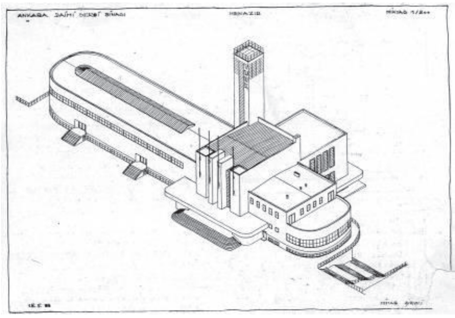

Image 3: a) The competition entry by Şevki Balmumcu ('Sergi Binası Müsabakası', 1933).
b) The Exhibition Hall designed by Şevki Balmumcu, 1933-34, Ankara (*Fotoğraflarla Türkiye*, 1936).

Image 4: a) *Mimar / Arkitekt*, the cover of the first issue, 1931. **b)** *Yeni Mimari*, the cover, 1931 ([Arseven], 1931). **c)** *Ankara Guide Touristique*, Ernest Mamboury , 1933 (Mamboury, 1933). **d)** *La Turquie Kemaliste*, the cover of the first issue, 1934.

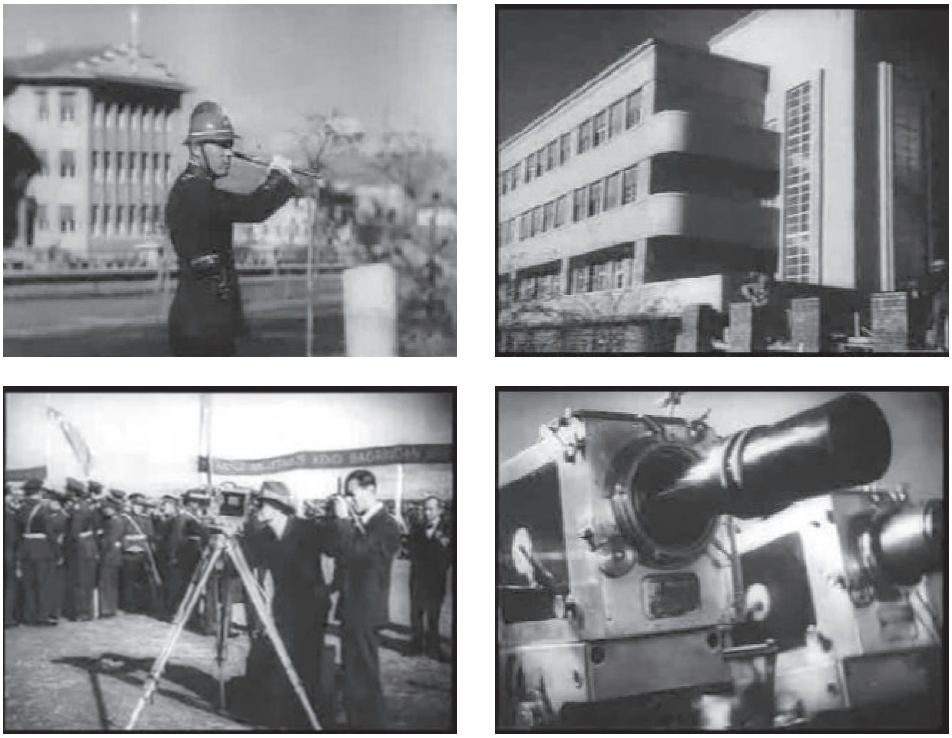

Image 5: Screenshots from the documentary, *Ankara: The Heart of Turkey***,** 1934.

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AS YOU SEE: PHOTOGRAPHIC CONSTRUCTS OF ARCHITECTURE

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ABSTRACT
From the earliest days of its invention, photography and architecture have been in a continuous interplay. Through photography, all kinds of images of the built environment have been produced and circulated. Photography has not been a passive or naïve tool for recording, describing, and documenting architecture. As a process of image-making, it has had many choices for picturing architecture. It renders what a camera sees in a photographic space. As a technique operated by different ways of seeing to capture images and construct a discursive medium, photography has had significant effects on architectural imagination, design, practice, and critique. This essay aims to track photography's implications transforming architecture by displaying several interfaces between architecture and photography.

KEYWORDS
Architecture, photography, representation, design

Introduction

From the down of the invention, photography has presented an irreplaceable ability to picture architecture. Because of photography's peculiar mechanical drawing ability, photographs were initially perceived as objective representations that man plays a minimum in their productions[1]. Because of this burden of objectiveness, photographs have been regarded as truthful records. Accordingly, photography has been affiliated as one of the main representational tools of architecture. This usage has never lost its weight, yet, in time, photography's capability as a tool of architectural exploration and conception was also discovered. Photography has its own promises and limits to represent architecture. It renders what the camera sees to a photographic space, and accordingly, it produces something new. As a technique governed by different intentions and providing different ways of seeing, the photograph is a discursive medium[2]. Recently, interactions between architecture and photography have been studied by many scholars from different disciplines. These studies have revealed photography's effects on architectural representation, imagination, conception, design, practice, and critique; moreover, vast literature focuses on photographs of cities and our built environment. While leaving the latter out, this essay focuses on how photography has been implemented in architectural representation and design. By displaying several interfaces of interactions between architecture and photography, photography's implications transforming architecture are traced.

Recording World architecture

Since the first photographic image showing Le Gras's roofs, produced by Nicéphore Niépce (1765-1833) in around 1826, architecture and photography have had a symbiotic relationship. Initially, their relationship was based on reciprocal

1. Photography is a continuation of the representational tradition based on Alberti's perspective system in his treatise, De Pictura (1435). Alberti suggested that the picture frame is like a window that the view appears as an exact representation of the things on the other side of its frame. There is a lengthy discussion on photography's suggested transparency and indexicality. For a brief overview of the subject, please see Helmut and Alison Gersheim, (1965), *A Concise History of Photography*, New York: Grosset and Dunlop; Peter Galassi, (1981) *Before Photography Painting and the Invention of Photography*, New York: Museum of Modern Art; Anne Friedberg, (2009*) The Virtual Window*, Cambridge: MIT Press; Steve Edwards, (2006) *Photography. A Very Short Introduction*, New York: Oxford University Press.
2. Roland Barthes (1978) argues that a photographic image has a paradox, which is the co-existence of two messages: "a message without code" and its "connoted meaning." Barthes observes two integrated levels of meaning of a photograph. The first level is denoted/objective, a natural imprint of the world; the second is an invested and culturally connoted meaning. Connoted meaning is imposed on a photograph at different production levels so that the audience/the reader can interpret it (pp. 15-31). Similarly, in his essay, Alan Sekula (1974) points out, "On the Invention of Photographic Meaning," a photograph is a message whose readability is determined by a discourse that comprises the domain of high art and popular press.

instrumentality. The built environment was mainly photographed because buildings could stay still during long exposure times required to make photographs; on the other hand, in architecture, photography was regarded as a tool for scientific rendering and was praised for its truthfulness. Photography was used for documenting historic and culturally significant buildings, the transformation of cities, and the progression of new constructions (Ackerman, 2002). Within several decades a vast array of photographs, including antique sites, medieval buildings, and architectures of remote cultures, especially those of Egypt, Byzantium, and the Middle East, were produced. These photographs affected architectural knowledge, culture, and practice (Elwall, 2004, 12-20; Robinson, Herschman, 1987, 2-54). Photographs became an important source for the studies of architectural history (Acar, 2013). Indeed, one of the nineteenth-century historians, James Fergusson (1808-86), who wrote a world history of architecture book series, used photographs and wrote that "[p]hotography has probably done more than anything that has been written" (Fergusson, 1876, v). In the field of restoration and conservation, photography was used to keep records of the current status of historical buildings (Ackerman, 2002, p. 29). Moreover, nineteenth-century architects used photographs as referential and inspirational sources for their designs.

Mass media

Architects immediately noticed that photography was a perfect medium to show and promote their works since photography had a great capacity to record minute details, convey design ideas, and create impressions. In the 1880s, the first architectural photographers and their firms appeared. In the same decade, the halftone technique was invented and enabled photographs to be published more easily. By the twentieth century, architectural photographs appeared in magazines and books (Heiferman, 2018, 21; Elwall, 2004, pp. 90-1). From then on, the relationship between architecture and photography radically changed: Editorial strategies became decisive in how buildings were presented (Elwall, 2004, p. 91). No longer buildings have only been seen by their users or visitors. Architecture, whose photographs were fabricated dexterously and distributed efficiently, reached a wide audience, and became influential.

Modern architecture made public through its photographs published in modernist journals such as Bauhaus (published in between 1926-1931), Domus (founded in 1928), L'architecture d'aujourd'hui (founded in 1930). In these years, media constructions of architecture started to be as important as the building itself.

Remarking modern architecture's reliance on photographs, in the 1930s, H.S. Goodhart-Rendel, a British architect, had said, "[t]he modern architectural drawing is interesting, the photograph is magnificent, the building is unfortunate but necessary stage between the two" (as cited from Elwall, 2004, p. 9). The recognition and the adaption of European modern architecture in other countries were realized through the photographs exhibited and published. In the exhibition, "Modern Architecture - International Exhibition," organized by Henry-Russell Hitchcock (1903-87) and Philip Johnson (1906-2005) at The Museum of Modern Art in New York in 1932, the new style was introduced by drawings and models, as well as many architectural photographs. These photographs efficiently presented the principles of international style: simplified geometry, regularity and standardization of features, and plain surfaces. Indeed, the critic Philip Morton Shand (1888-1960) wrote in 1934, in an article published in Architectural Review (founded in 1896), "[d]id modern photography beget modern architecture or the converse?" (as cited in Elwall, 2007, p. 53). Then, after World War II, American modern architecture reached Europe through photographs exhibited and circulated (Zimmerman, 2014, pp. 207-37). As Richard Neutra (1892-1970) admitted, by implying photographs of Julius Schulman (1910-2009), "[h]is work will survive me [f]ilm [is] stronger and good glossy prints are easier [to] ship than brute concrete, stainless steel, or even ideas" (Rosa, 1994, p. 49). Beatriz Colomina argues, the tight engagement of modern architecture with photography transformed architectural production: "[architectural production] no longer exclusively located on the construction site, but more and more displaced into the rather immaterial sites of architectural publications, exhibitions, journals" (Colomina, 1996, p. 14).

Architectural photography as a genre

By the twentieth century, photography companies specializing in architectural photography such as Hedrich Blessing in Chicago, Nyholm § Lincoln in New York, and Dell §Wainwright in London were well known (Heiferman, 2018, 22). Around the mid-century, photographers such as Ezra Stoller, Julius Schulman, Balthazar Korab worked closely with the leading architects of the period, such as Frank Lloyd Wright, Eero Saarinen, Mies van der Rohe, Richard Neutra, and they produced beautiful, perfectly crafted works of the genre. As a specialized genre, after World War II, being parallel to the increase in publishing opportunities, architectural photography matured. The conventions of the genre today, which are also valid, were already established. Wide-angle lenses are used to fit the entire mass of the structure in the frame; interplays of light and shadow are sought to emphasize volumetric relations of masses; the parallax correction is made to align the converging verticals of perspectival views as drawing parallels with the frame of the image; interiors are usually photographed from the viewpoints looking through open doors showing the sequence of rooms while the parts and spaces which are hard to capture are ignored. Photographs in architectural journals have mostly shown buildings new and flawless, by being excluded from their surroundings, and under the best weather conditions and light (Higgott, Wray, 2014, p. 7-8). A brand-new building published in an architectural book or a journal has been photographed soon after its completion just before its users occupy it. It is the most abstracted time in a building's life that the building is in a realm that is closer to the Platonic world of ideas than the mundanities of everyday life. Yet, this kind of representative strategy has been criticized for the difference between perfection in a photograph and the building's authentic occupants' real life. In the 1960s, a photojournalistic approach, which was parallel to the sensibilities of some architects such as Aldo van Eyck, Herman Hertzberger, who insisted on their architecture being shown in everyday use, appeared (Elwall, 2004, 163; Higgott, Wray, 2014, p. 9).

Photography has the capacity to create images of architecture that provides architecture fame and desirability. As a specialized genre, contracted architectural photography has more similar concerns with fine art, fashion, and advertising photography than documentary photography or photojournalism. Professional photographers have sought to develop a visual interest in both the photograph and the subject depicted by using medium-specific tools. They have communicated their patrons' intentions, who have been architects, builders, journal editors, or have acted according to their artistic pursuits. Moreover, since a photograph is just a fragment of a building in a fleeting moment, naturally, seeing architecture from a photograph and being on the spot has been different.

Photographic influence in architectural design

Architects have involved in photography not only because they became dependent on photographs to publicize their works, but they have also appreciated its potential to generate new visual experiences, its promise to a novel conceptual engagement with space, its ability for configuring spatial relations between existing and imaginary, and its ingenuity for capturing fleeting impressions of light and movement. Those architects have employed photography as a new tool and a medium for their artistic search, experimentation, and expressions.

Exploration and imagination

In the 1920s, photography and architecture were influenced by contemporary art, particularly constructivism and cubism, and developments in cinema. Architectural photographs reflected the new aesthetics of the photographic avant-garde. Abstractions, high tonal contrasts, wide angles, close-ups, unconventional viewpoints, bird's and worm's eye views, photomontages, extreme cropping, photograms, short and long exposures, which are techniques and qualities unique to photography, were used rather than the previous picturesque approach mimicking the painting or conventions of the architectural drawing. As Robert Elwall states, new photography and architecture established a "visual and philosophical alliance" due to their similar concerns considering "distill the essence of the subjects" (2004, 120). Bauhaus was very influential in presenting the potential of photography through its education and publications. Such essays by László Moholy-Nagy (1895-1946), "Production-Reproduction" (1922), and "Painting, Photography, and Film" (1925) were on new undertakings of photography in the communication and the new optical experiences. Moholy-Nagy described the new way of seeing stimulated by photography:

> [T]he photographic camera reproduces the purely optical image and therefore shows the optically true distortions, deformations, foreshortenings, etc., whereas the eye together with our intellectual experience, supplements perceived optical phenomena by means of association and formally and spatially creates a conceptual image. Thus in the photographic camera we have the most reliable aid to a beginning of objective vision (1969, 28).

Regarding photography as a new creative means, Moholy-Nagy experimented with light and movement to explore novel spatial relations. He dematerialized objects in his photograms by reducing them to a composition of straight and curved lines generating new ideas of space (Wingham, 2014, p. 260).

Conception and contemplation

Starting from the early twentieth century, photomontage was used for projecting a future building. For the Bismarck Monument competition (1910), Mies Van der Rohe (1886-1969) montaged a carefully taken photograph of his proposal model on to the photograph of the site supplied for the competition (Figure 1). By matching perspectives of photographs of models and their real sites, Mies continued to create persuasive photorealistic architectural scenes merging fiction and reality. In his proposal to the Alexanderplatz competition Berlin (1928) and his plan for the IIT campus in Chicago (1939-41), he superimposed model photographs, taken from above, on aerial photographs (Diamond, 2014, 270-72). Through a complicated photographic manipulation, Mies obtained pictures as if the monument were already built. Mies' photomontages depicted something which did not exist; they were renderings of something imagined.

Le Corbusier (1887-1965) used photographs extensively in publications such as Vers une architecture (1923) and L'Esprit nouveau (1920-1925). It is known that he manipulated some photographs. As Beatriz Colomina discusses, in these publications, drawings, found pictures, and photographs appear like his thoughts' fragments. He continuously gathered these bits and pieces, eradicated their contexts, composed them in a new setting by constructing different meanings posing his arguments (1996, p. 100-28). Le Corbusier did not regard photographs as mere representations of a building but a medium through which he thought architecture. He altered photographs to demonstrate and argue his ideas that geometric forms are the main elements constituting architecture (Piotrowski, 2014, p.41). Since he used photographs as a medium of inquiry in his creative processes, as an example, on Villa Schwob's photograph (Figure 2), he removed all indicators of the context; changed the villa's appearance following his understanding of purist aesthetics. Daniel Naegele suggests that "Le Corbusier understood that photography, rather than simply picturing an architecture that was, could visualize an architecture that could be." (1996, 262) For Le Corbusier, the building did not mark the end of the design process but just a stage within an ongoing design process; architecture was a conceptual process than a mere building act (Colomina, 1996, p. 118-128).

Naturally, any building transformed into a picture on a photographic surface operates in a realm offering new possibilities of seeing and thinking that are different from spatial material context. Like Le Corbusier, Richard Neutra (1892-1970) had the habit of re-experiencing his buildings through photographs. When he died due to a heart attack, he was taking photographs of his Kemper house in Wuppertal, Germany. He had an archive of presentable photographs of his works, including the Kemper house, so his urge for taking photographs was not because he needed better photographs. (Niedenthal, 1993, 108). It is evident from his archive that included prints on which he marked and studied; he had a routine to study photographs of his works. Neutra was aware of the photograph's limitations and seeing architecture through photographs was certainly a different experience than being there. Yet, for Neutra, photographs offer a contemplation in the realm of ideas, a meditation on his design intentions (Niedenthal, 1993, 108-11).

Learning from photographs

As photography became easier and widespread, many people, artists, journalists, architects, and photographers have made photographs of architecture with different intentions and approaches. Produced by diverse intentions, carrying the traces of memory, evidence, communication, and representation, the increase of photographs have influenced architecture in complex ways. In her book Photographic Architecture (2014), Claire Zimmerman explores how photography and photographs have been included in architectural processes. One of her subjects is the Hunstanton School, designed by Alison Smithson (1928-93) and Peter Smithson (1923-2003), completed in 1954. During and after its construction, several photographers photographed the building for different purposes, including Smithsons themselves. A local photographic firm took photographs of the process for the firm erecting the steel structure. Smithsons took their own photographs to follow the construction from start to finish. While the building was under construction, Eduardo Paolozzi (1924-2005), sculptor, and Nigel Henderson (1917-1985), documentary photographer, took a series of photographs. These photographs displayed the building's instantaneous situation, together with its neighborhood's everyday life (Zimmerman, 2014, pp. 239-41). After its completion, the building was also photographed by an architectural photographer and a staff photographer for Architectural Press. These photographs depicted the building empty, spacious, light, harmonious spaces formed by a matrix of transparent frames. They display a particular similitude to the photographs of Mies van der Rohe's Minerals and Metals Research Building, Illinois Institute of Technology, published in Architects' Journal in 1946. By using these photographs, Architectural Review (founded in 1896) published an article about the building, which included Philip Johnson's comment[3]. Johnson praised the young architects that though they had never seen Mies's works, the school's plan was as good as Mies van der Rohe's building. The photographs of Hunstanton School also present a similarity with the photographs of Mies' building, yet these two buildings had fundamental divergences. Although Smithsons were aware of these differences, this photographic kinship established between their work and Mies' building provided them a recognition (Zimmerman, 2014, pp. 242-57). In this example, photographs have two different roles: Like many architects, Smithsons encountered American modernism through photographs. As Zimmerman writes, Peter Smithson recalled the moment that he first saw the photographs of the IIT buildings published in The Architect's Journal in 1946 as life changing. While Smithsons never visited IIT buildings, they understood the ideas and spatial experience suggested in the photographs. While they learned history of architecture through photographs, they simultaneously learned how and which photographs could circulate (2014, 249-67). Accordingly, "[t]he cognitive operations

3. The issue of the article can be reached by the link, https://www.architectural-review.com/buildings/school-at-hunstanton-norfolk-by-alison-and-peter-smithson.

involved in translation from two to three dimensions and back again demanded that architects decode photographic images as spatial constructs and reencode spatial constructs into pictures. (Zimmerman, 2014, p. 257)

“Parallel to art and life”

As it is evident from exhibitions of architectural photographs held by the Architectural Photographic Association of London in 1858 and 1860, by the advent of photography, architecture started to be communicated through exhibited photographs (Elwall, 1985). In the history of architecture, exhibitions held by leading institutions like MoMA or local institutions have played a significant role in defining trends, raising awareness, communicating ideas, and creating discussions. The exhibition Parallel of Life and Art (1953) held at the Institute of Contemporary Art, London by Alison and Peter Smithson and two artists Eduardo Paolozzi, and Nigel Henderson was unorthodox in terms of its content and presentation (Figure 3). It was an exhibition of a vast array of images that photography could produce, ranging from Henderson’s darkroom manipulations to aerial and x-ray images. As a press release remarked, “[i] n this exhibition, an encyclopedic range of material from past and present is brought together through the medium of the camera which is used as recorder, reporter, and scientific investigator” (as cited from Kitnick, 2011, p. 73). One hundred twenty-two panels of diverse sizes hung at various heights and positions from the ceiling and walls. By putting different images from familiar to the eye to the strangest one in the form of a spatial collage, they led visitors to relate things in their own subjective ways. Rather than displaying their own works, curators exhibited images that influenced them (Kitnick, 2011, p. 73). In the exhibition, pictures came together irregularly by referring to their erratic appearances in life and their chaotic existence in our minds[4].[4] In the exhibition, photographs transformed their referents to signs and pictograms, patterns, and shapes by distorting their sizes. While the likeliness of things was imparting, and familiarities were becoming estranged, strange things became acquainted; each picture started to relate to each other by creating a web of new associations. A visitor entering the Parallel exhibition saw was not much different from the world itself, which was becoming saturated with all kinds of images. In the late twentieth century, the phenomenon of being immersed with photographic images impacted architectural design. The works of James Stirling (1926-1992), Aldo Rossi (1931-1997), Michael Graves (1934-2015), Peter Eisenman (1932), Robert Venturi (1925-2018) and Dennis Scott Brown (1931), and many others have referred and used images playfully in their works. Florey building, designed by Stirling, exemplifies how

4. Here, the notion of chaos refers to Deleuze and Guattari, the place where sense and nonsense exist and collide. Gilles Deleuze and Felix Guattari, (1994), *What is Philosophy?* (p.118), New York: Columbia University Press.

images become referents of a design. Stirling's Florey building comprises diverse volumes, each of which has its own referents and roots of inspiration (Figure 4). A part of the structure presents a direct resemblance with Russian Constructivist theatres, particularly Melnikov's Rusakow Workers Club in Moscow of 1928; it also resembles both greenhouse architecture and functionalist architecture of the 1920s, interwar modernism in sanatoriums and hospitals in terms of its glass facade arranged to increase sunlight filling rooms; the building also recalls nineteenth-century British factories and row-houses covered by red bricks (Zimmerman, 2014, 274-78). Indeed, an article published in The Architectural Review in 1972 writes:

> The explosive originality of the Leicester Engineering Building lifted Stirling immediately into the magic circle of the image-makers, and the image was so strange and captivating that the architectural periodicals set to work hopefully and hopelessly to explain how it had to come about. St'Elia, Wright, Lissitsky, ships, decks, aerodynamics, rockets, sewers, viaducts, silos, bunkers, angry young men, and the Victorian working classes were among the sources, images, and associations called into service (Girouard, 1972).

Stirling brought together diverse fragments of images. His design was governed by a photographic vision, which was not much different than a photomontage or a collage. Stirling chose the images representing architectures synecdochically and combined them as a kind of collage in a self-directed way to create a totally new understanding of architecture.

Conclusions

Seeing through camera lenses is a different visual experience than seeing by naked eyes that lets visual experiments in perception by revealing and defining new relationships between the material and immaterial constituents of space. For this reason, architects have used photographs for their conceptual journey. Techniques have used to construct a photograph such as collage, montage, zooming, and multiple exposures have inspired architects in their designs to organize space and create surfaces, masses, and volumes. In the pedagogical aspect, through books, journals, exhibitions, and recently via the internet, photography has had an important role in architects' education. The assessment of different buildings by narrating on their photographs was a part of architectural discussions. Photographs produced out of commercial and promotional architectural photography have provided more diverse perspectives and critical views to our built environment by revealing buildings' relation to life and time. Those photographs have had the transformative power of social and artistic criticism. (Elwall, 2004; Wood, 2009; Tormey, 2013; Redstone, et.al., 2014; Longwell, 2018).

Regarding representing architecture, photographs have been widely used, but at the same time, they have been suspected. Photography was claimed as bad for architecture due to its inadequacy for depicting three-dimensional, spatial, haptic qualities of buildings. The use of photographs as architectural imagery is criticized for many reasons: its political nature, its aestheticization of buildings, its power of abstraction and reduction (Borden, 2008; Colomina, 1996, p. 42-47, 64, 107, 270; Connah, 2001, 47-59;63; Elwall, 2004, 129; Leach, 1999, 1-13.). In the 1990s, Fredric Jameson suggested the photograph of an already existing building, a "bad reification," which is "the illicit substitution of one order of thing for another, the transformation of the building into the image of itself" (2003, pp. 124-125). Yet, as an ever-evolving means of image-making, photography has never lost its importance in constructing and disseminating architectural knowledge. Inevitably, most of the buildings we know, we know them through their photographs. The problem appears when we regard photography simply as an automatic tool for seeing and recording (Snyder and Allen, 1975). Because its indexical character implies it as a direct imprint of a world, the photograph is mistakenly presumed as an eyewitness sworn to tell the truth only. Even if we esteem photography as an eyewitness reporting the things that were there or happening, we should consider that the camera narrates things in a way it sees, similar to all eyewitnesses. Besides, the meaning embedded in a photograph is not fixed; as other discursive means, it is context-dependent (Barthes, 1978, pp.15-31; Sekula, 1981, pp.452-453). Undeniably, photography has always been an art and craft technique that has been open to be manipulated by numerous techniques. Those include using different lenses, filters, zooming, lighting, and darkroom techniques such as airbrushing, scratching negatives, dodging and burning, vibrating exposing, painting negatives, multiple exposures, combination printing, photomontages. Since the dawn of the technique, photomontage and other manipulative techniques have been applied for deception or artistic purposes or used to make up technical inadequacies of photography (Fineman, 2013, p.11). Today, they are incredibly easier than ever before. Therefore, photography's loyalty to "reality" has always been up to debate. Like other visual media produced as a result of image-making processes, architectural photographs are open to interpretation, which requires visual literacy and intertextuality. It is a versatile medium through which the reality dissolves or breaks apart into its constitutive parts, reflecting some political, cultural, and professional agendas or artistic imaginary. Because of this versatility of its potentials, photography has been used to illustrate, display, promote, explore, design, contemplate, teach, learn, and criticize architecture.

IMAGES, CHARTS OR GRAPHIC LEGENDS

Figure 1: Ludwig Mies Van der Rohe. Bismarck Monument Project, Bingen, Germany, 1910 https://www.moma.org/collection/works/87492 Retrieved on 3.6.2020

Figure 2: Le Corbusier, Villa Schwob as published in L'Esprit Nouveau 6, 1921 http://arti.sba.uniroma3.it/esprit/ Retrieved on 3.6. 2020

Figure 3: Nigel Henderson. Photograph of installation view of Parallel of Life and Art exhibition, 1953 © The estate of Nigel Henderson & © Tate CC-BY-NC-ND 3.0. https://www.tate.org.uk/art/archive/items/tga-9211-5-2-89/henderson-photograph-of-installation-view-of-parallel-of-life-and-art-exhibition Retrieved on 3.6. 2020

Figure 4: Photograph of Florey Building, Oxford published in the Architectural Review on 10 November 1972. https://www.architectural-review.com/archive/florey-building-in-oxford-uk-by-james-stirling Retrieved on 3.6. 2020

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CHAPTER II


materialization
urban
today's
idea
context
materiality
designers
existence
process
interaction
change
products
abstract
poem
tangible
nature
impact
buildings
concept
spatial
matter
different
text
fashion
materials

INTRODUCTION: MATERIALITY AS ARCHI-TEXT(URE)

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In the field of architecture, theory, design, practice, actors, materials, and research have been transforming. MateriART symposium defines materiality as an umbrella concept that embraces all the fragments of the whole materialization process starting from architectural imagination, conceptualization, and design to the act of construction. In case this special session leads to the concept of materiality, an alternative perspective, that is, the concept of **archi-text(ure)**.

According to Etymology Dictionary, **materiality** is a concept in the 1520s, "that which is the matter of something, material substance", from Modern Latin *materialitas*, from *materialis* "of or belonging to matter", from Latin *materia* "matter, stuff" (URL-1, 2020). From the 1560s as "state or quality of being material"; 1640s as "quality of being important to matters at hand, essentiality". Besides the word **text** is from Latin *textus* "style or texture of a work", literally "thing woven", from *texere* "to weave, to join, fit together, braid, interweave, construct, fabricate, build". On the other hand, the word **texture** refers to "structural character" meaning that is recorded from the 1650s.

The term materiality has been heard in architectural critics and debates in past years, representing a hot architectural topic. Its meaning refers to the touchy-feely nature of the material used in a building design –what a building is made of and what it feels like (Porter, 2004). American historian Sarah Williams Goldhagen sees materiality as seeded in the existentialist philosophy of Jean-Paul Sartre and the search for a heightened state of mind (Forty, 2000). That is, its meaning is less concerned with materials and more with how people are or can be, affected by materials.

If this material is a text or a texture, how can we deal with it in the field of architecture? And how can we re-define it? Is it a necessity in architecture? Is it a literal form or a natural element of architecture? Is it possible to say that the term archi-text(ure) as a new interpretation of materiality? How does one approach a study of the archi-text(ure)s of the materialization process? Can we evolve the term archi-text(ure) into an architectural fiction of teaching, learning, building, experiencing, reading, and writing? For these questions and more cases, this session will question **archi-text(ure) relationships** in the **deconstruction** and **reconstruction** of the concept of materiality. Thus, the session will familiarize and restructure our architectural knowledge via a set of metaphors, discourses, narratives, and ideas of archi-text(ure).

It is clear that the articles that will be briefly introduced here will not answer all the questions above. However, I would like to emphasize that they are crucial essays on how the term archi-text(ure) can be expanded and a breakthrough conceptual barrier, that of the necessity of materiality in architecture (Ots, 2011). The articles approach the term of materiality as an example of archi-text(ure) and expand in four directions: theory, experience, urban scale, and fashion-other disciplines. As a theoretical existence, the unity of design, thing, and text bring the users to the relationship between physical experience and architectural design, while the building scale makes its users an important part of the city with all the objects/things they are in. The building scale, which strongly emphasizes the importance of the material, reaches the concept of materiality as objects on an urban scale and reaches the relationship between fashion and texture and its traces in architecture with an interdisciplinary approach. After all, the first two articles display the deconstruction of the term archi-text(ure), while the others display the reconstruction.

In the first article called "DESIGN AS A THING: DE RERUM NATURA" which is written by Asu Beşgen with the keywords of "materiality, text, De Rerum Natura, architectural design, De Architectura", the term archi-text(ure) is presented as a new interpretation of materiality for design as a thing. The article establishes the relationship between "design is a thing" and "design object can be a text" with the reduction of materiality as a matter, (and/or) existence, (and/or) be(com)ing, actually wants to show the mains of design activity. The textual materials that are deconstructed through the conceptual analysis method by comparing a poem and a book bring up the concept of material as a text and materialization of architectural design.

De Rerum Natura (On the Nature of Things) (a first-century BC) which plays an important role both in the development of be(com)ing as a didactic poem by Lucretius and De Architectura (probably written between 30 and 15 BC) which the nature of things and the nature of architectural design are discussed as a book by Vitruvius are discussed to put forward the relationship between the "nature of things" and "nature of architectural design". The "nature of things" which is formed by Lucretian concepts is compared with the "nature of architectural design" with

Vitruvian concepts. Thus, the article deforms the materiality as a text from matter to materialization in philosophy and architecture.

The second article called "MATERIALITY AS AN ARCHITECTURAL EXPRESSION: THE CASE OF ODUNPAZARI MODERN MUSEUM" which is written by Pınar Öktem Erkartal with the keywords of "architecture, materiality, phenomenology, Kengo Kuma, Odunpazarı Modern Museum" draws attention to the importance of the material phenomenologically. It discusses the power and possibilities of the materials in the example of Eskişehir Odunpazarı Modern Museum and defines architectural expression as an interface that architecture establishes with the human body.

The architectural structure that is conceptualized as an anti-object by Kengo Kuma shows the unusual use of materials and the reality of wood. This structure, which represents the existence of time and place in the article, that is the relationship between body and experience, transforms into materiality with the idea, material, and form. Thus this paper brings the concept of materiality for discussion by solving it, seeing the architectural expression as a text, while deconstructing the structure as an alternative monumental example, while unifying it in another way by "disintegration" and "dissolution".

The third article called "URBAN SCULPTURE AS/TO EMPHASIZE ARCHITECTURE" which is written by Aslıhan Öztürk and Nilgün Kuloğlu with the keywords of "urban sculpture, public art, urban art installation, built environment, architecture, material" approaches the term archi-text(ure) in terms of the relationship between material and urban sculpture. In the article, creating the spatial effects of urban sculptures and the partnerships of material selection in creating this effect are discussed through 5 design products.

Approaching the subject with perception and space, space and built environment, built environment, and urban sculpture reduction, the article considers urban sculpture as an architectural message for the context. The sculptures that emphasize the spirit and background of the city make important contributions to the continuity of the context and textualize the relationship between the user and the built environment.

The last article called "ARCHITECTURE, FASHION AND INTERDISCIPLINARY INTERACTIONS" which is written by Nihan Canbakal Ataoğlu with the keywords of "architecture, fashion, design, interdisciplinary interactions, material, textures" approach the interaction between architecture and fashion in terms of material. Redefining materiality as a texture, it focuses on how we are affected by and how we influence it in the relationship of architectural style and fashion.

According to the author, the change in clothing and space designs can be observed simultaneously with fashion through architectural styles (Minimalism, Maximalism, Rationalism, Futurism, Deconstructivism, and Constructivism). When the concept of fashion which has original results about the material and its use is synchronized with the discipline of architecture, it can be said that the acceleration of fashion and the search for innovation affects architecture. So the transformation in architecture is reversed and affects fashion. With this aspect, the article presents an example of reconstruction of materiality to its reader with the analogical relationship it has established.

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DESIGN AS A THING: *DE RERUM NATURA*

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ABSTRACT

"As materiality is a process that starts with the ideation and ends up with the tangible object, we may focus on the process of materiality within the frame of alternative architectural design/making process, places and designers … starting from architectural imagination, conceptualization, and design to the act of construction", says the MateriART Team. Parallel to this motto, "DESIGN AS A THING: DE RERUM NATURA" is mainly based on determining what materiality is, in intangible and tangible natures; the natures of the abstract ideas from the field of philosophy, and the physical expressions in the field of architecture.

"Materiality" is defined as "the quality of being composed of matter". In this context, the word "matter" is the basic phenomenon to discuss the existence of "materiality". In general, materialism is a theory, argues that all phenomena are the result of the interaction of matter. According to Marx and Engels, the "being of matter bases on the being of existence". The word "existence" comes from the Latin word and in a technical sense, this refers to a "be(com)ing".

"De Rerum Natura (On the Nature of Things)", a first-century BC didactic poem, plays an important role both in the development of be(com)ing, written by the poet and philosopher Titus Lucretius Carus (c. 99 BC - c. 55 BC). In his poem, Lucretius explores the principles of atomism; the nature of the mind and soul; explanations of sensation and thought; the development of the world and its phenomena; and explains a variety of celestial and terrestrial features, proving the existence of atoms.

According to the "Materiality as Archi-Text(ure)" discussion, "De Rerum Natura" poem is chosen as a text. In this aim, De Rerum Natura's six parts are deconstructed by the conceptual analysis method. The "nature of things" which is formed by Lucretian concepts is compared with the Vitruvian concepts, figured in the book; "De Architectura (On Architecture/Ten Books on Architecture)", parallel to the materialization of "nature of architectural design". The nature of things and the nature of architectural design are discussed to synthesize the architectural design process of imagination, conceptualization, planning, forming, and construction.

KEYWORDS

Materiality, text, De Rerum Natura, architectural design, De Architectura

Introduction: General Content

The introduction part of the article consists of the structure of the study parallel to the main theme; "Materiality as Archi-Text(ure)" discussions, (Image 1).

Basing on the hypothesis that the "design is a thing" which has its own materiality as a matter, (and/or) existence, (and/or) be(com)ing, a "design object can be a text" to show the mains of design activity. In this aim, "De Rerum Natura (On the Nature of Things)" poem is chosen as a text. De Rerum Natura's six parts are deconstructed by the conceptual analysis method and the "nature of things" is discussed with Lucretius' concepts.

In order to reach the objectives of the aim, first, the theoretical basis of the article is formed under two main titles: "From Matter to Materialization in Philosophy" and "From Matter to Materialization in Architecture". The words; "matter", "material", "materiality" and "materialization" are defined from the two points of view; philosophy and architecture, and the relationships between these words are put forward within two disciplines. Under the title of "From Matter to Materialization in Philosophy", the life of the poet Titus Lucretius Carus is given as a summary. On the second stage, the "De Rerum Natura (On the Nature of Things)" poem, for being a material as a text, is analyzed under three topics. The primary, secondary and tertiary concepts of Lucretius are brought into view corporally to detail the materiality step. In reaching the objectives of the aim as the second title; "From Matter to Materialization in Architecture", the life of Vitruvius Pollio and his book; "De Architectura" are given to explain the materialization of architectural design. Vitruvius' primary, secondary, and tertiary concepts are shown to mention his prerequisites and principles in the architectural design process starting from imagination, conceptualization, and, continuing with planning, forming, and construction.

In the last title of the article, the two books are discussed to put forward the relationship between the "nature of things" by Lucretius' De Rerum Natura and the "nature of architectural design" by Vitruvius' De Architectura.

From Matter to Materialization in Philosophy

"… Visible objects therefore do not perish utterly,
since nature repairs one thing from another
and allows nothing to be born without the aid of another's death…",

Titus Lucretius Carus.

"Materiality" is defined as "the quality of being composed of matter". In this context, the word "matter" is the basic phenomenon to discuss the existence of "materiality". Matter, material, materiality, materialism are the words coming from the "act of being" by the effects of "matter". In this context, the word "materialism" should be understood first, to originate the discussions on theory and practice, which architecture builds itself on.

In general, materialism is a theory that considers the entire existence of people and the universe as a physical matter. Materialism holds that the only things that exist are matter and energy, that all things are composed of material, that all actions require energy, and, that all phenomena are the result of the interaction of matter.

According to Marx and Engels, materialism focuses on the material world, perceptible to the senses, has an objective reality independent of mind or spirit. Neither Marx nor Engels deny the reality of mental or spiritual processes but affirmed that ideas can arise, therefore, only as products and reflections of material conditions. Marx and Engels understand materialism as the opposite of idealism, by which they mean any theory that treats the matter as dependent on mind or spirit, or mind or spirit as capable of existing independently of matter. In this context, the being of matter bases on the being of existence, (Marx and Engels, 1968).

The word "existence" comes from the Latin word "exsistere" meaning "to appear", "to arise", "to become", or "to be", but literally, it means "to stand out". In a technical sense, this refers to a "be(com)ing". Existence is the ability of an entity to interact with physical or mental reality. Existence refers to the ontological property of be(com)ing and defines it as the objective reality of various forms of matter. "An atom" is the smallest constituent unit of ordinary matter that constitutes an element.

"De Rerum Natura" plays an important role both in the development of be(com)ing written by the poet and philosopher Titus Lucretius Carus (c. 99 BC - c. 55 BC). It is the first century BC didactic poem, divided into six untitled books, with the goal of explaining Epicurean philosophy[1] through poetic language and metaphors. Namely, Lucretius explores the principles of "atomism"; the nature of the mind and soul; explanations of sensation and thought; the development of the world and its phenomena; and explains a variety of celestial and terrestrial features, proving the existence of "atoms".

1. Epicureanism is a system of philosophy founded around 307 BC based upon the teachings of the ancient Greek philosopher Epicurus. Epicureanism was originally a challenge to Platonism. Later its main opponent became Stoicism. The epic poem De Rerum Natura is the one unified work which presents the core arguments and theories of Epicureanism.

Titus Lucretius Carus

"So vast is your environment known to natural beings;
not limited to any size, distance and width.
From Spinoza to Nietzsche, thence to Deleuze,
Lucretius was one of the first to cast the molecules of line of thought into the Earth",
Lucretius: Evrenin Yapısı, 1974 (from the promotional newsletter of the book,
Turkish translation by Turgut Uyar and Tomris Uyar).

Titus Lucretius Carus, in short Lucretius, who was born about a century before Christ (c. 99 BC – c. 55 BC) was emphatically not our contemporary, but he is known as a Roman poet and philosopher who wrote the epic poem: "De Rerum Natura (On the Nature of Things)", which is considered one of the most influential works in the history of literature, philosophy, and science, (Image 2).

Lucretius is one of the first to discover that everything in this universe, ranging from planets and stars to mountains, has been corrupted. Centuries before the second law of thermodynamics, he says; "one day, the walls of the sky will be flung all over, demolished and turned into a ruin ... there is nothing but acorns and emptiness". He rejects the idea that it is an afterlife; states that the body is composed of atoms and is subject to the laws of nature.

According to Lucretius, living things change and transform over time, evolving in an endless cycle from straight to complex. Lucretius, with his doctrine and scientific approach, leaves a profound influence on countless writers, philosophers, and scientists[2].

De Rerum Natura (On the Nature of Things)

"De Rerum Natura" is a first-century BC didactic poem by the Roman poet and philosopher Lucretius with the goal of explaining Epicurean philosophy to a Roman audience, (Image 3).

Lucretius thought that worms were spontaneously generated from wet soil, that earthquakes were the result of winds caught in underground caverns, that the sun circled the earth. But, at its heart, "De Rerum Natura"; two-thousand-year-old poem, persuasively laid out what seemed to be a strikingly modern understanding of the world. Every page reflected a core scientific vision -a vision of atoms randomly moving in an infinite universe- imbued with a poet's sense of wonder

2. Thomas More's *"Utopia"* (1515), Michel de Montaigne's *"The Essays"* (1580), William Shakespeare's *"Hamlet"* (1599-1601), Thomas Jefferson's *"Declaration of Independence"* (1776), Karl Marx's *"The Difference Between the Democritean and Epicurean Philosophy of Nature"* (PhD Thesis, 1841), Stephen Greenblatt's *"The Swerve: How the World Became Modern (UK Title: The Swerve: How the Renaissance Began)"* (2011) are some of the examples which were influenced by Lucretius' *"De Rerum Natura"* (1st Century BC), (Greenblatt, 2011), (Flow, 2011), (Lezra & Blake, 2016), (Norbrook, et al, 2015), (Akyol, 2017).

(Greenblatt, 2011). When we look at the story of the poem, we see that the poem; "De Rerum Natura" was lost, apparently irrevocably, and then found one day in 1417, it came into the hands of a man; Poggius Florentinus.

"De Rerum Natura" is not an easy read. It was written in hexameters, the standard unrhymed six-beat lines, in total 7.400 lines. Divided into six untitled books, the poem yokes together moments of intense lyrical beauty; philosophical meditations on religion, pleasure, and death; and scientific theories of the physical world, the evolution of human societies, the perils and joys of sex, and the nature of the disease (Greenblatt, 2011) in general. As it turned out, there is a line from this work to modernity, though not a direct one: Nothing is ever so simple.

"De Rerum Natura" is clearly the work of a disciple who is transmitting ideas that had been developed in Greece centuries earlier. Epicurus[3] was Lucretius' philosophical messiah, and his vision may be traced to a single incandescent idea: Everything that has ever existed and everything that will ever exist is put together out of what the Roman poet called "the seeds of things", indestructible building blocks, irreducibly small in size, unimaginably vast in number. The Greeks had a word for these invisible building blocks, things that, as they conceived them, could not be divided any further: Atoms.

In the light of this era, in his work "De Rerum Natura", Lucretius focuses on two fundamental principles on the matter: "Nothing comes out of nothing" and "nothing can be eliminated". In other words; "nothing comes into being out of nothing or perishes into nothing":

"… Nothing from nothing ever yet was born.
Fear holds dominion over mortality
Only because, seeing in land and sky
So much the cause whereof no wise they know,
Men think Divinities are working there.
Meantime, when once we know from nothing still
Nothing can be create, we shall divine
More clearly what we seek: those elements
From which alone all things created are,
And how accomplished by no tool of Gods.
….
All things, were they not still together held
By matter eternal, shackled through its parts,
Now more, now less. A touch might be enough
To cause destruction. For the slightest force
Would loose the weft of things wherein no part
Were of imperishable stock. But now

3. Epicurus (c. 341 BC – c. 270 BC) is an ancient Greek philosopher and sage who founded Epicureanism, a highly influential school of philosophy, turned against the Platonism of his day and established his own school, known as "the Garden", in Athens.

Because the fastenings of primordial parts
Are put together diversely and stuff
Is everlasting, things abide the same
Unhurt and sure, until some power comes on
Strong to destroy the warp and woof of each:
Nothing returns to naught; but all return
At their collapse to primal forms of stuff ...",

(*De Rerum Natura–Book I, 150*-250)[4].

In these strings of Lucretius, the substance is divided into two parts: "Matter/Atom" and "Space/Void".

In representing the matter, Lucretius divides the matter into two: "Compound" and "simple". Of these, compound matters correspond to "things". In contrast, simple matters are the "atoms". Atoms are the basic building blocks of matter; existences, be(com)ings; have an unlimited number of, limited species, (Image 4).

In representing the space, Lucretius levels the space with "void". Void covers space and space exists with void:

"… But yet creation's neither crammed nor blocked
About by body: there's in things a void.
…
There's place intangible, a void and room.
For were it not, things could in nowise move;
Since body's property to block and check
Would work on all and at times the same.
…
Then too, however solid objects seem,
They yet are formed of matter mixed with void.
…
And voices pass the solid walls and fly
Reverberant through shut doorways of a house;
And stiffening frost seeps inward to our bones.
Which but for voids for bodies to go through
'Tis clear could happen in nowise at all.
…
Therefore, an object just as large but lighter
Declares infallibly its more of void;
Even as the heavier more of matter shows,
And how much less of vacant room inside.
That which we're seeking with sagacious quest

4. English version of the poem is taken from William Ellery Leonard's first translation in 1916, from the book: Lucretius. De Rerum Natura. E. P. Dutton Publishing, New York. (http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.02.0131%3Abook%3D1%3Acard%3D146 10.02.2020)

Exists, infallibly, commixed with things-
The void, the invisible inane…", (De Rerum Natura–Book I, 300-329)[5].

De Rerum Natura: The Analysis

"De Rerum Natura" is divided into six untitled books, with the goal of explaining Epicurean philosophy through poetic language and metaphors. Namely, Lucretius explores the principles of "atomism"; the nature of the mind and soul; explanations of sensation and thought; the development of the world and its phenomena; and explains a variety of celestial and terrestrial features, proving the existence of "atoms", (Image 5).

Whether or not the poem is altogether in the finished state that Lucretius would have wanted, its six-book structure is itself a clearly and a carefully planned one. It falls into matching parts such as: The permanent constituents of the universe: Atoms and void, how atoms explain phenomena, the nature and mortality of the soul, the phenomena of the soul, the cosmos and its mortality, the cosmic phenomena, (Sedley, 2018).

Book 1 deals with the ultimate constitution of the universe, which consists of infinite atoms moving in infinite space. The introduction part is an invocation to Venus[6] and appeals to Memmius[7]. The following parts consist of the general principles such as; the existence of first-bodies or fundamental matter in the form of particles; the existence of void or empty space; everything else is either property or accident of these two; the first bodies are atoms: Solid, eternal and indivisible particles; a refutation of rival theories: Heraclitus[8], Empedocles[9], Anaxagoras[10]. Book I ends with "the universe is infinite". Book II deals with the motion and forms of the atoms and their combination in things. The introduction begins with the blessings of philosophy; the motion of the atoms, the forms of the atoms and their effects in combination, and, the atoms without secondary qualities. Book III deals with the soul, its nature, and its fate. The introduction part is a praise of Epicurus and the effect of the fear of punishment after death. The nature and formation of

5. English version of the poem is taken from William Ellery Leonard's first translation in 1916, from the book: Lucretius. De Rerum Natura. E. P. Dutton Publishing, New York. (http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.02.0131%3Abook%3D1%3Acard%3D329 02.02.2020)
6. Venus is a Roman goddess, whose functions encompassed love, beauty, desire, sex, fertility, prosperity and victory.
7. Memmius (Gaius Memmius, died in 49 BC) is a Roman orator and poet, a patron of Lucretius, addressed in De Rerum Natura with the idea of making a convert to the doctrines of Epicurus.
8. Heraclitus (Heraclitus of Ephesus, c. 535 – c. 475 BC) is a pre-Socratic Ionian Greek philosopher, and a native of the city of Ephesus, wrote a single work; "On Nature".
9. Empedocles (c. 494 – c. 434 BC) is a pre-Socratic Greek philosopher, whose philosophy is best known for originating the cosmogonic theory of the four classical elements; water, air, fire, and aether.
10. Anaxagoras (c. 510 – c. 428 BC) is a pre-Socratic Greek philosopher, described the world as a mixture of primary imperishable ingredients, where material variation was never caused by an absolute presence of a particular ingredient, but rather by its relative preponderance over the other ingredients, also introduced the concept of "Nous" (Cosmic Mind) as an ordering force, which moved and separated out the original mixture, which was homogeneous.

the soul, the proof of the mortality of the soul, the folly of the fear of death are the following themes of Book III. Book IV deals mainly with the psychology of sensation and thought and also with certain biological functions. Beginning with the Lucretius' Mission, the existence and nature of the idols, sensation, and thought, some functions of the body, attack on the passion of love are within the contents of Book IV. Book V deals with our world and its formation, astronomy, the beginnings of life, and civilization. The praise of Epicurus takes part in the introduction. The world had a beginning and is mortal, the formation of the world, astronomy, the youth of the world, the beginnings of civilization are the themes. Book VI explains from the atomic point of view as a variety or occurrences, partly meteorological phenomena, partly terrestrial curiosities. The praise of Epicurus again takes part in the introduction. The rest of Book VI goes on with the celestial and terrestrial phenomena and lastly ends with the plague at Athens[11] (Image 6).

From Matter to Materialization in Architecture

The architectural theory encompasses critical commentary on or explanations of architectural works or styles or movements; instructions or guidelines for architectural design; musings on the origins of building types or styles; and advocacy for new approaches to the architectural discipline and practice. The theories written by architects, architectural critics, and architectural historians, range historically from Vitruvius through the present. From the philosophical and architectural perspectives, Vitruvian architectural theory introduces questions about how to best explore conceptual foundations or establish imperatives for architectural practice, design thought, or architectural history. The centrality of Vitruvian principles in architectural theory prompts further some questions as to what sort of materialization principles these are in the architectural design process starting from imagination, conceptualization, planning, forming, and construction and whether they are essential to define the architectural design.

In this aim, the Vitruvius' Book; "De Architectura" is chosen, as the second text to put forward the materiality and materialization process from the architectural point of view. Its principles are given by the conceptual analysis method.

11. There are more than 30 translations of De Rerum Natura from Latin to English, since the 1600s to 2000s. This summary was done by reaching De Rerum Natura's English translations from different authors: Guernier, et al. (1743), Watson (1851), Johnson (1872), (Bailey 1910), Leonard (1916), Allison (1919), Trevelyan (1920) from accessible web-sites, given at References.

Vitruvius Pollio

"In all matters, but particularly in architecture, there are these two points:
The thing signified, and that which gives it its significance.
That which is signified is the subject of which we may be speaking;
and that which gives significance is a demonstration on scientific principles", <

Marcus Vitruvius Pollio, The Ten Books On Architecture (English translation by Morris Hicky Morgan in 1914).

Marcus Vitruvius Pollio, (c. 80-70 BC – after c. 15 BC), commonly known as Vitruvius, is a Roman author, architect, civil engineer, and military engineer during the 1st century BC, known for his multi-volume work entitled "De Architectura", (Image 7). His discussion of perfect proportion in architecture and the human body led to the famous Renaissance drawing by Leonardo da Vinci of Vitruvian Man.

De Architectura (On Architecture/Ten Books on Architecture)

"De Architectura" is a treatise on architecture probably written between 30 and 15 BC by the Roman architect and military engineer Marcus Vitruvius Pollio and dedicated to his patron, the emperor Caesar Augustus, as a guide for building projects.

"De Architectura" consists of ten books, organized with the subjects such as; town planning, architecture or civil engineering in general, and the qualifications required of an architect or the civil engineer, building materials, temples and the orders of architecture, civil buildings, domestic buildings, pavements, and decorative plasterwork, water supplies and aqueducts, sciences influencing architecture (geometry, measurement, astronomy, sundial), use and construction of machines (Roman siege engines, water mills, drainage machines, Roman technology, hoisting and pneumatics), (Fisher, 2015), (Image 8).

As the only treatise on architecture to survive from antiquity, it has been regarded since the Renaissance as the first book on architectural theory, as well as a major source on the canon of classical architecture, (Kruft, 1994). In other words, Vitruvius' main contributions to the history of the architectural theory include his canonical account of the classical orders, and identification of the principles of architecture, followed by a train of architectural theorists and architects across the past two millennia, we may variously understand these principles -the "Vitruvian triad"- as fundamental categorical beliefs, imperatives for practice, or guides to architectural value, (Fisher, 2015), (Image 9).

De Architectura: The Analysis

The notion of knowledge through doing is apt for Vitruvius, as for so many who follow. Of the ten books of "De Architectura", eight are dedicated to building materials, civic infrastructure, civil engineering and technology (and the underlying science), and building types other than temples. In short, the Vitruvian picture of architecture is rooted in experiential knowledge of making, doing, and crafting.

Vitruvius was also the one who, in 40 BCE, in "De Architectura", invented the idea that all architectural designs should have three attributes: "Firmitas", "utilitas", and "venustas". The concept of "firmitas", which means "the strength", deals with the structural durability of the design. Is the design durable, are the materials durable, does the structure perform? … are some questions that need answers under this attribute. The concept of "utilitas", which means "the utility", is the functionality of the design. Is the design useful to all and how? is the basic question for "utilitas". The concept of "venustas" is the beauty of a design, assessed using the design principles; contrast, harmony, proportion, etc., (Image 10).

The asymptotic relation between these three Vitruvian prerequisites of design; "firmitas", "utilitas", and "venustas", and the principles of design has been one of the most striking and unresolved characteristics of the foundations of architectural theory from Vitruvius' text onwards. In his book; "De Architectura", the Vitruvian fundamental principles of design are also mentioned under six items: "Order", "arrangement", "eurythmy", "symmetry", "propriety" and "economy".

The "order" gives due measure to the members of a work considered separately, and symmetrical agreement to the proportions of the whole. It is an adjustment according to the quantity. By this, it means the selection of modules from the members of the work itself and, starting from these individual parts of members, constructing the whole work to correspond. The "arrangement" includes the putting of things in their proper places and the elegance of effect which is due to adjustments appropriate to the character of the work. Its forms of expression are; ground plan, elevation, and perspective. The "eurythmy" is beauty and fitness in the adjustments of the members. This is found when the members of a work are of a height suited to their breadth, of a breadth suited to their length, and, in a word, when they all correspond symmetrically. The "symmetry" is a proper agreement between the members of the work itself, and the relation between the different parts and the whole general scheme, in accordance with a certain part selected as standard. The "propriety" is that perfection of style which comes when a work is authoritatively constructed on approved principles. It arises from prescription, from usage, or from nature, in the case of hypaethral edifices, open to the sky, in honor of Jupiter Lightning, the Heaven, the Sun, or the Moon. Finally, propriety is due to natural causes. The "economy" denotes the proper management of materials and of site, as well as a thrifty balancing of cost and common sense in the construction of works, (Morgan, 1914), (Image 11).

Conclusion

Lucretius' problems, the issues he addresses, the questions he asks, and which he is trying to solve are the objects that our age as a whole is also interested in. The idea that developed from the birth of the old religions to its own time is to reconsider the field of existence with new measures under the light of new views. It is the inexhaustible effort of trying to enlighten and save the state of knowledge that seeks certainty from being "unknowable" until its most subtle element, for there is no "throwing to a shore" in knowledge or science without reaching a definite conclusion, (Eyüboğlu, 2017). Finally, Lucretius' answer to all his searches ends up calling these matters/existences/ be(com)ings with; "things", eventually; "atoms".

The fundamental questions about the nature of architecture motivate much of the contemporary philosophy of architecture: What sort of enterprise architecture is; whether architecture has essential features; what kinds of things architecture makes; what renders architecture distinct from other designs; and whether architecture includes all building environment. Yet another way to pose the question of what architecture is focuses on the sorts of things architectural objects are. In particular, and relative to architecture's possible status as a designer, architecture as a domain may be defined variously in terms of its objects being distinctive sorts of philosophizing, being an architectural theory, or belonging exhaustively to a special class of built structures.

From materiality to materialization process, the matter/existence/be(com)ing comes into being "thing as atom" and "void as space" in Lucretius, which these corresponds to "architectural theory" and "classical architecture" in Vitruvius, as the primary concepts of the texts; "De Rerum Natura" and "De Architectura", (Image 12).

As a matter of reasoned judgment, in reaching the secondary concepts of the two texts, the nature of things and the nature of architectural design can be attributed to their core or even to their essential features. According to Lucretius, the nature of things is formed by the essence of the atoms. In this context, "soul and mind", "sensation and thought", and, "celestial and terrestrial" dualities take a role to constitute the nature of things. The Vitruvian tradition has it that architecture embodies and is best understood through three aspects of firmitas (strength), utilitas (utility), and venustas (beauty), that any design aspiring to architecture features all three, (Image 13).

As to go on to uncover and give the relationship of the tertiary concepts of "De Rerum Natura" and "De Architectura", it can be said that the nature of things and the nature of architectural design are detailed separately, in a comprehensive manner. In his book "De Rerum Natura", Lucretius details the nature of things, totally, under six books with the concepts of "universe", "atom", "soul", "psychology", "world, astronomy, life, civilization" and "meteorology, terrestrial curiosities". In his book "De Architectura", Vitruvius details the nature of architectural design under six fundamental principles; "order", "arrangement", "eurythmy", "symmetry", "property" and "economy". Sure, there can be constituted numbers of comparative information about the relationship of Lucretius' and Vitruvius' whole concepts, nevertheless, the six parts of the two books' gradation are taken into consideration in showing the tertiary concepts' relations for detailing the nature of things and nature of architectural design, in the study.

In "De Rerum Natura", Lucretian universe is a kind of order, which universe is an infinite matter of being with its atoms and voids. In "De Architecture", the order has a whole proportional quantity as a matter of separate consideration and symmetrical arrangement -like a universe-. In the second gradation, atom takes place for Lucretius. Lucretius' atom is mainly defined with its philosophy, motion, and form like an arrangement defined in Vitruvius. The arrangement is an appropriate adjustment, referring to a proper place and character, a form of expression, which the atom has in its own. The soul in Lucretius basically deals with the formation as a eurythmy. The beauty, breadth, length and symmetry are the tertiary concepts which give rise to the eurythmy like the formation of a soul. The psychology in Lucretius is a kind of pure idol having a body and sensation-thought. Psychology is like forming a symmetry; the body part on one side, and the sensation-thought part on the other, setting out a whole standard as a scheme, in building the idol. The synergy of astronomy, life, civilization mainly indicates the formation of the world in Lucretius, which the whole phenomena can be equal to a perfect propriety in Vitruvius. The approved principles of/in nature are the prescriptions of/in usage, which these principles make the formation of the world. Finally, Lucretian celestial-terrestrial curiosities can be related with the Vitruvian material-construction interaction to organize a proper management and economy (Image 14).

As it is mentioned before in the "Introduction: General Content" part, the article was based on the hypothesis that the "design is a thing" which has its own materiality as a matter, (and/or) existence, (and/or) be(com)ing, in addition, a "design object can be a text" to show the mains of design activity. In this aim, "De Rerum Natura" poem was chosen as a text. The matter, (and/or) existence, (and/or) be(com)ing of the text was deconstructed for reaching its primary, secondary and tertiary concepts. This step was to analyze the process, beginning from materiality to materialization, and to put forward the “nature of things” in philosophy. In the second step, for the “nature of architectural design” -beginning from materiality and ending with materialization-, the process was exemplified by Vitruvius’ primary, secondary and tertiary concepts according to the text: “De Architectura”. In the end, the relationship of the concepts, similarities, and differences was discussed within the two texts and disciplines.

As a result of the discussion, through the medium of the one any only book of Lucretius’ “De Rerum Natura”, it is reached that a text, as a literal form, can represent the nature of the thing, and, through the medium of the one any only book of Vitruvius’ “De Architectura”, a text as a literal form, can represent the nature of architectural design, thus, the term archi-text(ure) can be a new interpretation of materiality for design as a thing.

> *“All such argument, all such interpretation is perverse, fallacious, puts the cart before the horse.*
> *No bodily thing was born for us to use.*
> *Nature had no such aim, but what was born creates the use.*
> *There could be no such thing as sight before the eyes were formed.*
> *No speech before the tongue was made, but tongues began long before speech were uttered.*
> *And the ears were fashioned long before a sound was heard.*
> *And all the organs I feel sure, were there before their use developed.*
> *They could not evolve for the sake of use be so designed.”*
>
> Titus Lucretius Carus, De Rerum Natura.

IMAGES, CHARTS OR GRAPHIC LEGENDS

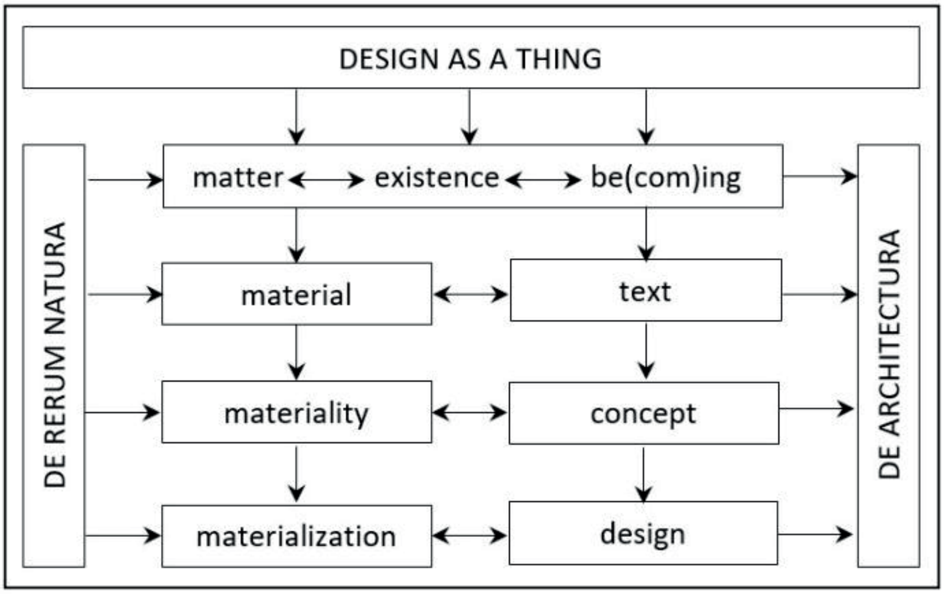

Image 1: General content of the article.

Image 2: Sculpture of Titus Lucretius Carus, 1859-1861, Parco del Pincio, Rome. The image is taken from; Lucretius, Philosopher by D., Nightingale, WAMC/Northeast Public Radio, 27 August 2017. (https://www.wamc.org/post/david-nightingale-lucretius-philosopher 10.02.2020).

Image 3: A manuscript copy of De Rerum Natura in Latin, copied by Girolamo di Matteo de Tauris for Pope Sixtus IV, Italy, 1483.
The manuscript of Lucretius's philosophical poem, copied by an Augustinian friar for a pope, is an example of the interest in ancient accounts of nature taken by the Renaissance curia. After the discovery of an early manuscript in 1417 by the humanist and papal secretary Poggio Bracciolini, it circulated widely in Italy, and is one of numerous copies made at that time. (http://www.ibiblio.org/expo/vatican.exhibit/exhibit/f-medicine_bio/Medicine_bio.html 12.02.2020).

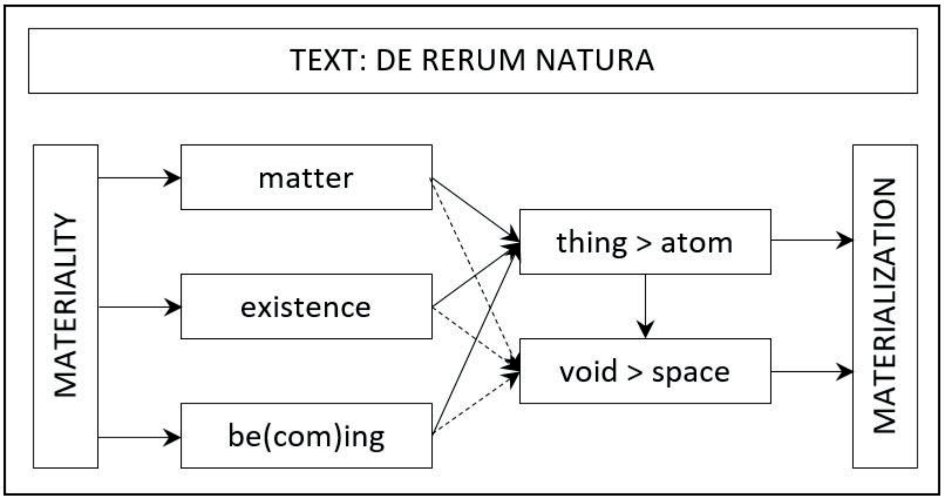

Image 4: From materiality to materialization: Lucretius' *primary concepts* according to the text: De Rerum Natura.

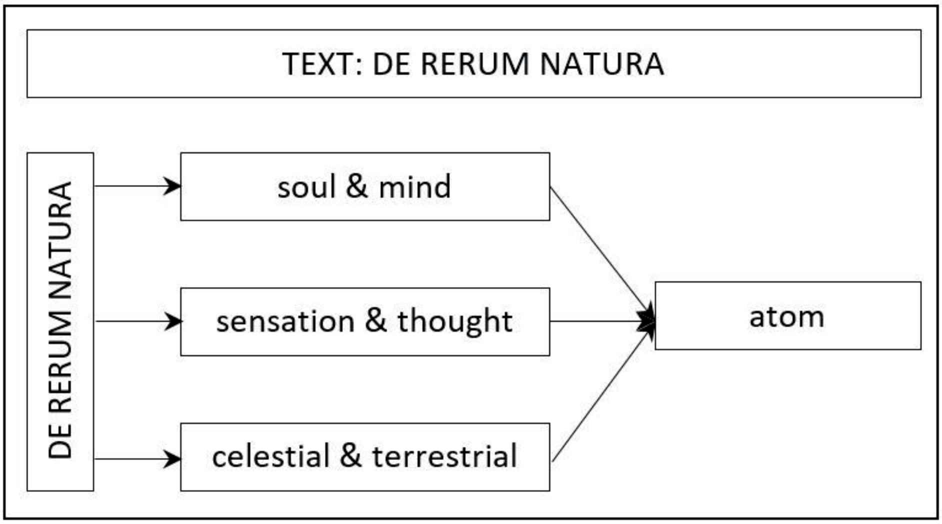

Image 5: Lucretius' *secondary concepts* detailing the "nature of things" according to the text: De Rerum Natura.

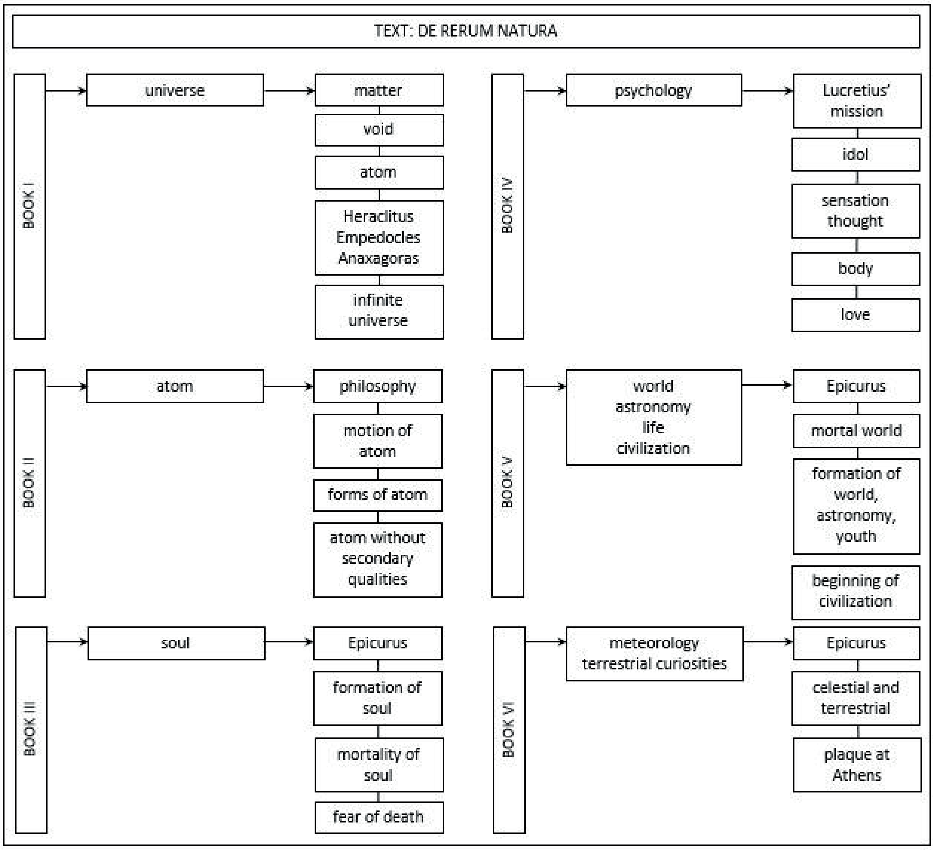

Image 6: Lucretius' *tertiary concepts* detailing the "nature of things" according to the text: De Rerum Natura.

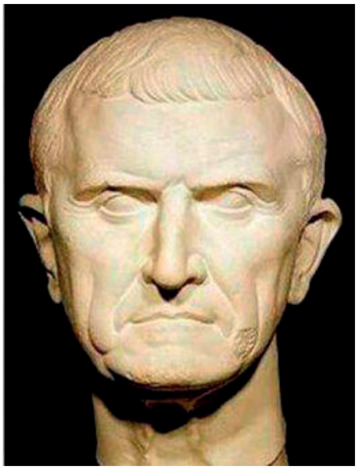

Image 7: Sculpture of Marcus Vitruvius Pollio.

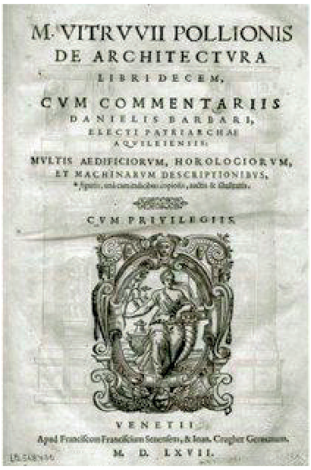

Image 8: A manuscript copy of De Architectura in Latin, published by Venetiis: Apud Franciscum Franciscium Senensem & Ioan. Crugher Germanumc in 1567

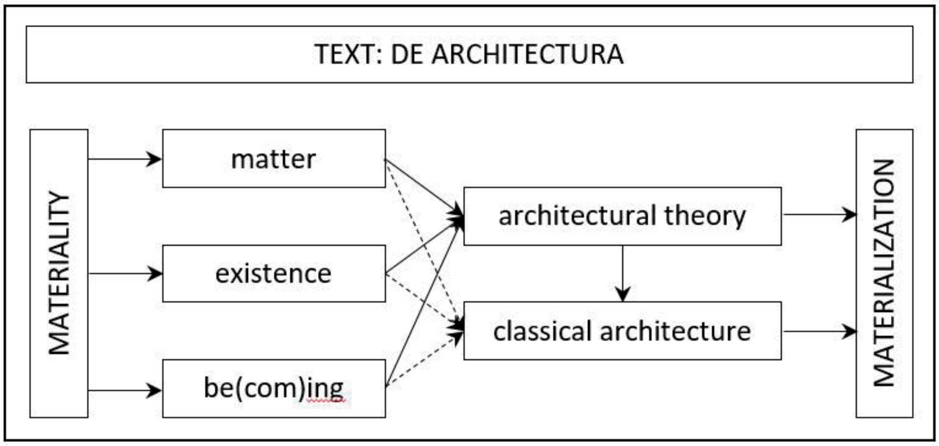

Image 9: From materiality to materialization: Vitruvius' *primary concepts* according to the text: De Architectura

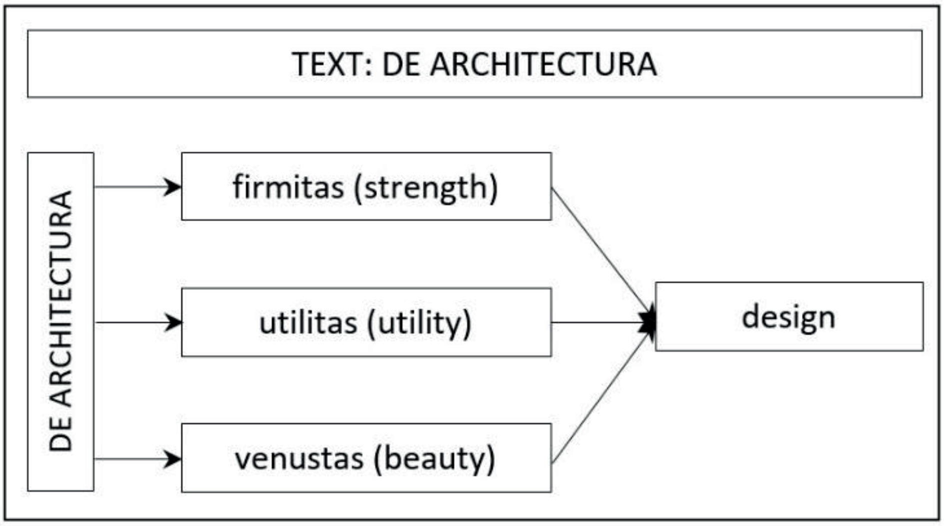

Image 10: Vitruvius' *secondary concepts* detailing the "nature of architectural design" according to the text: De Architectura

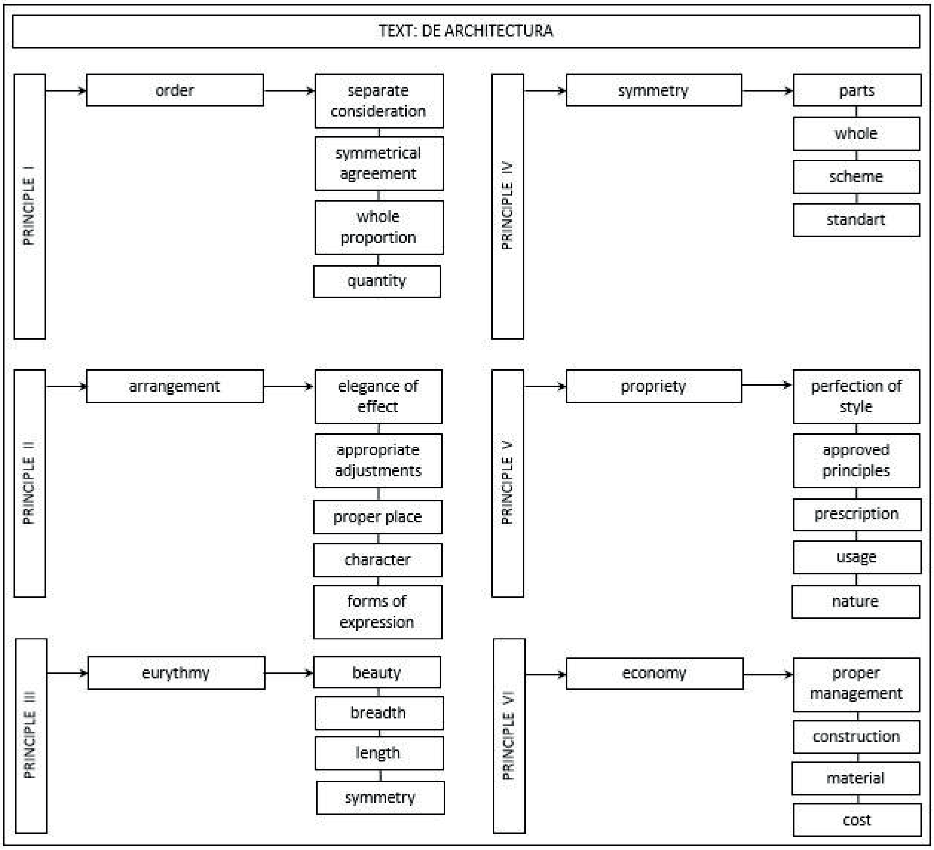

Image 11: Vitruvius' *tertiary concepts* detailing the "nature of architectural design" according to the text: De Architectura

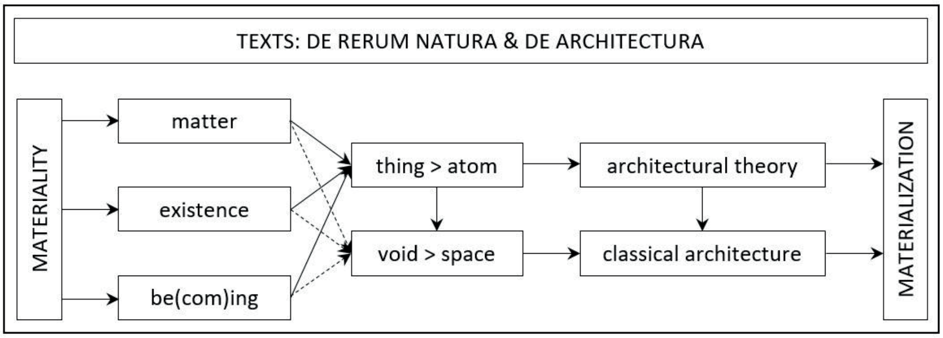

Image 12: From materiality to materialization:
Lucretius' & Vitruvius' *primary concepts* according to the texts: De Rerum Natura & De Architectura

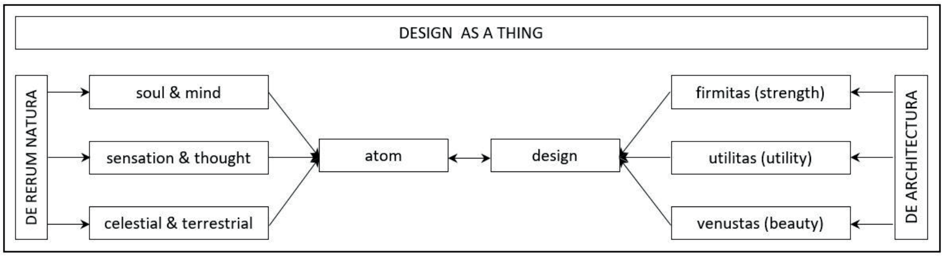

Image 13: Design as a Thing:
Lucretius' & Vitruvius' *secondary concepts* detailing the "nature of things & nature of architectural design" according to the texts: De Rerum Natura & De Architectura

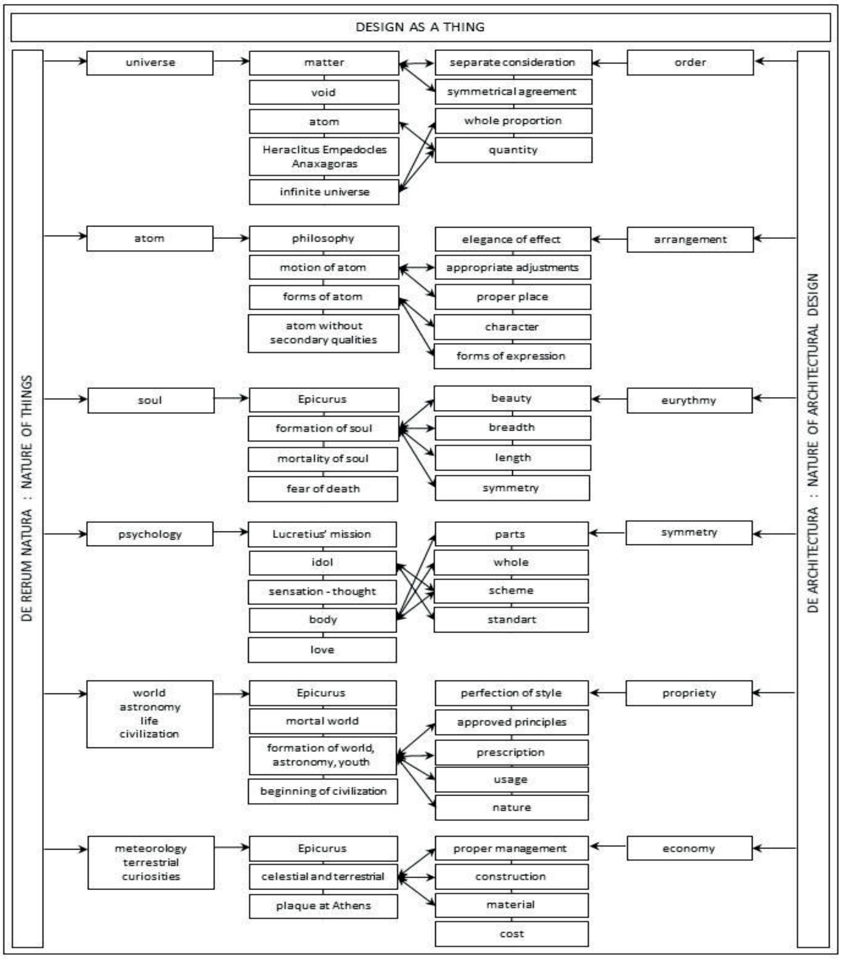

Image 14: Design as a Thing:
Lucretius' & Vitruvius' *tertiary concepts* detailing the "nature of things & nature of architectural design" according to the texts: De Rerum Natura & De Architectura

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MATERIALITY AS AN ARCHITECTURAL EXPRESSION: THE CASE OF ODUNPAZARI MODERN MUSEUM

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ABSTRACT

In the discipline of architecture, materialization refers to the state of transition of an abstract thing like an idea or concept into a concrete situation like the architectural structure. The creative idea, inspiration, or concept, which forms the root of the architect's design, enters the process of materialization as soon as it is visualized by the command of the mind to the hands. This process, however, is not complete until it becomes tangible and open to experience by the human body. In other words, the idea that constitutes the starting point of the design is materialized only when it is embodied with form, structure, and building materials. The special session of "Materiality as archi-text (ure)", which is held within the scope of MateriART 2020 questions and searches for alternative relationships between architectural design, materialization process, text, and texture. This study draws attention to the importance of the material in the phenomenological approach that focuses on body, feelings, touch, experience, and influence in architecture. The text mainly sees the concept of materiality as a form of architectural expression and tries to explain this argument through the Eskişehir Odunpazarı Modern Museum designed by the famous architect Kengo Kuma, who has built his design philosophy on the power and possibilities of the materials.

KEYWORDS

Architecture, materiality, phenomenology, Kengo Kuma, Odunpazarı Modern Museum

Introduction: Materiality in the Architectural Design Process

Architectural design is a highly complex cognitive process. This process is a non-linear flow that constantly switches between instinct and learned knowledge. Except for unusual situations, it starts with an idea, an image, or the dynamics of the site itself. This root, in which the design sprouts, often does not exist out of nowhere, and in fact, it is a reflection of the designer's accumulation that is fed with data from his life, memories, intellectual and professional experience, world view, and many more channels. It includes several actions such as creation, research, exploring, experimenting, mistaking, repetition, decision, persuasion, planning, and construction.

In the discipline of architecture, materialization, which means literally "the fact of taking place or starting to exist as expected or planned", refers to the state of transition of an abstract thing like an idea or concept into a concrete being like the architectural structure. It incorporates architectural design and construction stages; more specifically, the visualization, development, and finally construction processes of the main design idea. The creative idea, inspiration, or concept enters the process of materialization as soon as it is visualized by the command of the mind to the hands. This process, however, is not complete until it becomes tangible and open to experience by the human body. In other words, the idea that constitutes the starting point of the design is materialized only when it is embodied with form, structure, and building materials.

The primary reason for this is the paradigm shift in the visualization technique of architectural design. With the rapid development of technology, the tools of representation have turned from pen, pencil, paper, and model to keyboard, mouse, screen, and 3D modeling programs. While these digital tools, which save time and money, are immediately accepted by some architects and trainers (Ro, 2019), architects and educators who regard hand drawing as one of the most important parts of the design thinking process argued that architecture and hand drawing should never be separated (Pallasma, 2009; Graves, 2012; Holl, 2007).

Indeed, it is true that the architect added his own feelings and instincts to the design while putting the image in mind on paper and yet the architect goes to "where the hand takes". This is a reality that cannot be achieved with digital tools. Still, drawing, even if made by hand, is ultimately a representation, and the materialization of architecture is completed only when it can be experienced by the whole body. If form creation is the architect's domestication of the void, and structural design is a challenge to gravity, the use of the material is the incarnation of architecture. It is the restoration of its own skin, its molecular reality.

McCarter and Pallasmaa (2012, p.5) start their books with the following sentences:

> "Architecture cannot be evaluated or understood without our experience of it… Architecture has meaning and matters to us only when it is experienced…" They point out that the meaning of architecture can only be revealed when the human body meets the physical reality of architecture. According to them, architecture is defined through the life experience it provides to people. This experience is a specially framed version of everyday life by design. Space, texture, smell, and color of materials, joints, light-shadow, and acoustics are the most important design inputs that make people understand that they are in the material world. Nevertheless, they underline that the fascination of architectural work is the moment when it comes to meeting the physical reality of the body and the building, rather than its own characteristics.

The meeting moment of the building and the body can be designed with infinite variety. This is related to how the architect constructs the communication between space and human. It is precisely at this point that materiality appears as a form of expression.

Materiality as a Phenomenological Expression: The Message of the Building

An architectural structure is not just a volume with form and function; it is also a text which can be read mentally and physically. This text conveys the designer's point of view, the relationship between the building its surroundings, the aura of the time period in which it was built, and most importantly the message of the building itself and it has a narrative (Durmuş Öztürk, 2017). It can be very powerful, hence impressive and convincing, or can be weak and therefore interpretable. This difference is related to architectural expression.

As in literature, architectural expression enables two structures of the same function to have different effects on the user. Durmuş and Gür (2017) identify this expression with rhetoric, the art of influencing, and persuasion. They state that understanding rhetoric in architecture is trying to understand thoughts about what is said and how it is said. The architect transmits the message he wants to convey using his own rhetoric devices.

The architectural expression can be discussed through the form itself, tectonic or stylistic concepts. This is because the architectural expression is a desirable answer to the question of how the main design idea will be reflected in the process of creation, and of course it includes all or a few of the above. However, from a phenomenological point of view, the exact equivalent of the architectural expression is found in the consciousness of reality. This is the reality of the material world and can only be created through the subject's inevitable relation with the World.

Phenomenology establishes the perception of reality on what is seen, felt, sensed, and realized in the material world. In fact, the reality is based on how the subject perceives it rather than on its own independent being. Thus, phenomenology claims that the world cannot be understood through single and constant objectivity, since consciousness is subjective and relative. In other words, the entity needs a receiver to detect it (Thevenaz, 1962). As Merleau-Ponty says (1945, p.vii): "*It tries to give a direct description of our experience as it is…*".This is a view that glorifies the human body, the experience, and the way the human body establishes the relationship with the outside world. Experience varies each time depending on the person and time.

The reflection of Husserl, Heidegger, and Ponty's philosophy on architecture presents the space-time in the way how the human being lives it. The space can never exist regardless of the existence of the perceiver and is constructed by the forms of the relationship the subject establishes with it. The concrete reality of architecture reinforces the subject's presence in this world. Architecture should allow human being inhabit in the continuity of time (Pallasmaa, 2005) and, of course, to become a reminiscence that will take place in memory (Zumthor, 2006).

At this point, the question of "how one experiences the space" comes to mind, which Juhani Pallasmaa (2005; 2009) answers *"with the whole body".* According to him, architecture as an extension of nature into the man-made realm provides the ground for perception and for understanding the World through experience. He underlines that every memorable experience of architecture is multi-sensory; and everything related to space can be measured by the eye, ear, nose, skin, tongue, skeleton, and muscle. Because the noble task of architecture is to help the human being to locate his/ her own presence in the world and in the flow of time. This is possible by designing spaces that will help people to witness a certain moment, referring to Heidegger's (1972) "da sein" philosophy. The human body and the consciousness through the body record the spatial experience and remember his own existence in that time and place.

The relationship between the human body, environment, and architecture can be designed by different designers in different ways. For instance, the phenomenological perspectives of Peter Zumthor, Steven Holl, and Sverre Fehn come to life in different architectural expressions. Peter Zumthor puts past experiences at the starting point of the design (Zumthor, 2006) and focuses on the concept of "atmosphere". This is an image he dreams of in his mind based on his own memories and with that he aims to trigger the deepest architectural experiences of all users (Zumthor, 2010). Just like designing a kitchen that will remind someone of his childhood, he designs spaces to recall powerful images in the subject's memory. And as human beings perceive the atmosphere through their emotional sensibility, he focuses on special materials and sensory stimuli. Using the concrete attributes of the items as narrative elements, he gives a special meaning to them. This meaning is the essence that creates the senses, perceptions, and the atmosphere (Zumthor, 2006).

Pointing out that the design method cannot be formulated, Steven Holl (2000) intertwines the abstract and tangible side of architecture into each other. He twists the design idea, material, and space together and puts the perception depending on the movement at the center of its design. According to him, architecture should reveal the nature of the experience. He uses "parallax" as an experiential design tool to evolve the space from a static void to an interactive place. Holl redefines space with human movement thanks to moving surfaces. With the changing position of the body, new perception possibilities emerge, and the space is reproduced every time through perception. Briefly, perception makes it possible to reach the world of inner life and this is the key to understanding the outside world (Holl, 1994).

For Norwegian architect Sverre Fehn, blending modernism with regionalism and tradition, there is a "poetic idea" at the basis of each design (Fjeld, 2009). So every building is part of the story the architect tells about life, the world, and people. He constructs this story from the trio of earth, sky and horizon. Horizon is born from a dramatic combination of earth and sky, and the space is a dwelling between earth and sky just like it. Based on this, the aim of Fehn is to create a horizon that confronts the natural and the artificial. In this sense, in designing the handling of platforms and raised ramps, Fehn evokes the significance of the nature of the horizon (Marinovic and Baek, 2013).

The point where they all meet, that material, light, color, and construction details all participate to create a special moment for the mental and physical integration of the body with its surroundings. Similarly, Kengo Kuma expresses the unity that he wants to provide between body-experience-nature and space through the materials. He refers to the human body through the structure and tectonics of the materials. He integrates architecture with the place via permeability and blurred walls, destroys the form as much as possible, and leaves the tactility of the material back. In this way, he exalts the physical experience.

Kengo Kuma's Materiality

"My ultimate aim is to 'erase' architecture, because I believe that a building should become one with its surroundings" (Bognar, 2009). This discourse of Kengo Kuma, one of the most famous and successful architects of the world, is both brave and strange at first because it is unusual for the process of creating an architectural product to actually delete it. What Kuma means is that he wants his buildings to be in harmony with the surrounding landscape, the site, the topography, the built environment, and the human body who experiences it almost as if the building was not there. However, this desire has many difficulties in itself and Kuma finds the way out in the "possibilities of materials".

Material Reality and Relativity: Balance between "Subtlety" and "Monumentality"

It was a long-awaited and desired situation for architecture to be monumental. Spectacular architecture, which peaked especially at the end of the 80s, blessed the architectural objects that stand out with their popularity, form, height, or any feature that will create the wow-effect. For this reason, many investors still want structures with rare functions in urban texture, such as museums, municipalities, opera houses, or theatres to attract attention and become an icon. And this is a dilemma for Kuma, who desires to dissolve and erase the architecture in the environment. He found the solution that will meet both the will of the age and realize his own architectural philosophy while designing Chokkura Plaza in 2006: a challenge with respect to materials (Kuma, 2009a). According to Kuma, seeing the material as a finish attached to concrete is a disrespect to the material. For him, the material is also the structure. In his own term, *"material-structures"* should be laid out in a detail ranging from traditional techniques to the most contemporary construction techniques, chosen correctly and, if necessary, forced to go beyond their boundaries (Muscogiuri, 2013).

This coercion is actually a challenge. Using the material in a way that creates unexpected effects, flexing it, making it fragile, and making it "relative" is a difficult task. The purpose of this challenge is to understand the nature of the material, unleash its potential, and make it truly able to relate to the body. Kuma explains this through Deleuze's statement of *"elasticity of materials"*. According to Deleuze, all materials are elastic depending on the forces acting on them. Kuma agrees with Deleuze and adds that *"the relative state of a material is determined by the activity of the observer"* (Kuma, 2000).

The fact that the material becomes variable depending on the movement of the human body, or observer, transforms it from a static object into a dynamic process: a process that focuses on all possibilities of the material. It is to create a certain condition to be experienced by the body at a certain moment (Kuma, 2006). This creation is an alternative monumentality built on subtlety.

Anti-Object: Integration through "Disintegration" and "Dissolution"

According to Kuma (2010), the architectural structure is not a statue or object on display. On the contrary, he sees it as a part of the site that touches the human body. He compares this architecture, which he defines with the concept of "anti-object", to a stage designed for the human body" (Kuma, 2008). This stage and the human body are in constant communication, and this communication is a time-space sequence in which bodily experience will take place (Lübker, 2017). A fluid and transparent interval designed in infinity: "ma".

Commonly "ma" can be translated as *"the natural interval or the gap between two or more things"* (Iwanami's Japanese Dictionary, 2000) and is a word that includes the meaning of both space and time. However, ma is not an ordinary vacuum or a pause. According to Nitschke (1966), ma is something that takes place when the human experiences compositional elements and not these elements themselves. So, ma is the "sense of the place" and concludes the "change", "movement" and the flow of "energy" between things within this gap (van Dam, 2019). The architectural philosophy of Kengo Kuma focuses precisely on this flow and provides the relations between architecture-site, architecture-body, and architecture-light by removing the boundaries between interior and exterior space.

This is achieved by the fragmentation of the outer contour. For a more permeable form that is freed from its contours (disintegration) and integrated with its surroundings, Kuma demolishes the traditional concept of "facade" and replaces it with the new architectural body created by the method he calls "particlization" (Kuma, 2008; Bognar, 2009; Lübker, 2017). Just like the human body, the architectural form created with the particulate materials filters out the stimuli such as light, air, and sound coming from the outer space to the interior. It is transparent and permeable, like lace or blinds rather than glass or tulle. This transparency differs from the transparency of Modern Architecture that provides only visual continuity: it is a condition that dissolves space (dissolution) into the environment through fusion (Kuma, 2005).

After all, the facade is no longer a wall that separates the interior and exterior. It is an interface that interacts with its environment both visually and tactically. In this way, the space is no longer an object that can be viewed from afar, and it turns into an interactive stage that varies depending on distance, speed, position, and orientation of the body (Kuma, 2005). In the end, the tactile feel provided by the full portions of the materialized surface is combined with the visual continuity provided by the empty parts (Vignjevic, 2015). Thanks to the particulate material, the form crumbles and disappears, leaving only a sequence of experiences based on perception and motion (Muscogiuri, 2013). The space is integrated and united both with its environment and the human body through the material: in other words, the immaterial reality is expressed by materiality (Vasilski, 2012).

Eskişehir Odunpazarı Modern Museum (OMM)

Designed by Kengo Kuma and his partner Yuki Ikeguchi, Odunpazarı Museum of Modern Art (Image 1) is located in Odunpazarı, the oldest settlement in Eskisehir. Named after the historical timber market it once hosted, Odunpazarı (meaning 'wood market') was founded on the hills in the south of the city and dates back to the Seljuk State. The district, which is on the UNESCO Intangible Cultural Heritage List, has been taken under protection with its curved roads, dead-end streets, and old adjacent Turkish houses with wooden ornaments and bay windows. The houses are built around the Kursunlu Kulliye, which is located in the middle of the region. In accordance with the typology of the traditional Turkish house, Odunpazarı Houses are planned to have service areas on the lower floors and living areas on the upper floors. Their facades facing the street are cantilevered and thus visual communication with the street has been established without compromising privacy. The first floors of the structures are generally made of rubble stone or wood loam, while the second floors are again made of wood and adobe (Özkurt, 2006; Atıcı, 2017).

OMM, located on Atatürk Boulevard (Image 2), one of the main streets of the city, was born out of the businessman and collector Erol Tabanca's need to exhibit the increasing number of works of art under a museum roof. As a university city with a young population, Eskişehir, the place where Tabanca was born and defines as "*a modern civilized and bright city of Anatolia*", was deemed suitable for this contemporary museum. In order to make Odunpazarı one of the world's modern art destinations, it was requested that the museum design was made by a famous architect who would make a sound as well as the collection. As a result, Kengo

Kuma, known for his unusual use of materials, dialogue with the ground, and his passionate relationship with the traditional, undertook the design of the first and only Modern Art Museum in Eskişehir.

The museum, which is 4500 square meters in size, is made up of rectangular blocks that are intertwined and form terraces on each other. Each block faces various views of the city with a different orientation. Some of the blocks facing the street are cantilevered like the characteristic feature of the historical Odunpazarı houses. Since the museum rises towards the middle of the form, it creates the perception that it is the same height as the neighboring historical buildings regardless of the point of view (Image3). The neutral attitude of the façade enabled the museum to be added without trying to resemble or contrast the historical environment (Öktem Erkartal & Özüer, 2016).

OMM that clearly conveys Kuma's architectural philosophy, presents the respect of the past, dialogue, fluidity, and blur through the ability of wood to be permeable. The structure, which refers to the wooden cantilevered Odunpazarı houses, relies on its place without passing the height of surrounding buildings or avoiding them. Wood, which gives the museum its character, once again narrates to the world the architectural discourse established by Kuma on the concepts of "material relativity", "dissolution and disintegration" and "filtering".

The "Reality" and "Relativity" of Wood

The material that defines and even describes OMM is wood (Image 4). Besides the facade of the Museum, everything that complements the building (seating units, sales kiosks, floors, etc.) is made of wood. Kuma and his partner Yuki Ikeguchi adopted the idea of reviving the history in the visual character of the building, based on the fact that Odunpazarı is a place where wood was bought and sold. According to them, wood is an increasingly less preferred material in contemporary structures due to its difficult construction techniques and maintenance. Despite these difficulties, almost everywhere in the museum wood was used and the building was provided with a certain iconic expression (Ikeguchi, 2019). In this design, wood has become a structural expression that symbolizes the history of the region by going beyond being just a façade. Once again, the geometry, structure, and material melt into each other and turned into a material structure.

The reality of wood is that it is a warm, textured, and organic material. It is the color and its haptic feeling that make it warm. The perception of "sincerity" created by these conveys the message that the museum respects the environment, history, and human body by bringing it closer to the human scale both in the square and in the interior space. Furthermore, thanks to the details applied by Kuma in the corners, the unique texture of each block forms a natural piece of modern art. Wood is also a natural material, it is porous, breathes, and continues to live. Natural materials tell their ages, histories, roots, and the story of their use by man (Pallasmaa, 2005). This refers to Kuma's view of the material as a process, not an end, and his definition of organic architecture (Kuma, 2009b): something that *"possess the characteristics of generative dynamism of living organisms"*. This dynamism stems from the relativity of wood.

Kuma and his partner used wood almost like a backbone in this structure. Wood is unusually permeable, depending on the position of the minister, it disappears and reappears in places. The skylight, located in the center of the space and continuing from the ground floor to the roof by splitting all floors, and the shuttered facade allow redefining the space every time according to the perception of the body. Energy flow occurs between the architecture and the body. There is constant variability and transition or "ma" in the structure. In the words of Kuma (2000), *"materials are turned into ingredients for action"*.

Continuous Flux

It is possible to easily detect four different continuous flux in the museum: Flux from city to museum; the flux of the light from outside to inside, flux of the spaces into each other, and flux from past to present day.

OMM creates a museum square with other museums in front of it. This plaza can be accessed from Atatürk Boulevard by ramp-stairs and can be entered from four different directions. The material of the square's floor continued to the interior of the museum and thus the ground floor became a continuation of the plaza. In this way, visitors automatically orient inside the building and create a continuous flux between the city and the museum (Ikeguchi, 2019).

Another continuous flux is achieved by taking the light into the interior. The light which is filtered through the gaps between the wooden planks on the façade and on the skylight atrium flows into the installation spaces (Image 5). So, light touches the walls, floor, and even the art objects. It flows differently each time according to the time of day, the weather, and the angle of the body's stance. In this way, time is felt as the fourth dimension in space. The light, filtered in different ways from the facade and skylight depending on the time, is a work of art in itself. So, light fluxed into the space and materialized there.

The atrium, which forms the heart of the museum, allows the spaces to flow into each other. Thanks to the form rising to the middle and rotating, the exhibition spaces at different heights create continuity by communicating visually with each other (Image 6). However, the most impressive continuity that makes the museum belong to its place, is the flux of the past to the present. This is possible through the concepts of "dissolution" and "disintegration", the most powerful and unique aspects of Kuma's design philosophy.

Dissolution and Disintegration: Dialog with the Past

The facade of the museum, which feels quite opaque from the outside, creates a very different perception for the visitors in the interior: the shell of the building dissolves in the historical environment. Thanks to the intermittent wood laid over each other like combs at the corners, the surrounding structures appear and disappear in a surprising way (Image 7). Like the old houses of Odunpazarı, the museum sometimes overflows towards the street and it is definitely in dialogue with the historical environment with its view terraces, permeable facade, and formal orientation.

Conclusion

From a phenomenological point of view, the space testifies that the body lives in this world. It confirms where, when, and how a human being inhabits. It does this by preparing moments that the body can perceive and make sense of. This moment can be constructed for different architects through different concepts or parameters, just as a sentence with the same meaning in literature can be expressed in unlimited different ways. Space, material, structure, and how they come together to generate the architectural expression. This is also a message the architect conveys through the building, a style, and what makes the design unique. However, one of the common tools of all these expressions is materiality. Because materiality is the interface of the relationship that architecture establishes with the human body. Through materialization, architecture becomes an extension of the human body. Texture, permeability, elasticity, transparency, opacity, fluidity, density, fragility, and color are the inputs that affect and manipulate the body's signification process.

It is seen that “particlization” is the basis of Kengo Kuman’s architectural expression. By particlizing materials, he challenges their potential and adds a relative property to their realities. In this way, the material ceases to be an object and turns into a process with dynamism. The material appears, disappears, and thus dissolves within its environment. It gets rid of its borders and maintains the flow between space-body, space-environment, and space-light. These flows enable integration between the human body - space and the environment. In other words, architectural design unites the world and the body through light and material, and senses. It gives the message of unity, integration, and tactility.

OMM, the only modern art museum of Eskişehir, is before us as an example reflecting the architectural philosophy of Kuma and its partner. Although there are also harsh criticisms about the building, the message of Kuma’s unification through dissolution and thus achieving a bond with the past can clearly be read from the building.

IMAGES, CHARTS OR GRAPHIC LEGENDS

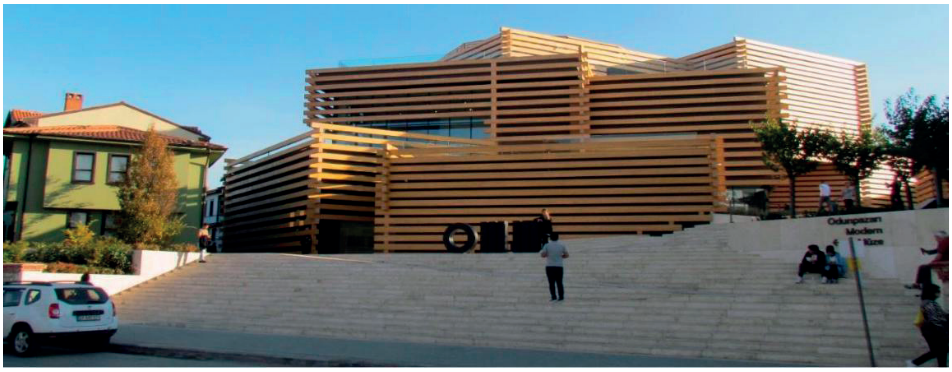

Image 1: Odunpazarı Modern Museum of Art desiged by Kengo Kuma and Associates (Photo: Öktem Erkartal, 2019).

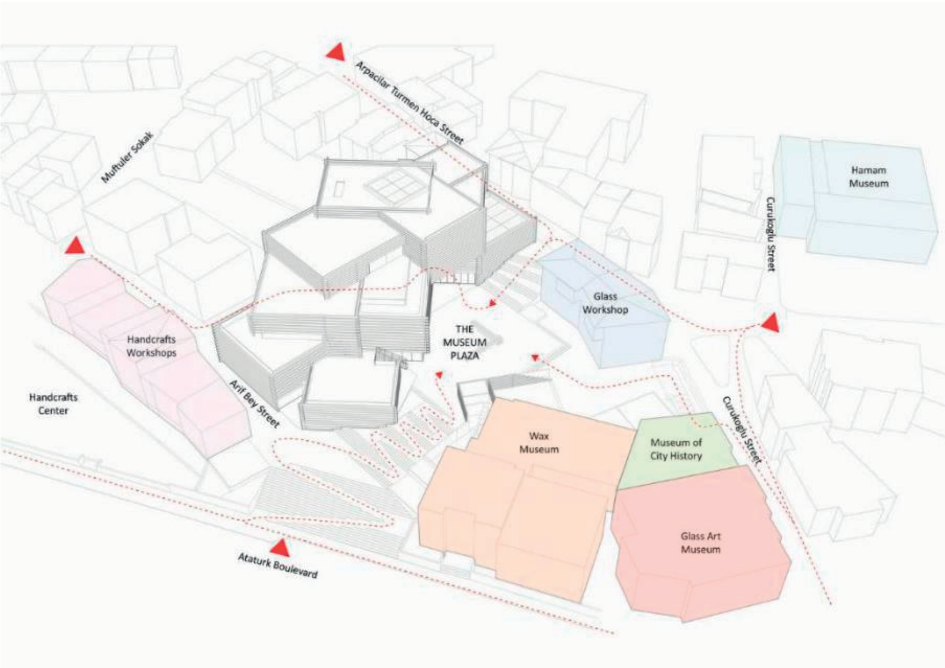

Image 2: The Site Plan of OMM © Kengo Kuma and Associates-KKAA (URL-1).

Image 3: Museum’s visual relationship with neighboring buildings (Photos: Öktem Erkartal, 2019).

Image 4: The reality and relativity of wood (Photos: Öktem Erkartal, 2019).

Image 5: The Flow of the Light (Photos: Öktem Erkartal, 2019).

Image 6: The Flow of Spaces into each other (Photos: Öktem Erkartal, 2019).

Image 7: OMM’s Dialog with the Past (Photos: Öktem Erkartal, 2019).

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URBAN SCULPTURE AS/TO EMPHASIZE ARCHITECTURE

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ABSTRACT

In the scope of this study; the relation between design products named as urban sculptures and the city and its immediate environment is discussed. The importance of the "creating of a spatial impact" by this relation has been attached to and scrutinized in this context.
For this purpose and within the scope of this study; 5 pieces of design products created by various designers, having a spatial impact with common features in the material selection are examined. These are defined as;
Cloud Gate, Anish Kapoor; The Caterpillar, David Harber; Overdeepening, Amorepacific Headquarter, Olafur Eliasson; The Wave, Schneider + Schumacher; Sphere Within A Sphere, Arnaldo Pomodoro.
Upon literature research related to the examples, certain information has been gathered and interpreted based on discourses and comments. In the results section of this study, the urban sculpture's spatial impact creation potential in terms of the selected examples is discussed in the context of the achieved findings.
In this study, urban sculptures and their materials' positive and negative contributions to their immediate environments are discussed and comments are made over their influences on architectural-urban space.

KEYWORDS

Urban sculpture, public art, urban art installation, built environment, architecture, material

Perception and Space

The built environment consists of a combination of components such as urban space, architectural space, habitat, artificial environment, etc. In this multi-layer formation, each component plays a major role. Our positive or negative impressions against the built environment consisting of various components are a result of the perception process. With the perception process, we gain certain feelings related to the environment.

A vast number of studies related to the perception process emphasize the fact that perceiving the environment is realized through sense organs, (Gür 1996; Rasmussen 2010; Gezer 2012). Moreover, we can talk about criticisms brought on by prioritizing seeing, among other senses, in architecture for centuries and researchers saying that other sense organs are as much important as the eye. These theorists emphasize all sense organs' role in spatial perception, (Pallasma 2011; Erkartal 2014).

There are many factors that affect perception. They vary on a large scale, from cultural codes to individual infrastructure. Yıldız and Seçkin (2019) collect the variables which have an impact on perceptual selectivity into two groups and state that the first group has characteristics related to the perceived stimulus means material and the second has characteristics related to the perceiving individual. According to them; "while designing a building, the experience which the architecture wants the user to acquire is established by both parties' relation with material". Also, Elmazi (2019) says that any material in or environment has a story to tell, such as sound, echo, form, geometry, and odor.

In this study; the matter of reception involves different effects, emotions, and senses created by the relation established between the urban sculpture and its immediate environment and is, therefore, underlined. In this study, it is aimed to question the spatial status created by an urban sculpture from different perspectives. The term spatial status means the relation which the sculpture establishes with space and immediate environment. Therefore, space and environment should be mentioned as well.

Space and Environment

The relation established between space and its surrounding environment is among the priorities of urban and architectural space. This relation is established by various means. These are selected according to their priorities among the indispensable concepts of design; such as texture, form, color, dimension, etc.

In this context, the primary goal of designers is to bring out products that create positive impressions and emotions in persons. In order to create this positive impression, a designing process is experienced from an urban scale reaching out to the architectural building, urban equipment, and even floor material. In this process, designers of various scales may collaborate sometimes, or the design products may take place in the same space section independently.

To give an example, in the theater building in Dublin designed by Daniel Libeskind, the form has been shaped almost according to the square opening to the harbor (Image 1). Although the environmental design belongs to a different designer (Martha Schwartz) the building, spacing, square, and harbor are perceived as a whole and not individually. The huge spacing created in the building's side opening to the harbor flows to the square to the front and the square and building establish a dialogue (Kuloğlu, 2013).

Another example is an installation, a commemorative to the Jews expelled from the borders of Hungary and slaughtered along the Danube River. In this work consisting of 60 pairs of iron shoes such as men's boots, high heel ladies' shoes, and children shoes the relation between architecture and civic has been ensured by the fact that the artwork is right in front of the parliament building and is positioned along the river (Image 2).

This work as others leads us to the concept of urban sculpture. These installations which are applied in urban and architectural circles take place under different names in literature. For the purpose of understanding the concept of urban sculpture the process in which the sculpture and urban sculpture passes have to be mentioned briefly as well.

Environment and Urban Sculpture

Tanyıldızı (2016) mentions that the hybridization in art, architecture, and design brings space specific art to a new platform. Tanyıldızı also states that the new generation works to expand in public space and gets the opportunity to contact living much more. He also says that, in daily life, public spaces and buildings in the city have become artists' work areas and that space specific art has conceptually and formally evolved since the 1950s and has achieved its contemporary form.

The sculpture is also one of the artworks having experienced this evolution. Until the second half of the 20th century, it has been acknowledged as a solid form and art of mass whereas later on with the recognition of the significance of spacing the importance of its spatial impact has become undeniable (URL 5). The spilling of sculptures outside and expanding in public spaces has brought the concept of "place" to the forefront (Rendel, 2006). And this led the way to new ideas, creativity, and design as the impact point of sculpture.

Public space is the "place" where the general public has free access for spending time and which enables to participate in activities that raise life quality and gathers people from any category. The spatial quality level of such areas provides a positive impact to users which also increases space-human interaction (Uzgören and Erdönmez, 2017). Urban sculptures play a major role in this spatial quality increase as well. Şahan (2016) mentions that urban sculpture may generate relations on experiencers such as intensity, stun, internalization as an emotion or sense, gaining different experiences, questioning, improving perspective, reminiscence, and aesthetical pleasure. The increase in this interaction uplifts the city and this mutual feedback mechanism develops the city, increases recognition, and converts it into a piquant element for tourism. Therefore, the relation between urban spaces and sculptures and also with the users is pretty important. And in order to improve this relation, it is of importance that the designers who design the urban spaces and sculptures have to think of details such as from urban planning scale to the sculpture's texture, material, color, and compactness-void ratios. Kurtaslan (2005) quotes a reference to urban planner Moughtin (1999) and mentions the significance of principles such as "unity, rate, scale, harmony, balance, symmetry, rhythm and contrast" which support the relation between urban sculptures and the environment.

The urban sculpture is not just a decoration element taking place in the environment, it may also have some messages to be relayed together with other works. It takes place in various spots and emphasizes the city's background, spirit, and its spaces. It also assists in the continuity of the urban context (Liu and Han, 2016). It also functions as forming an identity, image, social message, cultural communication, and space identification. And this is directly proportional to its perceptibility and its relation to the environment and the user (Erman and Boran, 2015).

Since the renaissance up to today, urban sculptures have been taking an important place in urban order. However, with time and social-cultural changes, as urban sculptures have been serving with a more concrete expression until the 20th century, their relation to the city and citizens has changed after the 20th century, and sculptures have converted into more abstract identifications. This has strengthened the relation to the structural environment and increases the exchange with public spaces. Having become more and more abstract, urban sculptures flourished in terms of material, form, expression, compactness-void space as well. The urban sculptures of today created by a mutual collaboration of different design branches are, unlike those of the past, aim more to enable interactive communication between the sculpture and public rather than the sculpture's own emphasis (Çil and Alp, 2018).

While the discrimination between public-private areas in European cities was rather weak before the industry, these two areas have been separated from each other with the age of enlightenment. This brought the fact of the redesign of urban elements. With the modernization process, public-private areas have fallen apart completely. A significant example of this is the gentrification of Paris with the industrial revolution in the 19th century. Haussmann, has transformed the city, demolished the city's units such as streets, blocks in bad condition and aimed to rebuild them. He cleaned up boulevards and squares and placed sculptures at the ends of the newly established boulevard networks and in squares to make Paris more impressive (Bermann, 1994; Kedik, 2011).

After the industrial revolution, the interest in technology and modern life grew strongly which affected art, especially in the '60s. But the art circles which were not fond of this situation have embarked on a different art approach as a reaction and with progressive thoughts at the beginning of the 20th century. The tendency to abstract thought has increased and sculpture got shut off the concept of the "base" in the classic understanding and has started to interact with urban space. Nevertheless, spaces and artworks which have an impact in urban areas aim to change the experiences of urban life (Erdönmez and Ünlü, 2009). Artists who attempted to leave dependency on Image have made some trials on vacancy in sculptures and inward spaces (Kilimci, 2012). The need for renovation of urban spaces which emerged due to physical damage especially after World War II has brought prominence to space-art objects in the city (Erdönmez, 2005).

On the other hand, in the 1960s in America, urban order has changed, especially with gentrification in cities and a new vision has been headed whereas the importance of artistic works as increased for the development of society. Concentration has been directed on the issue of "increasing peoples' quality of living" by the integration of city and art. For the purpose of providing support and finance to urban art projects of the country "The National Endowment for the Arts" (NEA) has been established in 1965 (Kwon, 2001). The first project sponsored by the institution was an urban sculpture project (Image 3). Built in 1967, the purpose of this sculpture was to bring alive an unutilized area of the city that was spatially in bad condition. Aiming to reanimate this area of the city by a sculpture instead of spatial intervention makes this sculpture. Another important fact is that the sculpture has no traditional base and has defined the "place" as a base and so, it has established a relation to the urban space. It has abstract and impressive dimensions being shiny red and metal. With its existence, it has not only influenced the spaces in the region of the city but also and has become the heart of the entire city. Every year, on the birthday of the sculpture an art festival is organized and local people are very satisfied with the existence of the sculpture and its contribution to development (URL 6). Here we can see the outputs of how a sculpture correctly interacting with the correct space can influence the city's development.

The "place making" concept, emerging in the 1970s, aims the active role of citizens in the public design process and to provide positive effects in their lives, and by this concept, the interaction of urban spaces with art has become more important. Because the direct/indirect role of the city's users in the production of urban artworks and spaces increases their sense of belonging to the city (URL 10). In the 1990s the role of public art has changed in such a way to affect a wide range from the renovation of the physical environment to society's development, from improving aesthetical quality to contributing to the quality of living, from enriching lives to saving lives and so, public art has assumed a major role. This public art model is not a matter of design, architecture, and sculpture anymore and publicity becomes the essence. Focusing on people converts this design process into a dialogue. And this has opened the path to the fact that the primary aim of art shall be providing a dialogue area open to the public instead of elements designed in public spaces with the primary aim of aesthetical compliance (Perelli, 2003).

In the last 30 years, at this point, major changes have been experienced in public art. Two of the public art parameters as (2001) mentioned by Kwon, summarize the actual status of the relation between urban space and public sculpture. Accordingly, art in public space is an abstract sculpture placed in an outdoor area to emphasize, in general, on urban space, area, and buildings or enrich them. Art in public space establishes a more conscious relation to its environment and enables the creation of more complicated and effective works by multiple collaborations with architects, landscape architects, urban planners, urban designers, artists, and city administration.

The most significant development in our country which could be considered a radical step in respect to urban sculpture is the formation of the group "Espace" (Space) in 1953 by sculptor İlhan Koman, sculptor Hadi Bara and architect Tarık Carım with the purpose of "creating new humanitarian living areas in the city, assessing space as a whole with its social and natural structure and proposing practical solutions in this respect". In this context, their manifesto named "Groupe Espace Manifesto" was published in the d'Aujourdui magazine in 1955. This manifesto which had foreseen the contemporary sculpture art after the 1990s underlines the importance of interdisciplinary collaboration in the creation of artworks of urban scale. Artworks take the relation between space and the public as a base and underline the importance of communication (Koman, Bara, and Carım, 2010).

At this point, it will be meaningful to mention the relation between architecture and urban sculpture.

As the existence of architecture and sculpture in public space get a "foothold" in the three-dimensional physical environment they serve similar public functions. Therefore, their problems are more or less identical. In general, it can be said that the aim of both architecture and sculpture in public space is to render psychological and physical arrangements in the "place" and to carry out the design to an aesthetical result. However, there are some differences. For example, the sculpture has usually no aim to serve for a function but for architecture, this is pretty important (Carter, 2010). But at this stage, it can be stated that sculptures massively contribute to perceiving the city, get acquainted with it, and the sense of direction. In this context, we can tie urban sculptures with the crucial point concept which is one of Lynch's five principles (Lynch, 1960). Some sculptures have found their "places" in the city in terms of meaning, material, and location so much that they have become a global brand being referred to with the city's name or even surpassing it. According to Tolman people living in modern cities are like mice in a labyrinth. The symbolic enhancement of the environment they live in contributes to this. Whereas historical cities owe their uniqueness and their charm to the artistic and structural elements which make them unique and increase the bonds to the city as well (Januchta-Szostak, 2010).

Here we have to point out the concept of memory. Because the more the impact rate of something on an individual the more is its place in the memory and the recollect rate will increase accordingly. Nora (2006) says that these symbolic works and architectural elements affect first individual memory and later on collective memory and that emotions and textures created by the combination of concrete elements remain to exist by relaying from generation to generation. Shudson (2007) states that works created for the memory to relay are made on purpose to create impact and to keep memories. Halbwachs (1980) explains that the cities' memories are maintained fresh by these works in cities and built environments and increasingly contribute to take roots. Kedik (2012) who mentions the indispensability of sculptures, especially in the west, also points out that the "social, technical, ideological, political and similar use of public space, as well as its aesthetical aspect, is very important in the formation of collective memory".

Briefly, starting with the individual perception, the sculpture-built environment relation takes place in memory and gains the power to relay from generation to generation. Therefore, creating and enhancing this relation strengthens the existence of cities and increases the brand values in a global world. By saying "the privilege of a historical and old city center comes not from the uniqueness as a center of art and culture but from the multilayer in the course of history", Yaman (2011) summarizes the meaning of life experience in the texture of cities; urban sculptures and buildings are the primary ones of these elements.

Having been changing since its very beginning urban sculpture has shaped itself into totally different expressions with the development of material and technology.

In this study, it is aimed to start a discussion about the relation between the design products named urban sculpture and the spatial situation in which they are located. These products may have been positioned under different approaches. The products may have established relations of harmony or adversity with their environment. This harmony-adversity relation may be generated by material, texture, color, scale, etc., or at the intellectual level as well. And most important, design products may be designed to make a sculptural (Image 4) and sometimes to make a spatial (Image 5) effect.

The artworks dealt within the scope of this study are questioned in the context of spatial relations established with the environment. Examples have been selected among those who created spatial effects and in which reflecting materials have been used. In the selection of the examples, attention has been paid to the fact that the sculpture shall be among those taking place in literature.

Urban Sculptures: Sampling

As it is very difficult to question all of the said relations in this scope, this study addresses examples that are produced by a designer, which support the architectural structure or environment, attempts to create a spatial effect, and puts forth the relation established with its environment especially by material use.

In the selection of examples; criteria such as the spatial relation of the urban sculpture with the urban environment in which it is located, material characteristics, and being products of well-known designers have been taken into consideration. The samples having been reviewed within this context and the information cards of such examples have been created in the charts as shown below (Chart 1-5). The underlined texts in the descriptions of the examples are the information that constitutes the data for the discussions.

The sculpture consists of 168 stainless steel plates. The big dimensions of the sculpture, with about 10 meters of height and a floor space of 20 x 13 meters plays an important role in the sculpture's reflection of its aim. Because for the fulfillment of the sculpture's task located in Millennium Park (Image 6) which is one of the city's regions with a high utilization rate since its design, and in order to reflect Chicago's landscapes day and night this size is necessary (URL-16, 2020). This project is, according to Gilfoyle's (2006) definition, is an artwork in which the concepts of "the visual between the earth and sky is a bridge" and "existence-nonexistence, place-homelessness, concrete-abstract" are handled massively. Just for this very reason, Kapoor named its work "Cloud Gate"; the sculpture is an imaginary, visual road to the sky and skyscrapers. With its reflecting characteristic, it provides the opportunity to everyone experiencing it to be a voyager. This matter eventually brings interaction and feedback as well. Its official name is Cloud Gate but Anish Kapoor does not entitle its works until they are completed. As the building was still under construction the images of the design have been published and having seen its shape it has been called "The Bean" by the public (URL-17, 2020). Today its nickname "The Bean" is still as famous as its official name. The stunning thing here is the urban sculpture's influence on the public at this level even before its placement and its reinforcement of this influence by its existence (Chart 1).

The sculpture which is positioned in the corner parcel of its location has a convenient point for a public experience within the park. It joined the project simultaneously with the adjacent headquarters building. The existence of the park where the sculpture designed by Olafur Eliasson and of the building in the park have changed the urban structure of the Yongsan region right beside the USA base where they are located in (URL-21, 2020) (Image 7). As the building right beside has cubical lines the sculpture consists of circles. However, the sculpture with its massive use of metal and besides the building covered with aluminum stripes are in harmony. The building and the sculpture support each other in terms of structure usage, hollow structure, angular placement on the land, and light and shadow play. This situation increases the public effect. Their emphasis on each other increases as well (Chart 2).

In the center of the sculpture, there are two ring halves which their reflections complement a full circle. With these reflections created into the mirror and the pond, it has been aimed to create an emotion in the experiencer as if the space seen in the mirror is an extension of the real physical space (Image 8). The artwork which brought, together with the adjacent building which it has been designed to, innovation and a different perspective to the region also provides additional spatial deepness to the park with the spatial illusion created by reflections. Symbolically; the mirror represents the mind, the pond's reflecting surface represents the emotional subconscious and the metal rings represent the physical body that supports the mind and emotions (URL-21, 2020).

The Wave takes place in a building complex used mostly by the service industry, built in the West End region of Frankfurt in the late 1990s. The new owner of the buildings asked for a new design recommendation in order to render the buildings interacting more with the public, attractive, and benefiting from daylight. With that, Schneider + Schumacher, inspired by the name of the complex, created the idea of an aluminum wave sculpture consisting of six elements and reaching among the space between the buildings like a wave. (Image 9). They gave a name for each of the waves and have enabled them to serve for a certain function (Chart 3).

This interaction with the experiencers not only brought dynamism and identity to this region but also has transformed the place into an activity area for locals. Here it is shown again how an urban sculpture can be a strong element if included in the urban space design. (URL-23, 2020). Hundred tons of aluminum and a special welding application of 2 kilometers for the joint points of the parts have been used in the sculpture (URL-23, 2020).

Arnaldo Pomodoro creates multilayer and complex spheres. One of them is in the center of the pine cone yard of the Vatican Museum. Each sphere of the sculpture breaks up and unveils a new layer which shows a new cracked sphere and also a complex inner perception (Image 10). Although the artist's main idea is unknown, the artwork reflects, with its sphere structure, the complexity of the world and how easily it can break up (URL-24, 2020). Its contrast with the yard where it is located and with the surrounding buildings in terms of material and texture and their reflecting characteristics increase their attraction and interaction with experiencers (Chart 4).

Made of bronze, this sculpture is the first of the artist's series in the 1960s but later on, he continued to produce these monumental spheres in different parts of the world. According to Pomodoro, "which derives from the world of magic, wizards, whether it is of crystal or bronze, or full of water, reflecting everything around it, creating a contrast which sometimes can be invisible, leaving only its interior, tormented and corroded." (URL-24, 2020).

This urban sculpture is a concept project which he created in order to try his artistic ideas in public areas. It is a project in which the designer has just created the idea for any urban area. In the design, the characteristic structure of the imagined environment to be placed in and church architecture has been an influence (Image 11). A structure with void space and permeability has been created with the intention of creating a place where children have fun and to present a focal point in the urban environment. The sculpture which consists of almost two-dimensional, thick, very close, and sequential plates is in harmony with the environment yet shows a contrarious attitude. The aspects which make the sculpture a focal point is this impressive attitude and the functional idea which enables mutual interaction between the user and design. (URL-26, 2020) (Chart 5).

Discussions

In this section of the study, matters such as the spatial effects of urban sculptures on the immediate environment, materials' positive and negative contributions to this effect are discussed over the selected examples, and comments are made over urban sculptures' influences on architectural-urban space.

Upon an assessment based on the comments made by designers or critics of the sampling groups selected after scanning related literature, it is observed that the discussions can be addressed under 4 main topics. Accordingly, assessments have been identified which can be classified as context, concept, function, technology-material-physical phenomenon on the selected examples.

- **In Contextual Relations**: Expressions such as reflection of the environment, simultaneous design between the sculpture and building, harmony with the environment, contrast with the environment, support and underlining each other of urban space building and sculpture, involvement in the urban space design, establishment of relation with environmental characteristics and placement on the land represent that contextual phenomenon between urban sculptures and the spatial environment where the sculpture is located is influential.
- **In Conceptual Relations:** Discourses such as existence-nonexistence, place-homelessness, concrete-abstract, state of being a traveler, imaginary road, visual bridge, earth-sky, deepness, mind-subconscious-body, inspiration by the building's name, spatial illusion, complex-disintegrating world represent the conceptual phenomenon. This shows that conceptual approaches are as influential as a contextual phenomenon in the design of urban sculptures.
- **In the Functional Approach**: It is understood that the interaction and communication between the user-sculpture-spatial environment are noticed and that urban sculpture plays a major role in the increase of this relation.
- **In the Topic of Technology-Material Use and Physical Elements:** It is observed that emphasis is made on phenomena such as structural approaches, use of reflecting material, use of water, cavernous structure, the relation between compactness-void space and light-shadow play effect.

In conclusion, it can be said that the relation between urban sculpture and the environment is established firstly by the contextual and conceptual phenomenon. In the relation created by context, it is aimed to put forth the environment values by the use of reflecting material. This relation is achieved also by harmony and/

or contrast. The relation established between urban sculpture and spatial environment provides a positive effect on the environment and the created atmosphere becomes meaningful with the existence of urban sculpture. The technology and material selection support the contextual and conceptual phenomenon and assists in the enhancement of the idea of the design. Urban sculptures which are impact points positively contribute to the user-space interaction.

Under these descriptions and comments, it is understood that designs being produced-built as urban sculptures assume the task of, beyond being a sculpture, being an instrument to emphasize the environment-space where they are located in. Urban sculptures draw attention with their existence to the environment-space where they are located in. And as they have landmark characteristics they may increase the usage frequency of the area they are located in. They may cause the organization of events in the place where they are located, rendering the place to be a gathering and meeting point and therefore may increase the active use of such a place. This may be regarded as a positive impact on the public area. On the other hand, depending on the rate of contribution to the formation of urban identity, they play an important role in the branding of the city as well as advertising and promotion on a global scale. Therefore, urban sculptures help for and support the development, improvement of the urban space they are located, and further, of the entire city by touristic activities.

These results have been identified on the selected sampling group different or similar comments may be made for different sampling groups.

IMAGES, CHARTS OR GRAPHIC LEGENDS

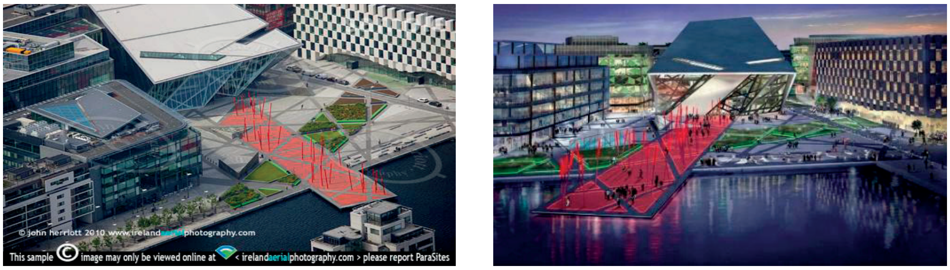

Image 1: Theater Building and Harbor (URL 1, URL 2).

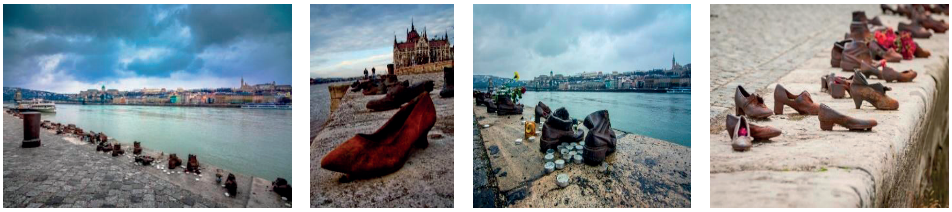

Image 2: "Shoes on the Danube Bank", Budapest, film director Can Togay and sculptor Gyula Pauer, film director Can Togay and sculptor Gyula Pauer, 2005, (URL 3, URL 4).

Image 3: La Grande Vitesse, Alexander Calder, Grand Rapids, 1967 (Respectively; URL 7, URL 8; taken by the author, 2020).

"Body", J. Luc Moulene. "Outdoor sculpture" J. Plensa. "Colorful Sculpture", O. S. Miguel.

Image 4: Sculptural relation established with the environment (URL 10, URL 11, and URL 12).

“Twain”, Richard Serra. “The Adventurer”, G. Lester. “Layover”, G. Lester

Image 5: Spatial relationship with environment (URL 13, URL 14).

Image 6: Respectively, Cloud Gate’s location in the park-city, Millennium Park (URL 15, URL 16), Cloud Gate (taken by the author, 2019).

Image 7: The sculpture’s position in the region (URL 17, URL 18).

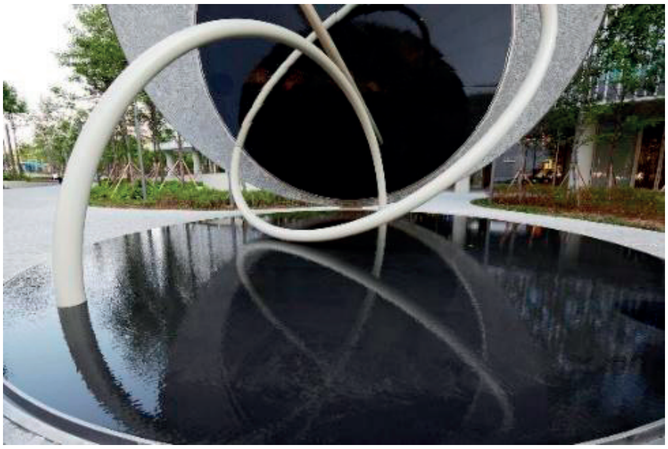

Image 8: Reflections created by the sculpture and the pond (URL 18).

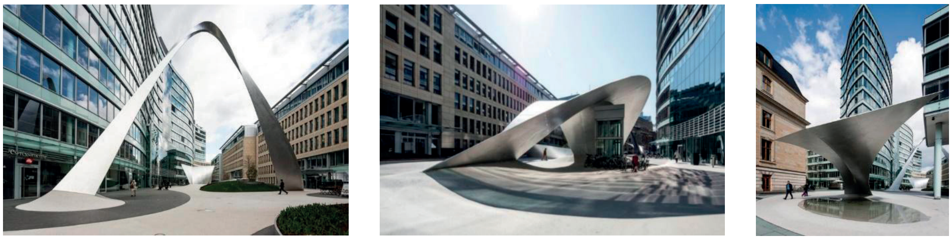

Image 9: The relation of a wave-formed sculpture with buildings, environment, and ground plane (URL 19).

Image 10: The relation of a wave-formed sculpture with buildings, environment, and ground plane (URL 20, URL 21).

Image 11: Sequentially cavernous and reflecting thick plate surfaces a Vista from the inner view (URL 22).

	**Sculpture**	**Cloud Gate**
	Designer	**Anish Kapoor**
	Built in	**2006**
	Location	**Chicago, USA**
Material	Stainless steel	
Texture	Plain, shiny, firm	
Light and Shade, Reflection	Reflecting light and visions	
Color	Metallic grey	
Dimension – Scale	About 10 m of height, floor space 20 m x 13 m	
Compactness - Void Space	A void space that is effective and open for experience available	
Relation with the existing environment	Due to its reflecting characteristic and its positioning in the location which has been defined during the design phase, it is in direct relation.	

Chart 1: Cloud Gate.

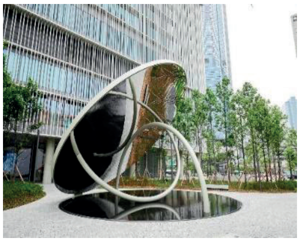	**Sculpture**	**Overdeepening**
	Designer	**Olafur Eliasson**
	Built in	**2018**
	Location	**Seoul, South Korea**
Material	Metal and Water	
Texture	Rugged, smooth, shiny, pale, firm, soft, wavy	
Light and Shade, Reflection	Reflecting light and images in different shapes due to metal and water.	
Color	Grey, transparent and white	
Dimension – Scale	Height of about 2 floors. The water basin and the two main parts of metal support each other in terms of magnitude	
Compactness - Void Space	It has a cavernous structure. A cavity is used as a transition element between different reflective surfaces.	
Relation with the existing environment	Built while the architectural building was designed, therefore it has a meaningful relation to the region it is located in.	

Chart 2: Overdeeping.

	**Sculpture**	**Die Welle (The Wave)**
	Designer	**Schneider-Schumacher**
	Built in	**2016**
	Location	**Frankfurt**
Material	Aluminum	
Texture	Plain, pale, firm	
Light and Shade, Reflection	With its dynamic structure and fluctuations, it creates visual and functional shadings in the ground which it is linked to	
Color	Grey	
Dimension – Scale	Consists of three separate parts being 18, 7, and 7 meters	
Compactness - Void Space	Apparent void space, emphasize is made by void space rather than by creating compactness	
Relation with the existing environment	In direct relation to the built environment, taking place in a public area can be used both visually and functionally	

Chart 3: The Wave.

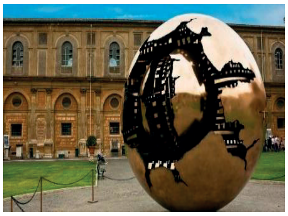	**Sculpture**	**Sphere Within Sphere**
	Designer	**Arnaldo Pomodoro**
	Built in	**1983**
	Location	**Vatican City State**
Material	Bronze	
Texture	Plain, shiny, firm	
Light and Shade, Reflection	As it exists as a singular sphere placed outdoor its shading remains the whole day and never loses its round apparent lines which increases its emphasis	
Color	Metallic grey	
Dimension – Scale	A sphere with an out-to-out diameter of 4 meters	
Compactness - Void Space	Consists of a sphere within a sphere and also of void spaces that are impermeable by various disintegrations	
Relation with the existing environment	It creates a crucial point with its material, firm standing, and threaded structure and by creating a contrast with the historical structure	

Chart 4: Sphere Within Sphere.

	**Sculpture**	**The Caterpillar**
	Designer	**David Harber**
	Built in	**Concept Project**
	Location	**-**
Material	Metal	
Texture	Plain, shiny, firm	
Light and Shade, Reflection	Semi-reflecting, semi pale surface	
Color	Metallic grey	
Dimension – Scale	About 6 meters of height	
Compactness - Void Space	Cavernous structure	
Relation with the existing environment	A design has been aimed which should be a focus in the environment and can be a leisure area for children and also reflects the architecture of the surrounding church.	

Chart 5: The Caterpillar.

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ARCHITECTURE, FASHION, AND INTERDISCIPLINARY INTERACTIONS

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ABSTRACT

Studies about fashion started in the second half of the 19th century. Fashion, until this time, had been considered as a period of change associated merely with clothes. Sociologists, like George Simmel, handled fashion as a phenomenon nourished by perpetual innovation desire in community and pointed out that fashion is the reason of interaction developed simultaneously with design, indoor, architecture, costume design, behavior and attitudes, spoken language, haircut, and food presentation.

When recent popular fashion magazines, fashion designers' works, and contemporarily-constructed-buildings, design objects, and furniture are considered; it is observed that buildings are affected by the change created by fashion and fashion expands into the consumption world with new quests, new concepts, and a big momentum. It is striking that clothes are designed more architectonically and volumetrically, and today's buildings are more flexible. While aiming to be original and different; today's design-products seem to be open -more than ever- to the interaction of different-design products with different functions and scales and of fashion winds thanks to globalization.

Change in clothing fashion is now faster than ever and the design world, in this case, keeps space with this change with both technological developments and the propulsive force of consumption. Macrocycles, through which the dominant line of fashion can be determined, have recently turned into microcycles dependent on and conflicting with each other. Many designers, even if they harbor timelessness claim in their designs, should be aware of popular styles, forms, and materials along with the fashion concept which vanishes at a meteoric speed and that are nourished from perpetual innovation desire in order to catch up with the current. In this sense, this study, with the concepts it handles, aims to illuminate the styles that can simultaneously be determined with fashion in clothing and place designs in order to provide insights into today's design world.

Strong interactions with new materials, technical, aesthetic effects, and material coordination in the triangle of architecture, design, and fashion are born. The material, the ways of using the material, texture, and three-dimensional textural surfaces attract attention in the designs, even if the designs are in different functions and on different scales. From the beginning of the 20th century, architecture, design, and fashion have become much more visible today, thanks to the material, textural surfaces, concepts, and formal configurations. The material and textural similarities combine with the concept of archi-texture with a strong link.
Simultaneously experienced concepts, material, and textural surface in design and fashion, as well as stylistic similarities, will be touched on in the study via analogy method in order to specify current geometry and fashion that cultivates today's design world.

KEYWORDS
Architecture, fashion, design, interdisciplinary interactions, material, textures

Introduction

Common expectations of society and trends to answer these expectations are the spirit and fashion of the age. The atmosphere, geometry, moral values, aesthetic tastes, and fashions of the age are determined with a collective will. According to Baudelaire (1846, 90), "Fashion is a concept related to the present time and what makes the present time beautiful is reality of innovation." Fashion shapes the present time with a desire to be new and different and likewise; fashion of all ages is different. The Spirit of the age is shaped by the changing fashions.

It is thought that it is effective upon the acceptance and popularization of fashion that fashion creates not only excitement in life by answering the expectations of the human being for the new and different but also meets common expectations of the society (Davis, 1992, 28). Davis (1992), Blumer (1969), and Klapp (1969) argue that fashion aims at collective faces of the social identities, use powerful collective movements that are dominant on our self-concept in different periods and at different historical moments, many of us experience similar passions, tensions, worries, and discontents seeing that all of us are subject to same conditions in life, and these passions, tensions, worries, and discontents try to find an expression regardless of how we understand them and therefore there are powerful collective constituents in our identities.

During the pre-modern periods and modern periods, movements whose styles and boundaries were more evident have today been replaced by multi-formations and multi-styles that have no boundaries at all or flexible boundaries determined arbitrarily and in which many movements and styles are simultaneously seen. With this arbitrary multi-structuralism, global expressions are apparent in every aspect of design. Today, global forms have been popularized due to stylistic responses in the design of both architectural products and daily objects. Instead of being imitated products; these designs create forms of globalization and today's fashion.

What is Fashion?

Although the term 'fashion' is generally and mostly associated with clothes; the design object of everyday life is affected by fashion. As Watson puts it (2007), "History of fashion somehow draws the attention of anybody and fashion is deeper than the size of a skirt, silhouettes, and colors. Fashion rivals with psychological changes and social habituation –from eating habits to private art tastes and music; etc.-. It is not only the most charming and impressive entertainment habit but also is the most infallible indicator of time."

Walter Benjamin defines fashion as the "[c]ontinual rebirth of the new for fashion." According to Simmel (1905, p.46); we can conclude that only a thing that becomes extinct as fast as its birth is called fashion.

Adam Smith argues that fashion is associated with gusto formation. Kant emphasizes the effects and changes that fashion creates on lifestyles. Barthes tells that clothes are the material of fashion but claims that fashion is the system of cultural meanings. Baudrillard suggests that the aim of fashion is infinity and fashion must create new forms forever (Göle, 2008, 145).

Fashion, Design, Architecture And Interdisciplinary Interactions

Matching clothes with architecture metaphor dates back to Vitruvius' age. Architectural and clothing matching of the same period carries the traces of the same stylistic characteristics. For example; Art Nouveau residence-houses and Art Nouveau dresses were designed for the landlady by Henri van de Velve -which were popular at the end of the 19th century and at the beginning of the 20th century- reflect the characteristic traces of the period. (Picture 1)

In the recent past, architects, too, explained modern architectural movements with positive and negative analogies to clothes. Isolation of clothes from the 19th-century ornaments and decorative objects was integrated with the goals of modern architecture. It is wished that Bauhaus and a new language of the modern designs can be derived from natural functions and relationships of the objects (Gropius, 1926). Modernism created aesthetic values of the era by forming its own aesthetic values in this new language which has refused ornamentation and has been based on standardization and rationalism (Picture 2).

When he explained the principles of Bauhaus production, Gropius (1926) told that:

> "A modern residence which is equipped with modern daily wares and is suitable for itself and his era is needed for modern humans who put old-fashioned clothes aside and started to wear modern clothes."

The 1920s explained the objectives of Gropius' modern architecture and emphasized the simplification of the clothes and also an era of simplification was born. What Vogue underlines in 1924 is that:

“We are in the era of short skirts, short blouses, and even small isms. To sit down and to stand up easily was a novelty for women. Simplification is a modern concept and has been an influencing fashion.” (Watson, 2007, 40-41).

Crane (2000, 17-18) draws attention to the change in the nature of fashion, and the reactions individuals have demonstrated against fashion today. Modern fashion is more ambiguous and multi-dimensional in line with the fragmental structure of the society after modern industrialization … Dressing styles and personal images fashioned lead to confusion-like chaos created by complicated order and plurality as in a variety of the market options. Different dressing styles represent different social masses and there is no agreement on fashion ideal that represents the modern era nor are there certain rules about what to wear.”

Baudot (2001, 184-186) emphasizes that European fashion saw radical changes between 1960 and1970:

“What is on the agenda is not one-way tendency or one fashion but a mosaic of tendencies are talked about. These tendencies affect other fields of daily life, too. “

As Baudot and Crane emphasized, these tendencies of the society seen in the world of fashion are concomitant with the period when multiple tendencies in architecture are seen. Siegfried Giedion, a famous critic and historian on architecture commented on the presence of these multiple tendencies during the 1960s as follows:

> “A kind of architecture of well-off child is popular. An architecture that deals with the problems like well-off children follows adventures one after another and is quickly fed up.” Jürgen Joedicke says that limitless opportunities surprise the architect and a valid differentiation in forms is born and following the new becomes popular at all costs.” (Kortan, 1996).

The designer’s inspirations vary. Fashion designers often state that they are inspired by the architecture while explaining their sources of inspiration. As journalists and academics frequently state in their fashion writings in biographical studies, fashion designers are extremely conscious and sensitive about the developments in art, especially in visual arts such as painting, sculpture, architecture, and dance (Davis, 1992). Also, Crane (2000), defends that associating fashion design with art adds meaning to fashion design and gives respect to the profession.

Works of art are one of the most important inspirations for design. To exemplify how art affects design: Piet Mondrian’s Red, Yellow and Blue arrangement can be an inspiration from Schroder House to the 1965 winter collection of Yves Saint Laurent. (Picture 3).

In this modernist era of fashion history, architects such as Mies van der Rohe, Adolf Loos, and painters such as Piet Mondrian simplicity and function, found in his works, led to efforts to rationalize clothing. Such as Victor Tatlin, Kasimir

Malevich, Sonia Delaunay, Walter Gropius, Jacobus Oud have tried to bring the modernist revolution in art to the field of clothing.

Art and fashion have developed tight links that have emerged from the early twentieth century. Between designers and artists, an interaction has become visible, aesthetic, or conceptual.

As a result of the rapidly globalizing world and rapid consumption, original ideas belonging to designers, artists, and architects travel around the world overnight. Original ideas, materials, usage of these materials, details, new forms, and patterns stand out in every field of design; and designs, therefore, can inspire the occurring of interactions at different scales and in different functions. With new searches and innovations in today's designs; the synergy of technology, patterns, material, form, and texture in all aspects of design calls attention. (Picture 4)

Interactions in Fashion and Architecture Relations Depending on Concepts

When popular fashion magazines, works of fashion designers, and the concomitant buildings are recently analyzed together, it is observed that fashion spreads in its quest for new things and innovations with a big momentum and buildings naturally get their share from this change. While the world of fashion renews itself with new forms and concepts, old concepts can survive together with the new concepts in the cycle of fashion as confirmed by fashion theoreticians.

It is striking that there is an interaction between the fashion of clothes and buildings, and it is emphasized that architecture keeps pace with the fashion of clothes and undergoes a fast and dizzy change during the 1980s (Canbakal, 2002, 2003).

With Benjamin's words; while fashion –like a tiger that leaps upon the past- brings old forms to the world of fashion again using the pilei, pilei contain the innovational reality of fashion with lineal layers, accidental layers, and more organic forms. The Bilbao Guggenheim museum of Frank Gehry –creating a huge sensation- seem to have had a big effect upon the world of design with folding art and draping techniques. With the invention of curtain walls, the term transparency has always been popular in architecture. The term transparency is also on the agenda today and has been a reference point often used by the world of fashion because it represents self-confidence, bravery, rebellion, breaking the rules just like the Mies van der Rohe'un Farnsworth's house (1950). Modern metal and colored clothes and architectural buildings with metallic appearance material are some of the most effective fashion expressions that define our space age. Cubic forms with crystal surfaces give impressive and new appearances both in architecture and clothes. Reconstructive effect and fluency in architecture seem to be affecting the fashion of clothes, too. (Picture 5)

The following fashion concepts that define today's fashion and stand out with innovation and impression are important: draping (folding), balloon volumes, amorphous forms, lacework and decoupe, pilie draping (linear folding), the effect of pattern and color, patchwork, cubic-crystal surfaces, transparency, skeleton cage, reconstructive, metallic effect. (Picture 6)

Interactions in Fashion and Architecture Relationship Depending on Architectural Style

The key feature of today's architecture and design world is the copiousness of intellectual and stylistic approaches and difference; nowadays, as at the beginning of the modern period, universal design and planning principles cannot be mentioned, produced designs are independent of a certain ideology or a mode (İnceoğlu and İnceoğlu, 2004). The new vision of this age is the way of espousing overlapped cultures in which we all live together. Concurrent forms in art emerged in a way never seen before at the beginning of the 20th century. A moment there is neo-expressionism and suddenly minimalism shows up. Both modern and neo-classic styles are used (Paz, 1992).

When literature of the post-modern 2000s are checked, it is seen that there are numerous styles that compose the current and pluralist frame for design and architecture styles: Minimalism, Maximalism, Rationalism, Deconstructivism, Constructivism, Brutalism, Futurism, High-tech, Industrial, Neo-gothic, etc…

Minimalism

Minimalism is a modern design form that radically severed all its ties with the past in the 1920s. In this movement following the philosophy of Mies Van Der Rohe's less is more, few materials and finesse in details leap to the eye. Plain walls, as indoor designs, maintain the effect even today, with surfaces not deteriorated with ornaments or dissolution. Minimalism came into play in modern art and music in the 1960s, featuring simplicity and objectivity. Minimalists, in order to sever art connections with tradition, focused on ideas underlying art. They classified colors, shapes, lines, and texture by grounding them on ordinary geometric shapes against the risk of adding personal expression. Minimalism left an indelible impression on art, design, and architecture (Hodge, Wilkinson). Minimalist aesthetics in fashion manifests itself via assiduity for luxurious fabric, puritan plainness, details, and quality (Fogg, 2014) (Picture 7).

Maximalism

Maximalism was originated in reaction to the plainness of minimalism. For minimalism that sides with Mies Van Der Rohe's *less is more* philosophy, Robert Venturi retorted as *less is a bore*. The more minimalism is plain and simple the more complicated and excessive maximalism is. Minimalism that aims to get rid of every non-functional elements and that is purged from every kind of ornaments, is criticized for not reflecting personality features. Fashion and indoor designs in the 1980s took shape in line with personal preferences by extravagant items and eclectic designs that know no rules at all. Maximalism, without paying regard to any kind of rule, order, harmony, uses colors, patterns, textures, forms, and materials all together. Today, vivid colors, ostentatious forms and cuts, and any kind of excessiveness take stoutly place in fashion designs with maximalism. (Picture 8)

Futurism

Futurism started as an artist and author movement in 1909. In his futuristic manifest, Italian architecture Antonia Sant'Elia issues a call for a new brave structure understanding which is purged and backed down from ornaments and historical styles. Sant'Elia also asserts that futuristic architecture will take effect by using striking forms bravely and via sincere usage of modern materials like concrete, glass, and steel (Wilkinson, 2015).

The space-age period has unveiled a new futuristic view in product design, indoor architecture, and fashion. Fashion designers such as Paco Rabanne effectuated innovative space-age designs by gathering new materials and techniques together fashion and science (Fogg, 2014). (Picture 9)

Deconstructivism

With new stylistic creativity, theoretic foundations of architecture were characterized through the concept of Deconstruction in Jacques Derrida's literature field and Deconstructivism, a broad combination of Constructivism (Melvin, 2007). In deconstructivist architecture, experimental places challenging traditional space understanding, collecting concurrent aspects with disjoined forms and obscuring limits were produced

Deconstructivist fashion draws attention to the completed form of clothes, clothing element parts that generates the whole cloth and deterioration of this order as well as frisky tests on them. It shows generally invisible platforms that sustain the dress like forceps, tacking, interlinings, which are traditionally left hidden (Fogg, 2014). (Picture 10)

Constructivism

Constructivism with its appeal in the abstract style language of engineering products took place in experimental movements in the early 1920s that constituted modernism. Constructivism that exposes structure using concrete and steel, pioneered deconstructivist architecture in which extraordinary aspects and forms created new and provocative effects (Wilkonson, 2015). Strong and innovative forms were produced with the structural dynamism of buildings and clothes. (Picture 11)

RESULT

It is observed that in the past; styles, movements, manners, and tendencies fashioned were long-lasting while the world of fashion of today has a much more changeable and dynamic structure. As Baudrillard emphasizes (1970, 16):

> "We live the age of objects: what I mean is that we live according to the rhythm of objects and their nonstop comings. While durable objects, tools, or buildings of the past civilizations survived much more than many generations, today we can witness their birth, growth, and death."

In this fast cycle; if it is necessary to put it with the popular words of today, what was "in" yesterday may be "out" today. As stated by Davis (1992, 173); form has been shaped by collectivism and multi-forms in the world of design:

> "It is hard to find an answer to the comprehensive theoretical question in fashion as well as other fields of modern culture in which similar phenomena (for example; painting, architecture, recreational activities, health, and care) are seen why a macro cycle as a whole has been replaced by numerous and different micro cycles."

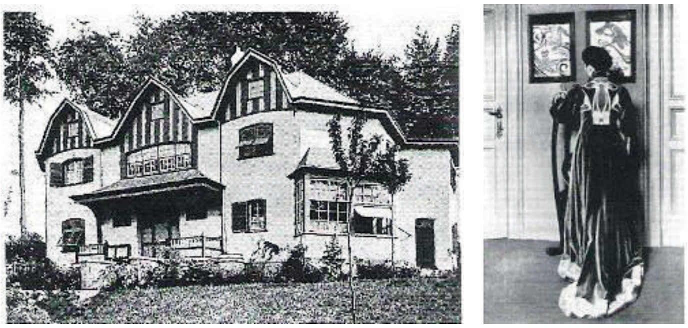
As emphasized by sociologists who investigate fashion and Simmel (1923, 44) who argues that change in the fashion is the criteria for blunt anger and the angrier an age is the faster fashions change; and therefore, change in today's fashion is much faster and therefore today's architects and designers are in search for originality and individuality. As a result of the fast-globalizing world and fast-consumption, original ideas that belong to a designer, artist, or architect may travel all around the world in a short time. Original ideas, materials, use of the materials, details, new forms, and patterns have been drawing attention in all fields of design and designs lead to interactions in spite of having different functions and being different levels and thus fashion that determines the spirit of the age is born with these interactions. It is hard to decide whether a design or idea or material will create only interaction or will remain fashioned as the fashion of the age by becoming more popular or will survive much longer and will be accepted by broader populations as a tradition. However; today's design objects seem to be more open to interaction with other design objects, having different functions and being different levels thanks to the effect of globalization and consumption.

As a result:

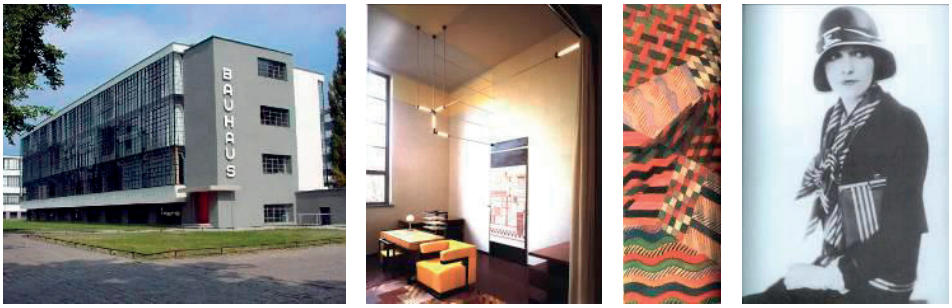
- When we evaluate the relationship between architecture, fashion, and design, it is possible to see interactions depending on architectural style and concept.
- It is possible to detect new and extraordinary forms, structural shaping, printing, color, texture, material, interactions with interdisciplinary relationships at every scale of the design.
- Fashion designs have turned into artistic works with their sculptural forms beyond being wearable. Also, these designs created an area in the literature defined as wearable art.
- At this point, it can be said that architecture has turned into a sculptural shell design that hides its function and has moved far from conventional forms.
- Science, art, social events, popular culture, technological developments, conceptual and formal configurations in different disciplines can simultaneously affect the world of fashion and design.
- Designers and architects can use many fields as inspirations. While fashion designers explain their inspirations, they often state that they are inspired by architecture and art. In this case, the interaction becomes much clearer.
- Recent fashion exhibitions, organized by curators on the axis of art, architecture, and fashion show that fine arts, architecture, and fashion are a rich source of inspiration and interaction for designers.
- In addition, design sites in social media draw attention to the interaction of fashion, art, and architecture, and associate various concepts with analogies.

Finally, when evaluating popular fashion magazines, websites, fashion designers, and simultaneous buildings of recent years, it is possible to say that art, design, fashion, and architecture create a rich source of interaction and ideas with interdisciplinary relationships.

IMAGES, CHARTS OR GRAPHIC LEGENDS

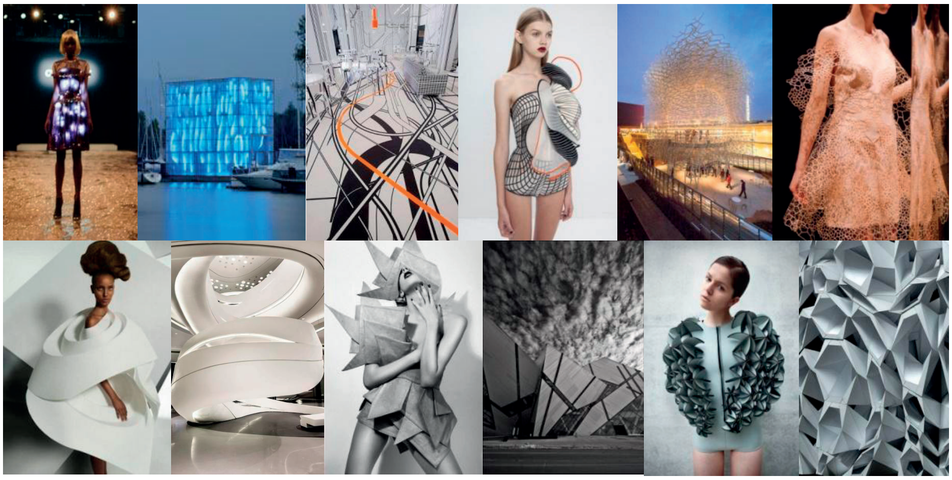


Picture 1: The house and dress designed for the landlady by Henri van de Velve, Bloemenwerf, Uccle, 1895 (Heynen, 2001).



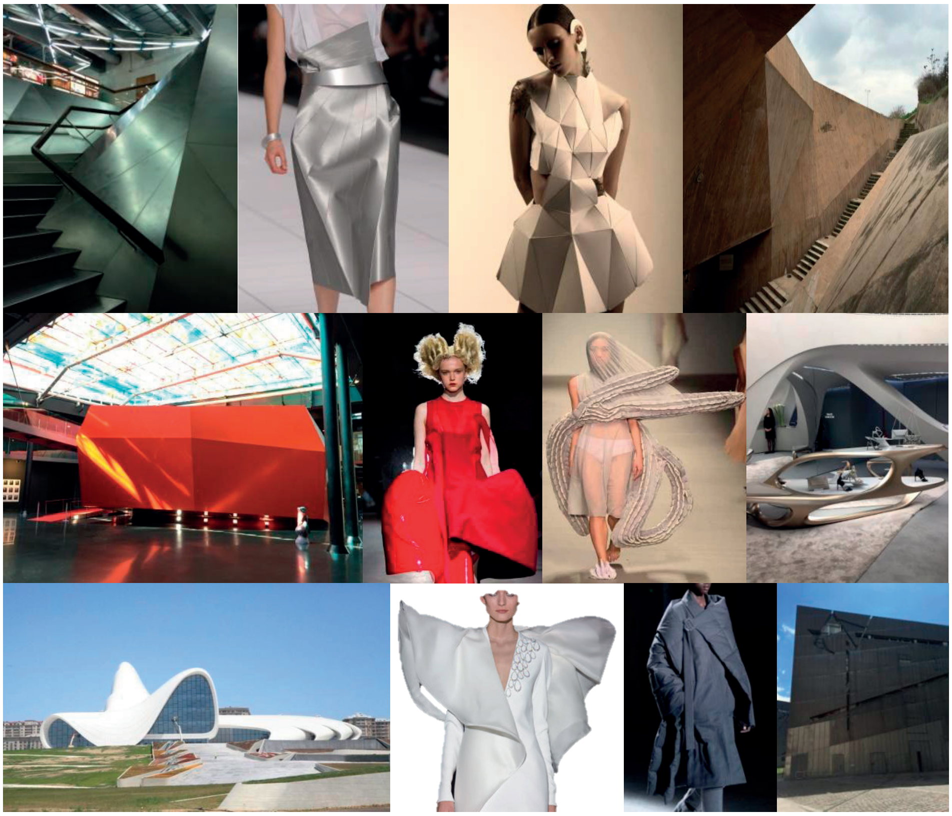
Picture 2: Bauhaus, Walter Gropius, Dessau, 1926 (URL-1); Gropius' office, Weimar, 1923; Bauhaus pattern design, 1927 (Engels and Meyer, 2006); clothes being simplifying at the same time period (Baudot, 2001).

Picture 3: Piet Mondrian, Red, Yellow and Blue Arrangement, 1920 (URL-2); Rietveld Schroder Hoıse, Gerrit Thomas Rietveld, 1924, Netherlands (URL-3); Jersey dress by Yves Saint Laurent, Winter 1965 (URL-4)



Picture 4: Interdisciplinary interactions: Technology, Print, Material, Form, and Texture (URL-5-16).

Picture 5: Walt Disney Concert Hall, Frank Gehry, Los Angeles, 2001(URL-17); the costume of the artist (Habertürk, 2010); Zaha Hadid's work as the inspiration by Judy WU collection (URL-18)



Picture 6: Today's fashion concepts: CaxiaForum, Herzog de Meuron, Madrid, 2008 (personal archive); Issey Miyake, Spring, 2014 (URL-19); Geometric fashion (URL-20); Urban stairs, Toledo, Elias Torres Architecture, Toledo (personal archive); Macro Museum, Odile Decq, Roma, 2007 (personal archive); Comme des Garçons, Spring 2015 (URL-21); London Fashion Week, Winter 2015 (URL-22); Shoe Store, Zaha Hadid, Rome, 2014 (personal archive); Heydar Aliyev Center, Zaha Hadid, Bakü, 2013 (personal archive); Stephan Roland, Spring, 2018 (URL-23); Dries Van Noten, Fall, 2019 (URL-24); Jewish Museum, Daniel Libeskind, Berlin, 1999 (personal archive).

Picture 7: Minimalism: Shoe Store, Rome (personal archive); Minimal Fashion (URL-25); Minimal Design, Leonie Barth (URL-26); Ara Pacis Museum, Richard Meier, Roma, 2006 (personal archive).

Picture 8: Maximalist design and fashion: Quai Branly Museum, Jean Nouvel, Paris, 2006 (personal archive); Junya Watanabe, Spring 2015, (URL-27); Marni, Fall, 2016 (URL-28); Desigual, Madrid, (personal archive).

Picture 9: Futurist design and fashion: Skyfall House, Marentes+Partners Architects, Mexico, (URL-29), 2018; Iris van Herpen, Winter, 2018, (URL-30); Giles Deacon, (URL-31); Louis Vuitton Foundation, Frank Gehry, Paris, 2014 (Photo: Birsen Enisoğlu).

Picture 10: Deconstructivist design and fashion: MAXXI, Zaha Hadid, Rome, 2009 (personal archive); (URL-32); Mugler, Fall 2012, (URL-33); Klein Bottle House / McBride C. Ryan, Australia, 2008 (URL-34)

Picture 11: Constructivist design and fashion: Athens Olympic Arcades, S. Calatrava, Athens, 2004 (personal archive); Jean Paul Gaultier, (URL-35); Pam Hogg, Spring 2013 (URL-36); TGV-Station, Santiago Calatrava, Lyon, 1994 (URL-37)

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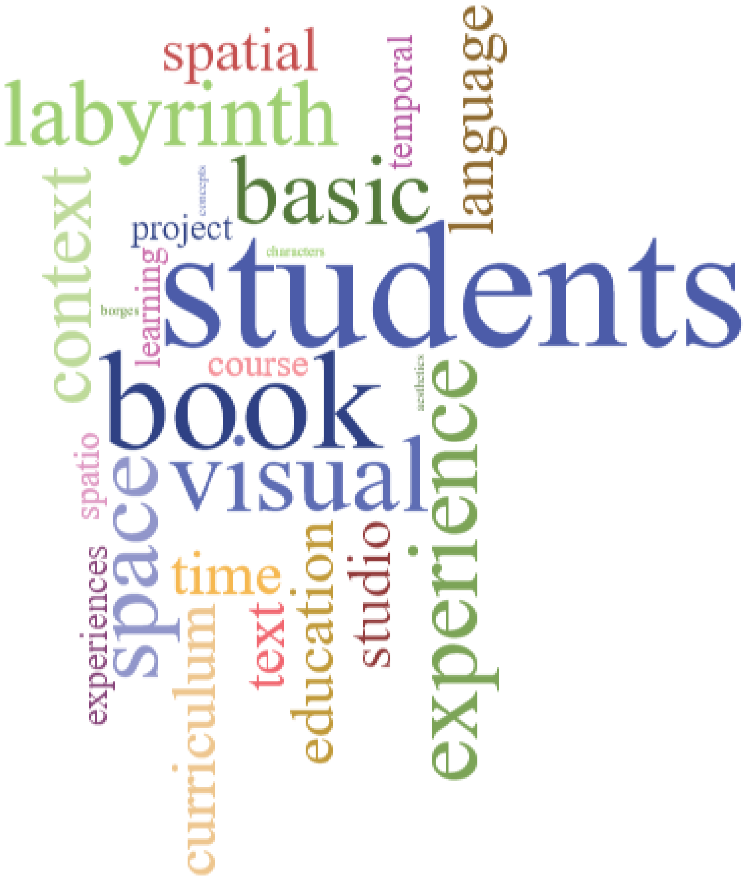
CHAPTER III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MATERIALIZATION OF LITERARY SPACE THROUGH ARCHITECTURAL EDUCATION

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ABSTRACT

Departing from the strong interdisciplinary aspect of architecture, this panel dwells on the possible diverse uses of literature and literary analysis in architectural education. Literary fiction has its own methods and tools to investigate the spatial realm and borrows elements from that realm. But how does the architecture look into literature and materialize it? In this respect, the educational realm of architecture is considered as an efficient medium to question this relationship through its pedagogical instruments. In the educational territories, literature can be employed as a textual medium to reveal the potentials of creativity of architecture students. The aim of this panel is to convey several examples that intended to establish an innovative link between architecture and literature where students were asked to search the sources of inspiration in literary texts in different design studios at different institutions in Turkey. The intention was to encourage students of indirect visual interpretations of the spatial elements of the environment described in the chosen literary works; thus, to stimulate their creativity. In all of the papers, the main keyword of employing literary analysis in architectural education is "translation" or "conversion" from one realm that is purely textual to another realm that is mainly physical. As a result, "knowledge" enclosed within the disciplinary frontiers of literature is reproduced and dispersed into the pedagogical section of the architectural realm.

KEYWORDS

Literary fiction, literary space, materialization of literary space, architectural education

Introduction

The most important reason for the interdisciplinary study is that the disciplinary boundaries are not sufficient enough or that they form some boundaries for structuring some knowledge. Interdisciplinarity gains meaning when answers are found in a different discipline that one discipline cannot supply (Fuller, 2007). Architecture has a strong interdisciplinary content in terms of scholarly research. This is to find a more powerful and stable reference system for itself. As stated by Süveydan (1999), traveling into other disciplinary realms has long been the essential prerequisite of architectural theory in terms of opening up the plurality of several prospects. The objects that form the discipline of architecture, whether a building, a practice, a discourse, or all, have been discussed extensively. It might be proposed that architecture, besides the apparent concrete production of it, has a strong aspect which is related to language, namely the discursive aspect of the discipline. As Nesbitt (1996: 16-17) states, "in the process of associating architecture with other disciplines after the 1960s, there has been much concentration of space as a direct text and/or reading of it through literary texts about the production of knowledge related to space". Kristeva (1980) also generalizes the theoretical agenda of the postwar period with emphasis on the power of language by stating that the sixties witnessed a theoretical ebullience that would be summarized as the discovery of the role of language in all human sciences.

One may question why literary analysis is being employed more commonly in the medium of architecture today. With the wider acceptance of the interdisciplinary situation in all fields of science, the frontiers began to melt, the definitions of "discipline" diversified, disciplines began to be recognized that richer solutions could be produced to the problems identified in the scientific field.

On the basis of an interdisciplinary approach, the employment of literature and literary analysis in the architectural realm can be considered in diverse components of architecture; namely architectural education, architectural research, or architectural practice. In the educational territories, literature can be used as a textual medium to reveal the potentials of creativity of students of architecture. This method can be considered to serve as a novel method within the boundaries of architectural design education. The aim of this panel is to convey several examples that intended to establish this innovative link between architecture and literature where students were asked to search the sources of inspiration in literary texts in different design studios at different institutions in Turkey. The aim was to encourage students of indirect visual interpretations of the spatial elements of the environment described in the chosen literary works; thus, to stimulate their creativity. As stated by Antoniades (1992), it is possible to develop students' fantasy and imagination through architectural exercises that depend on metaphoric departures as a channel to architectural creativity.

Employment of Literature in Architectural Realm

As Stein et al. (1990) propose, "to bridge the gap between architectural research as merely a technocratic means to an end and as a reflection of ourselves as progressive social beings, we have to give up the modernistic idea that architectural research must be based purely on the scientific model" (p. 14) and have "to consider literature and art". This methodology is also justified by Havik (2006: 37) as follows:

> *After all, the relationship between humans and their environment, one of architecture's raisons d'etre, is often described with great accuracy and detail in novels and stories. I would argue that literature, in fact, provides essential information about the way in which space is experienced, about the role of time, about the role of memory and imagination. If existing literature can provide such insights, a literary approach using instruments from the literature should also be conceivable within the domain of architectural research.*

The necessity and significance to view language derive from its richness to show us things that do not exist. Language presents us with some realities that we never experience. So through language, we are transported to other realities. The importance of the role of literary texts within architectural/urban research is explained by Thomson (1996: 321) as follows:

> *Our physical experience of architecture is apparently finite – bound by such constraints as time, place, and mobility. But literature offers us the opportunity to inhabit much different architecture in many different times and through this serves to strengthen our understanding of the chief poetic resonance of architecture – its latency, it's capacity for shadowing forth the invisible and the illusory. This idea of latency is really the key to framing the portal between literature and architecture.*

As suggested by Tümer (1981), writers are sensitive people who make good observations. While conveying people's situation they also consider their spatial relationships. And also, literary texts are primary sources read without the prejudices of the writer on space. Tümer (1981) resembles this research method to the reference scanning of the historians from the primary sources. Similarly, Thompson (1996, 321) states: "*Our individual interpretation of space and place is endlessly dynamic and subjectively charged with our own perceptions. A writer can offer us another experience of space – another point of view, no less subjective, but outside our own, and charged with a different perception*".

Literary fiction can be regarded as a rich medium where the materiality of architecture can be found as textual translations. It is the medium where spaces are verbally represented. Although there is concrete materiality offered to direct experience in architecture; that is, they are defined by the non-representative, contrary to literature; the reciprocal relationship between architecture and literature is quite obvious. In line with the interdisciplinary interaction and the production of disciplinary knowledge, the literary text is seen as a source that architectural discipline has the potential to interact and enrich its knowledge from this medium making use of its richness to illustrate things that do not exist and to present some realities that the reader has never experienced. In other words, literature has a greater scope to direct our experience from the "as-is" to the "as-if".

Four essential elements of literary fiction are time, space[1], character, and plot. Writers used architecture as a narrative allegory for the purposes of character definition, symbolization, and contextualization. As stated by Tally (2013), today, spatiality has become an inevitable and often valuable concept for a number of critics working in current literary works. It is not wrong to state that the significance of "spatial" content does not go back too far considering the fact that the concept of time and history was at the forefront in the nineteenth century.

There is a discursive exchange between architecture and literary fiction in terms of representation, discourse, and language, formal analogies, influence, and inspiration (Mungan, 2017). Regarding this, Mungan (2017) establishes a structural analogy: Architectural metaphors are often used to describe literature, as in the architecture of the novel. Similarly, in any architectural project, there is a usual narrative structure: e.g. a sequence of spaces, surprises and suspensions, hierarchies of space and function, and so on[2].

Literary Analysis in the Educational Realm

Literary analysis can be offered as a legitimate methodology for architectural research (Tuna Ultav, Çağlar, Durmaz Drinkwater, 2015). This research methodology can contribute to both the educational and practice-based realm. In the educational domain, the results of Literary Analysis, i.e. research papers, reports, theses, and critiques of architectural theories, can be instrumental as a part of educational programs through seminars and/or workshops. Architectural historians

1. It is possible to cite certain writers associated with certain cities: Joyce with Dublin, Dickens, and Woolf with London, Zola and Balzac with Paris, Kafka with Prague, Gogol with St Petersburg, Pamuk with İstanbul.
2. In fact, this analogy is made very much between music and architecture since both are structural compositions.

can utilize Architectural Literary Analysis in their presentation of verifiable periods and styles, or potentially the analysis of these periods as a valuable source to the "vocabulary of specialist knowledge", which is "formal and constructional" (Shonfield, 2000). The results of Architectural Literary Analysis can likewise give inspirational spatial portrayals to architectural studio courses. Literary fiction has its own methods and tools to investigate the spatial realm and to borrow elements from that. But how does the architecture look into literature and materialize it? In this respect, the educational realm of architecture is considered as an efficient medium to question this relationship through its pedagogical instruments.

When two disciplines are taken into account together, they create a variety of meanings rather than they can themselves do. The tool that will reconcile both disciplines is their common meanings. Creating meaning from the texts is defined by linguists (e.g. By Barthes) as a reader activity. According to Emmot, although we rarely realize what we do when we read a text is to try to gain meanings from the texts. The reader establishes hidden relations, fills in the blanks, and makes deductions. In order to make this s/he must have a pre-knowledge. Text is something given to the reader for him to establish the meaning. Barthes (1967) suggests that the meaning is produced by the reader because s/he combines further meanings rather than put forward by the author. Fowler (1977: 25) repeats this idea as:

> *And without contradiction, the reader is the producer of meaning since he, as much as the writer, is a repository of the culture's linguistically-coded values, and has the power to release them from the text. Among other values, the reader creates an image of the author's voice, and of other voices, supplanting the discourse of the author within a conventional voice comprehensible within the community's shared expectations.*

The fictional realm is fragmented. The spatial dimension in fiction is formed by the power of words; must be completed and developed with the imagination of the reader as literary space defined by Jahn (2000) as "the spatial environment and the inventory objects created in the reader's imagination on the basis of incomplete textual cues" (as cited in Bolak, 2000: 9). At this point, it is also important to ask how we complete incomplete textual cues as architects and how is it different from other disciplines for the architectural discipline.

This panel aims to portray the potentials of the use of literary analysis in architectural education[3]. The first two papers discuss the fundamental level of design education that is "basic design" where notions of creativity and design thinking are to be conveyed to students efficiently. Basic design students are closer to

3. Using this method as an educational tool is becoming more widespread. It is important to cite "The Laboratory of Literary Architecture", which defines itself as "a cross-disciplinary exploration of narrative and Space", addressing those who are interested in literature –from high school through graduate school and beyond".

dealing with language since they are into figuring out creating meaningful design works out of a language, they come across recently. The third paper in this panel discusses literary analysis in the upper-level studios of architectural design education. The fourth one discusses literary analysis at the graduate level. In all of the papers, the main keyword of employing literary analysis in architectural education is "translation" or "conversion" from one realm that is purely textual to another realm that is mainly physical. The translation may occur on different layers: Translation from textual to textual or from textual to visual. While realizing this translation, "representation" is employed as the second keyword.

In the first paper, students' task was to imagine and build the fictional building in the novel The Time Regulation Institute (*Saatleri Ayarlama Enstitüsü*) (1961) by Ahmet Hamdi Tanpınar (1901-1962), a renowned figure in Turkish literature of the twentieth century.

The second paper displays basic design students' ability to make the translation from two different realms: the first one was based on Invisible Cities (1972) by Italo Calvino (1923-1985), because of its essentially recognized position within the architectural realm; and the second one was based on a film, Nightmare before Christmas (1993), by Tim Burton (1958-…). Both selections owed much to their linguistic or visual potentials in providing students a rich textual or visual atmosphere.

The third paper explains the experience of establishing design strategies so as to reflect the mood in the novels of Kafka (1883-1924), Borges (1899-1986), and Pamuk (1952). Metaphors were significantly employed as tools of this translation. The challenge was that the translation is not sought in a direct one from the text of the author to the architectural medium, that is the building; but rather from the fictional narrative to the architectural one. This sort of translation enabled students' creativity in narrating and preventing them from referring to direct formal references.

The fourth paper is based on an exercise of students' translation of the text of Book of Places (*Beldeler Kitabı*) (2003) by Faruk Ulay (1957-…), into a three-dimensional collage/assemblage and re-narrate it in the Architectural Narratives course.

Conclusion

Although an interdisciplinary approach aims to stretch disciplinary boundaries, it needs boundaries of its own to protect its free-ranging activities (Fuller, 2009). The papers of this panel seek to answer the question to which original answers can be found within the frontiers of the so-called fruitful relationship between architecture and literary fiction in the specific field of architectural education. The goal is enriching the creative thinking process in design studios through an innovative method of integrating literary texts into these processes.

Although there are several other studies that analyze spatial narratives in novels through the lenses of architecture, one can hardly find any comprehensive theorizations of the relationship between architecture and literary fiction (Tuna Ultav, Çağlar, Durmaz Drinkwater, 2015). The problem in the architectural side of this relationship is that methodological tools can hardly be revealed and that there are no recognized methodological models. Our answer to this problem is that the education realm is an efficient medium where learning outcomes of several courses –whether it is a studio course or a theoretical one– can be met through a creativity generator literary analysis practice as opposed to conventional methods.

In this study, literature was put forward as a textual repertoire, which is regarded to able to enhance the relationship between literary fiction and materialized spaces, creating new practices of understanding penetrating into the layers of meaning of spaces (Uz Sönmez, 2007). This methodology is to limit our area of research not to the texts of professionals, namely architects, but to literary texts to avoid pre-knowledge and prejudices of professionals (Tümer, 1981). So in this case, it is possible to reach subjective evaluations and expand architectural/pedagogical perspectives. As a result, "knowledge" enclosed within the disciplinary frontiers of literature will be reproduced and dispersed into the pedagogical portion of the architectural realm.

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DOES FORM FOLLOW TEXT? ON THE IMPOSSIBILITY OF BUILDING *THE TIME REGULATION INSTITUTE*

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ABSTRACT

This paper tells the story of a workshop developed for first-year architecture and design students, which challenged its participants to "build" the fictitious building described in Ahmet Hamdi Tanpınar's famous novel, The Time Regulation Institute by means of transferring its literal descriptions to the visual field. In this paper, I first situate the book within the political and cultural context in which it was written. Then I briefly talk about the storyline, focusing on the last chapter in more depth, before giving a brief description of student works. I argue that the last chapter of Tanpınar's book plays with the idea of an actual spatial construct through the interior/exterior divide at the same time as alluding to more abstract concepts (such as modern bureaucratic organizations), which makes the story a rich resource for a design studio exercise. Finally, the paper discusses how to mobilize such creative interactions between architecture and literature by exploring the possibility of using such workshops or elective courses as an imaginative pedagogical tool integrated within the core curriculum.

KEYWORDS

Architecture education, literature, representation, The Time Regulation Institute, Ahmet Hamdi Tanpınar

Introduction

Ahmet Hamdi Tanpınar is one of the most celebrated names in the history of modern Turkish literature. *The Time Regulation Institute* (*Saatleri Ayarlama Enstitüsü*) is his last and "most complex" novel.[1] It was first published in 1961 in Turkish, but with its recent English translation, the attention that the book received has increased significantly, both in and beyond Turkey, much to the joy and happiness of its dedicated readers.[2] The author of this paper is no doubt one of them. When I first read the book, I was fascinated by its undeniable wit and charm, and by its satirical review of Turkey's experience with modernization. Through subtle ridicule of a fictitious institution that serves no sensible purpose, the novel cleverly illustrated the absurdity of believing that "newness" alone was and had a value in itself.[3]

But as an architect and architectural historian, I was most particularly drawn to the last chapter, which has much less been the subject of literary conversations.[4] In this chapter, Tanpınar ventures into "building" the Institute.[5] After reading it the first time, I suspected how the main character imagined and described the building might not make much sense in real life (since some of the parts did not seem to come together or the design solutions sounded "absurd"). In my other, subsequent readings of the Turkish original and the English translations, I found it more plausible, since this obviously was not a building manual *per se*, but a work of fiction and certain ends could be met with added imagination by the reader. But, even so, an important question persisted: did Tanpınar mean his incredibly detailed narrative, which included clear formal descriptions, to be actually built in the first place? Was this perhaps another way of showing the absurdity of the Institute and the futility of its existence and (lack of a proper) function, and therefore the tragedy behind its "impossibility"?

This question of "impossibility" prompted me to read this chapter in more depth by designing a three-day workshop for the first-year design students at İzmir University of Economics (2012-2013). My question to the participants of this brief workshop was the following: how can we "build" the Institute by translating

1. Ahmet Hamdi Tanpınar, *Saatleri Ayarlama Enstitüsü* (Istanbul: Dergâh Yayınları, 2019); "About the Authors and Translators", in Ahmet Hamdi Tanpınar, *The Time Regulation Institute*, translated into English by Ender Gürol (Madison, Wisconsin: Turko-Tatar Press, 2001), ix.
2. Ahmet Hamdi Tanpınar, *The Time Regulation Institute*, translated into English by Alexander Dawe and Maureen Freely (New York: Penguin Classics, 2014).
3. Recently, several new essays have brought fresh perspectives for the understanding of Tanpınar's motives in writing this book. Please see, for instance, Özen Nergis Dolcerocca, "Free Spirited Clocks": Modernism, Temporality and *The Time Regulation Institute*, *Middle Eastern Literatures* 20.2 (2017): 177-197.
4. The following two studies put an emphasis on architecture: Nergis Ertürk, *Grammatology and Literary Modernity in Turkey* (Oxford: Oxford University Press, 2011), "Time Regulation Institute: Dwelling in a Mechanized Language", 111-134; Ertan Engin, "Ahmet Hamdi Tanpınar'ın Romanlarında 'Resim' Ve 'Mimari'" [Painting And Architecture in Ahmet Hamdi Tanpınar's Novels], *Uluslararası Sosyal Araştırmalar Dergisi - The Journal of International Social Research* 2.8 (Summer 2009): 162-168.
5. We learn later in the book that İrdal's project gets built.

it to a different design medium and using visual tools? The assignment explored the creative possibilities that the book's last chapter provided and encouraged the participants to brainstorm on the possibility of "translation" from the realm of literature to the visual. Since then, I have continued thinking about this work of fiction as a potential teaching material, and I currently work on designing an elective course, which will provide more time to reflect on Tanpınar's book (or similar other books) and reconstruct its narrative with the use of supporting readings.

This paper ends with the story of this workshop and a brief description of student works. The main question it seeks to open to discussion is how we can learn from and mobilize such experiences as an imaginative pedagogical tool in schools of architecture and design, not only as an external activity but also as part of the core curriculum? But to accomplish this, I first situate the book within the political and cultural context in which it was written. Then I talk briefly about the storyline, focusing on the last chapter in-depth and the interior/exterior divide that lies at the core of the imagined institute building.

Background: Setting the Time of the Modern

Following the proclamation of the Turkish Republic in 1923, a series of cultural reforms were put into place. These included the adaptation of time to Western standards. For instance, the Islamic calendar was replaced by Europe's "universal" (Gregorian) calendar, weekly holidays shifted from Friday to Sunday, and the working schedule was redesigned accordingly.[6] The alphabet was changed to Latin from Arabic, and the dress code in public service was Europeanized for both genders.[7] Ankara, the new capital city became the testing ground for the implementation of these reforms. Numerous foreign and European trained Turkish architects played a role in its development.[8] With various new institutions, the city "brought visual as well as official dimensions into the enterprise of modernization."[9] Similar to other modern cities, its rhythm was to be "measured by clock and calendar."[10] In the minds of the governing class, Ankara also represented a complete break from the Ottoman past. As the administrative, economic, and cultural center of the Ottoman Empire for centuries, Istanbul had now fallen out of fashion. To the newly established republic, the urban makeup of the city symbolized its imperial

6. Erik-Jan Zürcher, *Turkey: A Modern History* (London, NY: I.B. Tauris, 1994), 195-196.
7. Ibid., 195-200.
8. See, Sibel Bozdoğan, *Modernism and Nation Building: Turkish Architectural Culture in the Early Republic* (Seattle, WA: University of Washington Press, 2001).
9. Nilüfer Göle, *The Forbidden Modern: Civilization\Veiling* (Ann Arbor: University of Michigan Press, 1996), 69.
10. Benedict Anderson, *Imagined Communities* (London: Verso, 1993), 24.

and Islamic past, and the governing elite sought to build a model that would replace this imagery.[11]

For Abdülhak Şinasi Hisar, a Turkish novelist, Ankara was "superior" to other cities because of "its newness and its always being the newest."[12] The obsession with the new, however, also created an interesting tension in the minds of the intellectuals at the time. For instance, Yakup Kadri Karaosmanoğlu, in his famous novel, *Ankara*, took a close picture of the city in the late 1920s and early 1930s. His illustration of the architectural changes in the city center exemplifies an approach common to many of his contemporaries. He applauds the arrival of modern architecture, immediately replacing the "exotique" and imitative styles of the early years.[13] Yet, some other developments were upsetting for Karaosmanoğlu: there was a lack of consistency between the modern exteriors and the "degenerate", distasteful, "rococo" style decoration of the interior spaces.[14] The author's emphasis on the discord concerning the exterior and the interior of homes implies the existence of two different choices of taste, one fulfilling what is "modern", fashionable, and therefore proper, and the other is what people do out of habit, reflecting their individual positions and perhaps even "temporalities."

The narrative of Tanpınar's book is set in Istanbul, not in Ankara, but the story of a fictitious modern bureaucratic institution may easily be situated within the framework outlined above. Furthermore, the issue of irreconcilability between the interior and the exterior also becomes central to Tanpınar's novel when the institute is to be designed.

The Time Regulation Institute: Building the Notion of Time

Penguin Books has announced the new English translation of *Saatleri Ayarlama Enstitüsü* on their website with the following words:

> *At its center is Hayri Irdal, an infectiously charming antihero who becomes entangled with an eccentric cast of characters … at the Time Regulation Institute, a vast organization that employs a hilariously intricate system of fines for the purpose of changing all the clocks in Turkey to Western time… the story of Hayri Irdal's absurdist misadventures plays out as a brilliant allegory of the collision of*

11. Çağlar Keyder, "The Setting," in *İstanbul: Between the Global and the Local*, ed., Çağlar Keyder (Lanham, MD: Rowman & Littlefield, 1999), 3–10.
12. Abdulhak Sinasi Hisar, "Ankara'nın Güzellikleri", 1933, in A. Esat Bozyiğit (ed.), *Ankara'nın Taşına Bak: Türk Yazınında Ankara* [*Ankara in Turkish Literature*] (Ankara: Kültür ve Turizm Bakanlığı, 2000), 59.
13. Yakup Kadri Karaosmanoğlu, *Ankara* (Istanbul: İletişim Yayınları, 1991), 118.
14. Ibid., 118-119.

tradition and modernity, of East and West, infused with a poignant blend of hope for the promise of the future and nostalgia for a simpler time.[15]

This is an inevitably simplified description, but it conveys to the reader one of the most common interpretations of the book. My aim is not to offer a full or an alternative review of this masterpiece. However, providing a brief additional account of the story would surely be useful. The book has four main chapters and whereas the story sets off during the late Ottoman period, it continues in the early years of the Turkish Republic. The storytelling is done by a narrator who is one of the main characters of the book – the so-called deputy director of the Time Regulation Institute, Hayri İrdal. But the Institute itself is the creation of "Halit the Regulator" (Halit Ayarcı), a decidedly modernist figure who believes that "when there is new there's no need for any other merit."[16] For instance, when asked a question on the issue of function, he claims that the Institute "will create its own function!" [17] We later learn in the book what this function would be:

… We can assume that the institute has been established. There remains now for us to know what our occupations will be."
"You can't be serious. We are going to regulate watches.[18]

The same "approach" goes with the issue of employment. In İrdal's account, this is how Halit the Regulator explains according to which criteria the hires would be made:

Halit Bey opened a small notebook which he frequently consulted to give explanations. Given the fact that it was meant to be a full-fledged institution that had just launched on a study of social life based on ultramodern methods, he expounded upon the dire necessity of creating new posts that engage the relevant personnel.[19]

In another instance, Ayarcı comments that "an empty office or meeting room will find its own function, much in the way that a civil servant's function is guided by its title."[20] The idea of a complex bureaucratic organization with different branches and crowded staff, but without a "real" function, however, is absurd. Perhaps for Tanpınar then, as many of its readers have pointed out, the institute's main function in the book is to make an allegory; it is an elevated criticism of the blind

15. Penguin Books, "The Time Regulation Institute, Ahmet Hamdi Tanpınar," accessed February 7, 2020, https://www.penguin.co.uk/authors/59893/ahmet-hamdi-tanpinar.html.
16. Tanpınar (2001), 202.
17. Ibid., 323; 241.
18. Ibid., 241.
19. Ibid., 214.
20. Tanpınar (2014), 383.

pursuit of westernization as a matter of fashion and without really understanding what it entails.[21]

Building the Institute: Form over Function?

What inspired the author of this paper to think about the "translatability" of text into the visual, and how to use it as a pedagogical tool, was the last chapter of the book. Tanpınar called this chapter, "Every Season Has an End." It is where İrdal imagines the Institute, which is then built following his design. His decision to involve comes after the competition to embody the "most modern establishment of the world"[22] does not result in the desired outcome. So, İrdal takes the matter into his own hands. The difficulty none of the architects are able to properly tackle is that the competition brief requires both the interior and exterior to be "in an original and new style" and "suit the modern nature and name of the Company."[23] With each new project submitted, Ayarcı asks the same question to the architects: "In what way did you express the essence of timepieces, or of time and regulation, in the building's interior?"[24] The brief thus forms a direct analogy between time, measure, and architecture and challenges the entrants to "incorporate the idea of the clock into the very structure of the building."[25]

Then İrdal gets to work with the help of his teenage son with whom he has a strained relationship and is desperate to mend bridges. They spend days building an amateurish model using "hundreds of matchboxes."[26] What makes this text an even more valuable resource for a design workshop is that İrdal's account of the proposed building is meticulously detailed. Yet, these descriptions are also hard to follow at times and even abstract, and some of the solutions İrdal proposes for the design problems encountered during the process sound relatively vague. For instance, the following passage, which explains the relationship between some of the twelve pavilions, different floors, and the staircases, reads like one of the illusionistic drawings of M. C. Escher:

> *But instead of designing internal stairs leading from one floor to the next, I arranged for the stairs leading up to the second floor to come from the five o'clock pavilion, with those leading up to the third floor originating from the seven o'clock pavilion. Thus, two sets of stairs encased in glass – one*

21. Berna Moran, "The Time Regulation Institute, A Critical Essay", translated into English by Zekeriya Başkal, in Tanpınar (2001), 1, 6.
22. Ibid., 306, 320.
23. Ibid., 306.
24. Tanpınar (2014), 369.
25. Tanpınar (2001), 307.
26. Tanpınar (2014), 380.

relatively shorter than the other, which was less direct – connected the six o'clock pavilion to its neighboring pavilions.[27]

The difficulty of actually constructing the institute building is acknowledged by Tanpınar within the narrative. İrdal complains that although he receives lots of praise for the innovativeness and eccentric character of the design, because of the requirements of the competition brief (to which he contributed) he found himself in an "awkward situation, only to be forced to invent a compendium of absurd architectural innovations to suggest the inside and outside of a clock."[28] Further, practicing architects receive the project poorly, citing potential issues with the construction, and engineers are reluctant to take the responsibility of supervising the site and even to "calculate the required amount of reinforced concrete."[29]

The Workshop and Student Works

The dialogue and creative interactions between texts and spaces have been the subject of scholarly research in both spatial and literary accounts. More recently, the so-called "spatial turn" in literary studies opened more venues for cross-disciplinary interests, especially with modernity as a binding theme.[30] But, independent from scholarly works, imaginative texts have always inspired design educators as teaching tools. For instance, Umberto Eco's essay, "On the Impossibility of Drawing the Map of the Empire on a Scale of 1 to 1" could be read as an intellectual (design) exercise that puts the idea of a map (and that of representation) into question.[31] *Invisible Cities* by Italo Calvino, who is another well-known imaginative writer, has been a popular exercise-book in architecture schools worldwide for it inspired students to think further on the interchangeability between literary descriptions and architectural drawings or 3D models.[32]

The two texts mentioned above had a considerable impact on how I designed the workshop, and before all else, I wanted the "translation" to be inventive. İrdal's account of how the Institute came together was puzzling, which, lucky for me, made it very difficult for the students to go after straightforward, direct importations. One other factor which increased diverse outcomes was that although the

27. Ibid., 379.
28. Ibid., 380; 384.
29. Ibid., 384.
30. See, for instance, Robert T. Tally Jr., *Spatiality* (London and New York: Routledge, 2013); David Spurr, *Architecture and Modern Literature* (University of Michigan Press, 2012).
31. Umberto Eco, *How to Travel with a Salmon & Other Essays*, trans. William Weaver (New York, San Diego, London: Harcourt Brace & Company, 1994), 95-106.
32. Italo Calvino, *Invisible Cities*, trans. William Weaver (San Diego, New York, London: Harcourt, 1974).

participants were all basic design students, they studied in different design disciplines – Architecture, Interior Architecture and Environmental Design, Industrial Design, Visual Communications Design, and Fashion Design. The description read like the following:

> In this workshop, we will read excerpts from the last chapter in Ahmet Hamdi Tanpınar's famous novel *The Time Regulation Institute* (*Saatleri Ayarlama Enstitüsü*) and begin transferring the literal descriptions in Tanpınar's book into the visual realm. First, each student will make sketches of this imaginary Institute. The next step will be to use one of the methods of representation (i.e., freehand drawing, collage, montage, or assemblage) to reimagine any aspect of the institute (such as the interior, exterior, the people who "work" in it, the colors used, the texture on the surfaces, and light). You can also build architectural models. In the end, we will exhibit the works ranging from 2D to 3D representations.

I also provided the students with a list of items to be obtained before the first day of the workshop, encouraging them to use recycled material. Since the workshop did not impose any medium or method of producing, I tried to keep the contents of this list as much list as flexible.

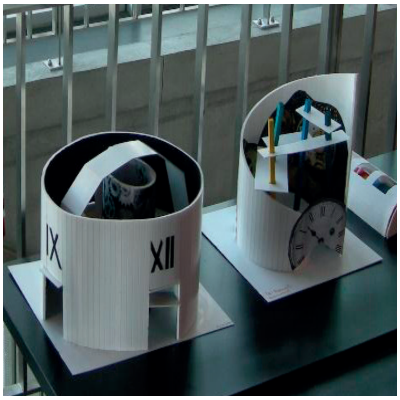
The final products were varied, and the time limit had an impact on their completion. Most of them worked with models or thick cardboard rather than making drawings. None of the students attempted to really "build" the Institute in its spitting image, but some followed the "manual" to some extent: one group wanted to give their work a realistic impression and made a rendering. Another group was able to give form to some of the main elements described in the text, especially in the exterior (Fig. 1). Yet, most participants dwelled on the concept of time and temporality. One group thought this story to be a "stage" of events unfolding through time (Fig. 2). One other group took on the issue of repetition, and the inevitable cycle of time and life, and came up with a box with mirrors that reflected the numbers found on a clock (Fig. 3). There was one clock mechanism, which apparently would not work because all parts including the hour wheels were fixed to one another (Fig. 4). And finally, one Fashion Design student designed a dress of her liking – dress is a "regulator" of the body after all.

Conclusion: Building a Narrative of a Building

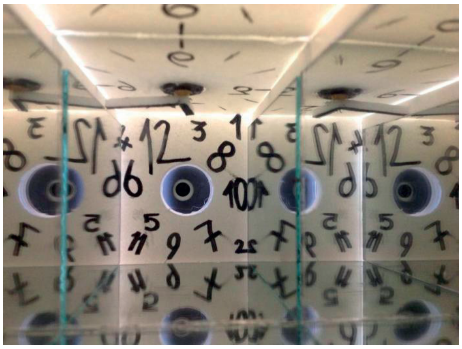
Christine Boyer once wrote that "Every discourse sets up a spatial order, a frozen image that captures the manner in which the transitory present is perceived."[33] Yet how can we capture the spatial order that Tanpınar's narrative set out to build? In this case, part of the main story is constructed directly through the descriptions of a building, and a series of spaces in it, in architectural terms: The last chapter of the book plays with the idea of an actual spatial construct but in fact alludes to more abstract concepts (such as modern bureaucratic organizations), which makes the story a rich resource for a design studio exercise. The ambiguity of function, as well as the complexity and eclectic character of the building described, compel students to read it not literally, but with added imagination.[34] In doing so, the story minimizes the likelihood of "copying" the content and simply transferring it into familiar forms of architecture. To "build" the Institute in a visual medium, students first need to build an additional representational realm where they imagine and make sense of it. At this "interface", textual description and architectural forms will then meet and engage in a dialogue. *The Time Regulation Institute* provides one such interface through which cross-fertilizations between architecture and literature can be adopted as a creative learning tool, beyond the conventions of design education.

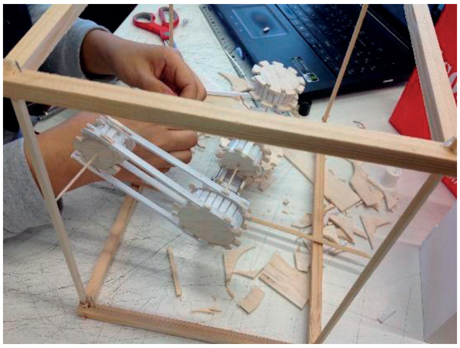
33. M. Christine Boyer, *The City of Collective Memory, Its Historical Imagery and Architectural Entertainments* (Cambridge, Massachusetts, London: The MIT Press, 1998), 32.
34. Such direct "translations" are harder to avoid if a text provides very naturalistic descriptions of a place or building.

IMAGES, CHARTS OR GRAPHIC LEGENDS



Images 1 and 2: Student works from the workshop, IEU (2012).





Images 3 and 4: Student works from the workshop, IEU (2013).

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VIEWING TEXT AND READING IMAGE: PROPOSAL OF A NEW TRACK FOR BASIC-DESIGN STUDIOS

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ABSTRACT

Basic-design education in architecture schools corresponds to the core/compulsory course-set in the first-year curriculum, and have equal importance in design learning. Tendencies in basic-design education have been transformed by the changing dynamics after the Bauhaus School, which had played a crucial role in setting a common language for design practice and shaped the spine of basic-design studios throughout the twentieth century. The basic design corresponds to a specific language having certain rules, and in the education of architectural design, this language is utilized as a medium for both visual and textual translations or conversions/transpositions—though its potential is generally underestimated in the current basic-design education, in Turkey.

As a matter of fact, in Turkey, before higher education, especially in the secondary one, students are gone through a four-year curriculum having a course titled "Visual Arts" of which plan also includes the learning of design approaches and tools[1]*. It contains three learning domains, art criticism, and aesthetics, cultural heritage, communication and formation in visual arts, which provide students with the abilities of understanding about the design, culture, artworks, ethics, and aesthetics. However, students, who are in a hurry to pass the university-exam, focus on the lessons that will be useful for the exam, and unless they have a special interest, they do not regard the visual-art class. Therefore, university freshmen generally do not have sufficient awareness about design issues in both practical and theoretical respects. In this context, setting a basic language of design in the studios has crucial importance. To achieve this purpose, experiments of viewing and representing the text as an image, and reading the image as a text may be introduced in the curriculum to facilitate the use of language in design activity.*

1. Republic of Turkey Ministry of National Education, 2018. The course of Visual Arts has been excluded among the compulsory common-courses, in the secondary education, since the education year of 2018-2019—although this decision does not cover the academic year of 2013-2014 during which we have conducted our curriculum-proposal. Therefore, the course could not take attention even during the time that it was compulsory.

Therefore, this study concentrates on the formulation of an alternative track or model for the curriculum of basic-design studios, by analyzing the procedures of an experiment based on the conversions, in order to establish the synchronical use of visual and textual media in the design process. In this respect, the proposed model was structured with two projects: the first project was on a textual work, Invisible Cities, by Italo Calvino,[2] and the second one was on a film, Nightmare before Christmas, by Tim Burton[3]. The book of Invisible Cities was selected for the studio experiment because of its generally accepted importance and respect in architecture milieu[4]. Its lingual potential[5] facilitating "representation and representationality as a collage"[6] was especially widely recognized. For the second project, the film of Nightmare before Christmas was selected because of its visual richness in its atmosphere, spatial aesthetics, and legible unity observed in the composition of the spaces, frames, characters, and objects. Since the context of the first project was based on a book, it may be claimed that it has a multi-dimensional character necessitating mainly verbal analysis. The context of the second project, on the other hand, was based on a movie; thus, it has a four-dimensional character (with the addition of time) necessitating both visual and verbal analyses. In this way, at the end of the term, the students enhanced their experiences about trying out different languages of design by speaking, writing, watching, and drawing them actively, and discovered how these tools are available for a mutually permeable and interactive use in the design process.

KEYWORDS
Basic design studio, education of architectural design, alternative curricula for basic design studios

2. Calvino, 1972; 1974.
3. Burton, 1993.
4. It has been included in the list of "33 Book-Recommendations from Architects & Designers" in 2014: see Archdaily, 2014.
5. Silberblatt, 2011; Welsh, 2007, n. pag.
6. Jia-Lin Lu, 2009, p. 47.

Introduction: Basic-design studio or the space of crossed tracks

The aims and content of the recent education system in basic-design studios, in Turkey, are mainly based on the genes coming from the Bauhaus system. Basic-design courses commonly cover the first year of the education program and play an important role in forming design perceptions of freshmen. In Turkey, before higher education, especially in secondary one, students are gone through a four-year curriculum having a course titled "Visual Arts" of which plan also includes the learning of design approaches and tools[7]. It contains three learning domains, art criticism and aesthetics, cultural heritage, and forming in visual arts, which provide students with the abilities of understanding about the design, culture, artworks, ethics, and aesthetics. However, students, who are in a rush to pass the university-exam, focus on the lessons that will be useful for the exam, and unless they have a special interest, they do not pay attention to visual-art classes. Therefore, university freshmen generally do not have sufficient information about design in both practical and theoretical respects. In this context, setting a basic language of design in studios facilitates teaching and communicating with the students in basic-design courses as well as accelerating their learning capabilities of design throughout the consecutive years in architectural education.

Although the Bauhaus system generally determines the mainstays of the current basic-design education in Turkey,[8] there are also needs and attempts for adapting the curricula to the new century, professional practice, its needs, atmosphere, and tools. In the first year studios, there are enthusiastic and challenging trials by teaching-teams to introduce new models, or at least, set a hybrid one of which rules are mixed with the ones of the Bauhaus: theatrical performances, improvisations, and personations, sensory and perception-based assignments, approaches to integrate parametric or computer-aided design into the basic design, or approaches that purely refer to art education and measure talent with the abilities to make sketches and models constitute some of the examples of experiments aimed at digressing from the dominant Bauhaus-spine[9]. Although the routes are different, the targets planned to be achieved are the same: setting a common language of design by the way of basic-design assignments, forming the communication styles of the students in the consecutive architectural-design studios, and to adapt to the changing conditions of the profession of architecture, in the new century.

7. See no.1 in this text.
8. For a research conducted in sixteen different basic-design studios, in the Departments of Architecture, in Turkey, to figure out their curricula, structures and evaluation methods see Çil, 2012 (work for this report was made possible by a Scientific Research Grant from the Institute, 2009 İYTE 43). One of the authors of this paper also participated into this study.
9. Çil, 2012.

The basic-design studio covered two semesters in an eight-semester education-period, in the architecture department that we experienced the proposed structure. In the first semester, a curriculum based on the Bauhaus education system was applied. The first semester comprised the topics of Gestalt and composition principles, abstraction, drawing techniques, typography, illustration, 2D and 3D representation techniques. We were able to try the alternative model with the second-semester students who had already attained the basics of design learning, as already established by the Bauhaus system. In the second semester, however, we constructed the alternative curriculum not only by referring to the Bauhaus concepts to maintain some of the basic principles but also by introducing a set of exercises comprising a *play* of conversions in-between the visual and textual media. In other words, we tried to introduce a conversion-play between visual and textual design products, by adopting the idea that design is a *play of language*. We were also inspired by Hieronymus van Alphen's poem titled *Het vrolijk leeren* (Learning Happily), in this context: "My playing is learning, learning is my play.[10]"

In terms of the design procedures, we utilized the language as a design tool to make conversions between visual and textual works. That is, in order to set a communication method, and a common language of design between the students, we took support from the language itself, in the form of literary texts and scenarios, as the layouts to facilitate design-wisely inspirations in visual imagery. Thus, there is an analogy between the structures of design product (or physical world) and language, since both have their own specific components integrated and perceived via an order and rules to be meaningful[11]—in the former, we call them as design elements, while in the latter, the letters or words. Hence, the playing activity actually comprises the activity of analyzing, is focused on seeing the whole as well as perceiving the components as the pieces of that very whole. In other words, analyzing a design product and analyzing a language mainly have similar procedures and principles; design has its own linguistics.

Converting a textual work into a visual one, or a visual work into textual one by using imagination and interpretation determined the fundamental procedures of our trial. Accordingly, reading a literary work (textual), decomposing it (textual), and re-composing it in a new manner by converting it (visual), and composing a parallel content with it (textual) were the steps of the first phase of the proposed structure. Watching and listening to a movie scenario (visual and

10. Van Alphen, 1787; 1998, p. 25. Original words are as follows: "Mijn speelen is leeren, mijn leeren is speelen." A similar version of this motto, "Let my playing be my learning, and my learning be my playing," has often been mistakenly attributed to Johan Huizinga and his *Homo Ludens* (Man the Player)—yet this work is also based on similar connotations. See Huizinga, 1944; 1980.
11. Roy, 2005, pp. 171, 179, 181.

textual), again, decomposing it (textual), extending it (visual and textual), and composing a parallel content with it (visual and textual) were the sub-phases of the proposed structure. Therefore, having the students try to figure out and analyze the language formation in the given media was seminal, since, by this way, they were able to build their own design products by playing with and being inspired from the components of the previous wholes to compose them in a new way. Regarding the content and goals, this paper aims at revealing and examining these procedures, in detail, to formulate an alternative education-structure for basic-design studios.

History: Walking in-between or out of the Bauhaus track

Education of basic design—and design, in a general sense—in architecture has a multifaceted character; therefore, it has been generally undertaken and discussed in respects of educational models, paradigms, schools, interactions between the models, interdisciplinary education systems in the sense of relationships between art and design, cognitive processes and representation, learning styles, cultural codes in the education of architecture, and the notion of creativity[12]. In the related literature, discussions, and critiques of the educational models referring to the Bauhaus as well as learning styles and curriculum proposals in basic design after the Bauhaus are among the most frequently undertaken issues[13]. As it is widely recognized, basic-design education dates back to the founding of the Bauhaus school by the architect Walter Gropius, that is, to 1919 of Weimar Germany. Regarding the highlighted importance of the Bauhaus in the literature, we may also claim that, after its foundation, the Bauhaus has been the dominant figure in basic-design education in the schools of art and architecture. However, before this classical system was introduced, there had been also some other sets of education models served as the basis for the Bauhaus[14]. Moreover, near the German Bauhaus, models of two other prominent schools were also utilized in conceptual and technical respects, in the education-plans: they were the French Ecole des Beaux Arts, and the Russian Vkhutemas, though they differed totally from the Bauhaus in serving for practicality and effectiveness of design as well as in reaching the masses[15]. Over time, nevertheless, only and extensively the Bauhaus manifesto could have

12. For example, see Kvan and Yunyan, 2005; Prager, 2006; Visser, 2006; Çıkış and Ek, 2010; Koehler, 2010; Birlik, 2012; Deane, 2012; Vossoughi and Alviani, 2012; Yurtkuran, Kırlı and Taneli, 2013; Bulat, Bulat and Aydın, 2014.
13. For example, see Prager, 2006; Tallman, 2010; Daichendt, 2010; Koehler, 2010; Birlik, 2012; Yurtkuran, Kırlı and Taneli, 2013; Bulat, Bulat and Aydın, 2014.
14. Cross, 1983, pp. 43-52.
15. Oxman, 2001.

been transformed into an educational model, into a common basic-design language, and even into a vision for making design[16].

While the original curriculum of the Bauhaus has seldom been criticized, the new curricula obtained by the *transformation* of the Bauhaus curriculum in some schools of art and architecture have been extensively criticized by the minds who believe in the perfection of the original curriculum—such that these criticisms of the new curricula were able to reach harsh expressions of the type of "bastardized Bauhaus.[17]" Thus, the Bauhaus system is, in essence, considered as a form of perception of the world rather than as a model of education,[18] and even if its transformation is described as a kind of corruption, the traces of Bauhaus has continued to exist in the proposed alternative education-plans. Today, in a sympathy with the Bauhaus system, it is defined by the scholars as a sort of "palimpsest,"[19] which metaphorically connotes its prolificacy as well as datedness, resembling a multi-layered education-site waiting to be excavated.

The fundamental aim of the Bauhaus was integrating arts and crafts within the same education structure. This integrative model was designed as a system coordinated by an artist (or Form Master) who teaches theory, together with a craftsman who teaches techniques and technical processes. Therefore, the emphasis of the Bauhaus on integration or unity also echoed in Gropius's words, in the Weimar international exhibition: "Art and Technology: A New Unity.[20]" In the Bauhaus School, the manifesto integrating the theory with practice could also be followed by the coordination logic and aims of the main course called *Vorkurs* (Foundation Course)[21]: the division between form-teaching ("*formlehre*") and industry-teaching ("*werklehre*") in the curriculum referred to the very structure and aim of the new model[22]. Although this division was not highlighted clearly in the brochure of the Bauhaus-manifesto—which was written by Gropius as the curriculum as containing Lyonel Feininger's famous cathedral-drawing—, the first steps toward establishing it were taken in the period that the School was founded:

> *Instruction at the Bauhaus includes all practical and scientific areas of creative work. A. Architecture, B. Painting, C. Sculpture including all branches of the crafts. Students are trained in a craft (1) as well as in drawing and painting (2) and science and theory (3).*[23]

These first steps of the Bauhaus system, which combine arts and crafts to support mass-production, continue today in design studios by a new common

16. Daichendt, 2010, p. 157.
17. Conant, 1965, p. 240.
18. Daichendt, 2010.
19. Schuldenfrei and Saletnik, 2008, p. 79.
20. Original expression by Gropius is as follows: "Kunst und Technik: Eine neue Einheit." See Kaplan, 1995, p. 6.
21. Lerner, 2005, pp. 211-226.
22. Findeli, 2001, p. 6; Daichendt, 2010.
23. Gropius, 1919.

structure bringing together art, design, mathematics, and science in the same education-plan[24]. As a matter of fact, the goal and model of the Bauhaus, which was quite innovative for its period,[25] has become a common design-language for design studios and restructured the education system of art and architecture schools, in general, throughout the twentieth century. Nevertheless, it has been interpreted in architecture schools in different manners through consecutive periods. By criticizing the inured system of the Bauhaus, some of the successor basic-design approaches have also tried to set alternative curricula.

The Bauhaus system was a *design* itself; therefore, the transformation story of this system has shared the same destiny with a design product, and the very concept of design itself, as also stated by Gropius: "[design] is a thing dynamic, not static. It lives."[26] After the Bauhaus was closed in 1933, its traces have lived in the basic-design curricula of art and architecture schools, although some of its concepts were changed, transformed, reduced, or reproduced in order to adapt the curricula to changing trends. Basic-design course became the area of trials, and experiments of visual language set by the Bauhaus; its syntax has been deconstructed, re-constructed, and applied within the studio-exercises, in diverse characters to attain a new universal basic-design language, as the Bauhaus had already tried. The Bauhaus School could set a balance between the studios; the theories and techniques taught to the students were sufficient for them in shaping their professional lives. However, the main problem and criticism emerged at this point: Bauhaus's theoretical and technical knowledge were no longer sufficient to capture the ever-changing technology. In the long term, this situation caused the emergence of an incremental need for the new curricula-trials, to search for and set contemporary traces to prepare the students in both practical and theoretical sides of the profession of architecture.

Proposal: In the search for a new track

The proposed model for the basic-design curriculum was performed with a team of 130 second-semester students and 9 instructors in the basic-design studio, in the 2013-2014 academic year. The model was structured with two projects: the first project was on a textual work, *Invisible Cities* (Figure 1), by Italo Calvino,[27] and the second one was on a film, *Nightmare before Christmas* (Figure 2), by

24. Lerner, 2012, p. 141.
25. Tallman, 2010, p. 89.
26. Gropius, 1956; 1963, pp. 94–107.
27. Calvino, 1972; 1974.

Tim Burton[28]. In the first one, on Calvino's, the students worked as a team of two persons, and in the second one, on Burton's, they studied individually. Thus, in the first project, there was one final product by two students, while in the second one there were separate products for each student. Phases, procedures, requirements, and presentation techniques of the projects can be summarized as follows, to make a comparison between two (Table 1):

The book of *Invisible Cities* was selected for the studio experience because of its generally recognized importance in architecture milieu[29]. Its lingual potential[30] facilitating "representation and representationality as a collage"[31] was widely accepted, by also referring that the book is a postmodern work. The term of *collage* was very proper to describe the attitudes in the postmodern culture, and even, the term of *pastiche* was more proper to that kind of description, as stated by Fredric Jameson: thus, collage or pastiche are two media by which reproducing, remixing and representing the already existing properties of an object/phenomenon in a new hybrid form are possible[32]. According to our perspective, too, *Invisible Cities* is one of the architectonic books triggering the imagination in visual creativity. Furthermore, it is among frequently undertaken works in design education of architecture, in Turkey. There have been plenty of examples covering studio-projects or workshops, focusing on Calvino's *Invisible Cities* with the aim of transforming it into the visible world.

For the second project, the film of *Nightmare before Christmas* was selected because of its visual richness in the spatial atmosphere, aesthetics, and legible unity observed in the composition of the spaces, frames, characters, and objects. It was directed by Henry Selick, however, the scenario and production belong to Burton—who is also a film director prolific in producing new architectonic languages by idiosyncratic spatial-design approaches in his films[33]. It is among the films that we can distinctively figure out the Burtonesque aesthetics in the design manner of spaces and characters. On the other hand, this part of the studio was an original trial in the sense of undertaking Burton's film in basic-design studios, in Turkey.

Since the context of the first project was based on a book, it may be claimed that it has a multi-dimensional character necessitating mainly verbal analysis. The context of the second project, on the other hand, was based on a movie; thus, it has a four-dimensional character (with the addition of time) necessitating both visual

28. Burton, 1993.
29. For this importance see "Shelf Life: 33 Book Recommendations From Architects & Designers," http://www.archdaily.com/533789/shelf-life-33-book-recommendations-from-architects-and-designers/, 25.01.2020. It has been included in this list since 2014.
30. Silberblatt, 2011; Welsh, 2007.
31. Jia-Lin Lu, 2009, p. 47.
32. Jameson, 1984.
33. Odell and Le Blanc, 2001, pp. 81-88; Cashdan, 2009, p. 52; Coghlan, 2009; Bernardo, 2003, pp. 42-43.

and verbal analyses. In the first project, the students totally depended on the stories, and could not go beyond the given text—though we let them free to make interpretations—, while in the second one, they chose to design freely from the given movie, even by going beyond the limitations of the given scenario.

In terms of conversions, the first project had one phase: from text to image. We assigned a story from the book to each group, and we expected them to analyze the given story by highlighting the characteristic keywords of the text, as the first procedure. As the second, they began to visualize these keywords by making sketches (2D), and as the third, they visualized them by the models (3D). They selected the materials for these mock-up models freely—such as paper products, recycled and leftover materials, and natural materials (Figure 3). In the presentation of the final model, the qualities provided by the material character were also discussed by referring to the character of the city (Figure 4). At the end of the 2D design process, they produced presentation boards and presented their final models together with these boards (Figure 5)—in some of which the keywords they utilized were also written (Figures 5a and 5b).

Though not included in Table 1, in the first project we also added an intermediate phase and required the students to write their own stories about their own invisible city-proposal. This would form conversion from text to text. However, few of the students achieved this assignment: they could not go beyond the limits of the dominant context and literary style of the *Invisible Cities*. This situation points out that the creativity may be influenced from the direction and destination of conversions: that is, when the conversion is from text to image, the students may feel themselves free and work more creatively; and when the conversion is from text to text, they may not feel free and not work much creatively, without being affected from the sentences and writing style of the author.

The second project had four procedures in two phases, regarding the required conversions: the first one was from image to text, and the second one was from image to image. In the first conversion-phase (image to text), after watching the film, the students are required to analyze and figure out the keywords helping to describe the atmosphere of the scenario and film, as the first procedure. As a second one, they wrote a scenario by taking inspiration from the film. However, in contrast to the previous project, the students did not prefer to work as dependent on the given context of Burton's film, and they designed their own scenarios freely, under the influences of the selected keywords. During the second conversion-phase (image to image), in the third procedure, the students designed the main characters of their projects by making models and sketches as well as the supplementary-characters and/or objects, which should also have been a part of the scenario (Figure 6). As the final procedure, they proposed the living environments specific for these characters, which necessitated solving the ergonomic and architectural problems peculiar to the proposed characters (Figure 7). In this respect, the scenario, characters, and object of the previous procedures were also revised according to the problems that emerged during the design process of the living environment. Thus, especially and mainly the scenario step (second procedure) was revised through the whole process, and synchronically worked on with the other two procedures (designs of the characters and space).

The students had not had to be so much dependent on the given context of the film while creating their visual compositions. However, they were generally inspired by the atmosphere and unity between the spaces, characters, objects, and scenario of the film, yet they produced within a different and new visual vocabulary. Only one of the students preferred to use the given scenario in visual respect; however, she wrote a new short story to be added and extend the original one (Figure 8). Therefore, in contrast to the previous project, all of the students could design their original scenarios, characters, objects, and spaces, in both 2D (storyboard) and 3D (model) environments (Figure 9). They could go beyond the limits of the context and style of the *Nightmare before Christmas*, which may show that the creativity is influenced from the direction and destination of conversions, again: that is, when the conversion is from image to image or image to text, the students may feel free and work more creatively.

The other inference in our trial may be that, in both cases, the students generally had resistance in going parallel with the authors of the works: they could not place their own textual-proposals for the fifty-sixth city to the *Invisible Cities*—for the original work is already a text having a dominant writing-style—and similarly, they could not place their own visual-proposals for some new scenes/characters to be added to the *Nightmare before Christmas*—for the original work has already consisted of a dominant visual-language. On the contrary, for the *Invisible Cities*, they could produce the visual counterparts for the selected texts/cities, while during the *Nightmare before Christmas* exercise, they could produce their own scenarios/texts by being inspired by the visual imagery of the film. Therefore, rather than the conversions between the same media—from image to image, or text to text—, our trial pointed out that the conversions between the different media—from text to image, or image to text—may be more convenient and preferable for the students of architecture to extend their design capabilities in an interdisciplinary environment.

Epilogue: Walking on the new track

Basic-design studio is one of the core courses in architecture departments, because of its importance in setting a common design-language for freshmen. The students are faced with cognitive problems of design and its procedures, at the beginning of the first year, which was the main reason for our inquiry for an alternative education-model. In this way, we planned to overcome those problems which, according to our observation, fundamentally refer to the ones related to conversions between visual and textual languages, creative thinking, and understanding in basic design. In order to propose a proper solution, we chose the cases from the disciplines of literature and cinema which are among the ones closest to the design language of architecture—for they generally share a common visual and textual repertory. This selection also facilitated our setting of the studio curriculum which comprised the textual and visual assignments.

Works of the students were exhibited in different venues in Izmir. By these exhibitions, the students could have the chance of sharing their very first projects and design opinions and the chance of taking feedback from the instructors of different universities and different disciplines as well as hearing the interpretations of visitors in general. Feedbacks of the instructors and students as the outcomes of the studio pointed out that this kind of curriculum-model is promising for a better adaptation of the freshmen in creative and interdisciplinary design-thinking as well as in the use of different design tools and media, by utilizing conversion as a technique. Through this experience, the students become accustomed to thinking by making conversions between different design-media, in further design processes, in their educational lives. Furthermore, because they learned how to convert a design element from one medium to the other, they were expected to easily adapt this way of thinking in their professional lives, as well.

The fundamental aim of a first-year design-studio is to trigger the creativity in design thinking and to establish the basic design principles in theoretical respect, and to have students maintain using these principles through the practical phases of the profession. As a matter of fact, after we proposed this model, through almost five years, we have had a chance for adapting some variants of it, in our workshop experiences with the architecture students as well as with the children. Although the experiments that followed the original model contained some corrections and changes due to the different profiles of the addressees, all subsequent experiments were merely variations of the first model. In this respect, the positive outcomes have led us to that this model can be repeated and applied in different schools, as well, which can also provide a new chance for testing the proposed curriculum, for new adaptations, integrations, and modifications.

IMAGES, CHARTS OR GRAPHIC LEGENDS

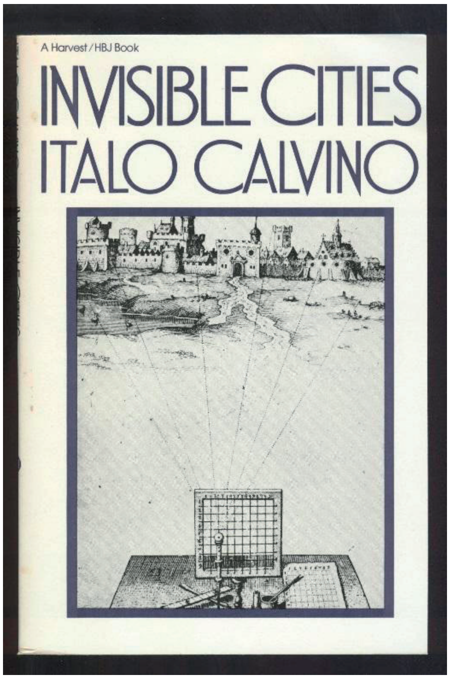

Image 1: Book cover of the 1974 edition of Italo Calvino's *Invisible Cities.*

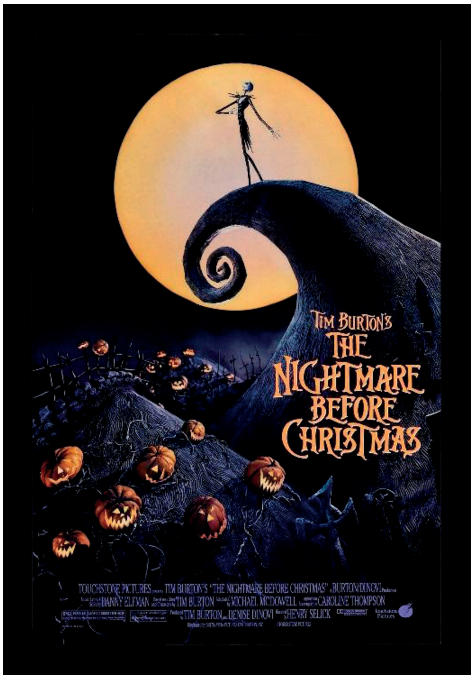

Image 2: Original theatrical-release poster of Tim Burton's *Nightmare before Christmas*

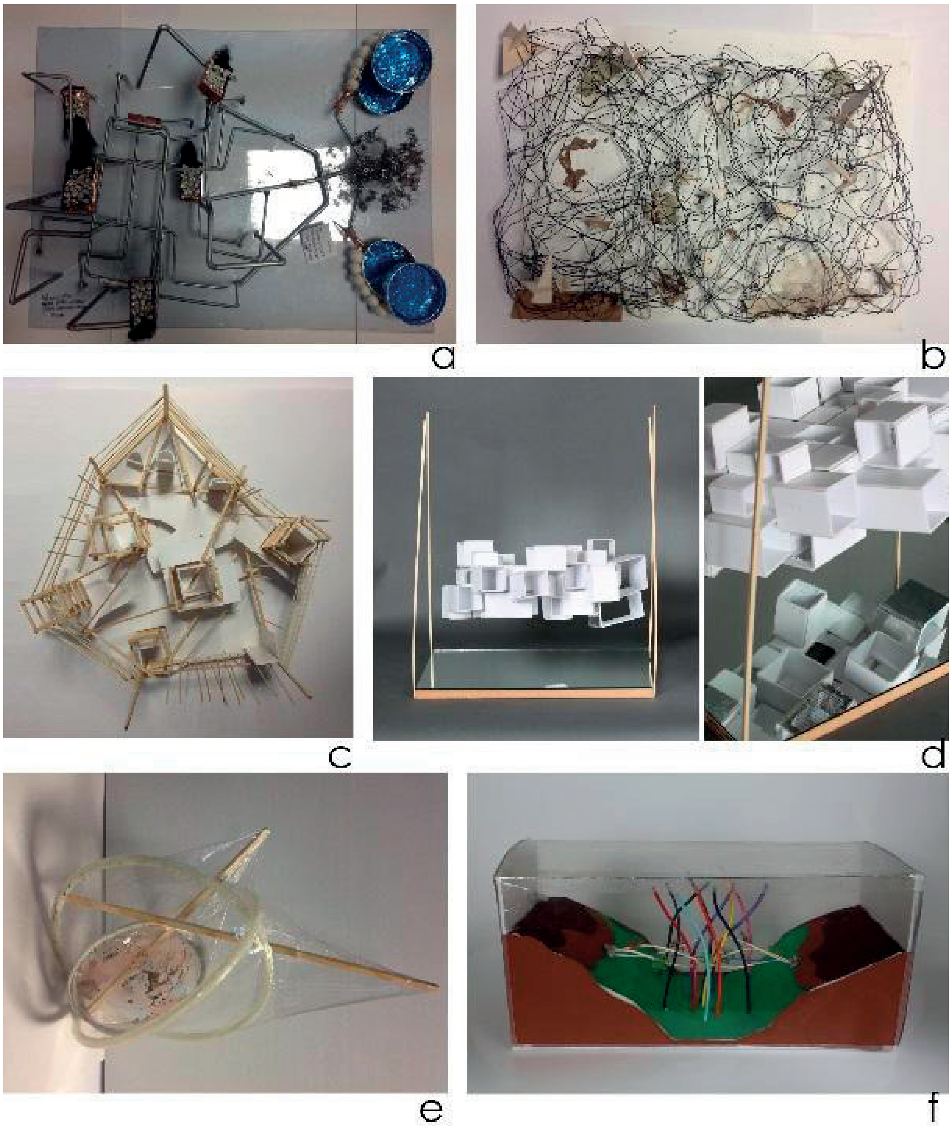

Image 3: Mock-up models of the first project: a. Armilla, b. Penthesilea, c. Thekla, d. Valdrada, e. Marozia , f. Phyllis

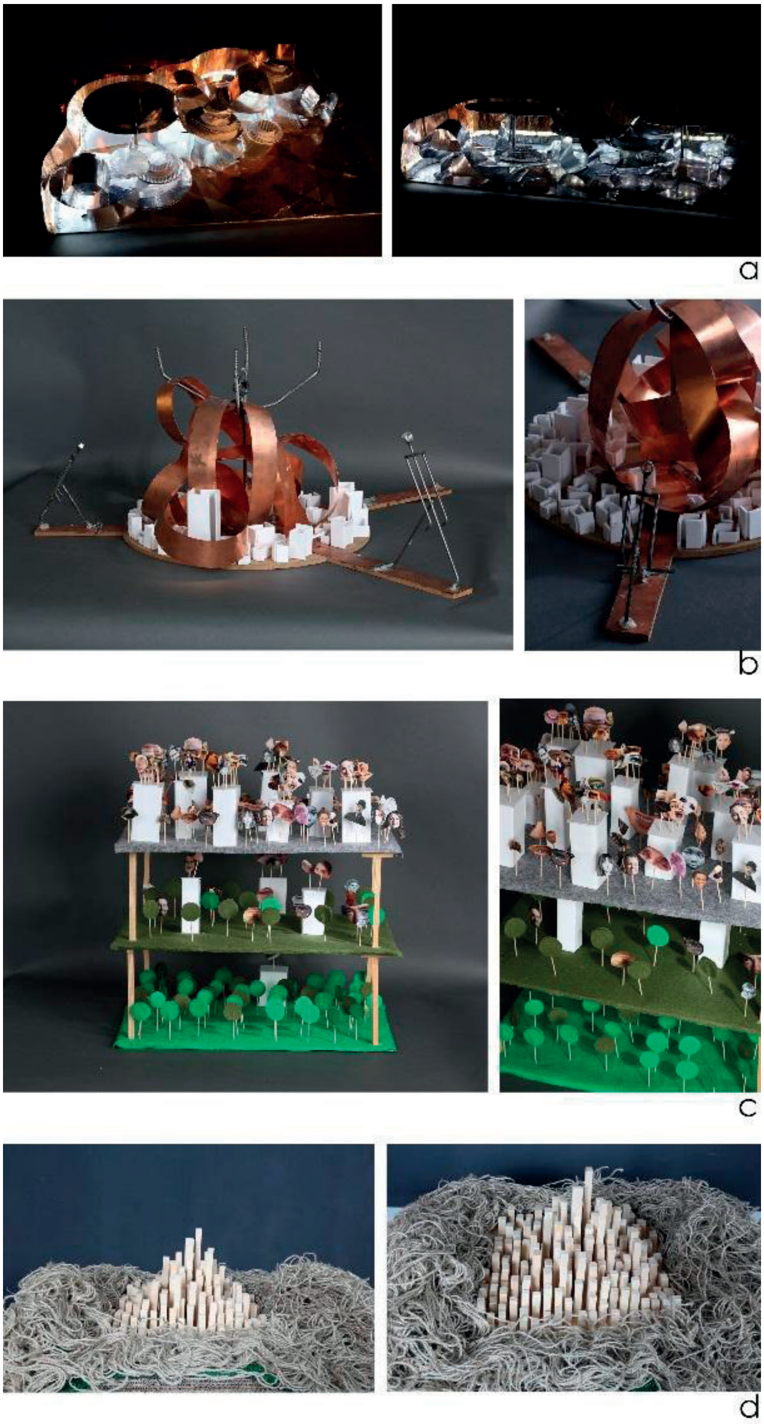

Image 4: Final models of the first project: a. Diomira, b. Zobeide, c. Procopia, d. Leonia.

Image 5: Final models and presentation boards of the first project: a. Zenobia, b. Dorotea, c. Ersilia.

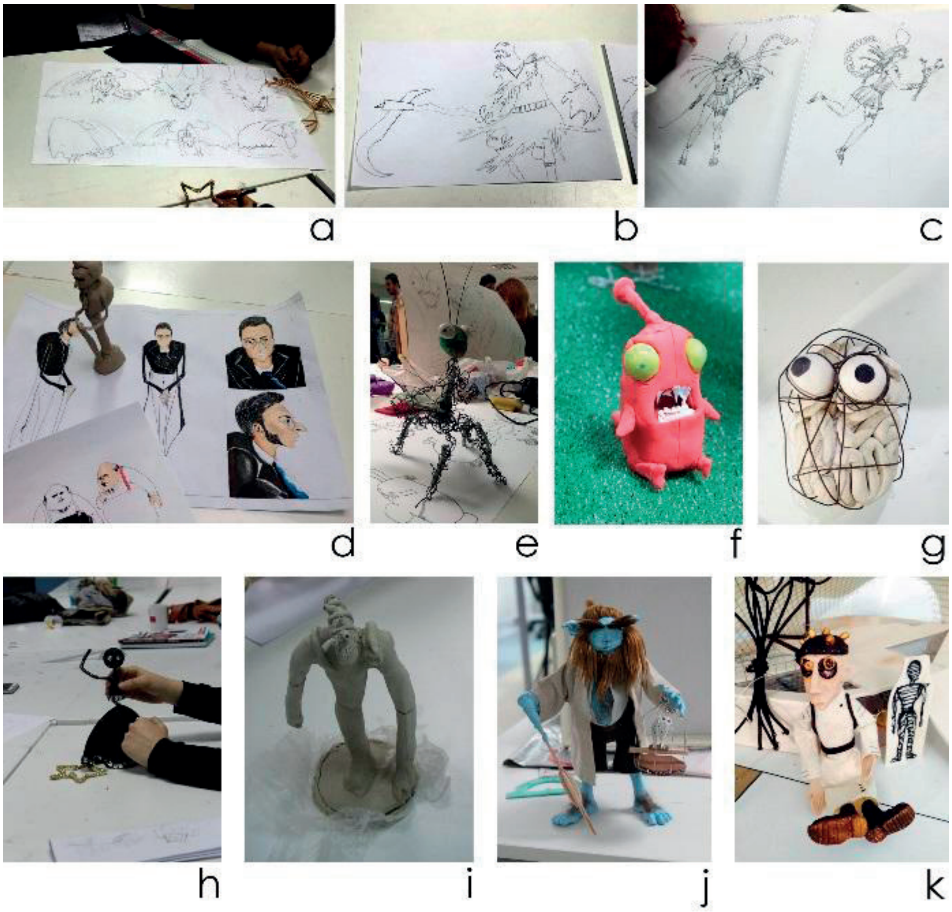

Image 6: Character models and sketches in the 3rd procedure of the second project: a., b., c. Sketches, d., e. Sketches and mock-up models, f., g., h., i., j., k. Mock-up models.

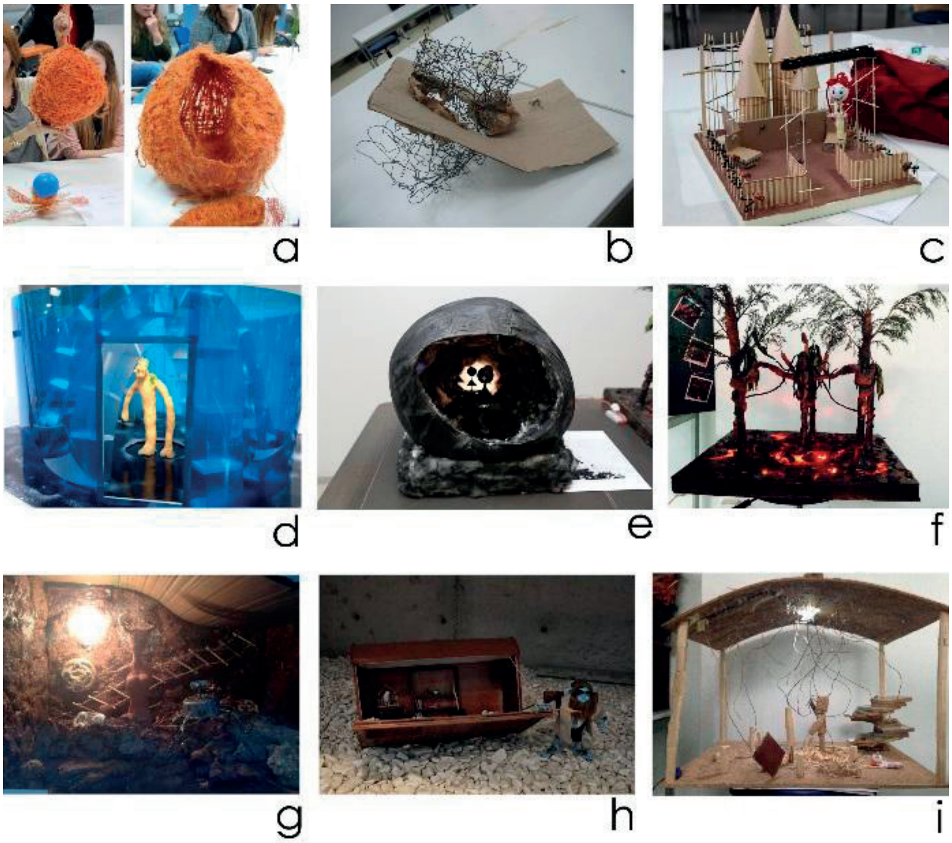

Image 7: Models showing the characters with their living environments in the 4th procedure of the second project: a., b., c. Mock-up models, d., e., f., g., h., i. Final models.

Image 8: Final model and story board of a project loyal to *Nightmare before Christmas* in terms of visual vocabulary.

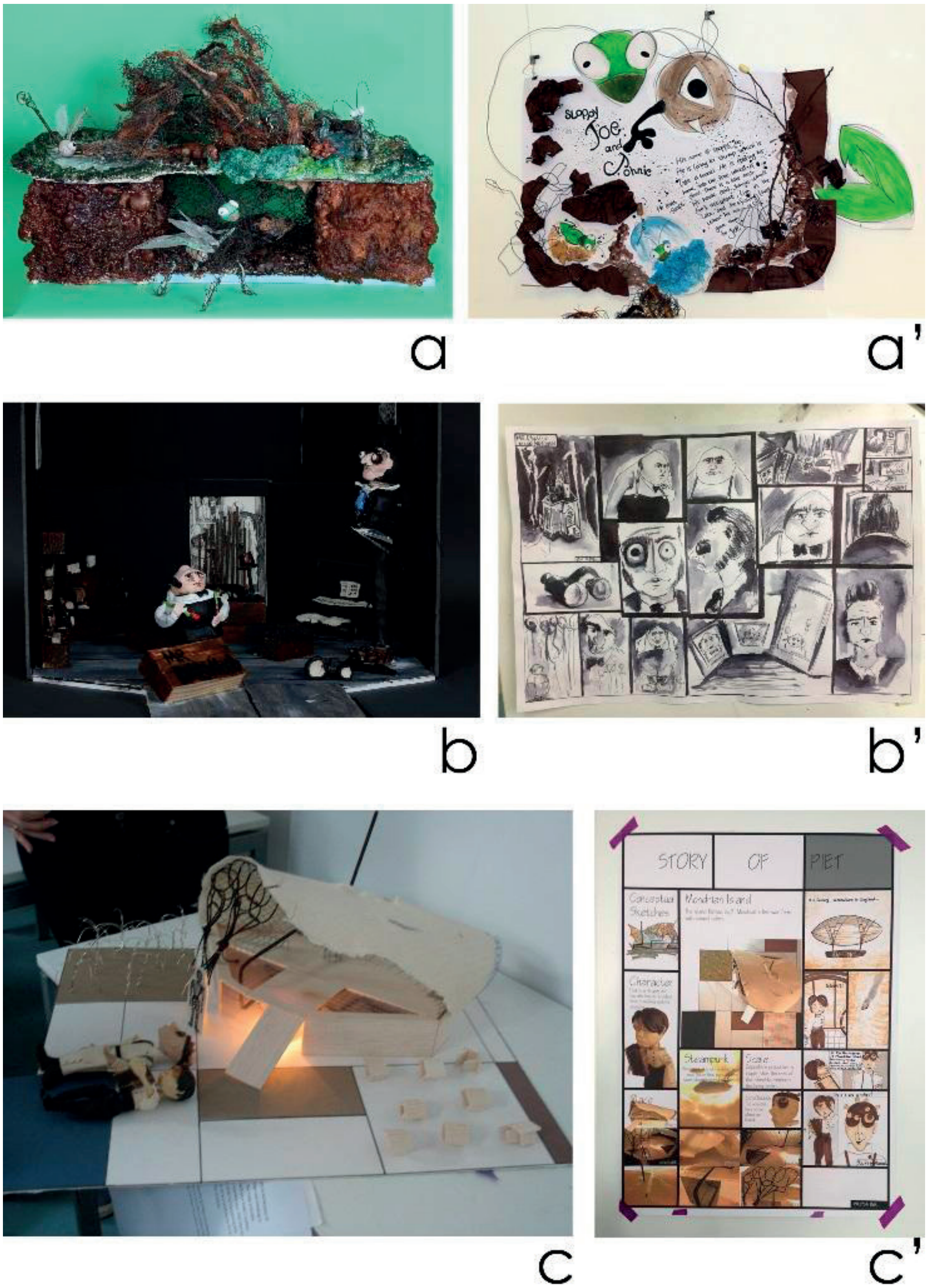

Image 9: Final models and story boards showing some of the final proposals, in the second project.

	Project 1: *Invisible Cities*	Project 2: *Nightmare before Christmas*
Duration	4 weeks	4 weeks
Number of phases/ requirements	One (conversion from text to image)	Two (conversions from image to text, and image to image)
Number of procedures	Three: 1-figuring out the conceptual keywords (verbal analysis) 2-design of the 2D composition 3-design of the 3D composition	Four: 1-figuring out the conceptual keywords (visual and verbal analyses) 2-design of a new scenario 3-design of a main character, and supplementary character/object 4-design of the architectural space
Working manner	A group of two students	Individual
Character of the given context	Text: multi-dimensional, depends on verbal analysis	Movie: four dimensional, depends on visual and verbal analyses
Character of the expected context	2-D and 3-D representations	Text, 2-D and 3-D representations
Context of the design process	Dependent to the given text/ story	Dependent or independent from the given movie and its scenario
Final products	2-D representation (presentation board) 3-D model (architectural space)	Text (the new scenario) 2-D representation (story-board) 3-D models (characters, objects and architectural space)

Table 1: Comparison of the structures of two projects.

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CONSTRUCTING A NARRATIVE SPACE IN ARCHITECTURE DESIGN STUDIO: KAFKA, BORGES AND PAMUK

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ABSTRACT

This study demonstrates architectural design works as a construction of the narrative space in literary texts. In these works, literary texts are interpreted through spatio-temporal metaphors. By taking the texts of Franz Kafka, Jorge Luis Borges, and Orhan Pamuk, the student works to execute the spatio-temporal experience based on these metaphors in three separate design courses.
In the first one, students read three books of Franz Kafka– "The Metamorphosis", "The Trial", and "The Castle" – to design a "Kafka Museum". The rich metaphorical spatial content of the texts allows students to explore and experience space in numerous ways, which are ambiguous, incomplete, non-functional, non-geometric, and unusual. Thus, students are expected to design their works based on such a Kafkaesque spatio-temporal experience.
Second, students are asked to design the lost and mythical labyrinth constructed from the labyrinth-stories by Borges in a similar fashion. As a literary-labyrinth, the Borgesian Labyrinth is an architectonic symbol that contains all characters and all actions of the universe of all possibilities. Accordingly, students study the multi-layered depth of such a labyrinth that goes beyond personal disorientation. In this labyrinth, Borges advises turning left at every crossroads which is the route to the heart of a maze. Hence, students create several spatio-temporal experiences which themselves fork while designing a labyrinth based on an experience of forking in time and space.
Third, by reading "The Black Book" – virtually a "personal encyclopedia of Istanbul- by Orhan Pamuk, the students design an exhibition space in Istanbul. In this novel, Pamuk reconstructs İstanbul as the locus of his vivid childhood memories and he makes Istanbul a painstaking collection of objects, vistas, and characters.
These works present the experiences that provide students numerous ways to question the tenets of architectural space through exploring spatial forms, which are complimentary for our conceptual understanding of its abstract theoretical content.

KEYWORDS

Narrative space, architectural design studio, spatio-temporal experience, metaphor

Introduction

This study attempts to investigate the essence of spatial qualities focusing on the creative process of designing through the translation of literary fiction into architectural narratives, rather than sculpting an architectural object with direct reference to forms associated in terms of creativity. By taking the texts of Franz Kafka, Jorge Luis Borges, and Orhan Pamuk for this purpose, the student works to execute the spatio-temporal experience based on these metaphors in three separate design courses. Through these works that are developed in third-year design studios, students are challenged to interpret, synthesize and spatially translate the given texts of these writers. In this process, literary texts are interpreted through spatio-temporal metaphors. Rather than being confined with a specific design program, architecture students are encouraged to design works as a construction of the narrative space in literary texts in order to improve their skills and tools of spatial reasoning.

The Kafkaesque Experience

In the fifth term architecture design studio at Erciyes University[1], by reading "The Metamorphosis", "The Trial", and "The Castle" by Franz Kafka, reviews of these books, letters, diaries, biographies and the principal critical commentaries on his works, students designed a Kafka museum. During this process, along with watching films about him and visiting his home city of Prague, students wrote down their feelings and experiences on reports. Following this, they set the outcome of these experiences as a spatio-temporal frame of reference to a museum design that would reflect the author's narrative world. For this aim, they embody the world of Kafka by scale drawings and models of designs that were entitled as "The Vertical Labyrinth", "Away", and "Transformable Surfaces" (Image 1) as explained further below.

The first design work entitled "The Vertical Labyrinth" related to the architecture student's experience of reading "The Trial", is based on the metaphor of being in an underground labyrinth. The work is a reconstruction of an underground shopping center located in the main square of the city Kayseri in Turkey. The lead student stated that his aim was for visitors to not be conscious of visiting a museum. Instead, when walking through the city square, people are confronted with a box, in which there is a lift that takes them underground. In the stifling atmosphere of this labyrinth of multiple hallways and back rooms, of very tiny staircases,

1. Architectural Design Studio V, with Oktay Turan, Kayseri, 2011.

and of multiple doors leading to more and more rooms that look the same. As in Joseph K.'s experience of choosing a path in the labyrinth, visitors must try to find a way through the museum by following their own presumptions. Some visitors never found their way through to experience the museum exhibition and all experienced different Kafkaesque happenings based on their own individual presumptions. In this work, the intention is for museum visitors to feel as if they are lost in a labyrinth of hallways with doors and staircases – to experience a sense of displacement at being placed in a strange environment. In this labyrinthine underground museum, there are multiple doors leading to more and more rooms, to cul-de-sacs, and staircases that end suddenly at a solid wall causing visitors to experience disorientation. The student explained the design strategy for this museum as providing visitors to feel uneasy as they walk through dark corridors, open doors into unexpected rooms, climb without a parapet, hear strange sounds and watch enigmatic images on screens. The difficulty in finding a way out of this labyrinth provokes a Kafkaesque nightmare. The design of "The Vertical Labyrinth" plays upon the metaphor of being lost in the labyrinth: it opens up possibilities for spaces of transformation, paradoxical, never-ending spaces without beginnings or ends, all set within a complex underground construction connecting across different-leveled platforms.

The second design, entitled "Away", is based upon the metaphor of being away from the desired object, event or person, and is inspired by the lead student's interpretation of "The Castle". This museum is constructed as a very large complex of buildings situated at the top of the mountain of the city of Kayseri, which is impossible to reach by a direct path. In order to enter the museum, one must use a tunnel or a mechanical system slipping on the air. The appearance of the museum is not that of a 'stereotypical' castle, but is, instead, constructed of concrete prisms piled upon each other. The museum is on such a large scale that visitors are designed to feel small within it. The museum is intended to cause visitors to have very dark and apocalyptic experiences: within the Castle, visitors feel as if they are in a cage. The museum spaces are designed to be huge and empty so that visitors experience the solitude or alienation of Kafka's world. The museum is reported by the team to be like nowhere: an ambiguous place with no clues about the exhibitions because the building is intended to be an exhibition itself, a self-exhibiting building. As with the illogical happenings in the story, this museum contains absurd spatial experiences, such as rooms with stairs that go nowhere, or empty rooms placed side by side, giving the appearance of an endless hierarchy of bureaucratic offices.

The third museum design, entitled "Transformable Surfaces", is mainly based on "The Metamorphosis" and "The Castle". The plot centers on estrangement and alienation, hence, this museum cuts visitors off from their usual contacts with the world: the museum experience is for a single visitor, alone. It is located in a very dense urban area, wedged between high-rise apartments, and it is constructed from many manually movable panels, with the aim that each visitor will consequently have a different and strange experience of being in the middle of a city. As with the design "Away", that for "Transformable Surfaces" also plays with the spatial ambiguity found in the plot of "The Castle". The lead student intended the museum to create an unsettling physical and interactive experience for visitors. In order to move forwards through an area, a visitor will encounter physical obstacles and is required to construct their own route through the museum: they must slide horizontal and vertical panels and make vertical connections between two platforms at different levels in order to close the gap between them. Mirrors are used to add to the nightmarish quality of the museum for visitors. Being at a complete loss to place the museum spaces in context, the visitor speculates about the geographical framework of the exhibitions in hopeless solitude.

Common metaphors were being lost in a labyrinth; being away from the desired object, event or person; and being alienated in society. The most common designs involved the construction of narrow, dark, unexpected, multiple, unarticulated, and unapproachable places (Bolak Hisarlıgil, 2012).

The Lost and the Mythical Labyrinth of Jorge Luis Borges

Kafka was a precursor of Jorge Luis Borges who widely uses the labyrinth metaphor to indicate the intricate nature of not only space and time but being and existence that is inextricably intertwined in his essays. Thus, "the labyrinth in its innumerable spatial, temporal, logical and psychological forms become in his essays an architectonic symbol for the epistemological complexities of time and space" (Redekop, 1980: 95). As a literary-labyrinth, the Borgesian Labyrinth contains all characters and all actions of the universe of all possibilities.

In his essay "The Garden of Forking Paths", Borges narrates a labyrinth that takes on a temporal structure (Lewald, 1962: 631): the "diverse futures, diverse times which themselves also proliferate and fork" (Borges, 1962: 37). Within the multiplicity of all events and choices, Borges advised to get Stephen Albert's House:

"The house is a good distance away, but you won't get lost if you take the road to the left and bear to the left at every crossroad" (Borges, 1962: 33-34).

This reminds the character of the instruction to turn always to the left: the common procedure for discovering the central point of certain labyrinths (Borges, 1962: 34). When architecture students are asked to design the lost and mythical labyrinth constructed from the labyrinth-stories by Borges[2], they study the multi-layered depth of such a labyrinth that goes beyond personal disorientation. As for the advice to turn left at every crossroads which is the route to the heart of a maze, students create several spatio-temporal experiences which themselves fork while designing a labyrinth based on an experience of forking in time and space: each time one encounters countless alternatives that he/she chooses one and eliminates the others. This creates a paradox, as in "The Library of Babel" which is the image of the universe, infinite and always starts over.

Third-year architecture students are asked to design the lost and mythical labyrinth constructed from the labyrinth-stories by Borges. Selected design studio works are entitled as "The Cube", "The Journey", "The Placelessness", and "The Deep".

As a project in the middle of a pond that is located in the center of the Rabbit Island, "The Cube" (Image 2) is a lost and isolated labyrinth. There are no paths and no orientation for visitors who gaze on that lost maze that lays beneath the trees and water that gives the impression of an imagined infinity. Within this labyrinth, there is a cube that is composed of some cubic exhibition areas created by using random horizontal and vertical cubic lifts. These cubic lifts provide the visitors with forking exhibition routes: each time a visitor is confronted with several alternatives of which he chooses one and eliminates the others. Being composed of the vertical and the horizontal juxtapositions of the different exhibition halls, this cube gives a spatio-temporal experience which is an infinite-like. In addition, one can easily observe the cubic lifts through the transparent facades of the cube.

The design work entitled "The Journey" (Image 3) is located on one of the most important historical streets of Talas in Kayseri. Located on a region near the entrance of Ali Saip Pasha Street, this design work is a construction that makes visitors pass through the variable section corridors in a building buried under the ground on the rising slope of the street. By taking a route in such a time labyrinth narrated in "The Garden of Forking Paths", one can wander there where roads fork and corridors lead nowhere. Like the labyrinthine nature of Yu Tsun's journey to Stephen Albert, visitors will experience this settlement by the compulsory directions given to them as Borges narrated in his story: "The instructions to turn always to the left". Another design work entitled "The Placelessness" (Image 4), which is mainly based on the story "Two Kings, Two Labyrinths", is a mobile design that consists of container-shaped exhibition areas that have been reconstructed according to references in different locations.

2. Borges's essays using the labyrinth metaphor from Yates & Irby's edition entitled Labyrinths (1962); Interdisciplinary Design Studio, with Ali Günvar and Ekin Genç, Kayseri, 2016.

The design work entitled “The Deep” (Image 5), is an oblong stone niche excavated into the sharp slope of a mountain as narrated in “The Immortal” (Borges, 1962: 104). In this design, visitors go down through the chaos of galleries. There are niches with nine doors and long branched-out cellars connected with corridors and stairs and the unforeseen walls in the depths of these corridors halted the visitors. They turn into a kind of a little square or a courtyard. It is abounded with dead-end corridors, high unattainable windows, portentous doors that led to a cell or pit, and also there are inverted stairways whose steps and balustrades hung downwards. The width and height of the steps are not constant which made visitors fatigue. A number of niches called as The Invisible Room, The Klementinum Library, The Life, The Execution and the Miracle, The History of Zahir, Searching for the God, Losing the Zahir, The Prison, Be Under Arrest, Immortals of the History, The Word Chess, are the exhibiting halls of selected narrations of Borges. When one enters into The Deep, he or she confronts with several alternatives among these niches: every choice causes different narrations of exhibitions.

In all these stories, corollary, there is only the labyrinth in which one cannot be sure of whether he or she is in it or not. Wandering in these labyrinths where the form is more important than the content gives a sense of infinity.

Sings and Memories of İstanbul

In this studio, by extracting metaphors narrated on urban everyday life in the novel, the students are expected to design an exhibition space in Istanbul (Image 6) through reading “The Black Book” by Orhan Pamuk[3]. In “The Black Book”, most of the spaces narrated are based on places from Pamuk’s childhood. He reconstructs these spaces with fictional spatial information that exists beyond the boundaries of the actual space. In the novel, this construction can be grouped into two categories: First, actual space as a complex whole comprising existing buildings, streets, urban furniture, trees, objects, signs and so on; second, existential space – the relation between the actual world and the imaginary world as a concretization of the environmental schemas and images of the author and the reader (Bolak Hisarlıgil, 2011: 13). The existential space constructed from his collection of imaginations of objects and the environment is transformed into narratives by being interwoven with the “reconstructed spaces” of their imaginations.

3. Interdisciplinary Design Studio, with Doğan Türkkan, Bahadır Altınkaynak, Tunahan Koç, Erdem Dokuzer, Hande Türkkan and Ekin Genç, Kayseri, 2015.

The protagonist of the Black Book is Istanbul itself. While his childhood spaces in Nişantaşı constitutes the actual city, the others are imaginary, and they come from historical stories. Space is the dominating structural guide in The Black Book and Pamuk's focus is not on portraying characters, but on their journey in İstanbul that conflicts with themselves (Bolak Hisarlıgil, 2011: 17). A vision of the near future of İstanbul has been described briefly in the novel wherein the Bosporus dries up and a new life begins in this dark and diseased place. In the design studio, some of the design works are mainly based on such an apocalyptic image of the city: "The Veiling of the Bosporus", which was designed in the Artisans Park located on a sloping land overlooking the Bosporus in Beyoğlu, has a spatial construction where the museum is disconnected from the outside and where different objects are exhibited in different layers. Finally, the museum visitor reaches a terrace where the Bosporus is seen. The design works "The Doomsday" and "The Mystery" are also based on the metamorphosis of İstanbul and on deciphering the mystery of the city (Image 7).

The design works entitled "The Bottom of bottomlessness" (Image 8) and "The Dark Void of Istanbul" (Image 9), are mainly based on the place narrated as The Dark Void in the novel. It is at the center of the Heart-of-the-City Apartments described as if it was a pit, which has pervaded the building like the punishment for the sins of youth and has become the air shaft. The Dark Void is also a place that the Heart-of-the-City Apartments' dwellers "want to escape from like a fear they want to consign to oblivion and yet are unable to do so. They all mention this place as if they were talking about some ugly, contagious disease (Bolak Hisarlıgil, 2011: 48). "The Bottom of bottomlessness" has a structure buried in the sea with the form of a cone narrowing down to the shore of Tarabya. The narrowing of the structure downwards is designed to make the feeling of bottomlessness increase. When the museum visitor meets with the building, he will think that he has descended from a dark place into an invisible well, and as he goes down, he will encounter a bright place. The exhibition venues on this route will also offer sections from the plot of the novel and the signs of the city in that plot. Another design work entitled "Images" (Image 9) is mainly based on the way the objects /images/signs of the city being displayed in the "Signs of the City" section. In this section, what actually made objects enchanting is, in the way being displayed by a junk dealer; he arranged the articles four down and four across on the bedsheet as if it were a great big checkerboard (Pamuk, 1994: 190). Like a checkerboard, the images of Istanbul were exhibited: Bosporus breeze, steamboat sound, traffic, cobblestone, city walls, carriage sound, crowd, etc. were used. The work entitled "The Boundary", is designed along a long wall that consists of spaces on both sides that are connected by corridors that cut the wall upright and display the narratives in the Black Book (Image 9).

The design work entitled "East-West" (Image 10) is based on the chapters "Master Bedii's Children" and "Do you Remember Me?". Where İstanbul is depicted as an underground city, in the underground muddy chambers, mannequins who have been teamed into groups of mountebanks, impersonators, sinners, and imposters are seen. In order to join the colossal collapse foretold by the underground, to become a part of that inevitable doomsday, the mannequins populate all these passages, these underground corridors chock-full of treasures and infested with rats, skeletons, and spiders. Master Bedii's Atelier is an underground museum described in The Black Book. As an actual space, it is a strange small two-storey house in Kuledibi in İstanbul known as the "Mars Mannequin Atelier", which smells of oil paint and is full of boxes, moulds, tins, and various mannequin parts. The visitors can see the hundreds of mannequins as they go downstairs, passing through more rooms that open onto more steps. This building is designed as two wings that make it the threshold of East and West where tradition and modernity are contested. Considering that "Pamuk delights in shredding the East/West dichotomy as a part of people's universal quest for identity" (Innes, 1995: 245), the spaces of the Eastern wing exhibit the subconscious of the city by reflecting the unforgotten roots of the people by mannequins. According to the story, after cinemas came to İstanbul, people gave up behaving as they were and adopted the gestures of European artists. The Western wing of the building reflects this way of city life by providing museum visitors with an environment to make themselves feel as if they were in a movie scene.

Pamuk reconstructs İstanbul as the locus of his vivid childhood memories. Besides, he constructs the images in the text as the outcomes of the social, cultural, and physical metamorphosis of the city. Furthermore, he challenges the city in the novel where characters read their ways in it with its vertical and horizontal extensions. Pamuk makes Istanbul a painstaking collection of objects, vistas, and characters: a garden of memories, a labyrinth.

Conclusion

These works present the experiences that give ways to question the limits of architectural space through exploring spatial forms, which are beyond our conceptual understanding of its abstract character and theoretical content. In this context, this study brings a critical outlook to an architectural design studio that can enhance generative thinking in design works that are mostly reduced to a given program in a site in the curriculums. Through the use of narrative tasks and activities, both instructors and students can increase their capacity with respect to the aspects of creativity in terms of flexibility and novelty. Although creativity is often regarded as being associated with the notions of "genius" or exceptional ability, it can be industrious for design studios to consider creativity as a disposition to fruitful narrative activity that can be used effectively. By these examples, it is demonstrated that narrative-oriented design instructions, which contain problem-solving and problem-posing tasks and activities, can help architecture students to develop a more creative process for the spatial inquisitions.

IMAGES, CHARTS OR GRAPHIC LEGENDS

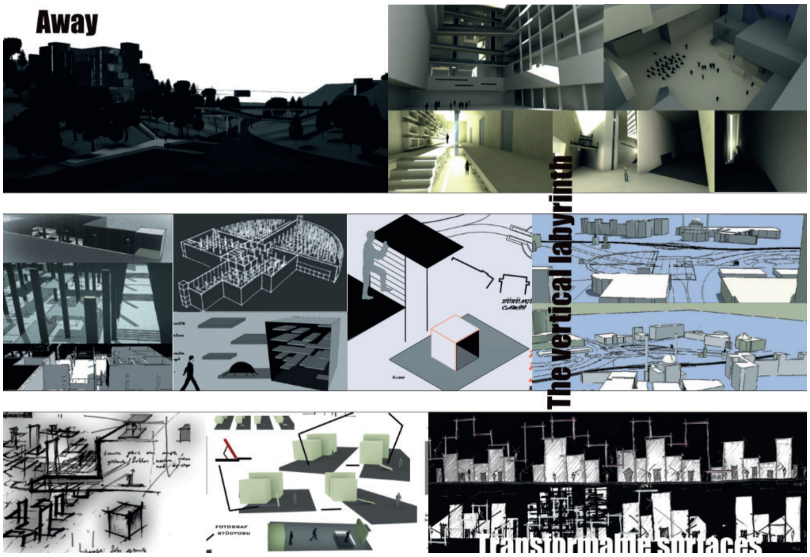

Image 1: "Away", by Ali Burak Yanardağ; "The Vertical Labyrinth", by Servet Köker; "Transformable Surfaces", by Damla Katuk (Bolak Hisarlıgil, 2012: 259).

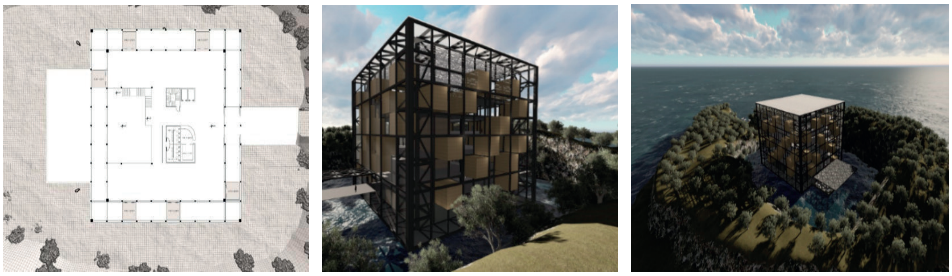

Image 2: "The Cube", by Canberk Bingol.

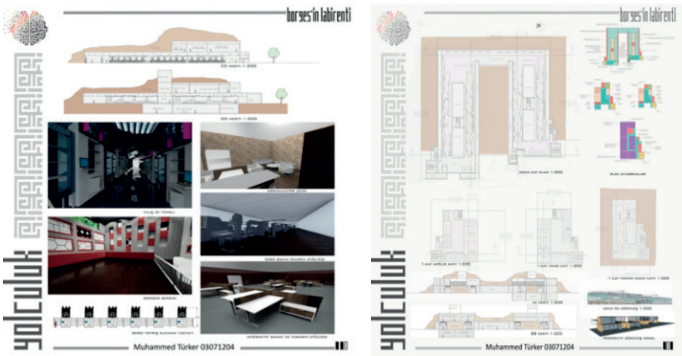

Image 3: "The Journey", by Muhammet Turker.

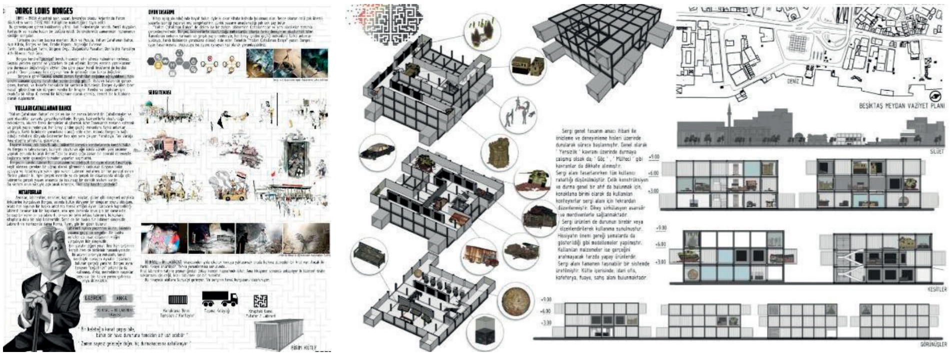

Image 4: "The Placelessness", by Recep Utku.

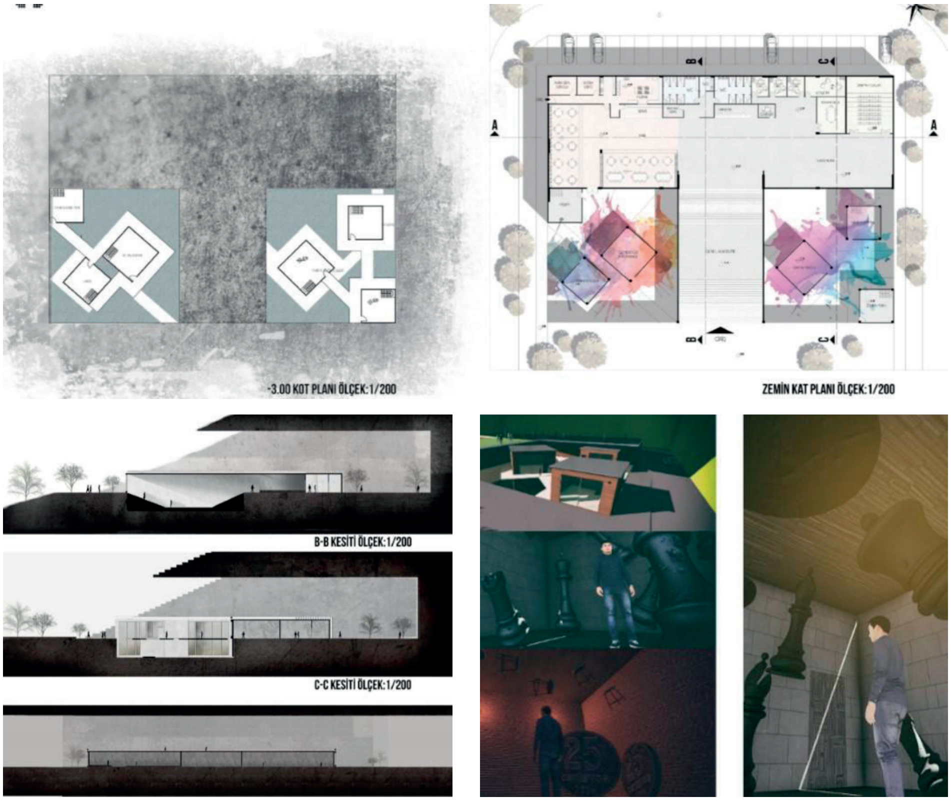

Image 5: "The Deep", by Mustafa Sarkısla.

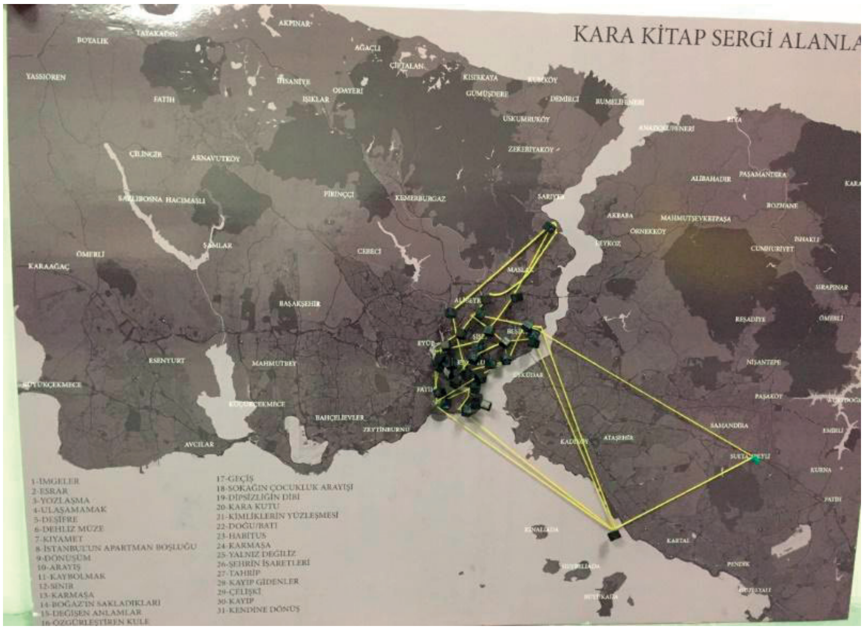

Image 6: The Map of Design Sites based on The Black Book.

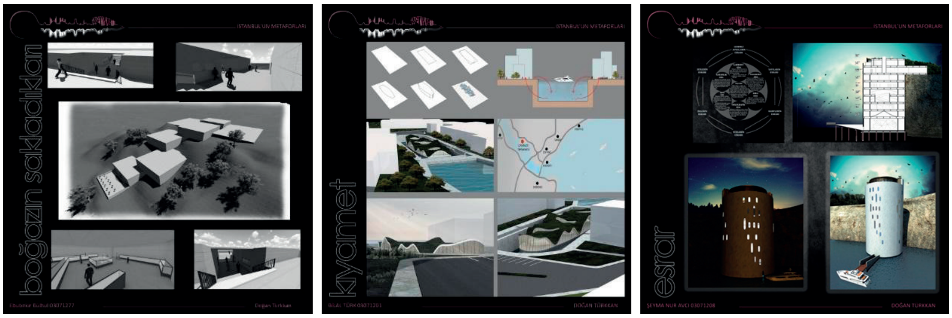

Image 7: “The Veiling of the Bosporus”, by Ebubekir Bülbül; “The Doomsday”, by Bilal Türk; “The Mystery”, by Şeymanur Avcı.

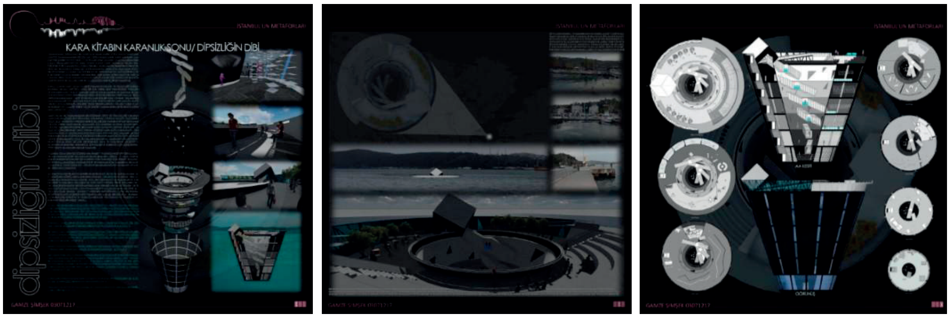

Image 8: “The Bottom of bottomlessness”, by Gamze Şimşek.

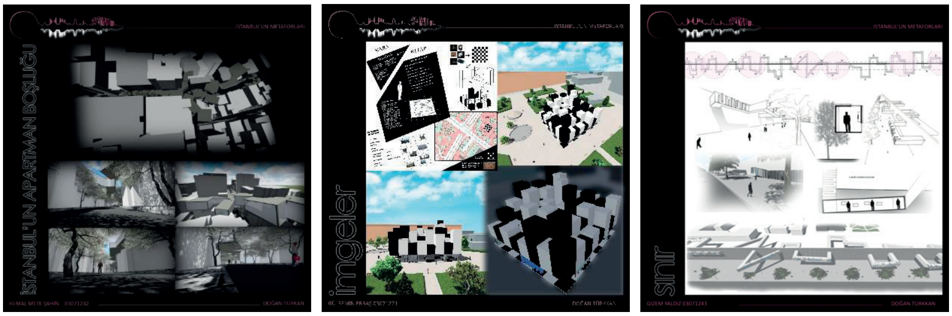

Image 9: "The Dark Void of Istanbul", by Kemal M. Şahin; "Images", by Gülsemin Erbaş; "The Boundary", by Gizem Yaldız.

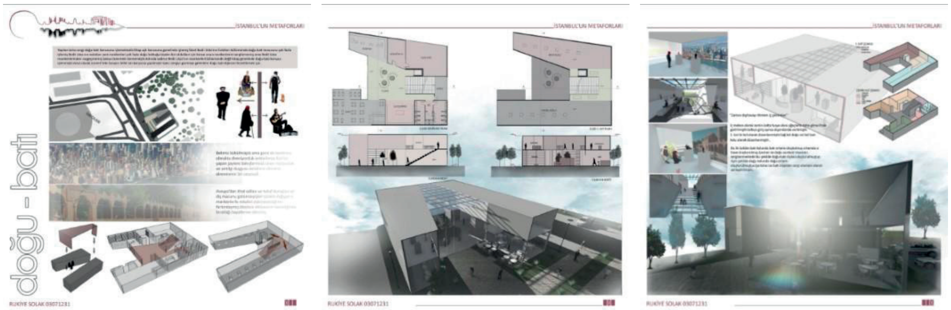

Image 10: "East-West", by Rukiye Solak.

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NARRATIVE AS MNEMONIC-ATMOSPHERIC MEDIATOR OF SPATIAL AND LITERARY ENCOUNTERS: AN EXERCISE ON "BELDELER KITABI"/"BOOK OF PLACES"

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ABSTRACT
The knowledge of space formed and enriched by experience consists of concepts such as "body, scale, proportion, experience, perception, atmosphere, senses, time, memory, context, light, structure, material, construction, tectonics, spatial relationships". The architectural design studio, which provides the students' perception of space through these concepts, also aims to create an environment in which experiences are recorded, shared, and reproduced. The main motivation of the "Architectural Narratives" course is to continue this approach of architectural studio based on research and learning; I have been conducting since 2010. The main objective of the course is to understand architecture as a part of the multi-narrative world and as a series of actions that are the source and reproduction of many personal and collective narratives in order to develop individual perspectives in the context of different activities and to experience different cognitive tools. A studio exercise that I created through Faruk Ulay's "Book of Places" stands out among other activities that I aim to enrich the possibilities of narration. Ulay's book is a powerful narrative that he produces on his own desert photographs. The book is constructed via three reading routes. The texts describing thirty-three places are on the left page of the book. On the right, it proceeds with a photograph of a desert and postscripts that can also be read as an independent text, can also be regarded as the inside-footnote-mystery / mystery of the text on the left. This is a study where students randomly select a text from the book and distribute it to each student individually. New spatialization, which they establish with what they read and interpret, gives rise to fruitful discussions.

KEYWORDS
Memory, atmosphere, object, narration, Beldeler Kitabı

Introduction/Prologue

“Spatiality”, with the complex relationships, codes, and changing rhythms of everyday life, needs to be read today with new tools, mediators, and methods within the vague range created by many encompassing phenomena. Therefore, the discovery of new views is important in the relationship established by individuals. “Memory” and “atmosphere” play very strong/attracting roles in the relationship between everyday life practices, intermediary “objects”, and the production of social space.

This paper is based on an exercise in which students translated a literary text into a 3-dimensional collage/assemblage and re-text/rephrase in the Architectural Narratives course, which I have been conducting since 2010 in the ITU graduate program. This paper attempts to decipher the potential of the target text (Book of Places) used as a material in education, in the context of inter-textuality, open work, representation, translation, and reproduction.

TimeSpace and Representation

When we look at the memory of the place-space, we see that it has faced a series of displacements and abandonments throughout its fragmented history and, despite this movement, carries different cultural, physical, and social layers together. It is life/human that nourishes, reveals, or hides urban layers. As a reflection of the whole of this layered and articulated structure that feeds on each other, the image of the city can be regarded as the common constituent of the meaning of the city for different readers.

Language is an important factor in the formation of the image of the city in the mind of society. It would not be wrong to claim that urban discourses are the linguistic expressions of the image of the city formed in the mind of society. Urban codes sustain their life through the language used in living spaces (physical environments, buildings, media, maps), which produce their own characteristic texts. Understanding and using language, which actually means the ability to define the human condition, connects social actions, conveys judgments, and responses and regenerates beliefs, relationships, values, and spaces.

In the city’s relationship with the language that reproduces it, social knowledge and social memory gain importance as the source and basis of life. Therefore, literature, an important form of expression of collective memory, can be used instrumentally to look at the reproduced spatial reality, the scene of spatial meaning shifts.

Contrary to what is generally assumed, space is not an empty gap isolated from time, passively waiting to be formed. Surely, all practices, discursive or not, constitute space with all other natural non-artefact essences; in other world, space is a full expansion (Tanju, 2007). Being transmitted in various representation methods and turns into spaces we can perceive and experience in all its aspects produce space, built in the mind of its architecture/designer. We can partially comprehend spaces that have totally disappeared or spaces in which we cannot experience the original physical and sociological dimensions of its time by different spatial representations. However, considering the time aspect and semantic changes of the space, it becomes more difficult to represent the space.

Ulus Baker underlined the fact that "Both music and cinema are thinking products in their own fields." in his preface to the Turkish translation of Gilles Deleuze's conferences on cinema and music (Baker, 2003).

Bulent Tanju uses the concept of time-space to open the way and think about the matter. "All production practices inevitably contain in their own fields the act of thinking and qualitative differences caused/created by this act." (Tanju, 2007) The claim of representation is fortified by the presence of an unchanging, ahistorical field and, subsequently, brings timelessness. Emphasizing on the temporality of "thinking products" allows us to understand more pluralistic definitions, open to possibilities, and the state of "constantly (re) producing itself."

According to Tanju (2007), representation is not outside of/above what it represents but – inextricably – exists with it; representation is a thinking product as well. This plurality of perspectives can be established neither on object nor on the subject; rather, it stems from the comprehension of a dynamic multiplicity that assumes all thinking products internally produce unexpected, unpredictable differences.

In such a state, instead of a pre-modern integrity cover that elevates time and space to transcendence, the plane of immanence is homologated and integrated. Thus, the act of accessing transcendent information about the space perceived with time is positioned inside, instead of outside or above, the plane of immanence of subject relations.

The relationship established by the subject that experiences and understands the space with time forms and guides perception (the present) that selects visual memory from a library of recorded data (the past), forces it to make a choice and, simultaneously, reshapes it by writing/recoding perception (the present) of the visual memory. In a circular relationship of time and space, our past specifies our present understanding and the past rapidly disintegrates.

Let's try to examine the state of representation integrated into time-space, augmenting meaning as a thinking product, through reproduction, which is a form of representation. We should look up the word *reproduce* in order to elaborate on the notion of reproduction: 1. Producing again, 2. Producing a copy, 3. Creating something similar to something else, especially in a different environment or context. These definitions of the word constantly refer to what was previously produced. Walter Benjamin discusses the difference between reproduction and production in his well-known essay "The Work of Art in the Age of Mechanical Reproduction." Benjamin's essay investigates the influence of the mechanical reproduction of the artwork on the difference between the original and the copy and has an important place in the development of the reproduction concept.

The literary text/narrative is the new semantic constructor of this representation converter. Words, images, sound-silence are all parts of this narrative that will transform meaning with other choices.

Artwork can be interpreted in a different way than the artist intended it and this allows us to evaluate the artwork as an open work. Open works don't form shapes specified for the first and the last time. Umberto Eco explains: "Not in front of works that want to be reconsidered and re-experienced in a certain structural direction, but open works realized the moment the interpreter attempts to intervene." (Eco, 1992)

We can position architectural space in the conceptualization phase suggested as an "open work" by Eco. When architecture, which is a field that produces open works, is regarded as the reflection of ideas of regulation, direction, and formation on the real world, it contradicts itself; what makes architecture "thinking product" is this contradiction.

Each different representation of architectural space, for instance, photograph, draft, sketch, model of the space, reveals architectural space in itself and establishes a link of transmission to other representations in its own production practice. This link bears the production codes of the space. A photograph narrates the space by saying something about it, i.e., transmitting the traces we have accumulated in our memory of the space by perception and experience.

Representation of space is interpreted as a thinking product and reproduction, translation or mimesis of the original and requires a different setting: narration. Philosophers explain or define the concepts of mimesis, reproduction, translation, or narration by referring to the existence of the others

Narrations are recoded interpretations of these images and traces with visual or written semantic devices. Narrations can transmit all sorts of information about the space.

All architectural representation methodologies other than narration imitate an aspect of architecture to explain it. The reader/audience is as close to information about the space as he interprets and reproduces in his mind what he reads and sees.

Narration-Space

The concept of Narration, which was previously theorized in the field of linguistics and literature, has an important place as a means of contextualization, especially in creative disciplines such as architecture in recent years. The way the narrative is set up in different media may change, but the discovery of the structure of the narrative brings the reader closer to the narrative.

A studio exercise that I created through "Book of Places" stands out among other activities that I aim to enrich the possibilities of narration. "Book of Places" is a publication from the YKY-Dream Traces series in 2003. Faruk Ulay's book is a powerful narrative that he produces on his own desert photographs

From the blurb: "*Faruk Ulay distances the poetic existence of objects and spaces in 33 places through the filter of sadness and irony and humour, and interrogates the conditions of personal existence in a one-man dialogue*"

In the preface author notes that he will leave to the flow of the reader/narrator/book reader, he starts the speech by making the place he describes as "special lands" as humanized, even if he resembles the desert. He talks about his atmospheric features, light shade, history, memory time, and the absence of all these.

And the space-building sentence of the narrative in the Book of Places declares the structure of the narrative without being bound to "It is not the desert; it is the place of objects ...":

"… It will be understood that, despite great stubbornness, these are not known deserts. Yes, ladies and gentlemen, they are open to the public, not desert. It is the objects that save these places from being desert and give them the title of the towns."

SceneSpace

The book is a scene with 3 tracks on the left and right pages (Image 2).

On the left page, there is a text that says, "It is not the desert, it is the place of …objects ". This untitled, unexplained text changes with this sentence, the space of which is filled in a different feature/characteristic on each page.

...

It is not the desert; it is the Place of the Uncertain Objects

It is not the desert; it is the Place of Translucent Objects

It is not the desert; it is the Place of Objects Reflecting Thoughts

It is not the desert; it is the place of Hidden Objects

...

The right page consists of original desert photographs and photo captions by Faruk Ulay, who is originally a graphic artist. The pages on the right are not included in the study during this exercise

Narration Modality

This is a study that I randomly selected and visualized the book texts that I distributed to groups of students individually. This new specialization that they set up with what they read and interpret creates productive discussions.

Each group first reads and discusses the text "It is not the desert; it is the place of... Objects". Then they make a model or a 3D collage. Then the group writes text this assemblage with reference to other concepts. In the last case, another student producing a criticism on this text. The book turns into an intertextual medium in the establishment of architectural narratives, a discussion that enriches and deepens.

One of the important pillars of the study is the constraints. There are basically two constraints for the study. Firstly, students are asked to think in 3 dimensions, as paper-models and work will be in 3D, not a flat 2D medium. Then, I want them to use only re-cycled A4 copy paper while thinking in three dimensions. Thinking with this constraint is a situation that students initially object to, but it adds an enriching dimension in terms of establishing a common discussion, focusing on the text, and allowing it to be transformed and explored for its potential rather than the model material.

What are the benefits of a constraint-based model then? Perhaps it can be argued that all the examples mentioned above, and the studio program could be analyzed without using the word "constraint" since the word may impose an effect that blocks creativity. However, we suggest that the model in question makes it possible to collectively explore and discuss the nature of the design situation at hand. Discussions and evaluations are goal-oriented and effective, providing a collective discovery for a moment of truth, a simple explanation for a portion of the world. We propose that students with such an experience are less likely to get lost in design situations at a larger scale. They become more adaptive to ambiguous or unprecedented design activities, hence more flexible without compromising their personal position and worldview in formation. Constraints are organized around the design activity without compromising on the possible amount of design proposals.

Representations: Places of Objects

The following texts are the students' own works in English.

İlayda-Can-Efe/

"The Place of Unmovable Objects / Monument of (Don't) Forgetting" (Image 3 original page-Image4 Paper Model)

The city is like a carpet pattern that is read by everyone and reproduced as it is read (Rossi, 2006). At this point, it can be mentioned a collective memory that it is not easy to delete. Because the efforts of erasing those who intend to erase begin to accumulate exactly where they try to erase, and this agglomeration continues to be recorded by the society. These agglomerations are like the objects of our memory that cannot be carried. They come out with the claim of changing things, they cannot even move the things they see the most portable and pull away without making the changes they want in our town. These frustrated efforts continue to accumulate in the Place of Unmovable Objects. Undoubtedly, Taksim Square is also a place in our social memory and turned into a Place of Unmovable Objects. For example, neither the closing of Taksim Square on May 1 every year nor its plastering with concrete could make it forget May 1. This place that does not die and sleep is both uncanny, reliable, full, and empty. It often empties with those who ignore nothing as it passes through, but from time to time it is overflowing with people who take care of it like their home. Derrida argues that unconditional hospitality is not possible in the text "On Hos(ti)pitality". According to Derrida, every "I" comes to change "another" who says "Who are you? / What are you?" he does not accept himself without asking his question. In our case, this is trying to change our "other" social memory. Every change that is tried to be made is questioned, whether it is accepted or not, the eventuality of this interrogation does not ultimately permit the change to be made. Just like "New (or another) AKM" which comes out with the claim of changing things. Our collective memory does not seem to change with the New AKM, just like the new square arrangement. It is not possible to say that the new AKM could be successful if it is "carrying objects" such as Bloody May 1 and Gezi Park Resistance. Regardless of whether the effort to change life is successful or not, it will take its place next to these objects in the Place of Unmovable Objects.

Derrida, J., Dufourmantelle, A., & Bowlby, R. (2000). Of hospitality. Stanford, Calif: Stanford University Press.

Rossi, A., Çev. Nurdan Gürbilek. (2006), Şehrin Mimarisi, İstanbul, Kanat Yayınları

Büşra-Zeynep /

"The Place of Sexual Desire Objects" (Image 5 original page-Image 6 Paper Model)

It is not possible to understand without experience this topography is a group of hills and pits that stand side by side. The bodies that oscillate in this whole are neither inside nor outside, they are actually among this topography. It is also part of it. It is the on-the-go experience, which separates the peaks and pits from each other and reveals the topography by turning them into different parts. Without it, this is different from topography because every change is recorded. This topography is activated by movement, it takes different forms according to different bodies. However, these formats are not only dependent on the moving parts of the topography. Lin (2006) sees topography as the coming together of simple "pieces" in the contiguous "relationship". These moving parts that differ each time and their relations with the inactive layers keep the topography together. All the new spaces offered by the topography are revealed by the interaction of these moving parts with the immobile layers. These spaces are indelible from topography, even if bodies leave. Because in fact, all layers of topography have traces of their past, not before. Tuan (1977) says that time is a change that leaves a mark on the space and can be read through space. Here, time is recorded on the topography. The mysterious piece of land, which newcomers go with curiosity, is actually the new space that the previous one unwittingly created while interacting with the topography (parts). This space defines new boundaries each time, according to multiple people, the inside of the first, the outside of the next. This topography, where we can witness frozen moments in infinite change, also includes the potentials of the future, whispers new places to its users at any time.

Lin, M. Y., Andrews, R., & Beardsley, J. (2006). Maya Lin: systematic landscapes. Yale University Press.

Tuan, Y. (1977). Space and Place, University of Minnesota Press, s.179-198

Zeynep- Serkan /

"The Place of Weightless Objects" (Image 7 original page-Image 8 Paper Model)

When people are tired of being amazed by these living and inanimate objects that defy gravity by defying gravity, people unravel their strings and watch them disappear. As the number of people loaded with the desire to free and destroy increases, the number of unweighted (extraordinary) objects decreases with the sounds of life. Pessimism dominates the town with a tense combination of admiration and violence. People continue to multiply by unlinking objects and themselves. The book/text brings to mind the concept of the thing-power materialism of Bennet. This grasp explains the energy of objects that he thinks might have a significant impact on people. Thing-power is located in a world where there is a line between inert material and vital energy, it is permeable between living and inanimate. This flow of energy, which human beings are able to sense, possesses of the object/material, provides intimacy with the non-human being. Although opposed to the separation of human and nonhuman things, thing-power materialism also tries to separate the human from the fetishized sense of commodity. It is against the pattern of disposable (which can be defined as watching the disappearance of extraordinary objects in the text) by American materialism. According to this concept, people are always in non-human composition, they are never outside the network or ecology. Bennet thinks that the sensitive individual, who has been able to perceive the energy of non-human, who has adopted the relationship with his environment and in some way, can somehow resist unconscious consumption today. Rather, he wants to develop a more enlightened personality in natural-cultural-and technological integrity on a story that increases the awareness of the person's world about the vitality.

Epilogue:

The relationship between literature and architecture cannot be easily described. The effort of the researchers, who produce operational formulas that one side can use for the benefit of the other, is in vain. However, it is possible to talk about similarities, interactions, or partnerships between fictional space in literature and the conceptual space of architecture. Spatiality in both fields has some common features, for example, it is reproduced by the participation of the reader/user; the multi-dimensional nature of the works in both fields enables a variety of spatial perceptions in different layers, spatiality enclosed by its time dimension, constructs a mutual language thus conveys the spirit of the age, and spatiality enables journeys between works through the references, associations, connotations.

Are these texts unique stories of thirty-three towns, or do they all tell about the same "place"? It cannot be said that the Book of Places has a direct relationship with Calvino's Invisible Cities, but we sense that there is an affinity. As Invisible Cities, with its rich spatial imagination, is the main source of a three-dimensional thought production exercise, which is frequently assigned to students in the early years of architecture-design education.

It can be said that the feature that aligns these cities/places is that the spatial experience remains on paper.

There is a place where any practice is conveyed as it turns into a narrative. This space is a “paper space”. It is Tschumi (1977) who made the first mention of the concept of paper space. It emphasizes that words and drawings cannot produce the experience of the real space, but only the paper space defines the imaginary. When we discuss the relationship between the narration in paper space and the experience, we see that this imaginary world is built on the codes of our existing space experience. Thinking these texts in 3D, producing a 3D assemblage from paper can be considered as an enriching action as it creates a meaning that the experience is reproduced.

As Jennifer Walklate states, “environments are constituted of ‘living beings’ and ‘things’ and each of these is an actant in the creation of a world”. Hence, according to Walklate, objects and their environments including human beings and other things are in the “mutual constitutiveness” which engenders “the physical, intellectual, and highly emotional relationships”.

However, from a holistic perspective, examining how human beings and things come together to constitute and express each other – for the lines between people and the objects with which they surround themselves are not always clear. Therefore, before the threads of the surrounding world can be picked apart, its weave and cloth must be examined. Writing on Orhan Pamuk’s Museum of Innocence Yin Xing defines ‘invisible values’ make the objects “an indispensable part of the human environment”. These values can be called as the ‘intangible qualities’ of the objects. Besides their ‘tangible qualities’ such as size, color, or shape defined as ‘visible values’ by Xing, their ‘intangible qualities’ bind them with the ‘quotidian’. As Xing stated, “to understand objects, in this sense, is to grasp essential clues for perceiving their invisibility, the interwoven human relations they embody.”

Encyclopedists, museum curators, photographers, and novelists all have something in common; that is, to represent their personal understandings of the objects through the process of cataloging, assembling them according to their significance, endowing the world of objects with structure, order, and readability (Xing, 2013)

When we look to the subject again in “The Book of Places”, the founding element of the text reminds “OBJECT” in three novels from the world of literature with different features. Perec’s “Things”, Pamuk’s “Museum of Innocence”, and Carey’s “Observatory Mansions” are novels in which the concepts of object-desire-memory progress with different patterns. “Memory” and “atmosphere” play a very strong/attracting role in the relationship between everyday life practices and intermediary “objects” and the production of social space. The atmosphere keeps the object in the familiar aspect of the everyday, while the memory makes the object special to us, and customizes it through the dialogue we establish with its counterparts. The visible and invisible values of objects are the constituent subject of the narrative.

The home and the street make up the scene of urban everyday life. Solitudes, encounters journeys are the actions in the stage. Daily life, established with routines, enriches with rituals and transforms with coincidences. The body that affirms the place and space is at the center of both architecture and literature. Constraints and consequent searches for alternative interpretations strengthen creativity in both architecture and literature. Memory and desire are the two most important common sources where literature and architecture are nurtured.

The reproduced representations of the narrative in literature and architecture can be considered as tools that provide the transmittance of meaning between two fields. These different areas of representation range from comic books, book covers, trying to transform the literary world's products directly into visuality, to the elaborate architectural theories and poignant manifestos that simulate architectural productions with a linguistic activity. Many times, another field of art, such as cinema, theater, dance, brings together architecture and literature, creating new intertwining connections.

Literature brings into discussion the places and cities, through its very subject, daily life. With some kind of testimony to collective memory, it not only records the existing (or fictional) but can develop a tougher and critical position that interrogates the existing state of affairs. However, this criticism is a stance that is created by the silence between the lines, carefully constructed word by word which is noticed only by the attentive eyes.

IMAGES, CHARTS OR GRAPHIC LEGENDS

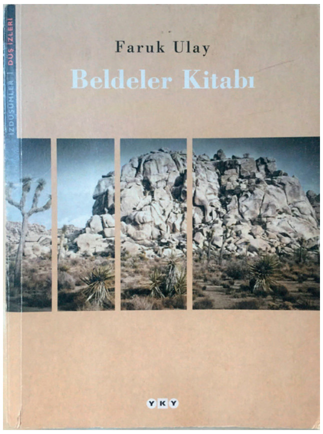
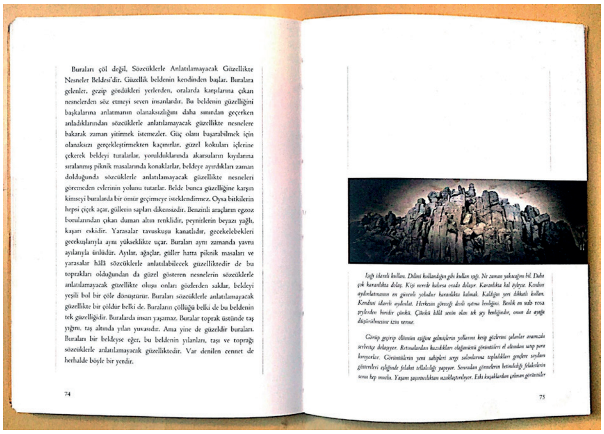


Image 1



Buraları çöl değil, Sözcüklerle Anlatılamayacak Güzellikte Nesneler Beldesi'dir. Güzellik beldenin kendinden başlar. Buralara gelenler, gezip gördükleri yerlerden, oralarda karşılarına çıkan nesnelerden söz etmeyi seven insanlardır. Bu beldenin güzelliğini başkalarına anlatmanın olanaksızlığını daha sınırdan geçerken anladıklarından sözcüklerle anlatılamayacak güzellikte nesnelere bakarak zaman yitirmek istemezler. Güç olanı başarabilmek için olanaksızı gerçekleştirmekten kaçınırlar, güzel kokuları içlerine çekerek beldeyi turalarlar, yorulduklarında akarsuların kıyılarına sıralanmış piknik masalarında konaklarlar, beldeye ayırdıkları zaman dolduğunda sözcüklerle anlatılamayacak güzellikte nesneleri göremeden evlerinin yolunu tutarlar. Belde bunca güzelliğine karşın kimseyi buralarda bir ömür geçirmeye isteklendirmez. Oysa bitkilerin hepsi çiçek açar, güllerin sapları dikensizdir. Benzinli araçların egzoz borularından çıkan duman altın renklidir, peynirlerin beyazı yağlı, kaşarı eskidir. Yarasalar tavuskuşu kanatlıdır, gecekelebekleri gecekuşlarıyla aynı yükseklikte uçar. Buraları aynı zamanda yavru ayılarıyla ünlüdür. Ayılar, ağaçlar, güller hatta piknik masaları ve yarasalar hâlâ sözcüklerle anlatılabilecek güzelliktedir de bu toprakları olduğundan da güzel gösteren nesnelerin sözcüklerle anlatılamayacak güzellikte oluşu onları gözlerden saklar, beldeyi yeşili bol bir çöle dönüştürür. Buraları sözcüklerle anlatılamayacak güzellikte bir çöldür belki de. Buraların çöllüğü belki de bu beldenin tek güzelliğidir. Buralarda insan yaşamaz. Buralar toprak üstünde taş yığını, taş altında yılan yuvasıdır. Ama yine de güzeldir buraları. Buraları bir beldeyse eğer, bu beldenin yılanları, taşı ve toprağı sözcüklerle anlatılamayacak güzelliktedir. Var denilen cennet de herhalde böyle bir yerdir.

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Işığı idareli kullan. Dilini kullandığın gibi kullan ışığı. Ne zaman yakacağını bil. Daha çok karanlıkta dolaş. Kişi nerede kalırsa orada dolaşır. Karanlıkta kal öyleyse. Kendini aydınlatmanın en güvenli yoludur karanlıkta kalmak. Kaldığın yeri dikkatli kullan. Kendini idareli aydınlat. Herkesin göreceği denli ışıtma benliğini. Benlik en sub rosa şeylerden biridir çünkü. Çünkü hâlâ senin olan tek şey benliğindir, onun da ayağa düşürülmesine izin verme.

Görüp geçirip ölümün eşiğine gelmişlerin yollarını kesip gözlerini çalanlar aramızda serbestçe dolaşıyor. Retinalardan kazıdıkları olağanüstü görüntüleri el altından satıp para kırıyorlar. Görüntülerin yeni sahipleri sergi salonlarına topladıkları gençlere saydam gösterileri eşliğinde felaket tellallığı yapıyor. Sıradan görmelerin betimlediği felaketlerin sonu hep mutlu. Yaşam şaşırtıcılıktan uzaklaştırılıyor. Eski kuşaklardan çalınan görüntüler

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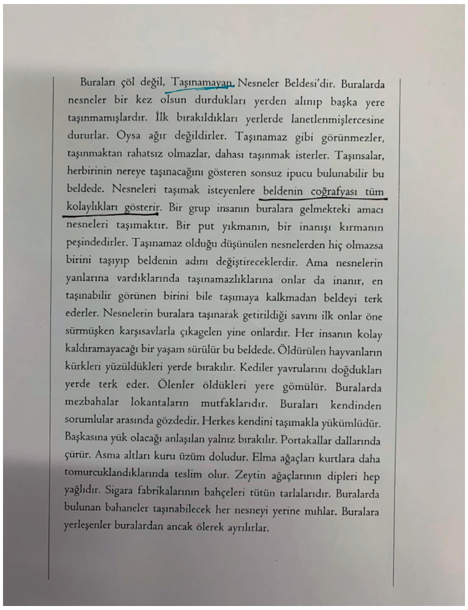
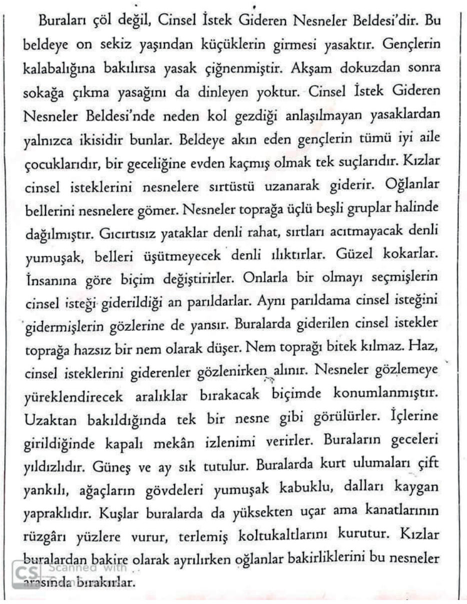
Image 2



Buraları çöl değil, Taşınamayan Nesneler Beldesi'dir. Buralarda nesneler bir kez olsun durdukları yerden alınıp başka yere taşınmamışlardır. İlk bırakıldıkları yerlerde lanetlenmişlercesine dururlar. Oysa ağır değildirler. Taşınamaz gibi görünmezler, taşınmaktan rahatsız olmazlar, dahası taşınmak isterler. Taşınsalar, herbirinin nereye taşınacağını gösteren sonsuz ipucu bulunabilir bu beldede. Nesneleri taşımak isteyenlere beldenin coğrafyası tüm kolaylıkları gösterir. Bir grup insanın buralara gelmekteki amacı nesneleri taşımaktır. Bir put yıkmanın, bir inanışı kırmanın peşindedirler. Taşınamaz olduğu düşünülen nesnelerden hiç olmazsa birini taşıyıp beldenin adını değiştireceklerdir. Ama nesnelerin yanlarına vardıklarında taşınamazlıklarına onlar da inanır, en taşınabilir görünen birini bile taşımaya kalkmadan beldeyi terk ederler. Nesnelerin buralara taşınarak getirildiği savını ilk onlar öne sürmüşken karşısavlarla çıkagelen yine onlardır. Her insanın kolay kaldıramayacağı bir yaşam sürülür bu beldede. Öldürülen hayvanların kürkleri yüzüldükleri yerde bırakılır. Kediler yavrularını doğdukları yerde terk eder. Ölenler öldükleri yere gömülür. Buralarda mezbahalar lokantaların mutfaklarıdır. Buraları kendinden sorumlular arasında gözdedir. Herkes kendini taşımakla yükümlüdür. Başkasına yük olacağı anlaşılan yalnız bırakılır. Portakallar dallarında çürür. Asma altları kuru üzüm doludur. Elma ağaçları kurtlara daha tomurcuklandıklarında teslim olur. Zeytin ağaçlarının dipleri hep yağlıdır. Sigara fabrikalarının bahçeleri tütün tarlalarıdır. Buralarda bulunan bahaneler taşınabilecek her nesneyi yerine mıhlar. Buralara yerleşenler buralardan ancak ölerek ayrılırlar.

Image 3

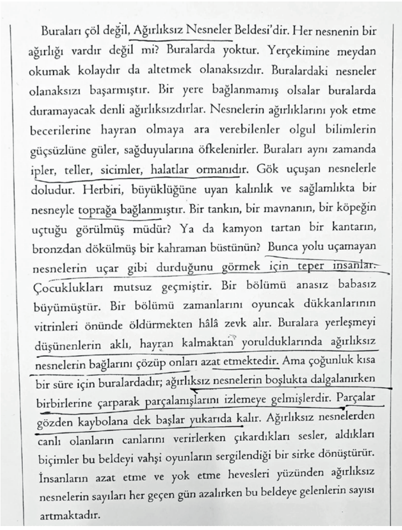
Image 4



Buraları çöl değil, Cinsel İstek Gideren Nesneler Beldesi'dir. Bu beldeye on sekiz yaşından küçüklerin girmesi yasaktır. Gençlerin kalabalığına bakılırsa yasak çiğnenmiştir. Akşam dokuzdan sonra sokağa çıkma yasağını da dinleyen yoktur. Cinsel İstek Gideren Nesneler Beldesi'nde neden kol gezdiği anlaşılmayan yasaklardan yalnızca ikisidir bunlar. Beldeye akın eden gençlerin tümü iyi aile çocuklarıdır, bir geceliğine evden kaçmış olmak tek suçlarıdır. Kızlar cinsel isteklerini nesnelere sırtüstü uzanarak giderir. Oğlanlar bellerini nesnelere gömer. Nesneler toprağa üçlü beşli gruplar halinde dağılmıştır. Gıcırtısız yataklar denli rahat, sırtları acıtmayacak denli yumuşak, belleri üşütmeyecek denli ılıktırlar. Güzel kokarlar. İnsanına göre biçim değiştirirler. Onlarla bir olmayı seçmişlerin cinsel isteği giderildiği an parıldarlar. Aynı parıldama cinsel isteğini gidermişlerin gözlerine de yansır. Buralarda giderilen cinsel istekler toprağa hazsız bir nem olarak düşer. Nem toprağı bitek kılmaz. Haz, cinsel isteklerini giderenler gözlenirken alınır. Nesneler gözlemeye yüreklendirecek aralıklar bırakacak biçimde konumlanmıştır. Uzaktan bakıldığında tek bir nesne gibi görülürler. İçlerine girildiğinde kapalı mekân izlenimi verirler. Buraların geceleri yıldızlıdır. Güneş ve ay sık tutulur. Buralarda kurt ulumaları çift yankılı, ağaçların gövdeleri yumuşak kabuklu, dalları kaygan yapraklıdır. Kuşlar buralarda da yüksekten uçar ama kanatlarının rüzgârı yüzlere vurur, terlemiş koltukaltlarını kurutur. Kızlar buralardan bakire olarak ayrılırken oğlanlar bakirliklerini bu nesneler arasında bırakırlar.

Image 5

Image 6



Buraları çöl değil, Ağırlıksız Nesneler Beldesi'dir. Her nesnenin bir ağırlığı vardır değil mi? Buralarda yoktur. Yerçekimine meydan okumak kolaydır da altetmek olanaksızdır. Buralardaki nesneler olanaksızı başarmıştır. Bir yere bağlanmamış olsalar buralarda duramayacak denli ağırlıksızdırlar. Nesnelerin ağırlıklarını yok etme becerilerine hayran olmaya ara verebilenler olgul bilimlerin güçsüzlüne güler, sağduyularına öfkelenirler. Buraları aynı zamanda ipler, teller, sicimler, halatlar ormanıdır. Gök uçuşan nesnelerle doludur. Herbiri, büyüklüğüne uyan kalınlık ve sağlamlıkta bir nesneyle toprağa bağlanmıştır. Bir tankın, bir mavnanın, bir köpeğin uçtuğu görülmüş müdür? Ya da kamyon tartan bir kantarın, bronzdan dökülmüş bir kahraman büstünün? Bunca yolu uçamayan nesnelerin uçar gibi durduğunu görmek için teper insanlar. Çocuklukları mutsuz geçmiştir. Bir bölümü anasız babasız büyümüştür. Bir bölümü zamanlarını oyuncak dükkanlarının vitrinleri önünde öldürmekten hâlâ zevk alır. Buralara yerleşmeyi düşünenlerin aklı, hayran kalmaktan yorulduklarında ağırlıksız nesnelerin bağlarını çözüp onları azat etmektedir. Ama çoğunluk kısa bir süre için buralardadır; ağırlıksız nesnelerin boşlukta dalgalanırken birbirlerine çarparak parçalanışlarını izlemeye gelmişlerdir. Parçalar gözden kaybolana dek başlar yukarıda kalır. Ağırlıksız nesnelerden canlı olanların canlarını verirlerken çıkardıkları sesler, aldıkları biçimler bu beldeyi vahşi oyunların sergilendiği bir sirke dönüştürür. İnsanların azat etme ve yok etme hevesleri yüzünden ağırlıksız nesnelerin sayıları her geçen gün azalırken bu beldeye gelenlerin sayısı artmaktadır.

Image 7

Image 8

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CHAPTER IV

urban
research
process
materiality
framework
voids
structure
paper
sugar
fragment
understanding
future
heritage
digital
areas
aspects
disruptions
city
perception
conception
perspective
qualities
representation
factories
resilience

INTRODUCTION

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We have devoted this chapter to the research papers of TOBB-ETU MArch program students. TOBB-ETU MArch program students learn the history, theory, and technology of architectural design, developing the skills and experience necessary for professional practice and the critical thinking required to create new ideas and drive invention and expand the discipline of architecture.

Presented papers are based on their ongoing/completed research and thesis work. Therefore, we allowed them an invaluable platform of converging in a book with architects, urbanists, theorists, artists, and academics from the globe to consider, debate, and dispute emerging questions in Materiality of Art of Science of Architecture. They are also allowed to articulate, propose, and defend their work to the MateriArt community and beyond.

They deserved such an award because throughout the three years of the Materiart Project's adventure, each of them contributed a lot to the materialization of the Project. We are grateful to them for the strong organic bond between the Project and the society of MateriArt.

The studies in this special chapter present a variety of case studies that are handled with fresh approaches suggesting new perspectives and methods on the ongoing issues of architectural theory, practice, and research. Written by Elif Ceren Yaşar, Zelal Öztoprak, and Nur Çağlar, "Towards a Dialogic Perspective for Urban Voids" delves into the issue that how urban voids are intertwined with the city before they return into lost spaces or patches. Parts of the cities are abandoned due to the decline of industries or institutions or migration or when buildings lost their functions because of economic, technological, political, or environmental reasons. These vacated spaces called urban voids are part of the urban experience and can potentially have a dynamic relationship with the existing urban fabric. Borrowing from Mikhail Bakhtin, "Heteroglossia" refers to the socially determined plurality of discourses; the authors argue that the cities' future can be created by "dialogism" that considers multiple points of view and the intense relationship of these spaces with its surroundings. In the study, "Dark ecology in Industrial Areas: The case of Turkish Sugar Factories," Kevser Özkul and Murat Sönmez suggest a new theoretical approach for the discussions of the future of abandoned industrial complexes of Turkish Sugar Factories that lost their original productive, social, and economic roles and are becoming obsolete brownfields. As their theoretical framework, they use the concept "Dark Ecology," coined by Timothy Morton, is a thinking system that proposes to be aware of multiple scales of life, human, society, nature, sense, etc. "A New Understanding of Resilience in Architecture: Learning from Disruptions" by Merve Nur Doğan and Zelal Öztoprak is a rethinking of the concept of "resilience" with a suggestion of a new definition of the term of "disruption" which is one of the main components of any discussion of the resilience in architecture. They propose that the term disruption, which commonly focuses on instant events' hazardous effects, should be extended to include events causing long-term consequences. They reframe the concept of resilience by posing a broader understanding, including tangible and intangible forces, and addressing long-term disruptions such as changing contexts of technical, organizational, social, and economic domains. Ömer Özgenç and Işıl Ruhi Sipahioğlu suggest a new method helping scholars to find research gaps in their field and design new courses with a map through a case study which is *ReSeARCHeS: Sustainability in Architectural Education. By reviewing a group of papers in the field, they created and visualized a network of relations that reveal* communication and interaction among studies. Authors Şeyma Nur Çalışkan and Aktan Acar in their essay"Digital Materiality of Historic Heritage Sites" explore the visual and spatial abilities of the Augmented Reality (AR) as a tool to concretize the historical, cultural, and structural information on built environments. In the essay "An Investigation of Patterns of Architectural Thinking," Defne Çakır sought an answer to the question of *how a design idea advances and changes through the processes of representation, conception, and perception.* "Structure and Fragment in Architectural Practice" by İlkiz Atabek Çelikli, Sibel Acar, and Nur Çağlar suggests a way to understand and interpret the contemporary architectural practice through its objects and images. Considering the fragment as a defining and descriptive concept in current architectural practices, they explore the relationship between the fragment and the structure. The essay focuses on the intellectual outputs of structure and fragment that construct and reconstruct themselves in a pair relationship within this context.

TOWARDS A DIALOGIC PERSPECTIVE FOR URBAN VOIDS[1]

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TOBB University of Economics and Technology, Ankara, Turkey

ABSTRACT

One of the primary purposes of urban studies is to investigate scenarios for the future of cities and how the decisions influence the urban landscape. Every decision taken by authorities changes the physical, social, economic, and political qualities and identity of the city, and these changes are reflected in the urban space and, therefore, in the urban experiences of people. These decisions are mostly taken by solely considering the tangible qualities of the urban space. However, there are also intangible aspects of urban space. This paper addresses the importance of these intangible aspects, with a particular focus on deepening urban experience.

Urban voids are an essential part of the urban experience. They are the cornerstone for urban development and the grounds for change; therefore, their design process should be considered thoroughly, together with the city organism and taking different viewpoints into account. There are two risks of not considering urban voids in such a manner: 1. These voids will become undefined areas and transform into lost spaces, 2. These voids will potentially break off from the city organism and become patches. Thus, they should be intertwined with the city before they become patches in every aspect. Only in this way will they be filled with meanings, identities, people, actions, subsequently, urban experiences.

The scope of this study is to scrutinize the potential of urban voids with the conceptual framework of Mikhail Bakhtin's theories of 'dialogy', 'carnival', and 'heteroglossia'. The Bakhtinian point of view aims to reveal a heteroglot and a dialogical perspective dominated by the carnavalesk state of urban voids. In line with this purpose, this paper aimed to bring a Bakhtinian perspective to urban voids.

KEYWORDS

Urban Void, Urban Experience, Carnival, Dialogy, Heteroglossia

1. This paper is based on the Master's thesis by Elif Ceren Yaşar, co-advisor Zelal Öztoprak and advisor Nur Çağlar, in the TOBB-ETU Graduate School of Engineering and Science, Department of Architecture.

Prologue

'Cities should open up opportunities, connect people to new people, free us from the narrow confines of tradition - in a word, the city should deepen the experience.'

(Sennett, 2017)

Cities have been continuously changing socially and physically from the time they were founded to the present. The direct or indirect effects of all social, cultural, economic, and political structures on the urban organism are perceived differently. These structures transform the city; meanwhile, the city provides the appropriate environment for transforming these structures. At the same time, the city develops with the continuity of human life, which causes changes in its organism. These changes also affect the zones populated by the active presence of the people of urban life. Different perspectives need to be developed to explore and analyze the changes transforming the city.

In the transformation of urban spaces, the relations of the users with the physical environment, their perception, and the definition of space play an important role. In his book titled *Consciousness and the Urban Experience*, Harvey claims that public demonstrations can be used as a means of urban transformation. He states that these events provide an opportunity for giving it a chance to recreate the identity of the city and thus strengthen its position in the global hierarchy (Harvey, 2016). As the center of the movement, the city provides the diversification and technological accumulation of modern society. Accordingly, the city has become a place where capitalism appears most strikingly. According to David Harvey, the city appears as the area of governments, where inequality has deepened; the principle of justice has gradually disappeared (Harvey, 1985, p. 256). In urban space, people can also communicate directly with other people and the society to which they belong; they can see, experience, and feel a sense of community. Accordingly, social formation begins in open spaces where the physical environment supports the relationship between individuals and society.

People experience urban spaces. Urban space, as an urban void, becomes meaningful with the life in it. Human relations are not independent of the spatial dimension (Harvey, 1985). However, as a result of social, economic, and political changes, some areas lose their city activities as useless and abandoned spaces. The reintegration of these areas into urban life will be possible with the urban experience of humans. Citizens in the same neighborhood meet each other in open spaces, share their experiences, socialize, and develop neighborly relations. Urban spaces shaped by the urban experience, provide the city with a multi-layered, continually changing phenomenon. The city is a multiple network system that is very dense, always open to intercourse, and always intersects. It consists of individuals with different personal characteristics that the concept of society adds to them, making different daily lives into urban space scenarios. Harvey suggests looking at the city and finding a descriptive framework to place the millions of surprises we face in the street. Harvey's view of seeing everything from above and comprehensively by looking at the city is like Horus's eye[2] Analogy and looking at the city's spaces holistically by showing the historical process and the present as a whole provides a perception of every detail in integrity (Harvey, 2016, p. 13).

People go outside of their houses in line with the needs of modern life or experience urban space. The urban experience is transformed due to social, cultural, economic, political, and technological changes in time. Following these changes, as Mitchell says, the urban environment demands a new definition of urban planning for the modern era (Mitchell, 1996, p. 8). In particular, the historical processes and the present circumstances have transformed the urban experience. In today's world, the term 'social', and thus the experience of the urban space, has changed. In his book titled *City of Bits*, William Mitchell discusses the new conditions that are brought by these changes. He describes the future city created by fiber optic cables and compares it with today's city. The city, which is in continuous transformation, reveals a changing living space and experience with the buildings used as data storage pools. Mitchell's book focuses on the scenarios developed on architectural changes, and requires the reconstruction of the concept of open space, while telecommunications and remote control allow people to experience the public space from home. The effect of even a cable in daily life changes the reason people are in urban space. For example, the number of people going to museums decreases day by day since the museums can be visited virtually. Virtual environments provide new publicity and enable discovering new places without going to urban spaces. However, urbanites still use urban spaces to meet their physical, psychological, and social needs. Because their daily routines such as cultural habits, personal development, and the interaction of people with each other and the experience of being urbanized are still experienced in urban areas, this critical role of urban areas in cities and human life continues, making cities more livable and dynamic.

In this context, urban areas are the means of transforming and reshaping the city physically, socially, and symbolically. According to Sennett, the urban area is where the city's feelings and memories are located, and it is the city's primary habitat (Sennett, 1976, p. 222). Similarly, Hannah Arendt defines these areas as the 'world' made by humans, consisting of human-made objects and shared by humans (Arendt, 1998, p. 52).

2. Eye of Horus is an ancient Egyptian symbol which means all-seeing eye.

In addition to the ongoing changes, currently, the coronavirus pandemic has changed the view of urban areas worldwide. The coronavirus, which appeared in early 2020 and spread in almost all world cities, caused people to review distances in the city and urban spaces. In this regard, the compact and high-density structure of the cities has made the need for open space a current issue. Socializing with people, blending in with the crowd, began to create a new sense of danger and vagueness. Pandemic life brought the notion of 'physical distance', which is now part of everyday life. As a consequence, the understanding of open/urban/public spaces has been questioned again.

Unlike today's conditions brought by the pandemic, in the 21st century, people performed many daily life practices outside and away from homes, such as eating and drinking, having fun, learning, and teaching, shopping, building social relations, and working. Today, these activities are being transformed into indoor activities due to the pandemic. The idea of activating open spaces underlying urban sustainability may become a current issue in the coming years because it is seen after the pandemic that people need open spaces, whether in the density of current cities. Therefore, large empty spaces where social distance can be maintained should be offered. In this current need for open spaces in cities, urban voids gain particular importance. Within the urban space, there have always been areas such as the waterfronts, roadsides, train tracks that can be considered as voids. In general, these areas are understood according to their physical and social use. There had been two different approaches to these voids: 1. Consider them as inactive, derelict, and abandoned areas and define them accordingly, like a wasteland, lost space, terrain vague or dead-zone, and 2. Approaching these areas as *grounds for change* and understanding them as potential catalysts or cornerstones for urban development.

Urban voids comprise both approaches. The term 'urban void' refers to the vacancies as well as the potential waiting for new demand and change. These voids also have the potential to create spaces that have a dynamic relationship with the existing urban fabric. The city itself is already a diverse organism, and the void is also a diverse entity. The potentials of this diversity can only be understood by developing a perspective that considers multiple scales and layers and involving as many actors as possible.

The city is diversified not only because of the rapid change and transformation processes but also due to the change of the urban experiences of urbanites. The urban voids are potentially suitable for new types of living, daily habits brought by new technologies, constructions, or other innovations, as they bridge over creative, flexible developments. In this sense, any urban void can be transformed into a *positive lost space,* so the design gives a contextual meaning derived to form its habitus (see Fig. 2). So, it is necessary to practice this from diverse perspectives. With carefully thought interventions, even the voids that became patches could be wholly transformed and filled with meanings, identities, people, actions, and urban experiences.

Considering all these, today, the urban voids and the particular experience they offer to people needs to be reconsidered. This study adopts Mikhail Bakhtin's concepts of dialogy, carnival, and heteroglossia to develop a renewed understanding of the urban void. In a Bakhtinian understanding, ways of thinking and relationships in urban areas are dialogic and heteroglot.[3] His perspective on literature is used in this study since both the novel and urban experience are fiction. Bakhtin describes the fiction in the novel through dialogic relationships between places and people. The characters, the places they live, and their ever-changing lives are part of this fiction. He organizes these relationships in the novel with its *polyphonic*[4] forms. Similarly, there is a fiction of life in the city, and people realize their experiences through this fiction. Both the novel and the urban area always contains a dialogue of diverse voices, cultural practices, and viewpoints. Today, the design and transformation processes of urban voids are mostly dominated by the authorities in a non-dialogic manner. In contrast, Bakhtin's notion of heteroglossia suggests that the reader/user should be as diverse and dialogic as possible.

In light of the preceding, first, different perspectives on urban void will be revisited. A new perspective will then be developed from the dialogism of Bakhtin, and his related notions of heteroglossia and carnival will be used to support a dialogical understanding of urban voids.

Negotiations on Urban Void

The fundamental elements that form the urban space are solids and voids. The term void has been used since the 18th century in *Nolli Map*, a primary but effective mapping method used in urban planning to analyze structured form dynamics and the unity of open space. Here, the potentials of the urban space are discussed within the theoretical framework of urban space. The void is a term that finds its place in the definitions of space. If there is no void, there is no space; it is the void that creates the space. The void can exist in the space for either physical, semantic reasons.

The void plays a significant role in the concepts of architectural space as a ground for new opportunities. Space could be perceived as a three-dimensional void covering people or shaping architectural and landscape design (Zevi, 1993). The void could transform the spatial structure in the city. It is a phenomenon that

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3. 'Heteroglossia' refers to the socially determined plurality of discourses, and 'dialogism' to follow and merge all discourses in words.
4. Bakhtin introduced the concept of dialogism (polyphony).

creates the space with all its known definitions, and that space creates the voids (Şamlıoğlu, 2010, p. 12).

The void has many expansions in the dictionary, such as containing nothing, not occupied, not inhabited, space, and many synonymous such as opening, gap, emptiness, vacuum (Merriam Webster). As Steen Rasmussen points out in his book titled *Experiencing Architecture*, architecture, and parallel disciplines are shaped by voids (Rasmussen, 1962, p. 128). The term void is common to architecture, landscape architecture, urban planning, and these disciplines are based on voids as one of the most important basic concepts for them. It affects architecture, from the very beginning of the design to spaces in large-scale urban plans. Everything that can be perceived by the human eye is part of the architecture. Therefore, when viewed on an urban scale, the term void is particularly crucial for substantial areas.

The city consists of structures that allow people to interact with each other. The urban area can be defined as the 'voids' that are the extensions spared from the structures. In this sense, it has excellent potential. Nevertheless, the void is defined by its relationship with the solid. If urban space is a combination of solid and void, it is the life in the void that defines the urban area. The urbanites own the 'empty' spaces they find, and with their experience, they can reveal or restrict the potential of these spaces as Jensen and Urry argue, "Societies are not static 'things' and 'places', but dynamic relations and networks" (Jensen & Urry, 2013). People blend into the crowd, participate in these areas. Consequently, the void is essential for the urbanites, just as urbanites are essential for the urban space.

It is important to note that urban voids are not only comprised of material qualities such as structural, physical aspects. They are also comprised of immaterial qualities, like social, mental, ethical aspects, which do not make sense alone but have many elements that can be defined concerning the habitus. In this context, urban voids should be approached with a comprehensive and holistic perspective, considering all material and immaterial aspects and the relationship between the void and the existing city fabric. This perspective would eventually eliminate the problems that make these voids intact and integrate patch areas to the city.

The displacements, redesign, and transformation areas within the existing urban structure alter the existing conditions to meet the new functions within the city's dynamic structure. Some urban areas lose their effectiveness due to these changes. These areas are mostly left behind and abandoned since they do not address the urbanities' current needs. As such, these voids enter a waiting process. During this process, people usually cannot get through these voids, and this interrupts their urban experience and creates patches in their minds. These voids may both limit movements within that society and create boundaries. Accordingly, urban spaces may become *lost spaces*, as Roger Trancik calls them. Trancik defines lost spaces as areas that have collapsed by losing their function or functionality, leading to the transformation of their environment as a problem for some areas. According to Trancik, decisions about the manner of growth are made on two-dimensional plans, and in the third dimension, the relationships between buildings, spaces, and human behaviors are not considered in the real sense. Within this general functioning, urban space is rarely seen as an outer volume with features of form and scale, and as such, many anti-spaces emerge (Trancik, 1986, p. 4).

There are various urban voids in the modern world. Some of them are abandoned, vacant, or terrain spaces. Most of them are located in the city center because of the high development rate of the cities. As Trancik mentions, modern cities have many lost or unused areas in city centers and that the drastic changes in economy, industry, and employment in the past years have made this area problem in urban centers worsen (Trancik, 1986, p. 1). Some places that are not accessible to urban people are now becoming lost spaces because they are not changed, or are not part of the urban experience. As a result, urban tissue in people's minds is being torn apart.

Urban space, which changes and transforms over time, brings new definitions spatially. For example, a bridge is an urban element that will help people move from one place to another. However, when it occurs, it also creates a spatial situation that is not like itself; under the bridge. While the bridges are functional spaces for urban life, *under the bridge* appears as a terrain, a dangerous place that needs improvement. Old factories, abandoned metro stations, highway edges, tunnels, urban spaces, and parks have similar spatial quality. When focused on the common aspects of such places, it is remarkable that almost all of them are dysfunctional places for the city, and they have different potentials for the people despite being uncanny and irritating. Besides, this uncanniness is often encountered legitimization in the reproduction of the city based on benefit and rent. These ambiguous areas are renewed and rehabilitated because they are 'old', 'dangerous', and 'useless', and acquire new functions that look for 'public interest'.

In this regard, the Spanish architect Ignasi De Solà-Morales described these areas as *terrain vague*, stating that the absence of use and activity in these areas has a positive relationship with the sense of freedom and the expectation of future possibilities (De Solà-Morales, 1995, p. 119). He emphasized that the evacuated areas in question can be evaluated with different motivations with their current potential. This approach of Morales led to the discussion of new potentials regarding terrain vague. Solà-Morales discusses the potential for large spaces, concerning the state of 'reuniting' the city's experiences by transforming these places into rebuilt spaces (De Solà-Morales, 1995).

Terrain vague offers creative and innovative spaces that produce their meaning with their relationships. These areas are considered as potential due to the new experiences and unpredictability they provide. In these areas, different approaches may be possible, where they will continue their existence by hosting new urban experiences without destroying the free parties arising from the uncertainty in the areas, the diversity of the areas, and the past layers.

Urbanity is open to new types, new encounters, and differences. The changes that occur with the cities' external dynamics eliminate each city's unique contexts and reflect its identity. As the same dynamics inspire the new spaces that emerge, cities that are day by day resembling one another more 'non-places'. Marc Augé defines these spaces, which appear in different parts of the world and in different time zones similarly, and that creates their context outside of the urban context, as 'non-place' (Auge & Howe, 1995). The globalized world produces many non-places. These non-places do not integrate with existing places, and they stand apart; no emotional and contextual connection is established with their surroundings. These areas can be exemplified as airlines, railways, highways, and the vehicles going above them and their stations, airports, train stations, hotels, supermarkets, big shopping malls, big amusement parks, internet cafes, and the like.

All these urban areas consisting of the daily urban experience provide the city with a multi-layered, continually changing, and moving phenomenon according to the functions defined by the city. The urban area as a multiple network system is quite dense, always open to intersect with one another. It consists of individuals with different personal characteristics that the concept of society adds to them, making different daily lives into urban area scenarios. In this regard, there is an urban area for the urban individual in the leading role of every city scenario, and an urban space open to everyday use, which relieves from the monologue structure of the place. Each layer that constitutes the urban fabric also defines places of encounter for the individuals and the urban life that provides continuity to the cities.

The presence of voids defined by architectural elements can be seen in various scales, from large urban areas such as urban parks or squares to small courtyards. The design is not enough by itself to create quality living spaces in urban voids. As mentioned before, designing new urban voids or intervening in the existing ones requires a holistic perspective and a comprehensive approach. Particularly in existing urban voids, any intervention should consider both tangible and intangible aspects of the area. If the vacated areas in existing voids are aimed at intertwining with urban life again, it is necessary to change the way people look at the conditions of the day because the way of thinking and relationship between these voids are multifaceted multi-layered.

In some cases, even if the larger voids emerge as a result of some adverse developments, they become tools for deepening the urban experience and positively affecting urban life. For example, the 18 years since the U.S. attack on the north and south towers of the World Trade Centre in New York City have created a completely different habitat. The new urban area was instrumental in deepening the urban experience created by the traces left behind by the towers in the monument that would represent the destruction of the World Trade Centre. Approaches to urban voids like this result in the city continuing its practices through permanent networks and creating an environment that is compatible with the whole. In this respect, the designed spaces are directly related to the enduring connections between urban life and space.

Current urban transformation examples show that they are mostly planned independently of the existing structure, without considering multiple dimensions. These areas mostly fail to function and become lost spaces. The transformation of the voids into lost and unused areas leads to disruption in people's minds. Patches emerge in inner-city movements. Urban voids in the city become independent of each other, and pedestrian movements will possibly be stopped between focal points. These lost spaces, which have undergone their effectiveness, continue to exist as hidden potentials in the city and await the opportunity to be discovered and re-participate in urban life. In this context, for the transformation of urban voids, both tangible and intangible relations and structures should be thoroughly discussed. Only in this way can social, economic, ecological, and socio-cultural sustainability be achieved.

A New Dialogical Urban Void

As presented, urban voids are approached in many ways. However, these approaches hardly respond to today's cities' needs, which are produced by the interaction of a multitude of different voices, intentions, and actions. As a result of this interaction, the boundaries, distinctions, and limitations within the cities are stabilized continuously and destabilized. Accordingly, the urban experience is economically, socially, politically, and physically dialogic than ever. In this multiplicity of spaces, users, and experience, urban voids gain particular importance and need to be reconsidered.

Bakhtin's work is particularly relevant to the study of urban voids, especially when considering the multiplicity and diversity described above. His work focuses on diversity, freedom, and normlessness. His concept of heteroglossia advocates that the reader/user/designer should be as diverse as possible. In line with this, as Bakhtin conceptualizes, a spatial carnival atmosphere offers a promising way of deepening the urban experience.

Bakhtin suggests that text should be handled with its historical, cultural, and sociological dimensions. In parallel, it is possible with Bakhtin's perspective to transform urban voids into useful and practical spaces that integrate into the city. According to Bakhtin, the writer establishes a 'dialogue' with a text itself and its environment. He writes:

> "Authorial speech, the speeches of narrators, inserted genres, the speech of characters are merely those fundamental compositional unities with whose help heteroglossia can enter the novel; each of them permits a multiplicity of Social voices and a wide variety of their links and interrelationships" (Bakhtin, 1981, p. 263).

The more a text is related to other texts in a dialogic relationship, the more heteroglot it is. Similarly, the more intense the relationship between the city and urban voids, the more heteroglot the urban void is. According to Bakhtin, the most dialogical and heteroglot type is the novel. The whole of the novel includes whole out of heteroglot elements (Bakhtin, 1981, p. 263), and the whole of the city includes diverse organisms. Because the novel is a set of interactions that can open up to different discourses, it is possible to experience intense interactions between events, people, places, and time in Bakhtin's concepts in urban spaces. In this line of thinking, urban voids could promote multiple points of view (dialogic) and interact with their surroundings (heteroglossia) and free (carnival) spaces. According to Bakhtin, a carnival is a form of performance in which the boundaries between actors and audiences disappear, social class and behavior types, and social norms are insignificant. Carnivals create an atmosphere of celebration, joy, and entertainment where the place is human-orienting. He sees the carnival as an affirmative, liberating, and creative force (Bakhtin, 2001, p. 109).

Until the second half of the 17th century, carnivalization was the carnival itself. In this sense, "people were direct participants of carnival acts and still live directly inside the carnival" (Bakhtin, 2001). In Bakhtin's texts, the idea of the carnival is closely linked to the 'urban square', which is defined as the most crucial scene for the nature of all carnival events. According to Bakhtin, the concept of carnival "lost its true meaning as a communal show in the urban square, while disruption and disintegration in carnival understanding and carnivals around the world disappeared" (Bakhtin, 2001). However, the idea of carnival provides a significant opportunity for deepening urban experience. The diversity it contains may potentially result in participating in future decisions, or voids can turn into a carnival environment where almost everyone from the city takes part. These areas can be the moments when a 'carnival' environment is formed in urban life.

Transforming the voids into 'carnival' environments leads to dynamic relationships with the adjacent urban fabric. In this way, these voids will be suitable for new technologies, constructions, or other innovations, as they bridge over creative and flexible developments. Today, urban life is quite diverse in economic, social, political, and physical aspects. It is a pluralistic and non-diminishing diversity that increases day by day. It became almost impossible to think of the city and its environment, the urbanites, and their relations as singular. As the city develops, its diversity increases. There are many different engagements in the city. People have different lifestyles, cultural, educational, and developmental levels. Therefore, their perspectives are very different from each other. In all this diversity, the viewpoint that can meet the wishes, desires, and expectations of all is *dialogical*.

Bakhtin writes for dialogy; “Every moment of the story has a conscious relationship set against them dialogically: one point of view opposed to another, one evaluation opposed to another, one accent opposed to another” (Bakhtin, 1981, p. 314). In line with Bakhtin, urban voids cannot be approached from a singular perspective. The design process of these voids should include many actors, such as the users, authority, people who want to make a profit, or legal responsibilities. A dialogic understanding of these voids supports such multiplicity and diversity.[5]

Architects and urban planners need to conduct design processes concerning the users’ needs and requirements and the common interests of as many people as possible. Similar to the Bakhtinian heteroglossia, which is dynamic, alive, and developing, a designed or constructed space continues to be structured and shaped by the influence of countless human relationships and daily life practices belonging to the individuals.

Epilogue

Urban voids are essential for cities. They have been the elements that supported deepening the experience in cities down the ages. It is necessary to reconsider these voids in today’s rapidly changing and dialogic world. The understanding of urban voids, their design, redevelopment, relocation, and such issues should be handled in a comprehensive and holistic perspective, including all related actors. In this regard, it is essential to scrutinize urban voids’ physical and social geography and their relationship with the city organism.

Today, daily routines are also changing and thus affecting the urban experience. Understanding the impact of each development and building new urban living practices is necessary to embrace these changes and support the urban experience. In some cases, like the pandemic mentioned above, changes in urban patterns transform

5. Nur Çağlar and Adnan Aksu understand dialogy as the relations between structures that contain plurality. For more information, please see Çağlar, N. and Aksu, A. Diptych III: Associations at https://www.materiart.org/glossary-diptych-iii.

urban voids like circles drawn in the parks. In others, changes in urban voids transform the city and urban experience. The removal of the military areas outside the city proceeding with the attempted coup on 15 July 2016 Turkey is an example. The vacant lands that are the remains of these areas have emerged as possible alternative urban spaces. Their transformation will possibly be a matter of dispute in the future, leading to a big difference in public life. Therefore, the material and immaterial aspects of urban spaces should be studied thoroughly. It should not be forgotten that the redesign and integration of these areas into the city fabric will go beyond repairing the urban landscape and offer to brand new possibilities to deepen the urban experience.

*F*As a consequence, urban voids' interventions profoundly affect the city and urban experience; therefore, they must be thoroughly examined. In this study, Bakhtin's concepts of 'dialogue', 'carnival', and 'heteroglossia' are related to developing a renewed understanding of urban spaces. The Bakhtinian point of view aims to reveal a heteroglot and a dialogic perspective dominated by the carnivalesque state of urban voids. These concepts are considered worthy of urban voids as they are the ground for change and a catalyst or benchmark for urban development. Change is inevitable in today's world, but the city organism must fulfill this duty. If urban voids are not considered thoroughly, they will potentially break off from the city organism and become patches. Thus, they should be intertwined with the city before they become patches in every aspect. Only in this way will they be filled with meanings, identities, people, actions, subsequently, urban experiences.

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IMAGES, CHARTS OR GRAPHIC LEGENDS

Figure 1: White circles promote social distancing on Domino Park grass, New York, 2020. (Source: https://www.dezeen.com/2020/05/20/social-distancing-circles-domino-park-brooklyn/. Retrieved at: 19.08.2020).

Figure 2: The urban void before and after the fall of the Berlin Wall (2018) (Source: https://www.spiegel.de/international/germany/history-comes-full-circle-before-and-after-photos-of-the-berlin-wall-a-1191495.html. Retrieved at 19.08.2020).

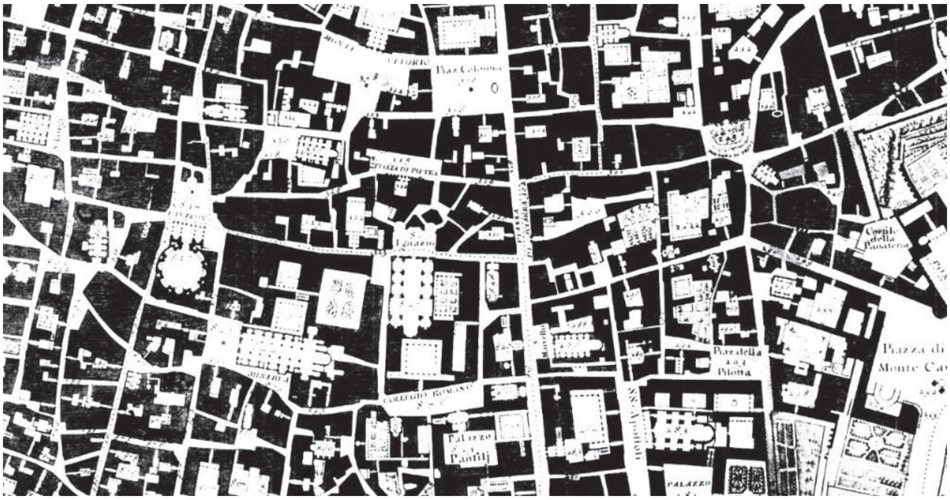

Figure 3: Detail of the Nolli Map of Rome (1748) (Source: https://www.researchgate.net/figure/Detail-of-the-Nolli-Map-of-Rome-1748_fig1_312244722. Retrieved at 19.08.2020)

Figure 4: New World Trade Center View, 2020. (Source: https://www.dezeen.com/2020/01/21/foster-partners-two-world-trade-center-design-to-replace-bigs-stacked-tower/. Retrieved at 19.08.2020)

Figure 5: Military Areas of Ankara. Collages created by the students of the Department of Architecture at TOBB University of Economics and Technology. (2016-2017 Fall Semester speculations of Studio 5 focused on the transformation of the military zones in Ankara. Studio 5 was conducted by Nur Çağlar, Zelal Öztoprak and Işıl Ruhi-Sipahioğlu, between 2015 and 2018.) (Source: http://studio5.etu.edu.tr/en/category/archive/2016-2017-en/2016-2017-fall/, retrieved at 19.08.2020)

DARK ECOLOGY IN INDUSTRIAL AREAS: THE CASE OF TURKISH SUGAR FACTORIES

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ABSTRACT
The sugar industry is one of the most important representatives of industrialization and modernization in Turkey. Sugar Factories have become the tools of urban and social transformation and developed the regions where they are established. But, over time, the ideologies that formed sugar factories decayed. Such a decay could be caused by reasons such as the lack of adaptation to the changing economic and technological conditions in a short time, the restriction of sugar production with the amendments made to the law, the inability to maintain the continuity of the modern daily life in the campus areas. In this respect, this study is to discuss the dark-depression faced by the sugar industry theoretically within the framework of Timothy Morton's concept of Dark Ecology. This phenomenon is developed from ecological awareness and is dark-depressing. This concept is a way of thinking about future coexistence called Dark Ecology. Sugar factories will become inactive and turn into brownfields as an inevitable end of all industrial areas such as the Ruhr region in Germany and Docklands in England. When the day of this inactivity comes, methods of accepting the dark sides of these areas and living with them have to be found. With this discussion, the uncertain future of sugar factories, which are the places of industrialization and modernization, will be approached with the new-dark perspective created by Timothy Morton. Thus, it will be possible to contribute to the infrastructure for the future of the areas theoretically.

KEYWORDS
Sugar factories, dark ecology, industrialization, modernization, industrial areas

Introduction

Turkish Sugar factories were established to provide sugar production with national capital and to strengthen the economy of the country. However, factory settlements have played an important role in gaining a modern identity of cities and towns by going beyond being mere production venues. In this context, campus areas can be considered as places of industrialization and modernization due to the developing structure types, materials used, design approaches, and social life qualities offered within the campus.

Sugar factories, which had economic and social gains during the establishment period, faced economic and political problems over time and lost their existing ideologies. It has lost its economic gains due to spatial and functional inadequacies experienced as a result of technological developments; its social gains due to the inability to capture the pace of modernization experienced throughout the world and the inability to maintain the continuity of cultural organizations. Because of these reasons, sugar factories were included in the scope of privatization and faced the threat of extinction. In addition, some of the industrial areas remained within the residential areas as a result of uncontrolled urbanization and were spatially trapped. As a result of all such problems, uncertainties emerged in the planning for the future of the Sugar Factory campus areas. Understanding the depreciation of these areas within the contemporary context in detail has the potential to eliminate future uncertainties. At this point, with Timothy Morton's concept of "Dark Ecology", the depreciation of these fields is discussed in a theoretical framework.

According to Morton, an area that has existed in the past should not be kept away from everyday life when faced with problems such as decay and deterioration of its integrity. In other words, it is argued that the built environment and ecology of these areas should continue to exist within life and the methods of such coexistence should be sought. In this context, solutions should be developed to the problems Sugar Factories have been facing and the methods of maintaining their existence in urban life should be sought. At this point, in this study, the infrastructure tools of redefining the place of sugar factories in urban life are discussed since they had failed to maintain the integrity of the area by losing its function due to the inadequate production, which appeared as an annuity space for self-interest.

The History of Turkey Sugar Factories

In Turkey, the Republican regime has given a national character to the attempts of establishing the sugar industry. The national identity, which is essential for the survival of such enterprises, has been the target of the first movements leading to the accreditation of the sugar industry through the wide economic opportunities opened by the Lausanne Peace Agreement signed on 24/7/1923 (Turan, 1958).

> *"The Government of the Republic of Turkey, on 3/2/1925, sent a law to the Grand National Assembly to take measures to encourage the development of the sugar industry and to ensure the industrialization has made an important contribution in our history and the sugar industry has given the goal and awareness of a formation"* (Turan, 1958).

It is obvious that Law No. 601 of 5/4/1925 had an important influence on the wake of the sugar industry and the industrialization movement and its relation to the national identity. The construction of the Sugar Factories, which are the proofs of the industrialization process, has started. Sugar factories made significant contributions to urban identities in the period they were established. The factories have become not only the development of the industry but also the representation of modernization throughout the country. In that period (1923-1950), a radical modernity project was applied in Turkey (Tekeli & İlkin, 2010, p. 12)[1].

The history of Turkish Sugar Factories starts with the first domestic sugar production on November 26, 1926, with the opening of the Alpullu Sugar Factory (Figure 1). Immediately afterward, on 17 December 1926, Uşak Sugar Factory was opened. After these two factories, the Eskişehir Sugar Factory and Turhal Sugar Factory were established on 5 December 1933, and on 20 October 1934 respectively (Veldet, 1958). For the coordination of these four factories, Turkey Sugar Factories Corporation (Turkish Sugar) was established in 1935. The purpose of this institution was to establish and operate Sugar Factories, to make by-products out of sugar production, to engage in the related industry, and to manufacture machinery by using contemporary technology (Sanayi ve Teknoloji Bakanlığı, 1973, p. 97). The Sugar Industry Extension Program was prepared in 1951 to develop the sugar industry. As a part of this program, eleven new Sugar Factories were built and started production. In 1960, the number of factories reached 15, 30 in 2000 and 33 in 2010 (Table 1) (Şeker-İş Sendikası, 2011). The function of the Sugar Factories was to produce sugar by processing the produced beet. These factories, where advanced technologies are used, carried out their duties as a training institution

1. Turkey's modernization efforts were occurred like the backward modernity project between 1839-1923, radical modernity project between 1923-1950, populist modernity project between 1950-1980 and the abrasion of the modernity project from 1980 to these days.

where technicians developed their skills and knowledge in the work. The operations of the sugar industry require a wide range of machinery and equipment along with continuous maintenance. Therefore, large capacity machinery repair, maintenance, and manufacturing factories and workshops were established within the sugar industry. These factories and workshops have developed so advanced that they produced almost all of the machinery and equipment of recently established Ankara and Kastamonu Sugar Factories and have reached a level where they support other industries (Sanayi ve Teknoloji Bakanlığı, 1973, p. 102).

With the developments in science and technology along with the industrialization, the formation of a more complicated division of labor became inevitable. Thus, society needed large-scale social organizations to support industrialization. Sugar Factories have also contributed to the development of many different sectors in a newly developing country. For example, private enterprise, statism, protectionism, cooperatives, national economics, economic activities, social policy are remarkable fields on issues related to human relations in terms of the sugar industry of Turkey's history (Turan, 1958, p. 8). Moreover, with these technical and social benefits, it has become one of the most important areas in the history of industrialization and modernization of the country. By means of the achievements of the Turkey Sugar industry, these factories can be considered as the implementation areas of the idea of the modern industrial city throughout the country. To achieve this multi-faceted development, the efficiency of each step was ensured at the highest level. In a country, the most natural and appropriate industrial institutions are industrial branches that are dependent on raw material from its soil, taking the strength from their own productiveness and are based on their own resources. The establishment of the sugar industry in Turkey, due to the rich agricultural conditions and opportunities, is a natural result of agricultural traditions of Anatolia (Şeker-İş Sendikası, 2011, p. 1). Using such advanced technological developments has led the sugar industry to a state where it becomes one of the most important sectors that increase the level of agricultural knowledge, provide employment opportunities for all employees and their families, and maintain the population of rural areas (Şeker-İş Sendikası, 2011, p. 2). Also, the factory campus areas have units for production such as sugar warehouses, workshops, office/administration building, workers' pavilions, automobile, and locomotive garages, weighbridge, ramps, railway line, highways and squares, water, sewage, and electrical installations. Additionally, they have units for social and daily life such as restaurants, cinemas, and guest houses, mosque, canteens, and retail stores, civil servants and craftsmen, educational units (nursery, primary, secondary and high school) health structures (hospitals, infirmary, etc.), sports fields (football, basketball, tennis, golf, swimming pool, etc.) (Turan, 1958).

Scientific organizations and organic solidarity areas in Turkey can be considered as Sugar Factories due to daily life on campus based on constant motion and mutual support. While the workers and officers worked at the factory, their families lived in lodgings and their children went to schools on campus (Figure 2). At the end of working hours, they gathered and socialized in public areas, such as the film screenings and theatre play that were held (Figure 3). The families of the employees attended the courses opened within the factory and developed themselves culturally. Furthermore, proms were held on certain special occasions, and a modern way of life far beyond its period was lived on campus.

The Achievements of Sugar Factories

Sugar Institute is the first versatile, spatial, and social organization for new modern architecture. In this way, these initiatives have reconstructed cultural identity and community, and the social structure in the Republic of Turkey. Sugar Factories have made many positive contributions to the regions in which they were established throughout the country. If we classify these contributions as technical and social;

Technical achievements:

- To meet the growing sugar needs of Turkey
- Reducing imports by supporting domestic production,
- Conducting scientific studies through established laboratories,
- The use of modern techniques and technological machines in sugar beet farming,
- To provide significant contributions to Turkey's industrialization and modernization,
- Development of advanced agricultural techniques (irrigated farming was brought to Anatolia with sugar agriculture),
- The machinery and engine factories established within the sugar factories to support the production units are also beneficial to factories belonging to other sectors,
- Dissemination of modern architectural approaches throughout the country by using contemporary construction techniques,
- Establishment of companies for large-scale organizations (Sugar Insurance A.P., Şekerbank A.P., Coal Enterprises A.P., etc.),
- Sustainable regulation of the internal dynamics of the production organization (use of the pulp, which has become idle as a result of processing sugar beet, as animal feed and the production of meat and dairy products from these animals, etc.).

Social achievements:

- To provide accommodation and basic needs to all individuals working in the factory,
- The educational facilities such as primary and secondary education and the courses such as music and painting for the children of the employees and the people of the region,
- Opening of educational and informative courses for employees' wife (evening girl's art school in Turhal Sugar Factory),
- Film screenings in the cinema hall to strengthen social relations (very high quality and new movies of Istanbul was screened in the movie theaters of the factories in the most remote corners of the country, provided that they change once or twice a week (Tarus, 2018, p. 22),
- The most living spaces in the factory are the assembly rooms after the cinema. These places were used for ball, festivities, trade union activities, congresses, and crowded meetings (Tarus, 2018, p. 22),
- Within the scope of modernization efforts, the organization of ball, music concerts, and theater performances in a la carte restaurants,
- The guesthouse structures in the campus area decorated with modern furniture for guests coming from upstate or abroad,
- Factory employees and their families benefit from meat, dairy products, and fruit vegetables produced in farms and orchards established outside campus areas,
- Providing employment opportunities for employees' children (training the girls in the accounting department or training the boys in the labor scales department),
- Training professional athletes (archery, tennis, football teams, wrestling between factories) (Figure 4),
- Application of different sports (swimming pool, mini-golf course) in regions where climatic conditions are suitable (Figure 5),
- Availability of health services such as hospitals and infirmaries in the campus area,
- Preventing problems such as internal migration and terrorism, particularly in Eastern Anatolia,
- Publishing books, magazines, articles to emphasize the importance of sugar factories in the modernization and industrialization history in Turkey (30 years in Turkey Sugar Industry book, Şeker (1951, November), Pancar (1951, October), etc.).

Dark Ecology: The New Perspective

The sugar industry has been encountering many different threats, especially for the last 20 years. Factory areas lost their past values because of campus areas staying in the city center, being considered as rent areas, quota applications for sugar production, etc. The situation of these areas is full of darkness. At this point, a new perspective is required to eliminate uncertainties about the future of these areas. To define such ambiguity more clearly, Timothy Morton introduced the concept of Dark ecology.

By using the existing methods of acquiring knowledge, our understanding of the present and the future can be clarified, yet in the present situation, these methods are not enough. New perspectives and methods should be developed to better comprehend the present and to discover different possibilities regarding the future. At this point, Morton's dark ecology could be a new perspective for such cases. Dark ecology is developed from ecological awareness and is dark-depressing, which is a way of thinking about the future in coexistence (Morton, 2016, p. 1). The fact that once called nature or environment has become idle due to a number of reasons such as deterioration, decay, or unavailability, should not be a separate case in living space (Morton, 2016, p. 5). Dark ecology directs us to multilateral thinking systems such as "life", "human", "society", "nature", "sense" etc. According to Morton, this phenomenon discusses the concertedness to ecological truth more exact than in daily life which includes the academy, media, and society (Morton, 2016, p. 159). Morton, in his "Ecology without Nature: Rethinking Environmental Aesthetics", has rediscovered the ecological debate and has developed a new critical language that leads to developing a new way of doing ecological criticism. Ecology without nature argues that the very idea of nature will have to disappear in an ecological condition of human society. This paradoxical situation, which is defined as dark ecology, tries to make ecological culture superior to the forms of philosophy, politics, and art. Dark ecology not only talks about plants, animals, and the weather but also investigates all types of thinking about place and space. And it also includes specific text, writers, composers, and artists. The first stage is an exploration of environmental art. And in the second stage, as Morton mentions, the ideology and history of beliefs, practices, and concepts gather current affairs about the environment in all its parts of culture such as, from experimental noise music to wildlife club calendars. In the last stage finds out different ways of taking an artistic stand on environmental problems. The book progresses from an abstract discussion to a series of attempts to determine exactly what our connection to environmental art and culture could be, as social, political existence (Morton, 2007).

Morton visited the industrial city of Nikel, located on the border of Norway, to examine the reflections of the dark ecology concept in industrial areas. The classical Western idea of landscape implies the opinion that “humans” and “glance” should be evaluated separately. But Morton has changed this idea deeply with the concept of dark ecology. According to him, the environment that once existed in nature and ecology can no longer exist outside the social sphere. The natural environment has been changed by humans so that it can no more be affected by the production and consumption societies. As a result, the human sphere and ecology are deeply surrounded by each other. It has become commonplace to control the world with all its resources, to use it for its own benefit, and to make basic criticisms of the information argument (Janike & Hemmersam, 2018, p. 95). Within the framework of the dark ecology, fundamental changes have taken place in nature, and the ecological environment has completely changed as industrial areas have built. According to Morton, the natural environment has gained a new definition and has become the place of production and communication. The ecology of these areas can now be defined not only by natural conditions such as vegetation, animals, weather but also by including everything produced by humans.

The Dark Realm: Sugar Factories

Although Sugar Factories had many achievements in various aspects of life in the past, they are facing many problems and threats today and these threats are now a part of its ecology. The detailed investigation of the causes that lead to a transformation of the factories and lifestyles into dark depressing might support the exploration of the potential design ideas for the future reconstruction of such areas. In Turkey, one of the industrial areas that remained in the city centers is the sugar industry. Today, factory campuses located in areas with high rent potential in urban centers face different problems. Also, these problems are increasing due to a number of reasons such as failure to meet supply-demand balance, being unable to maintain their economic efficiency, to decrease sugar beet quotas, not to keep up with technological developments. Sugar Factories have been active in production as depending on Turkey Sugar Factories Inc., from 1935 to date. For the European Union membership process, TSFAS was subjected to the new sugar law numbered 4634 issued in 2001. With this process, production restrictions were imposed on the sugar industry and other related sectors, thereby paving the way for the privatization process. While the production was determined according to the domestic supply-demand balance before the law numbered 4634, with this law, structural changes were made, which led to the transition to the alternative products (starch-based products). In this context, the biggest change made by the law is that beet cultivation quotas that have been transferred to alternative products included in the market. The purchase quota of TSFC has been narrowed and it has been decided to fulfill the empty quota with products such as corn, sunflower, soybean. Such transition has accelerated because of the decrease in sugar beet purchase prices and to decrease production incentives determined by the Council of Ministers (Taşdoğan & Taşdoğan, 2012, p. 61).

The sugar industry, which has a history of about 84 years, has been taken from the status of "state economic state organization" to the scope and program of privatization with the Law No. 4046 on privatization applications on 24/11/1994. After this process, a rapid privatization process was started by citing reasons such as the factories were operating with incomplete capacity and not making profit In the decision dated 12/08/2008 and numbered 2008/50 of OYK's concerning TSFAS's privatization program, it was planned that TSFAS would be privatized as portfolio groups.

These portfolio groups as geographically based are;

- Portfolio A: Kars, Erciş, Ağrı, Muş ve Erzurum,
- Portfolio B: Elazığ, Malatya, Erzincan ve Elbistan,
- Portfolio C: Kastamonu, Kırşehir, Turhal, Yozgat, Çorum ve
- Portfolio D: Bor, Ereğli ve Ilgın,
- Portfolio E: Uşak, Alpullu, Burdur, Afyon ve Susurluk,
- Portfolio F: Eskişehir ve Ankara Sugar Factories

Although there is a production requirement for all factories to be sold or sold under privatization, the future of these areas is quite uncertain. This practice, which seems harmless at first, may have negative consequences in the long run. As a result of profit and loss comparisons, sugar industry areas that remain in the free market are in danger of being eliminated due to their position in the city center carrying annuities. In the event of such a possible scenario, the problems likely to be caused by this dangerous situation that would take place in chains and cause problems across the country can be listed as follows;

- Since the Sugar Industry economy is primarily a field based on agriculture, farmers will be the first to be affected by this process.
- If the farmer leaves the farmlands, many families who lost their income source in Anatolia will have to migrate to the cities.
- This situation threatens the sustainability of existing rural life.

- In the long term, environmental problems related to water and soil will be encountered in areas where agriculture is not practiced.
- Foreign dependence of a country that does not provide its own adequacy in terms of production will become inevitable.
- Unemployment will increase with the end of the sector, which provides employment opportunities to 10 million people directly and indirectly.
- With an annual sales volume of approximately 3 billion TL, its contribution to the country's economy will be reduced.
- Because of the quota for sugar production, the sugar needs of the people will be supplied on a starch basis and in this case will directly affect the public health.
- As a result of uncontrolled urbanization, campus areas that remain in high-income positions in urban centers will become areas where self-interest can be applied.
- The uncontrolled destruction of the structures in the campus areas will erase the traces of their architectural identity and cultural values in history.
- Research and development activities in the field of agriculture and industry that have been ongoing for many years and were based on their own internal experience will be ceased. (Şeker-İş Sendikası, 2011, pp. 174-194).

Sugar factories turned into a dark area with current threats and future potential problems. State authorities claim that this dark situation will be solved by including factories within the scope of privatization. But this method only serves the interests of certain legal entities. Solution suggestions regarding the future of the areas should be constructed with sustainable solutions, which take the foundation period achievements as an example and include current architecture discussions. The organization of the future situation might be possible by making the correct redefinition of the nature of Sugar Factories.

Conclusion

If we examine the dark ecology in terms of Sugar Factories, the campus areas, which have a magnificent ecological cycle in themselves, have lost their current features with many threats they encounter. As a result of the deterioration in the ecological cycle, daily life balances of campus areas changed and lost their value. Questions about the evolutionary processes of all these dark ecologies, their current potential, the future ecological cycle of the areas should be answered. At this point, the discourse brought by this way of thinking is that we should not ignore these areas and continue to exist together with those areas. We cannot keep these areas out of the life cycle, or we cannot remove the ecology it creates in its inner world from everyday life.

Sugar Factories changed the regions in which they were established ecologically, sociologically, and culturally. In this case, the ecology definition of the areas in which factories are established must be changed and evaluated together with the existing nature and other concepts that participate in it along with the social organization. In other words, while the areas in question consisted only of the natural environment, the current definition of Ecology changed with the construction of the factories. Now, the ecology of factories should be redefined with their current production, social life, and the problems they face. As a result, redefining the Sugar Factories under the current conditions may form the basis of the future approaches of the areas. Sugar Factories are now a combination of abstract, tangible heritage, and present-day darkness. If this paradoxical situation can be built together, design approaches that belong to these areas will develop both compatible with the establishment regions, and not contradicting the past value.

IMAGES, CHARTS OR GRAPHIC LEGENDS

Figure 1: Alpullu Sugar Factory campus area
(Source: Archive of TOBB ETU Department of Architecture).

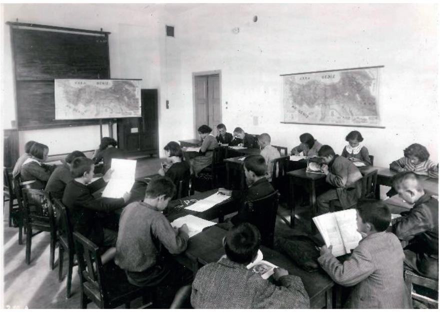

Figure 2: Alpullu Sugar Factory, Primary School (Source: Archive of TOBB ETU Department of Architecture).

Figure 3: Alpullu Sugar Factory, Film Theater School (Source: Archive of TOBB ETU Department of Architecture).

Figure 4: Turhal Sugar Factory, Swimming Pool (Source: Archive of TOBB ETU Department of Architecture).

Figure 5: Turhal Sugar Factory, Sport Competition (Source: Archive of TOBB ETU Department of Architecture)

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A NEW UNDERSTANDING OF RESILIENCE IN ARCHITECTURE: LEARNING FROM DISRUPTIONS

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ABSTRACT

With a common meaning of the ability to a system or entity to bounce back in the face of a disturbance, resilience has multiple definitions. The term applied to the different areas from particular disciplinary perspectives and investigated under several frameworks that are specific to the discipline and the disruption considered. This paper argues that disruption is one of the essential drivers of any discussion on resilience and suggests that a framework for resilience in architecture requires consideration of long-term disruptions, as well as the instant ones, with tangible and intangible aspects. In this context, this paper aims to develop a comprehensive understanding of disruptions that buildings face. It extends current approaches to resilience in buildings, which mainly focus on collapse prevention and hazard mitigation, by explicitly considering the protection of functions and the continuous availability of services and the disruptions other than hazardous events. It proposes a framework of disruptions in buildings that includes changing cultural and economic context with the changes in the user needs, technology, environment, legal regulations.

KEYWORDS

Resilience, disruption, functionality, built environment

Introduction

The last couple of years were not the best for the world, and 2020 does not go well so far. Just till April, we had already seen the Taal volcanic eruption in the Philippines, big fires in Australia, earthquakes in the border of Turkey and Iran, and more is coming as the outbreak of coronavirus that claimed more than 200,000 lives continue to spread. In the wake of disasters, such as hurricane sandy, earthquake, and tsunami in Japan, hurricane Isabel, interest in resilience gain importance among others (Hosseini et al., 2016). Apparently, it would gain more influence in the future. Concerning past disasters and current events, this paper puts disruptions in the center of the argument on resilience and addresses disruptions that buildings face as an essential part of achieving resilience in architecture.

We could have a clearer idea of the resilience in architecture only if we develop a better understanding of disturbances in the built environment. In general, buildings face two main categories of disruptions; 1) instant shocks, 2) long-term disruptions. The former includes natural and human-made disasters such as terror attacks, flooding, and earthquakes. These stresses, especially natural disasters are much better studied in the scope of architecture. The disaster response understanding solely concentrates on the act of structure and focuses on the technical aspects, with an emphasis on the engineering version of resilience. However, it provides a limited understanding of resilience in the built environment. It should be reminded that buildings are faced with both tangible and intangible forces throughout their lives, threatening both their structure and serviceability.

The latter, long-term disruptions, includes intangible forces acting on the buildings such as the changing social, ecological, economic conditions, and other events that have a slow pace. These slow-burn disruptions are hardly discussed in the scope of architecture in comparison with intense stresses. Only recently some of the researchers point out the need for a new resilience understanding for architecture that also considers these long-term disruptions and intangible forces (Genadt, 2019; Laboy & Fannon, 2016).

This paper aims to investigate the disruptions other than hazardous events which would lead to a broader perspective on the resilience of buildings. To do this, first, a literature review was conducted which aims to understand the existing discourse on the resilience and approaches to disruptions. This section draws on the resilience literature in different areas, including psychology, ecology, economy, engineering, and built environment, and examines various approaches to the idea of resilience, evaluation methods, principal components, and outstanding ideas. The existing definitions and approaches to the term in the building industry are also studied. Second, the significance of disruptions in resilience studies is examined with different perspectives from various disciplines. Third, some of the potential disruptions that buildings could face thought their lives are discussed, including social, technical, organizational, and economic changes. As there is no life in building in the construction phase and after demolition, only the period between these two phases considered.

Literature Review

Different Perspectives on the Term Resilience

Having a variety of definitions, resilience is commonly used to imply ‘’the ability of an entity or system to return to normal condition after the occurrence of an event that disrupts its state” (Hosseini et al., 2016, p. 47). The term applied to different areas from partic disciplinary perspectives and several definitions, evaluation methods, application domains, and frameworks that are specific to the discipline and the event proposed (Hosseini et al., 2016).

Different classification schemes organizing multiple definitions and approaches to resilience vary by the researcher’s perspective. Researchers have categorized four domains of resilience for assessment known as the TOSE model, and these domains are technical, organizational, social, and economic (Bruneau et al., 2003; Tierney & Bruneau, 2007). Michelle Laboy and David Fannon criticize this model not to include ecology, the natural world, or the environment clearly (2016). On the other hand, Hosseini et al., identify four domains of resilience as organizational, social, economic, and engineering while considering the natural environments as a subdomain of the social domain (2015). According to this categorization, the organizational domain refers to resilience in the context of companies, organizations, or enterprises and highlights the ability to respond to changing business environments. The social domain addresses the ability of individuals, groups, communities, and the environment to cope with disturbances and external stresses. According to a survey held by Hosseini et al., the academic discourse on resilience is dominated by disciplines such as environmental sciences, ecology, psychology, ecology, that are studied under the name of the social domain (2015). The economic domain refers to the ability of an entity or system to maintain its function and avoid maximum potential losses. The engineering domain is interested in the resilience of artifacts or products designed by humans, including technical systems. The infrastructure systems that require engineering knowledge, such as water distribution systems, nuclear plants, transportation systems, and locks, and dams are also examined under the engineering domain.

A second classification examined resilience under three types which are engineering, ecological, and social-ecological or adaptive resilience. This classification is based on the equilibrium number and fluctuant elements of systems. Carpenter et al. (1997,1999) and Scheffer (1993) examined these types of resilience by the use of the ball in the cup model (Figure 1). According to this model, the ball represents the system, while the surface represents the context, and the valleys represent stability domains. The different nature of ball and surfaces lead to behave differently in the face of disturbances (Gunderson, 2000).

Engineering resilience concentrates on requiring time to return to normal. This normal state refers to the original condition or previous equilibrium; therefore, engineering resilience leaving out the adaptation concept and criticized for being fragile (Laboy & Fannon, 2016). Engineering resilience mainly focuses on systems with a single equilibrium and associated with technological systems with a focus on disaster studies (Berkes & Folke, 1998). In most cases, this engineering perspective of resilience is adopted in architecture.

Ecological resilience considers the transition of the system (ball) to another stable state (a different valley), which is defined as the new normal (Pendall et al., 2009). It acknowledges alternative stable states and admits new normal. With a focus on disturbance, this framework measures resilience by the magnitude or scale of disturbance that can be absorbed by the system before the system changes in structure (Berkes & Folke, 1998, p.12). It also acknowledges systems with multiple equilibria and corresponds to complex and dynamic living systems with complex relations (Laboy & Fannon, 2016).

Different from engineering and ecological resilience, which consider the context is stable and the only moving component is the system, adaptive resilience presumes that the context (surface) and the shape of systems (not just position) might also be changing. Adaptive resilience underlines that as long as the context around the system changes, even unperturbed systems are not stable (Laboy & Fannon, 2016). In this context, socio-ecological resilience fits better for the resilience of buildings in terms of recognizing the changing context around buildings. Lance H. Gunderson summarizes these three types of resilience: "Resilience in engineering systems is defined as a return time to a single, global equilibrium. Resilience in ecological systems is the amount of disturbance that a system can absorb without changing stability domains. Adaptive capacity is described as system robustness to changes in resilience" (2000). Apart from these, there are also other studies deal with non-equilibrium systems that consider resilience ‘'as a process rather than as an end state or a resting state" (Pendall et al., 2009, p.7).

Besides varying definitions, there are some key concepts in the evaluation and definition of resilience, such as robustness, fault-tolerance, flexibility, survivability, and agility in the discourse of resilience. For example, Multidisciplinary Center for Earthquake Engineering Research (MCEER) developed the R4 framework of resilience, that consists four properties which are robustness, redundancy, resourcefulness, and rapidity, to examine the attributes and determinants of resilience (Bruneau et al., 2003; Tierney & Bruneau, 2007). National Institute of Building Sciences (2009) also determined that resilience can be characterized by 4R which are robustness, resourcefulness, rapid recovery, and redundancy ("Building Resilience | WBDG - Whole Building Design Guide", 2020).

Resilience in the Built Environment

As indicated before, resilience in the built environment, including infrastructure, urban studies, buildings, and designed landscapes, are often studied under the engineering domain, mainly with a focus on hazard mitigation. In the building Industry, resilience emphasizes ‘’preservation and rapid restoration of the physical environment's normal function in the face of shocks and disturbances of limited duration" (Laboy & Fannon, 2016).

Recently, some researchers argued that architectural resilience should be perused differently from engineering resilience, as architecture exists at the intersection of many sciences, including mechanics, ecology, and humanity. Buildings have intangible qualities such as social, cultural, aesthetic, other than quantifiable aspects of structural stability, energy and material use, capital, and environmental parameters. According to Ariel Genadt, architectural resilience should consider these intangible qualities (2019). In a similar manner, Laboy and Fannon argue that architectural resilience should concern the complex character of buildings which accommodate coupled social and ecological systems (2015). According to them, the social-ecological resilience model is the most suitable framework for architectural resilience:

> ‘’ Social-ecological resilience recognizes that buildings exist in dynamic panarchic relationships among technology, human use, and the natural environment. Instead of assuming these relationships will continue as in the present, social-ecological resilience embraces a changing social and ecological context, and the ways building will change with it… (So) The social-ecological or adaptive model best engages architecture's richness and complexity of connections with domains of urban resilience at multiple scales because it includes questions of culture, judgment, learning, and intentionality as critical components to absorbing change and adapting over time. ‘’ (Laboy & Fannon, 2016).

There is also a remarkable amount of studies on resilience outside of the academy conducted by non-profit organizations, NGOs, and practitioners. Rockefeller

Foundation supporting resilient cities across the world through the Global Resilient Cities Network (Global Resilient Cities Network, 2020). Similarly, a group of design and construction industry associations created ''The Alliance for a Resilient Tomorrow'', which promotes resilience in buildings, infrastructures, public spaces, and communities. The Building Industry Statement on Resilience is one of the pioneer resources that prepared by them under the guidance of the American Institute of Architects and the National Institute of Building Sciences, and it defines resilience as ''The ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.'' (Resilience Building Coalition, 2016). Furthermore, it considers design, planning, building materials, construction, and operational techniques as tools to approaching resilience while setting the life cycle of a building ''from the beginning of the planning and design processes and throughout the service life of the building'' (Resilience Building Coalition, 2016). Another organization focusing on resilience, Resilient Design Institute, provides resilient design principles and strategies to protect buildings against disruptions such as climate change and natural disasters (Resilient Design Institute, 2020). In addition to these, there are also event-specific guides prepared by organizations or governments which promote resilience after a natural hazard including flood, earthquake, and wind[1].

Disruption Concept

There are some key drivers in the studies of resilience, such as the state of the subject, the phenomenon, the extent of the disruptions, and recovery time. Among them, one of the central components in the representation of resilience is the definition and extent of the disruptions. As Walker emphasizes, any discussion on resilience should be begun by questioning 'The resilience of what to what?' (Walker, 2002, p.187). As well as the subject itself, which is the building in this context; the forces it faces, the disruptions, should be studied in any discussion on the resilience of buildings. Both the nature of disruption, such as immediate shock or slow-burn, and the magnitude of it plays an essential role in the measurement and definition of resilience. According to Steve Carpenter et. al. (2001) ''To assess a system's resilience, one must specify which system configuration and which disturbances are of interest.''

1. For examples of event-specific guides, please see FEMA's homeowner guides against flood, wind, and hurricane in https://www.fema.gov/building-science-publications-fact-sheets/flyers such as ''Protecting Manufactured Homes from Floods and Other Hazards (https://www.fema.gov/media-library-data/20130726-1502-20490-8377/fema_p85.pdf)

Moreover, there is a close relationship between the resilience understanding of the field and the scope of disruption. As disciplines deal with different stresses following the scope and character of the area, they have their own definitions of disruption, particular to that area such as slow burn, instant shock, intangible or tangible forces, stress, hazard, disruptive events, or disturbance. For example, resilience in psychology focuses on ‘’isolated and potentially highly disruptive event” which targets the psychological and physical health of people, such as ‘’death of a close relation, a violent or life-threatening situation” (Bonanno, 2008, p.102). While resilience in the economy means to ‘’ avoid maximum potential losses” (Rose & Liao, 2005, p.76). Social resilience, on the other hand, deals with ‘’external stresses and disturbances as a result of social, political, and environmental change” (Adger, 2000, p.347) such as economic crisis, unemployment, and endemic violence. Urban resilience adopts a more inclusive approach to the stresses, which includes all kinds of ‘’chronic stresses and acute shocks” (‘’Urban Resilience - 100 Resilient Cities”, 2020). United Nations International Strategy for Disaster Reduction (UN/ISDR) defines a disaster as: ‘’A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.” (UN/ISDR, 2004) As can be seen, different fields adopt varying definitions of disturbances within a broad context which corresponds to the forces they face. To discuss resilience in architecture, first and foremost, we need to examine the stresses buildings face as the other disciplines do.

In the built environment, despite a growing interest in resilience, stresses have been broadly conceptualized as instant shocks and hazardous events and the main focus is on hazard mitigation. Lee Bosher (2008) examines threats to the built environment accompanied by the society in two main groups which are ‘’extreme natural hazards (such as earthquakes, floods, and storms) and human-induced hazards (such as terrorist attacks, explosions at industrial facilities and mass transportation accidents).” But buildings are complex, active systems that have a unique set of performance and life cycle considerations. Thereby, the understanding of stress in the realm of the architecture needs to be defined thoroughly to address this complex character. Bearing in mind that ongoing research on architectural resilience is very important and the resilience of building in the face of hazardous events is one of the critical parts of the discussion, there is hardly any approach that accounts for other stresses than hazards. This narrow understanding of disruptions, which only subjected to buildings’ structure and physical attributes leads to a limited understanding of resilience. In this regard, it is necessary to contextualize resilience within a broader stress understanding, where both the stresses that compromise buildings’ structure, function, and serviceability are considered.

As Margaret Kurth, et. al. indicates, ‘’ At the same time as natural hazards take a toll, the built infrastructure faces persistent routine challenges related to its fixity and the intersection of design-life considerations, sustainability, and economic tradeoffs.” (2019, p.480). Built environments host human activity; therefore, it is crucial to overcome both natural and human-induced threats (Bosher, 2008). People’s requirements and expectations from buildings change just as physical forces around them. As a result, together with the physical disturbances, there are also intangible ones, including a change in personal needs, changes in the economy, and legal regulations (Öztoprak, 2018).

There are some efforts to extend the resilience concept that not only include traditional objectives such as collapse prevention but also focus on the protection of functions and continued availability of services (such as Laboy & Fannon, 2016; Tran et al., 2017; Joyner & Sasani, 2018; Genadt, 2019). These studies should be supported by the examination of the disruptive events that compromise both buildings’ structure, function, and serviceability. Laboy and Fannon (2016) underline the importance of adopting the changing contexts of technical, organizational, social, and economic domains in the context of resilience. While Kurth et. al. (2019) suggest that, beyond life safety considerations, the upcoming resilience research in the building industry should bear on the capacity to adapt changing interests and user needs. In this respect, ‘’ While resilience may not fully resolve these conflicts, it offers an opportunity to be better prepared for the unknown manifestation of economic, user and environmental change.‘’ (Kurth et. al., 2019, p. 489).

In this context, along with hazards, changes in the economy, user needs, technology, environment, legal regulations with changing social and ecological conditions are some of the potential disruptions that buildings face (Figure 2). They could affect building systems, prevent a building from maintaining its function and inhabitants to continue a high quality of life, and could limit the lifespan and performance of buildings. Some of these disruptions including developments in technology, changes in patterns of use, legal regulations, and economy are investigated in detail in the next section.

Possible Disruptions Buildings Faces

New Technology

The changing needs of people and the development of technology is one of the disruptions that architectural resilience should take into consideration. For example, in the case of industrial buildings, long-term disruption of changing conditions resulted in a rapid reduction in their number. Although industrial buildings worked with full capacity until the mid of 20. century, only 43 of 256 industrial buildings in Istanbul survived until 2005 (Köksal and Ahunbay, 2010) as they could not accommodate new developments such as changing production techniques and new technologies. This gradual stress of changing technology caused to function loose in these buildings. The gas stations, for instance, were producing store gas to use in heating and lighting but with the arrival of electricity and natural gas and with the change in demand, their function is over. Even if they were safe structurally, the ones that could not cope with the new production requirements and emerging technology are abandoned or demolished. In this context, these buildings are subjected to a long-term disruption of the rapid technological developments and changing needs of the modern world.

The digital revolution is another example of the slow-moving challenges of technological development. With the introduction of computers and the use of the internet, there has been a digital transformation in many areas including business, education, and culture. In this new era of digitalization, the way people communicate, buy, educated, socialize, and work changed as well as the spatial needs. As the digital transformation occurs very fast, some of the buildings could not cope with this change and the new world order. For example, with the introduction of online shopping, most of the shopping malls have lost their main function. Another example is the function loss of buildings in the coronavirus situation. Many of the daily practices become online including education, work, socializing during the lockdown. Therefore, all the places that host these practices are temporarily abandoned. During the lockdown, most of the countries move up education to online platforms, including exams, lessons, and assignments. In March, students in Turkey started to distance learning via television broadcasts and the online learning platform 'EBA' (Kazancı, 2020); while in China, nearly 200 million students follow classes online ("Japan to close all schools to halt virus spread", 2020). This change in the character of education directly affected educational places. Although this situation is temporal, it is envisioned that Coronavirus triggered the digital transformation and this shift in the fulfillment of the daily practices could be permanent in the future (Sahin, 2020; Dans, 2020). What would be the situation of these places in such a situation and would they resist these disturbances is one of the main questions that should be asked. As the digital revolution is continuing and is an important issue for the future, the resilience of buildings should also consider such disruptions.

Patterns of Use

Buildings should sustain the comfort levels of the inhabitants even in the face of long-term intangible stresses, including changes in inhabitants' expectations as well as changing social and cultural conditions. With the new improvements and services, the expectation from the building's performance changes in terms of comfort, cost-efficiency, and energy use. For instance, natural gas systems, elevators, and smart home systems are essential for buildings now and the buildings without them fail to provide a steady level of comfort for inhabitants. In terms of cost-efficiency, some implications such as thermal sheathing and insulation could reduce the economic burden. The increasing awareness of climate change and current ecological trends also promotes the use of environment-friendly systems such as solar panels, water recycle systems. These changes in expectations and needs create long-term challenges for buildings. In addition to these, new trends in housing and human intervention, such as plan reconfigurations, are some of the other disruptive events that buildings face. In this context, multiple changes in the patterns of use and expectations are disruptive events both targeting the design, structure, and services of buildings.

Legal Regulations

Changes in building codes and planning regulations also have a prior effect on buildings. With the change in social and environmental sensibilities building legislations are also changing. For example, the Americans with Disabilities Act (ADA), is a civil rights law that promotes equal opportunity for persons with disabilities and ''prohibits discrimination against individuals with disabilities in all areas of public life, including jobs, schools, transportation, and all public and private places that are open to the general public"(ADA National Network, 2017). These regulations also resulted in the arrangement of building configurations. After that, handicap access routes, including ramps and elevators, as well as wider doorways and other parts of building passageways, were implemented to allow disability access (IPEEC Building Energy Efficiency Taskgroup, 2017, p.22). Buildings also face legal regulations such as energy consumption and CO2 emission restrictions. Energy poverty is one of the critical challenges of today's world and the need for reducing pollution and energy consumption is one of the key challenges buildings face.

Economic Conditions

The resilience of buildings could also be assessed in terms of economy and loss of function of the building because of economic reasons. Especially commercial buildings that serve enterprises, such as shops, shopping centers, cafes, restaurants, theme parks, affected by adverse economic events and could become obsolete with the economic unviability. The severability of these buildings is based on the continuity of the enterprise and in the face of events such as loss of profit, halt of production, or the closure of these enterprises the building would lose its purpose of construction, thereby become abandoned. As commercial buildings are not independent of economic context, changes in the market affecting their resilience (Ferreira & Paiva, 2017). The relationship between shopping mall closures and the economic crisis in Portugal points out this; the number of shopping mall closures increasing in Portugal since 2011 which is the beginning of the economic crisis (Ferreira & Paiva, 2017).

As the life cycle of a building is both material and economic (Bosher, 2008), material deterioration should also be considered as one of the long-term disruptions of the building's faces. Building's physical fabric is affected by external factors such as radiation, water, air contamination, permanent loading, etc. (Öztoprak, 2018).

Conclusion

Over the past decade, the concept of resilience has been worked across different disciplines with different points of view. Moreover, recent events, such as the corona outbreak, earthquake, floods, climate change show that resilience would be a key concept in the future. As an outstanding component of resilience, disturbances have an essential position in the definition and measurement of resilience. In this context, this paper aimed to address some of the main challenges buildings face thought their life as an essential part of achieving resilience. To do this, first, the existing discussion on resilience researched. The literature review shows that in the scope of the built environment the resilience notion mainly adapts engineering view with a focus on hazard mitigation. This study proposed that focusing on instant shocks and hazardous disturbances alone lead to a narrow understanding of resilience in architecture. It is suggested that resilience in buildings should consider the protection of functions and continued availability of services apart from traditional objectives such as collapse prevention or life safety considerations. Therefore, this paper contextualizes resilience within a broader disturbance understanding, including both tangible and intangible forces, and addresses long-term disruptions such as changing contexts of technical, organizational, social, and economic domains. Some of these disruptions that compromise both buildings' structure and function are examined under four main categories which are technology, patterns of use, legal regulations, and economy. But this is not a classification, instead, it offers a number of examples of disruptions that buildings face such as changes in the needs of people, digital development, changing patterns of use, and economic conditions.

Although resilience could not prevent disruptive events to happen, it offers an opportunity to overcome these events and helps to prepare for the unknown challenges of the future. The ability of buildings to cope with disruptions beyond disasters is a relatively unexplored area. More study is needed to identify intangible and long-term disruptions and to address not only the strength but also the functionality of buildings in the context of resilience. It is required to develop a comprehensive understanding of resilience in architecture, considering all these aspects[2].

2. This study is part of a masters study carried out at TOBB University of Economics and Technology.

IMAGES, CHARTS OR GRAPHIC LEGENDS

Figure 1: Ball and cup model of system stability in competing resilience frameworks. The valleys in the surface represent equilibrium or stability domains, the ball represents the system, and arrows represent disturbances. (Laboy & Fannon, 2016).

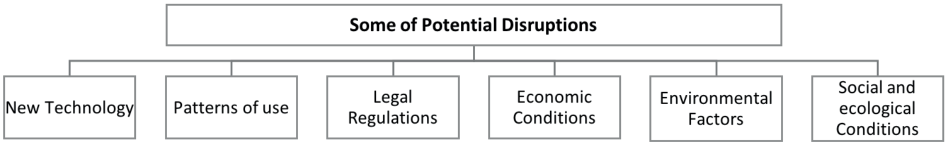

Figure 2: Some of the potential disruptions buildings are faced with other than natural hazards, by authors.

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RESEARCHES - SUSTAINABILITY IN ARCHITECTURAL EDUCATION: A PILOT STUDY ON INTERACTIVE VISUALIZATION OF A SCOPING REVIEW

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ABSTRACT

Doing a literature review is imperative for any scientific research for depicting the current state of the art, explaining what a research output will take part in the future, and offering future research directions. Existing literature defines four review types depending on their overarching goal, search strategy, appraisal of included studies, analysis, and synthesis. Review papers or reviews in articles mainly use Gantt charts to describe the number of publications addressing specific topics, the number of citations publications received, or draw co-citation or keyword co-occurrence networks supported with narratives. Hence, they remain inadequate in providing a visual overview of a specific research field, as they are not created by linking each publication to its research objectives, topics, case studies, methods, etc. This study believes that visualizing these links is potent for new researchers to access relevant literature and draw research gaps. This study aims to offer an experimental visualization entitled ReSeARCHeS, which is an interactive visualization of research outputs on learning environments (including tools, methods, courses, curricula) implemented towards to facilitate the integration of sustainability in architectural education. Based on the scoping study stages (work-in-progress), this study collects and categorizes relevant research outputs published from January 2018 to September 2020 on two electronic databases. The last step of this review, which involves the syntheses and analyses, is still on-going for a broader timeframe. The study codes each output based on content analysis with pre-defined categories from the field of architectural education. It then builds a network by linking each output to its codes on Graph Commons. This paper discusses possible applications of ReSeARCHeS in broadening researchers' understanding of a field and contributing to the universal circulation of knowledge and experience.

KEYWORDS

Scoping study, architectural education, sustainability, visualization

Introduction

"Science remains, first and foremost, a cumulative endeavour (Paré and Kitsiou 2016, 157)." Any research output, be it a conference paper, report, or article, stands in-between the retrospective and perspective of a specific research field. Hence, conducting a review is imperative for any scientific research to depict the current state of the art, explain what a new study will take part in the future, and offer future research directions. Doing a review is tedious work in the information age. Information and communication technologies have broadened our access to research outputs and diversified our collaboration platforms. The world is changing so fast, and the constant is the pace of change. Hence researchers require means that empower them to keep pace with the proliferation of new research, pursue advancements, and make new knowledge.

Review papers are written with this objective. The literature defines four general review type classified based on overarching goal, search strategy, appraisal of included studies, analysis and synthesis (Paré and Kitsiou 2016). Among all these paths, there lie specific rules of thumb in searching, identifying, and citing relevant research in the field, like index sites, choice of publications, and citation rules. This study points to two lacks in retrieving/archiving relevant publications and then depicting the state-of-the-art in a particular research field. First, existing filtering options of the online databases allow researchers to search for publications based on publication year, publication name, keywords, research fields, etc. yet they cannot visualize the relationship among publications other than representing citation numbers and citation connections. Second, publications are intertextual. Review papers or review sections of publications cannot visually represent the relative place of its objectives/ methods/results within the knowledge pool while relying mainly on citation hyperlinks. These hyperlinks create hidden networks among A, B, C publications. Such a network yields a network of referenced publications.

An experienced researcher may not require extensive time to refer to existing literature owing to his/her prior experience in the field. However, for novice researchers, delving into the perils of a tremendous amount of publications is a big burden. All these burdens triggered this study to create an experimental visualization of what we called locate your research in the *ReSeARCHeS* network created via Graph Commons (© Alter-lab LLC. All rights reserved).[1]

This paper explains how the on-going scoping study of researches on the integration of sustainability in architectural education[2] has created *ReSeARCHeS*. The paper consists of three parts. The first two parts discuss the necessity of such an

1. Graph Commons (© Alter-lab LLC. All rights reserved) https://graphcommons.com.
2. This network is created by the authors as part of the master thesis research of the first author.

interactive visualization network given literature review purposes. Building upon the scoping stages explained in the third part, the fourth part details the steps in the Graph Commons. Needless to add, this is an attempt to open up new horizons for cross-comparative, selective, or cluster-based analysis in review studies and ease the universal circulation of knowledge (Tanyeli, 2020).

Purpose of a Literature Review

The purpose of a 'literature review' is multiple and almost all require researchers to identify/build/examine/synthesize interactions among numerous research outputs in a particular topic, because researchers need:

- To know about the contributions others have made to the knowledge pool of their topic "to avoid reinventing the wheel (Royal Literary Fund 2020);
- To identify relationships between ideas, methods, and practice relevant to their projects that will provide a foundation of knowledge on the topic and position their project concerning others in the field; needless to add, this would prevent duplication and give credit to other researchers;
- To put their research in the context of existing literature, justifying why further research is needed regarding research gaps, inconstancies and conflicts in previous studies, open questions left from other research (Upstate Library 2020);
- To identify other people in the same field, given that vast funding amounts are dedicated to networking research actions.

Concerning these purposes, we observe that review papers or review sections represent the knowledge pool of a specific topic via narratives visualized with static charts.

The Network Levels: Visualization and Interactivity

In the words of sociologist Manuel Castells, we live in a network society that has been enabled by the pervasive implementation of ICTs (2010). A network is a set of interconnected nodes. A node is a point where two or more curves intersect. A network, as exist in our daily life, has no center. It is the nodes that determine the network performance. Networks are never static. Over the years, they change in form, delete some nodes, or add new ones (Baloglu Asut and Demir 2019).

We believe there exist multiple levels of networks for research communities. This study targets two levels: (1) Communication and collaboration; (2) research/knowledge pool searchable/communicable via networked knowledge applications. To better illustrate what we mean by these levels, the study first refers to Pellegrini et al. (2009), who defines "networked knowledge" as:

> The term "networked knowledge" exemplifies several important facets of knowledge: first, in a "knowledge society" knowledge needs to be connected in order to generate new knowledge or innovation, which can be realised by Semantic Web technologies. Second, knowledge also needs to be shared among people in order to be used effectively, and much of this sharing is based on collaboration, social software, and social networks. And third, knowledge is never isolated but always embedded in a context, connected with other information (Pellegrini et al. 2009, 1–2).

Pellegrini et al. (2009) describe "networked knowledge" as networks on a conceptual level, and its related term "networked media" refers to "the technological feasibility of integrated information and communication environments that connect and explore knowledge distributed over several systems and locations (2009, 2)." They state that this media shall not be limited to the textual content and include diverse media such as video, images, and documents to create new software applications that enable various knowledge processes.

Global research output has grown around 4% annually over the last ten years (National Science Board, National Science Foundation 2019). Today almost all these outputs are accessible online through scientific databases, thesis depositories, and libraries.[3] These online stocks offer a common search language, navigation environment, and a specific data structure coupled with filtering options, like keywords, fields, study types, publication dates, author names retrievable from specified parts of publications (abstract, title, full text) that enable researchers to explore broadly diverse resources. Indeed, various networks visualize citation connections enabling researchers to navigate relevant research results and measure impact, like Citation Network - (inherent to Web of Science (WoS)-,[4] Nautilus Vis-

3. Mitchell (1996) foresaw this coming almost three decades ago at the dawn of the internet. He contemplated replacing libraries with online databases with retrieval tools. However, Libraries have a positive side effect for researchers as the books with similar subjects are placed in close stacks. Nevertheless, today publishing in journals ensures researchers in reaching a wider audience.
4. WoS website provides the following details: "The Citation Network is represented for each paper through: Cites References – the backward references - the research that this paper cites, and its discoveries were based upon. **Times Cited** – the forward citations – more recently published papers that cite this one. **Related Records** – papers which share at least one cited reference in common with this paper. If they share citations, they're likely discussing similar topics (WoS 2020)."

ualization Demo,[5] and CitNetExplorer.[6] These tools enable researchers to determine the most influential, hence cited publications, and create links among papers based on citations.

Review papers or review sections of publications cannot visually represent the relative places of publications within the knowledge pool. The de facto review mapping includes the narration of results/gaps/future research directions supported with charts, tables, and other graphics. In the online version of publications, in-text or foot/endnote citations have hyperlinks to references in the bibliography that have hyperlinks directly to cited publications.

We are already working and thinking on two levels of these networks. We are in the midst of information flow in which researchers draw meaning, new knowledge, and hence make original contributions to this flow. For the first level, we see the emergence of social networking sites for scientists and researchers, like ResearchGate and Academia.[7] A version of the second level network is exemplified with citation networks discussed above. This study targets communication/interaction between research outputs beyond hyperlinks in-between by creating a network based on the research commons of the publications.

Another burden exists in visualizing networks. The term 'visualization' defines visual representations of datasets designed to help people carry out tasks more effectively. "We visualize data to produce information where that information is transformed into knowledge with the help of the user's experience (Baloglu Asut and Demir 2019)." As used in many reviews, static representations or views can only show one aspect of a dataset, for instance number of publications on elective courses on sustainability represented across years.

Interactivity is crucial to handle complex data set. We now have many computer-based visualization tools with interactively changing displays that support many possible queries (Munzner 2014). Munzner state that

> an interactive vis tool can support investigation at multiple levels of detail, ranging from a very high-level overview down through multiple levels of summarization to a fully detailed view of a small part of it. It can also present different ways of representing and summarizing the data in a way that supports understanding the connections between these alternatives (2014, 9).

Filtering and citation tracking tools ease exploring publication collections. Nevertheless, none of these databases create a more extensive network, like an assemblage, of studies beyond representing the relations among publications based on

5. *Nautilus Visualization Demo* is a visualization tool that "shows the influence a central collection of publications has had across different fields, telling the story of how this influence has developed over time." The tool is built upon citation links. Accessible via, http://scholar.eigenfactor.org/
6. *CitNetExplorer* is a software tool that visualize and analyze citation networks of scientific publications and allows identifying clusters of closely related publications. Accessible via, https://www.citnetexplorer.nl
7. To access ResearchGate, https://www.researchgate.net; to access Academia, https://www.academia.edu.

citations. Another growing research stream pursued in recent years is bibliometric analysis. By analyzing the bibliographic data of publications, this method provides an overview of the body of knowledge for a given field of inquiry.[8] These papers make visualizations to explore mostly co-citations, the co-occurrence of keywords.

We make new knowledge over these various network levels. Over the last few years, we see how emerging data visualization tools are used to depict relationships and collaborations among diverse platforms, like biennale, exhibitions, and people.[9] In the research process, we wondered whether it would be possible to visually represent the second level network transcending citation hyperlinks and author keywords, built upon the ReSeARCH commons of publications like research objectives, methods, and cases. This visualization may extend the scope of narratives and leaving space for readers in creating new meaning and in accessing relevant publications.

Review Method

Due to the contested nature of the concept of sustainability, there exist diverse meanings and logics of sustainable architecture. Thus diverse strategies are pursued in building design and its learning environment (Guy 2010; Guy and Farmer 2001; Guy and Moore 2007; Ruhi Sipahioğlu 2012). Architectural education is also replete with diverse challenges stemming from existing curricula, course contents, duration, and place of learning (Ruhi Sipahioğlu and Alanlı 2020; Tzonis 2014). Hence, there is no single track to address sustainability issues in architectural education, and there are no review papers on the intersection of these two fields. To this end, this study adopted a scoping review approach. The overarching goal of this review is to collect and synthesize all the research outputs that aim to enhance learning environments to facilitate the integration of sustainability in architectural education.[10]

There exists no universal definition for this review type.[11] Still, it is mainly used in 'mapping' a research field (Levac, Colquhoun, and O'Brien 2010). This study

8. Numerous articles are making bibliometric and visualization analyses—an example by Garrigos-Simon et al. (2018).
9. Official account of SALT: https://graphcommons.com/salt ; Artist Network Diagram prepared as part of the exhibition entitled "Inventing Abstraction, 1910–1925." https://www.moma.org/interactives/exhibitions/2012/inventingabstraction/?page=connections
10. This paper is limited to the creation of the ReSeARCHeS, hence the study present an exemplary of selected publications. The review study is still ongoing, and it will depict possible gaps in the literature with respect to pre-existing themes defined in this paper.
11. Including nomenclature 'scoping reviews,' 'scoping studies,' 'scoping literature reviews,' and 'scoping exercises' (Levac, Colquhoun, and O'Brien 2010).

pursues the main stages defined by Levac et al. (2010):[12] (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) charting the data; (5) collating, summarizing and reporting the results; and (6) consultation (optional stage). As this review is a work-in-progress, this paper details only the pursued scoping study stages to describe the creation of ReSeARCHeS.

(1) Identifying the research question: Research questions are vital in guiding the subsequent study stages because they delineate the type of information needed for the study and inform the authors about keywords for searching and selecting relevant literature. The study selected a research question broad in nature to provide the breadth of coverage:

> What kind of learning environments (including tools, methods, courses, curricula) are implemented towards to facilitate the integration of sustainability in architectural education?

(2) Identifying relevant studies: To identify the relevant studies that lie at the intersection between "sustainability" and "architectural education," we used the following keywords to query two online databases Scopus and Web of Science, from January 2018 to September 2020.[13] These databases were chosen as they were considered the most relevant and provide the highest impact journals and conference proceedings that cover the topic of sustainability in architectural education.

To store all citations, we used Zotero, a bibliography management tool, to list the results of searches from each database and take out duplicates. Out of these 448 studies, 83 were duplicates and were removed using Zotero. In total, there were 365 publications.

(3) Study selection: The study first specified the exclusion and inclusion criteria based on the research questions and new familiarity with the subject upon reading the studies.

In the first step, we examined 365 studies against the inclusion and exclusion criteria using the Zotero report (exclusion based on the analysis of title, abstracts, and keywords). In this step, we also eliminated non-useful results (i.e., results not listed as journal articles, workshop, or conference papers). In the second step, we excluded 262 studies, and 103 studies remained. We only took out studies that were clearly unrelated to the topic. In case there was doubt, we took the study to the next stage. In the third step, we examined the full texts of studies (excluded 21 studies without full texts) and eliminated further 24 studies. Finally, we had 58 studies (Appendix A).

12. For another study pursuing this method in the field of architecture can be found in Ucci et al. (2015)
13. The ongoing review study will cover a broader period, from January 2000 (Signature of the Bologna declaration) to September 2020.

(4) Charting the data: The study prepared a review protocol that specifies categories based on the central research questions and prior researchers for coding identified studies (Ruhi Sipahioğlu and Alanlı 2020). Table 4 details the categories. In an iterative process, we extracted data based on qualitative content analysis and we coded separately.

(5) Collating, summarizing and reporting the results: This stage is part of this on-going master thesis research. The scoping studies explain the analytic framework or thematic construction to provide the breadth of the literature in three steps (Levac, Colquhoun, and O'Brien 2010). The first step involves the analysis with descriptive numerical summary analysis and qualitative thematic analysis). The second step involves reporting the results regarding the overall research questions. The third step requires studies to emphasize how results find their place in the knowledge pool and discuss future research implications. This study expects to introduce another step based on the ReSeARCHeS visualization through filtering and grouping options provided by Graph Commons.

ReSeARCHeS: Sustainability in Architectural Education

ReSeARCHeS is an interactive network map created based on a node-link diagram in Graph Commons. Nodes are point marks, and links are lines connecting these nodes (Munzner 2014). Nodes include the publications selected at the 3rd step and the codes/categories defined at the 4th step of the scoping study. The connection lines are drawn for two types of relationships. One is between the categories, and the second is between the publications and their associated codes assigned for each category. We inserted each publication's content analysis in an excel sheet with categories and their codes and defined seven node types, as represented in Table 5.

The study defines the following details retrieved from extracted data for each publication node: Bibliographical reference; type of paper; publication date; country; data collection method; *data analysis method*. The study defined the following edge types as links between nodes.

After defining all the nodes and the links, the study included the filtering options per node types and edge links to obtain an interactive network map.

Conclusion

Review papers provide an overview of the advancements in a particular field regarding research methodologies, materials, and cases. In general, existing review studies provide static visualizations supported with narratives, precluding interactive displays, enabling researchers to tailor navigations in previous studies. The use of citation networks as a tool for understanding the state-of-the-art in a field might leave aside research outputs that have not drawn much attention. Therefore, this paper proposed materializing interactive network maps to visualize the retrospective of research fields.

This on-going study attempts to build this network based on a scoping study. By pursuing the scoping study stages, this paper first defined research questions, study selection methods, and ultimately coded each selected research output respecting pre-defined categories derived from previous research in architectural education. Consequently, '*ReSeARCHeS: Sustainability in Architectural Education*' network was built after this coding. We hope this would equip future researchers to find research gaps in the field and design new courses with a map that ease reading the evolution of how sustainability 'issues' have been integrated into architectural Education. By disseminating this network, we anticipate receiving more research outputs via the comments section, hence continuing to keep communication and interaction among researches. Future study will include links between author-defined nodes, including links between certain challenges and defined learning structures, a citations network, and analysis of dependency networks.[14]

14. For the analysis of the dependency network, please see: https://blog.graphcommons.com/mapping-networks/

IMAGES, CHARTS OR GRAPHIC LEGENDS

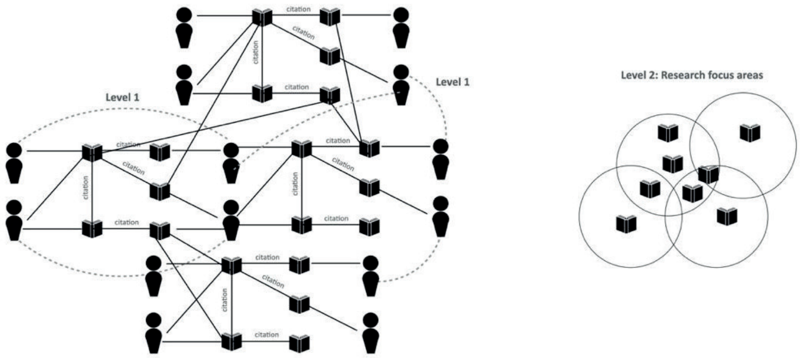

Image 1: Representation of the network levels (Diagram by the authors).

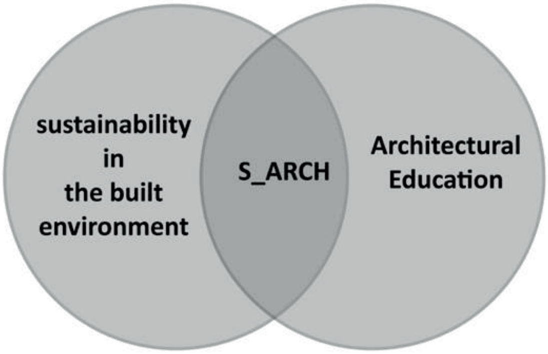

Image 2: Representation of the research fields.

Database	Search query (Search date: 01/10/2020)	Number of records
Scopus	TITLE-ABS-KEY (architectur* AND education) AND TITLE-ABS-KEY (sustainab*) AND PUBYEAR > 2017 AND (LIMIT-TO (LANGUAGE , "English")) AND (EX-CLUDE (LANGUAGE, "Italian")) AND (EXCLUDE (PUBYEAR, 2021))	315
Web of Science	(TI=(architectur* AND education) OR KP=(architectur* AND education) OR AB=(architectur* AND education)) AND (TI=(sustainab*) OR KP=(sustainab*) OR AB=(sustainab*)) **Timespan:** 2018-2020. **Indexes:** SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI. LANGUAGES: (ENGLISH)	125

Table 1: Number of records per database

Database	Document Type							Publication Year			Total Number of records
	Article	Conference Paper	Book Chapter	Conference Review	Book	Review	Editorial	2020	2019	2018	
Scopus	146	118	19	16	7	7	2	81	122	112	315
Web of Science	82*	45	1			3	2	31	49	49	133

Table 2: Number of records per database categorized based on document type and publication year.
*4 items in the Web of Science were shown as early Access, they are all journal articles.

We included articles that are:	We excluded articles that:
Full text	Conference review papers, editorial papers. Had their full text not available
Published between January 2018 and September 2020	Were not related to our research questions
Were written in English	Were outside our search time span
Were on the integration of sustainability issues in architectural education; including interior architecture	Were of duplicated studies

Table 3: Inclusion and exclusion criteria.This table representation is borrowed from Balaid et al. (2016).

Extracted data	**Description**
Study ID	Unique identity for the paper
Bibliographical references	Authors, title, publication source and publication year*
Type of paper	Book chapter, journal, conference or workshop article
Publication date	Publication year
Country	The country where the study is conducted.
Data collection method	E.g. survey, case study, experiment, observation etc.
Data analysis method	Quantitative, qualitative or mixed method
Challenges	Defines the challenges in addressing sustainability in architectural education.
Learning Setting**	Identifies the place of learning as formal (university or school of architecture), non-formal (workshops, internships, or traineeships), and informal learning.
Structure	Identifies the structure of learning setting (a design studio, workshop, must course in building technology, elective course, seminar, competition, curriculum, etc.)
People	Consists of all the people involved in the learning environment, like learners and tutors with respect to their disciplines and other stakeholders.
Principles	Defines the course principles, such as collaborative learning, interdisciplinary learning environment, building simulation performance tools, international mobility, study visits, lectures, etc.
Actual Outputs (students)	If the study focuses on a particular course, the coding includes students' actual outputs in the form of final submissions, like the final report, architectural design project, etc.
Intellectual Outputs (students)	If the study focuses on a particular course, the coding includes expected students' learning outcomes.

Table 4: Data extraction for each study.
*This data was stored in Zotero. **The study pursues the categorization of learning as defined by the UNESCO Lifelong Learning Institute.

<table>
<tr><th colspan="2">Node Types</th><th>Nodes included in these node types</th></tr>
<tr><td colspan="2">Publications</td><td>Articles, Conference Paper, Book, Book Chapter</td></tr>
<tr><td colspan="2">Challenges</td><td>facilities for digital fabrication; ambiguous definitions of sustainable architecture; the motivation of educators; transforming the status quo; fragmentation / links</td></tr>
<tr><td colspan="2">Learning Setting</td><td>Formal; Non-formal; Informal</td></tr>
<tr><td colspan="2">Structure</td><td>Research practice; Elective Course; Competition; Compulsory Course; Design Studio; Workshop; Curriculum</td></tr>
<tr><td colspan="2">People</td><td>Students (architecture); Educators (arch. department); Educators (other disciplines); Students (other disciplines); Stakeholders</td></tr>
<tr><td colspan="2">Principles</td><td>Experience-based learning (EBL) model; Collaborative learning; BIM; Design-build projects; Workshops; Socratic Seminar; Lectures; Interdisciplinary Learning Environment</td></tr>
<tr><td rowspan="2">Outputs (Students)</td><td>Actual Outputs (students)</td><td>Arch. Design Project; Research report; publications</td></tr>
<tr><td>Intellectual Outputs (students)</td><td>Ability to work in an interdisciplinary environment; Skills in collaborative</td></tr>
</table>

Table 5: Node types in Graph Commons.

<table>
<tr><th colspan="2">Edge Types</th><th>Definition of edge types</th></tr>
<tr><td colspan="2">Connected</td><td>Connects all the nodes to its associated category.
Example: Online Workshops is -connected to structure.</td></tr>
<tr><td colspan="2">Defines</td><td>Connects the challenges (nodes) defined by the publications
Example: Paper A, B, C define X challenge.</td></tr>
<tr><td colspan="2">In</td><td>Connects paper A's learning setting to its related node classified under the learning setting category.
Example: Paper A's research centers -in formal learning environments.</td></tr>
<tr><td colspan="2">Structure</td><td>Connects paper A's pursued structure in the learning environment to its related node classified under the structure category.
Example: Paper A's -structure is a student workshop.</td></tr>
<tr><td colspan="2">With</td><td>(If relevant) Connects paper A to its related node classified under the people category based on the people working/studying in Paper A's case study.
Example: Paper A works with an interdisciplinary student and teaching groups.</td></tr>
<tr><td colspan="2">Pursues</td><td>Connects paper A's pursued principles classified under the principle category.
Example: Paper A pursues an interdisciplinary learning environment.</td></tr>
<tr><td rowspan="2">Results</td><td>Actual Outputs (students)</td><td>(If relevant) Connect paper A's case study studio/course student outputs to nodes classified under the actual outputs (students) category.
Example: Paper A works in a design studio in which students finish an architectural design project.</td></tr>
<tr><td>Intellectual Outputs (students)</td><td>(If relevant) Connect paper A's case study studio/course learning outcomes to nodes classified under the intellectual outputs (students) category.
Example: Paper A works in a design studio in which paper A expects its students to gain learning outputs.</td></tr>
</table>

Table 6: Edge types in Graph Commons

Image 3 – Link to the ReSeARCHeS: Sustainability in Architectural Education (Powered by Graph Commons) (Created by the authors under Creative Commons 4.0 International License)
Link to ReSeARCHeS - Sustainability in Architectural Education, https://graphcommons.com/graphs/f0391315-6101-4d90-a48d-6b8e92f5b15c

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DIGITAL MATERIALITY OF HISTORIC HERITAGE SITES THROUGH AUGMENTED REALITY

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With the recent pandemic striking the world, digital culture is on the agenda more than ever. Progressively becoming the new norm of today's world, computational technologies requires a re-construction of our communication, learning, and perception tools. To explore the potential of digital materiality as a tool to concretize the historic, cultural and structural information on built environments; historic heritage sites with a lack of physical integrity are considered as convenient cases to work on the visual and spatial abilities of the Augmented Reality (AR) technology.

This study aims to investigate the scope and potential of digital materiality by examining the use of AR technologies as a new conservation tool and a content interface on historic heritage sites of said qualities. For a theoretical overview, concepts of materiality, digital materiality, and heritage authenticity are examined.

In the first part of the study, the concept of materiality, its definition, and scope are handled. Following a debate about digital culture to a material extent, augmented space as a tool for producing digital materiality and data interface are discussed. Later on, material qualities and authenticity of heritage sites are focused. Finally, with the examples of current applications, possible augmented reality implementations on the physically disrupted and distant heritage sites that obtain the discussed quality of materiality, is on the agenda.

Materiality and Network

In his book *La materialite de l'architecture,* Antonie Picon refers to materiality as connections. He claims that materiality is not necessarily the matter, but it is the complex relationship that we build with the physical world and objects that we think we can interact with (Picon, 2018, pg.15). Therefore, the materiality of an object or a phenomenon cannot only be identified by its tactility, its substance, or its physical entity. Its existence resists our willingness and establishes itself without our control. In his book *Materiality,* Daniel Miller (2005, p.11) states that materiality is not necessarily the entities itself, rather the networks of elements and relationships between them. Therefore, the definition of material goes beyond its physical entity and adds ideologies, human factors, and social culture.

Materiality is the regime of being in a world that manages the relationships between humans and the whole of phenomena and things. In other words, materiality is a separation and a bond between phenomenon, mute objects, and communicable or writeable elements (Picon, 2018, p.73-75). Therefore, it is a subprocess of co-production that includes all resources and elements in each age and society. John Law describes and names this issue with the term "relational materiality" (Law & Hassard, 1999). Created by Bruno Latour and Michel Callon, the "Actor-Network Theory (ANT)", is considered as an adaptable method of mapping how the material objects participate in human lives (Kien, 2016). Latour claims that reality occurs in the networks, not individuals. According to his theory, all things are relational, distributed, and shared in an "assemblage" (Latour, 2005). In this regard, ANT embraces a definition of materiality that emphasizes the unavoidable production of the networked and collective actions. Even though ANT never intents to explain materiality directly, in the material culture, it seeks to explore the relations between humans, technologies, actors, and networks. This method gives the material object its own voice and identity to describe its own alliances and struggles (Kien, 2009).

The scope of materiality can be easily associated with direct worldly experiences at first sight. Traditionally the world is considered as it appears to be. And the concept of materiality, as an essence of the material world, perceived accordingly. However, these traditional approaches are representational distillations of the dominant actors, and their politics celebrates the "symbolic" over the "responsive and rhetorical" (Amin, Massey, Thirft, 2000, p.223). Accordingly, ANT suggests "a more democratic and symmetrical" way of the chaotic and relentless emergence of the world (Lieto & Beauregard, 2016, p.13). Indeed, matter and its entity are far more complex than humanistic senses and physical existences (Picon, 2018, p. 67).

Materiality is not necessarily about the matter; it is rather a management process of the connections that are built between humans and matter. It does involve the body, and perceptions or sensations provided by the body. However, it cannot be degraded by the tangible aspects like being identified as a kind of mental image shared by members of the same culture (Picon, 2018, p73). Despite that traditional view may create an appearance of it, there cannot be autonomy or an actual singularity. Each entity has multiple identities and connections with other beings and cannot be perceived in a singular way. In this sense, singularity remains as an aesthetic result and a poor reflection of the way humans see (Kien, 2009). Accordingly, ANT rejects any pure categorizations and supports a heterogeneous world of hybrids. Things assemble not because of their similarities but because of their overlapping interest of matters. In this sense, it emphasizes connections rather than separations (Lieto & Beauregard, 2016, p.12). This understanding causes a rejection of definite definitions of things. Instead, what is done is a "Translation" process that the mechanism of the social and natural world progressively take form. Therefore, materiality becomes a part of the process of translation and performance by relationships constituting that process (Kien, 2016).

> "Since the "networked I", I am already everywhere I can be right now." (Kien, 2009)

Humanity is now networks. In a way, humans no longer just exist in the body but also dispersed and spread throughout all the connections that unite it to the world. Therefore, contact with materiality is a reminder that the human is not just a participant of the physical world but a repetitive co-construction of itself along with the physical realm (Picon, 2016). In the *Phenomenology of Spirit*, Hegel claims that humanity and materiality cannot be separated. Everything that humans are and do, is the result of the reflections of things created by human itself (Hegel, 1977). The world acts almost like a "material mirror" that continues to evolve through humans. It can be claimed that humanity both produce and are the product of the happenings of the world (Miller, 2005, p.8). ANT supports that each participating thing in this network has equal weight in the assemblage, even equal to humans (Lieto & Beauregard, 2016). In many similar qualitative kinds of research, humans get privileged. In the material culture, although the ruling factor seems to be human, objects and phenomena take over from time to time. This process is not linear, logical, or even predictable (Kien, 2016). Occasionally it is not the human that shapes the matter but the objects and phenomenon that reshapes the human. In this sense, materiality can be illustrated as ballet performance by humans, objects, and phenomena altogether (Picon, 2018, p.73).

Materiality is a cultural production. Being part of society requires being in a two-way relationship with all kinds of materials, tools, and elements that touch that society. This situation is also related to the social organizations, philosophical and religious approaches, in short, the culture (Picon, 2018, pg. 68). ANT suggests that "the social is nothing other than patterned networks of heterogeneous materials and relations" (Law, 1992, p.381), a composition of humans, animals, architecture, text, culture, symbols, and so on. Kien states that:

> "Material culture matters because we make it matter, and it's impossible to separate materiality from culture. Actor-network theory's non-hierarchical understandings of everyday life; see culture as performance and the effects of performance." (Kien, 2016)

Through the pace of time, materiality and what is considered as a material has highly affected by cultural and historical shifts. Therefore, the scope of the material itself is changeable and dynamic over the periodic alterations of the world. The concept of the "ghost" during the 19th century can be a good example of this process. In a period of belief and spiritualism, the assent of the materiality of the "ghost" was most likely more positive than today's skeptical and rational mindset (Picon, 2018, pg. 68). Therefore, it can be claimed that all the links and relations that create the materiality cannot be read outside the culture, periodical status-quo, and context.

Changes in the scope of materiality are highly related to the tools and practices of the age as well. The technology and practice evolve and develop within the scope of philosophical and cultural understanding of the world. As the physical experiences are highly shaped by periodical and technological culture, the new materials and approaches do not alienate the materiality but reestablish it (Picon, 2010, p.251). Picon here gives the example of automobiles and how it changes our understanding of the space of cities. By the integrations of automobiles into our lives, the city is no longer experienced by human speed but by the speed of the vehicles. It is inevitable that architecture, which deals with the project of organizing the connections between human and matter, faces the problem of alteration in materiality and the mechanisms and objects that determine its own evolution (Picon, 2018, p.70).

Digital Materiality

The changes in digital technologies have started to evolve our relationship with the world. With the emerging tools, computational products reshape our experience, perception, and understanding of the material reality. Thus, it can be claimed that the rise of computational systems redefines the materiality irreversibly (Picon, 2016).

As the world around us changes, the essence and usual unit of the world no longer possess the same characteristics as former substances and phenomena (Picon, 2016). According to Jean-François Lyotard (1984), the immaterial produce new materiality that is not a continuation of the traditional one. An important concept at the focus of this discussion is *virtuality*. Defined as "being on or simulated on a computer or computer network." ("Virtual", 2020), the term "virtual" is generally handled with prejudice of de-materialization. It is easily biased that digital tools and the term virtual focus more on imagery productions and damages the materiality. However, this understanding remains shallow in terms of possible novelties that can be experienced by this concept (Picon, 2010, p. 251). The virtual does not have restrictions by physical laws and material limitations. Blurring the strict opposition between what is abstract and concrete, it exists in another dimension that some of the understandings of space, physics, scale, and matter work differently. In parallel to the previous debates of relational materiality, Yuk Hui (2015) suggests that this new "immaterial" materiality of digital emerges the understanding of relations rather than substances.

Virtual and Augmented Realities are the two main concepts of virtuality. First mentioned in the 1950s, Virtual Reality (VR) is a computer-based image technology that simulates immersive virtual environments. Augmented Reality (AR) is a similar technology that merges the designed virtual element with the physical environment. As the main difference, AR provides additional sensory or information while the senses of the physical world remain engaged. (Picon, 2010, pg.55-56).

The ever-growing system of virtual redefines our relationship with the sensational world of seeing, smelling, hearing, and touching (Picon, 2018, pg.114). For an enriched reality, the digitally connected individuals change along with their sensations and perceptions. The dual body of the real and virtual raises the question of uniting and synthesizing these sensations and perceptions. Architecture in this sense may take on the task of this need of synthesis. With AR, beyond the tactical screens and digital gloves, the architectural space itself can become an integral part of the interface between physical and virtual (Picon, 2010, pg.57).

By definition "Augmented Space" is a physical space that is overlaid by a dynamically changing information in a multimedia form centering the user. With this concept, the dynamic between spatial form, information, and possible effects on the functioning of today's computer culture are matters of consideration (Manovich, 2003).

The digital age removes the information from the matter and stores it into 0's and 1's. These new tools can reconfigure the stored 0's and 1's in the ways that haven't been built before (Picon, 2018, p.36;123). When it comes to materiality, the digital environment can perform a more intensive process on its relational nature, which is data. It becomes the new material unit of the non-physical world (Hui, 2015). Augmentation can be considered as an invisible layer of information covering the physical world, altering the scope of space. By extracting data from it and augmenting it with data, the physical space turns into data spaces. Traditionally, the built environments are already covered with texts, images, icons as various presentations of information. Data interfaces usually remain in 2-Dimensional forms. Architecture as an information surface generally overlooks the fact that architectural communicated messages and narratives do not occur just through flat surfaces, direct narratives, and imagery elements but also through the articulation of space and the whole spatial structure. Even after the computational technologies, data remained in the 2-Dimensionally perceived screens. With AR, the data interface finally has at least 3-Dimensions. Various systems of augmentation and monitoring add new dimensions to the physical 3-D space turning it into multi-dimensional (Manovich, 2003).

> "Going beyond the 'surface as electronic screen paradigm', architects now have the opportunity to think of the material architecture that most usually preoccupies them and the new immaterial architecture of information flows within the physical structure as a whole. In short, I suggest that the design of electronically augmented space can be approached as an architectural problem. In other words, architects along with artists can take the next logical step to consider the 'invisible' space of electronic data flows as substance rather than just as void – something that needs a structure, a politics, and a poetics." (Manovich, 2003)

Designing an augmented space is an architectural problem. With virtual layers of contextual information overlaying the built environment, augmented space challenges architects by creating an opportunity to reconsider their practice. Layering contextual and dynamic data over physical space creates a particular dispute: how to combine the virtual and physical spaces. If the existing structures examined and integration problems of images, texts, or symbol systems into spatial architectural constructions are observed, they all can be considered as augmented space problems in terms of layering physical space with layers of data. In this sense, Daniel Libeskind's Jewish museum can be a proper example of augmented spaces in terms of combining two spaces. Libeskind preserved the existing dataspace for the new architecture that he constructs. Therefore, the Jewish Museum became a space where the past literally cuts into the present. With the immaterial layer over the real space, the previous dataspace got materialized and turned into a monumental sculpture (Manovich, 2003).

Despite being an augmented space, what Libeskind did was overlaying 2D planes of information onto his 3D architecture, rather than layering a new 3D virtual data space over the physical one (Manovich, 2003). With the computational revolutions as AR, Augmented Space has more possibilities than it ever had. The whole spectrum of possibilities of digital materiality is yet to be discovered in many fragments of built environments. One of these possible built environments is heritage sites. Along with the various materiality considerations, heritage sites are suitable cases for possible research on the layered nature of AR.

Materiality of Cultural Heritage

> *"The authenticity of a thing is the essence of all that is transmissible from its beginning, ranging from its substantive duration to the history which it has experienced"* (Benjamin 1969, 221)

Due to the scope of this paper, heritage sites are focused through the understanding and investigation of what materiality is, its tools, and its relational qualities. Historic heritage sites, inherently, are involved with various levels and types of connections. Even with a loss of physical integrity, the cultural heritage sites' connectional integrity remains intact. Connections may dwell upon and dispersed among its own physical body, real-time experience, collective and individual memories, visual and written documents.

Heritage by definition as traditions, languages, is "features belonging to the culture of or buildings, that were created in a particular society, the past and such still have historical importance" ("heritage," 2020). Authenticity is a key concept for preserving, curating, managing, and presenting the historic environment. About this concept, Sian Jones highlights the dichotomy between materialist and constructivist approaches on authenticity. The materialist approach for authenticity focuses on the measurable attributes of heritage, sourced by its material substance and pastness of its physical body. The constructivist approach focuses on the variable, negotiable, and relative elements of heritage in the social and cultural context (Jones, 2009).

Authenticity is not inherent in buildings, objects, places, or even cultural practices. Rather, it is a quality that is constructed culturally and varies according to who experiences it in what context. Parallel to the relational perspective of materiality, Jones demonstrates that the experience of authenticity is related to the network of tangible and intangible relationships that objects of heritage invoke with people and places of the past. Jones claims that the unique experience of objects comes from the web of relationships between humans and places of past and present (Jones, 2009). Therefore, the direct experience of a historic object can be formed by the personal integration into that network. She argues that the authenticity of heritage elements does not come from its objects' or substances' pastness but its cultural, social, and periodical context. Therefore, any object of the past relies on contemporary perception and cultural concepts. The authenticity of the heritage is a compilation of genuine and ineffable qualities of past identity, experiences, people, and places altogether. In this respect date, the original setting material fabric or design of it becomes less significant compared to the wholistic network of its relationships (Jones, 2009).

Some historic sites have more information about their past identity. Historic sites that highlight this information and create a personification to the object, build more connection, and makes more sense to the visitors. The visitor, who is outside the contexts of the object and personified object creates an intimate relationship and a direct connection to the observer. By building this connection, an opportunity to inhabit and rebuild the historic element today occurs (Jones, 2009). Another non-material entity is an oral culture. The form of information may vary and dwell upon collective memory and live on by the narratives through generations and communities. Each story, song, or even a rumor, through their making and transmission, forges relationships between people, places, and heritages. The effectiveness of this process depends on the people's ability to build this network of relationships that is associated with the unique cultural biography of the object. In this sense, any kind of physical and visual contact and experience is crucial for this establishment. However, this is not about its material, form, or provenance in a material sense but rather about its past relations, experiences, cultural being that can create an ineffable contact with those experiences and relations. This mainly is the way to carry and transfer the authentic features of the object to the present (Jones, 2009).

The perception of pastness dwells on the audiences' imagination rather than the chronological reality. This approach takes us to reconsider the heritage and its pastness with a much wider range such as its objects and phenomena rather than the conventional parameters such as its measurable age and material substance (Holtorf, 2013). The pastness of an object initially occurs in its appearance and shapes the perception and thought of the audience. Therefore, the age-value relationship dwells on the object's materiality through the experience of pastness. Undeniably, the material clues of the heritage such as its torn and disrupted appearance give a vast amount of ideas about its qualities. In that sense, the audience's perception is an effective issue. A good example of this is the Classical Greek temples. Despite what the historical evidence says, its original bright colors are non-relatable to the audience. Such a strong perception like this can give the main idea about how the heritage element is more complex than its historic facts and its substance. Ironically the more the heritage has qualities of being past and involved with its society the more it might have cultural assumptions of its observers. Therefore it can be assumed that the prediction of perceptions of a heritage element is harder than expected (Jones, 2009).

In short, heritage objects are both of a product of past and present simultaneously. Its authenticity is related to both its cultural and material existence. Therefore, in understanding heritage, focusing on the human experience and perception is as crucial as its physical facts and historical knowledge.

Objects, as well as non-material cultural aspects, are embodied in regimes of meaning and exchange that lead to framing heritage conservation and management. (Holtrrof, 2005; Philips, 1997). The dynamic social life, cultural, and contextual issues of historic objects have been considered in the management and conservation of heritage since at least the mid-nineteenth century. However, it is only in the last two decades that conventional approaches have been seriously challenged by alternative perspectives (Jones, 2009).

In this respect, Jones (2009) lists a series of suggestions in order to understand and preserve heritage objects in the sense of their relational nature:

- *Integration between intangible and subjective qualities.*

Intangible qualities are of great importance in terms of understanding, preserving, and displaying objects buildings, and places. Therefore, the intangible side of heritage should be acknowledged including language, religious beliefs, cultural practices, and oral traditions. On the other hand, subjective attributes such as materials, substances, form, and technic are also fundamental and cannot be discarded in this process. Therefore, there is a need for integration between these intangible and subjective qualities in the conservation practice.

- *Revaluation of what is important and what to preserve.*

In the current concerns of preservation, historic value and material entities tend to be favored over such concerns of intangible qualities. Given the importance of the latter, Jones's suggestion is to reevaluate the intentions and priorities for the preservation process of the historic environment.

- *Emphasizing the context*

In the process of preservation, management, and presentation of heritage elements, the past and present context become an important issue to emphasize. One step can be focusing on social biographies of the heritage from its origins to the present day. Another step can be maintaining the relationship with the place, whether physically and conceptually. When ignored, the core qualities and relationships might get dislocated and undermined in the process and carry misdirecting massages to the observer.

- *Interaction and engagement of people*

When it comes to the presentation of heritage objects, there is an ongoing tension between the physical preservation protocols and the degree of allowance of people's interaction. However, a very important aspect of the experience occurs with the people's engagement with the network of relationships embodied by the heritage objects. Therefore, the interaction and communication process of the experience needs to be reconsidered within the scope of material, form, and method.

AR on Historic Heritage

The main issue about heritage sites from non-related visitors is that they cannot relate and build connections at any level. Alternatively, architects and curators commonly use photos, technical drawings, physical models, and videos to translate the original state of the heritage and many various data into a useful presentation. However, these methods usually remain insufficient in terms of their ability to transfer the intended content. They cannot present the spatial relationship between the real element and its representational copy. Mostly the technical drawings do not make the same sense to the general visitor as to the professionals (Güleç Özer, Nagakura, & Vlavianos, 2016). Additionally, due to the non-progressive nature of heritage, mismanaged sites, and lack of renewal in visual displays and integration with technology is the current situation on the heritage exhibition culture (Farid & Abdelhamed, 2018)**.**

"Virtual Heritage Technology" is a combination of organized information and communication technologies over cultural heritage (Sullivan, 2016). Cultural heritage refers to sites, landmarks, buildings, and items of cultural, aesthetic, historical, scientific, ethnological, or anthropological significance, while virtual heritage refers to examples of the technical realm involving computer simulation of virtual reality environments (Bawaya, 2010). In parallel to the contextual needs, the augmented space works as a material manifestation of the mostly invisible public sphere (Manovich, 2003).

While virtuality is a relatively recent concept, the idea of virtual heritage is not a new issue. The phrase "Virtual Archeology" was first mentioned by Paul Reilly in 1990 and defined as the 3D modeling of the historic buildings and environments by computational technologies, in other words, "description or simulation of an archeological formation" (Reilly, 1990). In 1997 Lucet published his work about the process of building an appropriate virtual restitution model and the output of the new information as the restitution process evolves (Lucet, 1997). The interactive visualization techniques focused on the upcoming years (Gillings, 1999). The book, *"Virtual Reality in Archeology" offered* an extensive view of the issue by demonstrating the building process of virtual archaeological models, production of the narratives and including some case studies (Barcelo, Forte, & Sanders, 2000).

AR and VR are two concepts widely used in the representational culture of heritage sites. Unlike the fully virtual immersive environments created by VR, AR requires and encourages the use of real spaces. For this reason and many others, it becomes the appropriate tool for on-site heritage experiences. Augmented Reality (AR) is the direct or indirect virtual projection technology in the real and physical environment. Components that are extracted from real-world sensory inputs such as audio, video, and graphics; processed and inserted via the computer over the physical environment. Modifying the actual view through digital tools, enhanced reality improves the present perception of reality by the enhancement of the experience of situations and environments. Immersive reality technologies were initially used for entertainment and gaming purposes but are now found in various business industries where they are used, for instance, in information sharing, education, and remote meetings. Enhanced reality gives the individual a great deal of opportunity to gather and share implicit information. Commonly, methods for real-time enhancement are implemented with environmental elements in a semantic context. Users can experience the integration of information and virtual objects by multiple devices, including portable smartphones and tablets or devices worn as glasses, and contact lenses (Steuer, 1993).

Technology and methods evolved through time. One of the most revolutionary novelty might be mobility. Creating an opportunity to carry the digital work and study to the physical heritage site, one of the main mediums are mobile applications. The main aim of these user-friendly apps is to represent the "unseen" elements of architectural cultural heritage by documenting, calculating, and visualizing them for the observer. Most works aim to help the perception process of the structures, models, and information. Sometimes by being as simple information providers in forms of text or images or by being as tour guides for the exhibition experience both indoors and outdoors. While some of them using AR as a static combiner for digital interface and physical environment, some use the interactive representation possibilities of the technology (Güleç Özer et al., 2016; Luna, Rivero, & Vicent, 2019).

According to a 2019 study about AR-based heritage apps in Europe shows that %65.7 of the apps in Europe include a reconstruction of heritage spaces or structures wholly or partially. It is followed by %40 with ones that view the small-scale heritage objects and artifacts. Lastly, its followed by the apps that add written information on the physical object (Luna et al., 2019). The majority of the apps using AR just provides itineraries. Considering AR mainly works as reconstructions of scenarios, it is not an unexpected result. However, many opportunities are missed due to this attitude. An academic tone mostly dominates the apps and makes the user more of a passive information receiver than being a participant of the exhibition (Luna et al., 2019).

When it comes to historic presentation, there is still a persistence of the previous habits. Traditional and analogical approaches are repeated even with a contemporary tool as AR. However, AR has much more to offer. Being a relatively new technology, possibilities are yet to be discovered. AR can reproduce spaces, buildings, and artifacts that no longer exist, allow the objects to be fully viewed without the risk of damage. As the main focus of this paper, it can recreate the lost linkages and relationships that can only be built with deep research from many sources. From an educational perspective, AR enables viewers to have a better understanding of reality and have different perspectives on the observed elements by simulating and contextualizing the given data. It is capable to lead visitors to have a wider understanding of the case by customizing the content for the observer to give an efficient and enjoyable interactional experience (Luna et al., 2019).

Archeological ruins, structures, and places are usually well portrayed from the information viewpoint. Apart from occasional additions and corrections which require a few maintenances, there are very well documented, categorized, and stored in terms of being an information domain. For this reason, the content of heritage elements considerably is suitable for interactive augmentation (Deliyiannis & Papaioannou, 2014). Using the term "interactive" in the archeological field means that the user of such a system should access data in a multimodal manner and the system should have features that enable the user to display, examine, and explore the content that is stored in multiple modes (Deliyiannis, 2012). Today's dynamic and interactive electronic displays allow the content to change continuously and creates a potential space for dialogues. Rather than creating an observable object for the viewer, the viewer is placed inside a space that is filled with interactable and contextual data (Manovich, 2003).

Content augmentation is regarded as a complex process. About augmentation, this issue needs to be handled from different viewpoints in order to develop a system that covers both the emerging content presentation possibilities and the user requirements. To develop an effective interface three main parameters need to be handled simultaneously. Content issues; such as content management, presentation methodologies, educational objectives. User parameters;

such as technological proficiency, cultural and educational background, equipment, and network availability. Technical capabilities; such as service efficiency, development process, external necessities such as the internet (Deliyiannis & Papaioannou, 2014).

There are various examples of on-site interactive augmented heritage preservations via mobile devices:

Through Jones's perspective on the preservation of heritage elements, the possible approaches to AR application have been discussed. As a summary for the enhancement of the relational materiality of the AR experience, there are notes to mention. In order to regain the connections of the physically demolished ruins that produce its materiality, the first suggestion might be the reconstruction of the demolished structure of the previous physical state of the heritage. Another point is emphasizing the time and chronology within the periodical context. In order to re-establish the disrupted linkages of the demolished structures not only its visual entity but also its intangible qualities; identifying, locating, and examining the transitions and development through time becomes an important issue (Deliyiannis & Papaioannou, 2014). The third suggestion can be adapting the content and presentation for different demographics. As discussed before, the AR experience is directly related to the viewer. Creating adapting levels for different age ranges and demographics might be a proper reaction to this case (Luna et al., 2019). Last but not least, converting visitors from a static receiver of information into an interactive part of the exhibition is an important debate to address.

Discussion

The objective of this study was to investigate the qualities of relational materiality with the potential of digital materiality by focusing on the use of AR technologies as a conservation tool and content interface on physically disrupted heritage sites. In this respect, materiality is presented as an objective and relational organization of the chaotic and relative nature of the physical world. Within the concepts of Actor-Network Theory, relational materiality, and heritage authenticity; digital materiality of cultural heritage has been investigated since it properly exemplifies the previously presented phenomena of materiality. AR is considered a suitable platform for experiencing cultural heritage that is physically damaged or completely lost. It has potential in not only representing connectional integrity which remains intact but also re-constructing the connections dispersed among its own physical body, real-time experience, collective and individual memories, visual and written documents. Within the scope of this study, the potentials of the AR technology have been discussed in representing, experiencing, preserving, and protecting the cultural heritage within its historical, cultural, contextual, and social integrity and authenticity.

It is also possible to put further research questions. A deeper debate on the possible relational networks of each heritage element can be focused on. It is of importance to discuss and investigate how AR reconstruct and emphasize these relations of each historic element in the scope of their own contextual and physical conditions. In order to recreate the discussed networks, the potential of mobile apps in the context of this new materiality can also be further research. In light of the discussions that are made in this study, it is rather curious whether this new materiality is capable of altering the scope and attributions of architectural space as we know of.

IMAGES, CHARTS OR GRAPHIC LEGENDS

Figure 1: The Hera Temple, (Olympia, Greece). Augmented temple with the rendered model (Vlahakis, V., 2001).

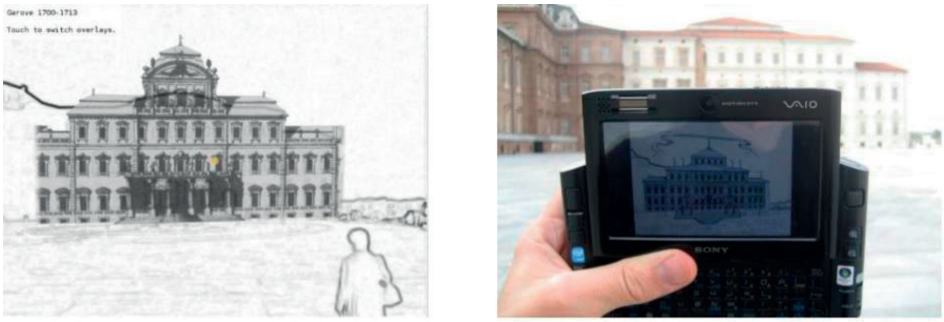

Figure 2: Reggia Di Venaria (Reale, Italy). AR viewing on a handheld device (Stricker, D. et al. 2009).

Figure 3: Tal Al-Amarna, (Minya Governorate, Egypt). AR through a mobile device (Farid & Abdelhamed, 2018).

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AN INVESTIGATION OF PATTERNS OF ARCHITECTURAL THINKING

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ABSTRACT

The design processes of architects have traces of their architectural approach. This process would be based upon the architects' way of thinking, drawing, and seeing. Architects reflect their architectural language and understanding through these three aspects, and to observe these aspects can be a means of exposing the identities of their designs. Architectural design processes begin with an image that an architect forms in her/his mind either completely or partially, and these images are the first seed of their design ideas. By going through the design processes that consist of thinking on, representing, and perceiving, these initial ideas develop and materialize. Hewitt's article "Representational Forms and Modes of Conception: An Approach to the History of Architectural Drawing" provides a framework for this paper to examine design processes. Hewitt suggests the triad of conception, representation, and perception as keys for understanding the design process, which is peculiar to each architect. The conception represents a thinking process that reflects differences in modalities as well as psychological schemata. The representation stands for the drawing process that shows the type, the mode, and the medium that architects use. This drawing process provides an opportunity to see how architects relate their patterns of thought with the forms of representation. The perception, the last notion of the triad, is an analysis to understand how architects visualize their works and how they express themselves. Also, the fact remains that these are not necessarily always equally weighted and discrete processes with a definite beginning end for an architect. These may be phases that support, interact, transform each other. These interactive processes enable the diversification of architectural ideas with infinite possibilities. After examining the framework that reflects architects' approaches, this paper tries to trace how a design idea evolves and diversifies through the constructive phases of representation, conception, and perception.

Keywords

C*onception, representation, perception, architectural approach, design process, modern architecture*

Introduction

An Architectural design process consists of intellectual and material components which are intricately interwoven. Intellectual processes are carried on and developed through material tools. For instance, a conceived idea is materialized by drawings, writings, models, or the acts made by the agency of these tools/media trigger ideas or elaborate thoughts and ideas. Architectural design processes begin with an image that an architect forms in her/his mind either completely or partially, and these images are the first seed of their design ideas. Through the design process that consists of thinking on, representing, and perceiving, these initial ideas develop and materialize.

The design processes of an architect reflect her/his architectural approach. A design would be based upon the architects' way of thinking, drawing, and seeing. Architects reflect their architectural language and understanding through these three aspects, and to observe these aspects can be a means of exposing the qualities that is architect-specific design language. Berlin Philharmonie by Hans Scharoun and National Gallery by Mies Van Der Rohe present two different modern architectural thinking even though they exist in the same context and were built in the same decade. These structures have two distinctive design languages. The contrast between Mies' geometric rationality and Scharoun's adoption of organic philosophy displays the differences in their architecture approach. This study uses the framework suggested in Mark Hewitt's article "Representational Forms and Modes of Conception: An Approach to the History of Architectural Drawing" to examine these two buildings' design processes. Hewitt argues that "types and styles of drawing are linked to ideas" and "drawing is said to be the language of architectural design." (1985, p.2). This study adopts Hewitt's triad of conception, representation, perception as key concepts to discuss the architects' own ways of thinking about design issues.

Conception

The first of the triad is the conception that is the foundation of an architect's creative activities. It is an intellectual process that conveys an architect's habits for designing. The conception forms a mental picture that allows "externalize ideas" by providing a "representation of an intangible mental visualization." (Williams and Sánchez-del-Valle, 2008, p.549). The architects' mode of conception holds clues of thought processes that provide us to trace the design approaches. The process is reflected through differences in representation modes as well as psychological schemata. To comprehend how Mies and Scharoun express their design ideas can help understand the two different design approaches of these two buildings standing next to each other. While Mies formulates his designs by considering the functional necessity, and by searching for harmonious geometry of simplified forms, Scharoun's principles of design oriented around "organic functionalism" discarding pre-formulations (Syring, Kirschenmann, 2004, p.8). Scharoun's approach's striking aspect lies in his rejection of the geometric setup of the perspectival space and his passion for freely organic arrangements. Thereby while Mies' thinking process is a compositional process through certain principles that form the architectural system, Scharoun's design idea is oriented around articulating space like an abstraction of the developing natural forms. So, we can say that mental images of their works were formed around these significant approaches. By examining their preliminary sketches, it is possible to trace how initial ideas are developed.

Looking at the preliminary sketch of Mies, we see that he has a desire to create a geometric system and to apply classical principles of composition. (Figure 1) His habitual mental process leads him to generate ideas based on articulating spaces and structural grid systems that create order. He reflects the clarity and simplicity that he develops through his design process as part of his mind's creative habits. On the other hand, unlike Mies, Scharoun's forms are not "replicated from one element to the other" (Kleiner & Reisenberger, 2018, p.115). The preliminary sketches of Scharoun show that his thinking process also reflects his architectural approach. (Figure 2). As Syring, Kirschenmann discusses, Scharon rejects "the rigid conventions of perspective observation." As a result of it, he offers more freely organic forms that create a different kind of space experience. (2004, p.8).

Similar to Mies, Scharoun also expresses his design, Berlin Philharmonie, with various forms of representation both for the development of his ideas and the presentation. However, because of the organic arrangements and the lack of classic perspective clues, his plans and sections are not proportional to orthographic projection drawings. As Alkan suggests, the Philharmonie's plans are "actually more likely footprints than to be called plans" (2004, p.74). In other words, his design made the orthogonal geometry useless. Due to the design's organization's irregularity and complexity, these plans and sections cannot convey sufficient information. His drawings are "synthetic act of projection" (Alkan, 2004, p.73). Because of it, Scharoun provides many detailed large-scale sections at close intervals through the whole building with the framing technique. (Figure 7) Nevertheless, his drawings are not precise. We can say that the forms of the representation of him reflect his design approach and principles. Besides his plans and sections, Scharoun works with models in the design phase. (Figure 8) It also helps him visualize his mental picture of the design and enables him to develop his ideas.

Remarkably, these two architects with different modernist approaches reflect their mental images through drawing conceptual sections and plans as a starting tool. Even though these two architects adopt different architectural frameworks, it can be said that their modes of conception or their mental imaging processes are similar when looking at their preliminary sketches. Although these two architects who have different concerns when designing used drawings to test their ideas, their drawings convey their own design approaches and reflect different architectural experiences, it can be stated that these two different types of conceptual drawings guide both architects in their search for a design.

Representation

To demonstrate the idea and mental images of a design, architects need to externalize them as perceptible forms. So, they make drawings representing their design ideas. According to Hewitt, "architectural drawings may be classified according to medium, to the purpose for which they are made, and to how they represent object." (1985, p.6). In other words, the drawing process for representation consists of the type, mode, and medium that architects use to develop, express their designs, or document and archive them. This simple classification system can relate Mies' and Scharoun's drawings of their designs with their thought patterns or their modes of conception.

The design coming into being can be envisioned through multiple forms of representation. Mies created the National Gallery's design using several representation types, such as sketches, development drawings, and presentation drawings. His first sketches drawn by pencil contain conceptual plan and section trials. He also produced a very proportional orthogonal line drawing of plans and sections. (Figure 3) These orthogonal projection drawings reveal the dimensions of the design modules and the structural system and the similarities and differences in size and proportion. He detailed his design with different modes of representation as perspective and isometric drawings. An expression of materials and precise detailing, which constitutes the main characteristic of his design approach, is seen in his drawings. (Figure 4) He also produced perspective collages. (Figure 5) As a medium, these collages give an idea about the spatial qualities and interior configuration that visually connects with the exterior. Besides these modes of representation, he produced models for testing his design's three-dimensional qualities and making a more effective presentation. (Figure 6) After all, it can be said that Mies generates his design with several types, modes, and medium of representation that reflects his approach and the design principles.

Mies and Scharoun produce drawings with various forms of representation to visualize the spatial, tactile, or other qualities of their designs. While Mies highlights the principle of simplicity in his drawings, Scharoun's drawings serve for his complex ideas. It can be seen in Mies' drawings that he emphasizes the clarity of his design; and how he images in his mind the quality of the spaces. He also was keen on details. On the other hand, it can be said that while Scharoun reaches the organic forms reflecting his mind pictures with sketches and models, the classical plans and sections do not accurately describe his complex design, and therefore he needs different kinds of forms of representation like large-scale drawings and working models. To conclude, their drawings influence their thoughts and development of their designs; in return, their thoughts matured by drawings affect the presence of a variety of forms of representation.

Perception

Hewitt suggests, "the comparison between the perception of the drawn image and the mental schema" is another framework to understand the architects' approaches. (2008, p.28). This analyzing process provides connections between the expressed design principles by drawings and the mind's habits that guide the architect. It can be said that this last of the triad reflects the relation between modes of conception and forms of representation. In other words, as Hewitt refers to Foucault, perception is about the aspects of the psychology of representation and the structure of thought. It is like the mechanism of seeing, and "the mechanisms of seeing contribute to the way we draw and the way we visualize mentally" (1985, p.7). To comprehend Mies's and Scharoun's architectural languages, it is important to differentiate their different ways of seeing.

Perception as an analyzing process is related to the architects' design methodology since it gives the pattern of how the architect conceives their designs in terms of quality of space, the architectural form, and the design principles. Mies's search for rationality and functionality lead him to pursue order and pure geometry. He organizes open and flowing spaces that emphasize the concept of the void and linearity, providing perspectival vision. The rectangular form of the National Gallery and the usage of architectural linear components either running parallel to each other like a large platform and a roof indicates or joining with ninety degrees characterize the architectural style of Mies. He describes his work as a "classical solution", as a building of clarity. (Krohn, 2014, p.209). In other words, he perceives it as a balance between the freedom of movement in space and a stabilized organization of the components. Besides, he wants to unite landscape and architecture by fitting the building into the landscape and creating a dialogue between the interior and the exterior spaces by connecting them visually with a glass façade and a framed skeleton. Mies calls his architecture "skin and bones" architecture. (Balik, 2017, p.147). He considers this system, which also provides transparency, as an expression of pure modern architecture. That is to say; his perception bears the traces of his mental schemata and his drawn ideas.

In their article, Syring & Kirschenmann quote Scharoun' words:

> Mankind is linked and indebted to the changing time and space, since we create them and are at the same time determined by them: thus, the space we live in, is - in its meaning and essence - not of a static, but of a dynamic nature. (2004, p.7).

With this understanding, Scharoun creates dynamic spaces like architectural abstractions of natural forms. His variety of spaces offer constant alteration of forms. The functions of the spaces generate the forms without the principles based on orthogonal geometry of modern architecture, and it creates a complex and organic organization. As Hwangbo and Suzuki mention in their article, Scharoun says, "We must call on things and let them unfold their own forms. It goes against our nature to impose forms on them, to determine them from without, to force upon them laws of any kind, to dictate to them." (2002, p.277). Scharoun thinks that the building develops from inside outwards. Accordingly, he perceives this inside-out planning as "a unity in life in which responsive between inside and outside" (Hwangbo and Suzuki, 2002, p.277). The irregularity that can be noticed in his drawing shows the fractured quality of the Berlin Philharmonie that he adopts as a design principle. To conclude, his way of seeing and accordingly his drawings, models, and design process expose the fundamental ideas in his mind through the forms of representation he made and preferred.

It cannot be wrong if we say how the architects analyze their design processes and their design languages are connected; and can be perceived. Since Mies and Scharoun adopt different approaches, their way of seeing develops around different points of views. Because both the design principles they adopt and the architectural understanding they emphasize in their buildings are distinctive from each other, the relation between their modes of conception and their forms of relations also differ.

Conclusions

The triad of conception, representation, and perception which are a means of expression of a design process, has been used to trace the architects' design processes that consist of the ways of thinking, representing, and seeing. Although Mies and Scharoun conceptualize their initial ideas by following similar patterns, to demonstrate their ideas, they prefer distinctive forms of representation for themselves besides similar modes of conception. The contrast between Mies' geometric rationality and Scharoun's "organic functionalism" creates this differentiation. Moreover, their inherent approaches and externalized drawn ideas influence their perceptions, leading them to interpret the architectural qualities in distinctive ways. To examine drawings in this framework has made them more comprehensible, and the influence of these processes on their designs can be observed more clearly. Also, there is an interactive relation between each phase that supports and transforms the other. After all, it can be said that two different modern architectural languages can occur with a different design process that enables the diversification of architectural ideas with infinite possibilities.

IMAGES, CHARTS OR GRAPHIC LEGENDS

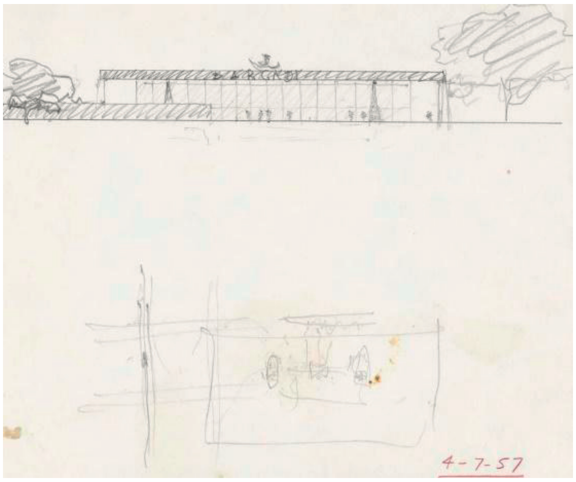

Figure 1: Concept sketch of the New National Gallery, Berlin, Germany. Ludwig Mies van der Rohe, 1967.
© 2020 Artists Rights Society (ARS), New York / VG Bild-Kunst, Bonn. Retrieved from Ludwig Mies van der Rohe. New National Gallery, Berlin, Germany (Longitudinal section). 1967 | MoMA

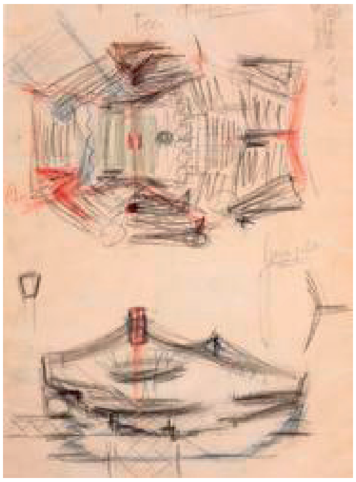

Figure 2: Concept sketch of the Philharmonie (detail). Hans Scharoun, ca. 1956. Akademie der Künste, Hans-Scharoun-Archiv.
Retrieved from archiweb.cz - Berlin Philharmonic

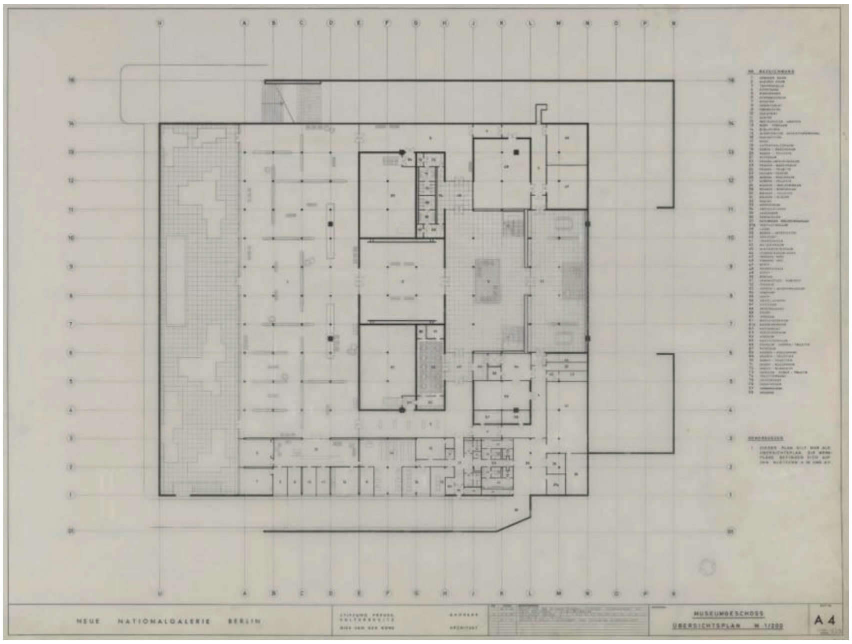

Figure 3: Plan of museum floor. Pencil on acetate. New National Gallery, Berlin, Germany. Ludwig Mies van der Rohe, 1967. © 2020 Artists Rights Society (ARS), New York / VG Bild-Kunst, Bonn. Retrieved from Ludwig Mies van der Rohe. New National Gallery, Berlin, Germany (Plan of museum floor). 1967 | MoMA

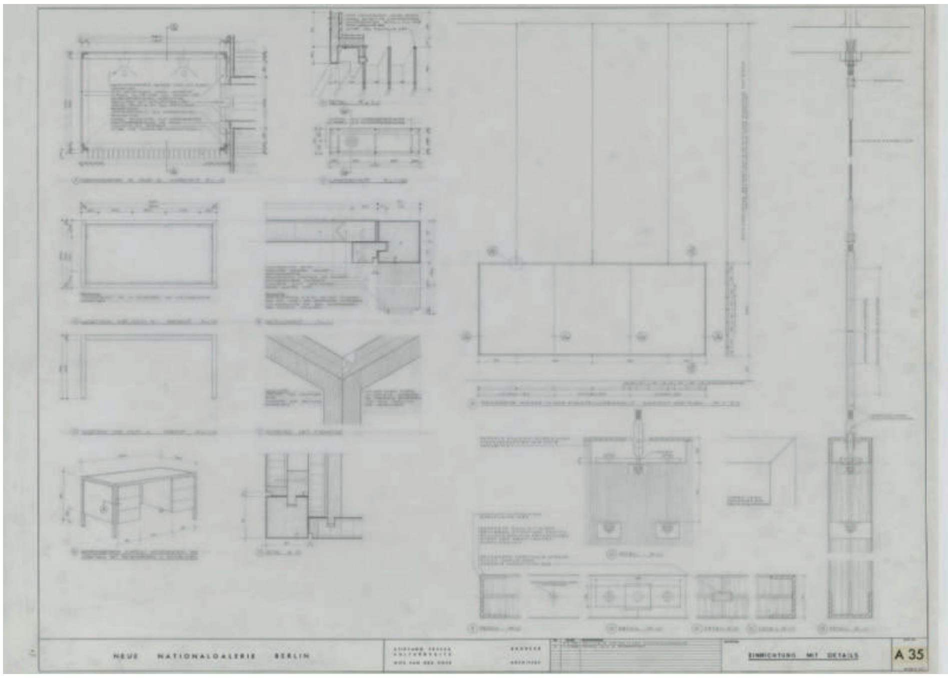

Figure 4: Furnishings with details (plans, elevations, sections, perspective, and isometric view), Pencil on acetate. New National Gallery, Berlin, Germany. Ludwig Mies van der Rohe, 1967.
© 2020 Artists Rights Society (ARS), New York / VG Bild-Kunst, Bonn. Retrieved from Ludwig Mies van der Rohe. New National Gallery, Berlin, Germany (Plans, elevation, sections, perspective and isometric view. Furnishings with details.). 1968 | MoMA

Figure 5: Interior perspective, Photomontage with marbelized paper, wood veneer. New National Gallery, Berlin, Germany. Ludwig Mies van der Rohe, c.1962-68.
© 2020 Artists Rights Society (ARS), New York / VG Bild-Kunst, Bonn. Ludwig Mies van der Rohe. New National Gallery, Berlin, Germany (Interior perspective). c.1962–1968 | MoMA

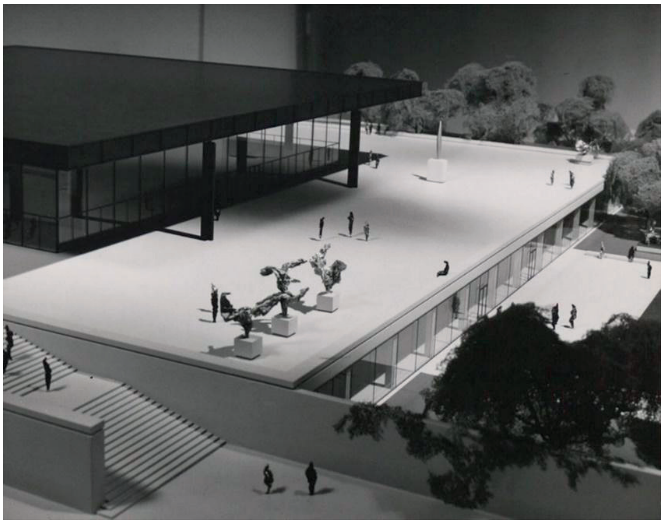

Figure 6: Architectural model of New National Gallery, Berlin, Germany. Ludwig Mies van der Rohe. © bpk / Kunstbibliothek, SMB / Dietmar Katz. Retrieved from Neue Nationalgalerie - Berlin | Mies van der Rohe building (inexhibit.com)

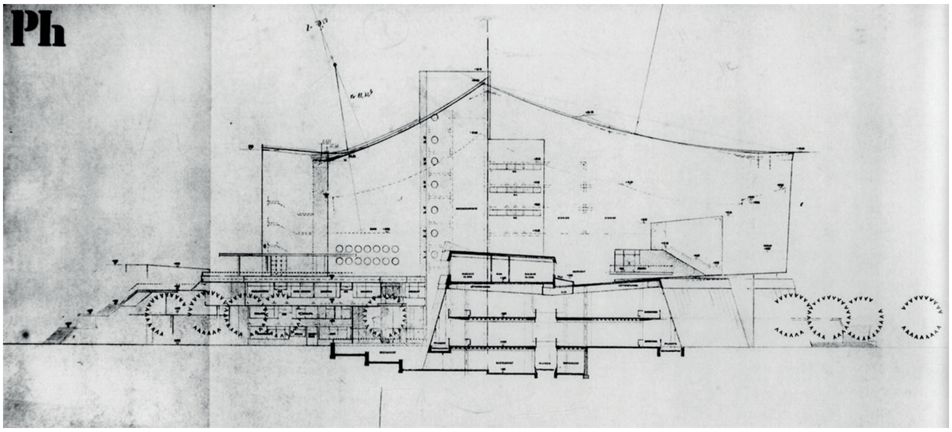

Figure 7: Section drawing of the Philharmonie. Hans Scharoun, ca. 1956. Retrieved from archiweb.cz - Berlin Philharmonic

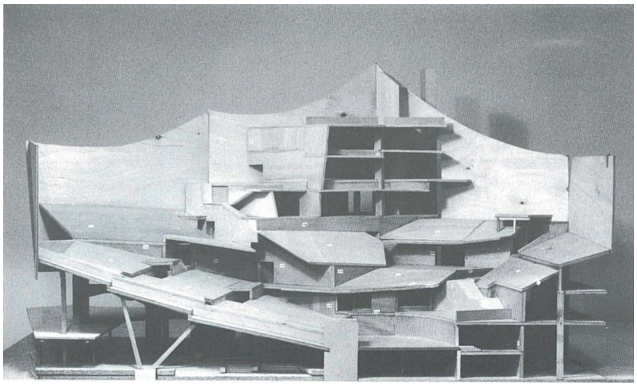

Figure 8: Model of the Philharmonie. Office of Hans Scharoun, ca. 1958. Akademie der Künste, Hans-Scharoun Archiv, WV 222 F.161.
Retrieved from Berlin/Los Angeles | Getty Research Institute | The Getty Research Institute.

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STRUCTURE AND FRAGMENT IN ARCHITECTURAL PRACTICE

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ABSTRACT
Since the last decades of the previous century, image production has increased more rapidly than in any other history phase. The visual culture environment has become dominant and affected architectural practices. The linear process that begins with an idea and ends with an end-product has disappeared. This study explores an alternative way of looking at the architectural practice, understanding its processes and products. By defining two concepts, "fragment" and "structure," and questioning their relationship as a pair, this study argues that; Each image is both a structure and a fragment. Fragments establish various structures by associating with other fragments while the structures break down into various fragments that go forever. Attention and responsiveness to each other, the communication of the fragment and the structure becomes a richer exchange, more cooperative, more dialogic. Thus, they provide a broader perspective to comprehend and interpret the present day's architectural practice through its objects and images. The relationship between the fragment and the structure that this essay focuses on is not a kind of dialog in which parties preserve themselves while they communicate, nor the fragment and structure have a part-whole relationship. Instead, this study focuses on the intellectual outputs of structure and fragment that construct and reconstruct themselves in a dialogic relationship within this context.

KEYWORDS
architectural practice, fragments, image, structure, visual perception

Prologue

"Architecture cannot do without grammar, and the rules cannot be changed from one day to the next. Language needs time to change to occur."

(Charles Vandenhove, 1990, p. 15)

Every era has expressions that can present its grammar. As Fredric Jameson (1991) discusses, culture has become a media subject, and almost every part of our lives, from ancient beliefs to thoughts and expressions, have been recreated as media products in different ways. The mechanization and the medialization of the culture became the significant phenomenon of our age and also within even the radical difference of older, precapitalist modes of production (p. 55). By insightfully understanding the importance of pictures for modern people, as early as in the 1960s, Heidegger poses that to grasp the world as a picture is one of the distinguishing characteristics of the modern era (1977, p.129). Today, we are surrounded by a wide range of pictures from micro to macro scale, profane to sacred, from the past to the future. Images have become the indispensable elements of our life, and they surround the world through networks of visual communication.

This change and abundance of images have affected architectural practices. Since architecture has flourished and responds to its time and culture, architectural practices have inevitably interacted with all kinds of visual media. Beatriz Colomina (1996) argues that the new communication systems (mass media) define twentieth-century culture as the real space of modern architecture. Beyond this, a building, a representation mechanism in its own right, is put forward as an image (p. 158). Therefore, the expansion of the visual field directly influences and transforms the architectural practice.

The practice of architecture is not limited to the design and the building; it also encompasses all discursive and practicing architecture fields such as criticism, theory, history, and architectural pedagogy. In today's world, the domain of architecture has expanded by including knowledge and practices from the social and engineering sciences. Uğur Tanyeli (2013) argues that "new practices and new approaches to architectural thinking are rising, new ways of performing the profession of architecture are emerging" (p. 223). Accordingly, the process becomes more critical than the end-products. He describes this situation as "instead of seeing the product of architecture at the same point, to reveal a way of thinking in which the architectural act, architectural practices and the architect's area of existence are at the focal point" (p.235).

Fragments

One of the main concepts discussed in this study, "fragments," has initially emerged more as a cinema term than any other discipline in our era. In cinema, we know that a fragment is a few minute presentations of the parts that reflect the film's main highlights. Having the meaning of "a small part of something that has broken off or comes from larger," the concept of "fragment" has become a concept used in many fields such as informatics, history, art, literature, biology, medicine, philosophy, cinema, media and photography (Oxford Learner's Dictionary, 2020).

With the invention of photography and the film machine, numerous pictures suddenly disperse to the world more than ever before in history. As in cinema, in the real world, people recreated all senses to convey visual communication. For example, it occurs by creating images to make people feel the wind (Figure 1). The realization of every feeling is not achieved only through that feeling, as in this example. Each feeling has a counterpart to another feeling that the image meets most of them that convey the spatial feelings. For Deleuze, cinema is precisely that kind of practice. Breaking down the world's static structure, taking its linear flow out of control, creating a new form of perception is an appropriate tool for witnessing the chaos (Deleuze, 1990, pp. 92-93). In the article "Fragments in Libeskind and Wittgenstein," Rossen Ventzislavov (2012) suggests that the concept of fragments has a similar role in Wittgenstein's later philosophy Libeskind's architecture that the fragments interrupt traditional linear approaches to architectural practices. So, we also conceptualize fragments as a challenging concept to linear approaches. We discuss that fragments are operated in and created through an open-ended process of the network of architectural practices.

By defining two concepts, "fragments" and "structure," and analyzing their pair relations, this study argues that each image is a structure, and each structure is a fragment. They decompose and evolve, and then they come together with different combinations and associations that this fragment structure relationship creates the design language. A pair relationship between fragment and structure will be sought rather than to deal with these concepts separately because thinking the interaction between two things provides us with an endless field of comprehension and interpretation. This pair relationship opens a way to understand the present day's architectural practice and comprehend it through its objects and images. This research instrumentalizes the rhizome concept coined by Deleuze and Foucault's four similitudes; Conjunctio, Aemulatio, Analogy, and Sympathies, to explore a new way to understand contemporary architectural practices.

Perception of The Fragment and The Image

> *"I see no way of withholding the name of "Thinking" from what goes on in perception. No thought processes seem to exist that cannot be found to operate, at least in principle, in perception. Visual perception is visual thinking."*
>
> (Arnheim, 1969, p.14).

Designing is more than a momentary act; it connects past and present experiences of the perception. Here, Joseph Kosuth's dialectical work, "one and three chairs" (Figure 2), may explain visual perception levels. As shown in Figure 2, the chair, its photograph on display, and the inscription of the dictionary description of the chair stand side by side. This work focuses on the perception of the image of the chair through separate fragments. Here, at first glance, there are three images; textual, pictorial, and spatial. The textual level is the dictionary definition of a chair. The pictorial level is the chair's photograph, and the spatial level is the chair's material existence. However, we cannot see the hidden fourth level in Kosuth's work; that is, our sense of sight identifies visuals as instantaneous frames of the world's images. This visual perception is not just a passive biological process; it concerns things outside the mind. Daryush Shayegan (2014, p.21) argues that perception occurs through active imagination, and an image provides the representation. In other words, we think through images and perceive the world of beings outside of us, both with what is present and what is not. Ron Burnett explains in *How Images Think* as "Images are also one of the most fundamental grounds upon which humans build notions of embodiment. Images speak to people because to see is to be within and out-side of the body." (2004, pp.20-21). So, it is possible to interpret that as soon as a human eye sees an image in the outer body, it communicates with it. Similarly, Juhani Pallasmaa states that "unconscious peripheral perception transforms retinal gestalt into spatial and bodily experiences. While peripheral vision integrates us with space, vision pushes us out of space, making us a mere spectator" (2005, p.13). Since the level includes interpretations and personal transformations of the textual, visual, and physical aspects of the relationship between the object and the environment in which they are formed, a phenomenological approach is needed to reveal the fourth latent's mental image level.

Fragmentation can both be a mental or physical act. This work recommends that the structure and fragment are neither similar nor opposite but contain/extend/form each other. Umberto Eco argues in *Open Work* (1989), by quoting from Luigi Pareyson, the work of art "has infinite aspects, which are not just "parts" or fragments of it. Because each of them contains the totality of the work, and reveals it according to a given perspective." (p.21). So, we continuously perceive, create, transform, and recreate fragments. Because of this phenomenon's mostly random, unplanned, and enduring nature, it is possible to think that this situation causes chaos in mind. Accordingly, referring to the Deleuzean expression of chaos, which contains all possibilities (Deleuze, Guattari, 1994, p.118), considering the mind as a mental medium in a state of chaos. Here, if we return to or analogical example of Kosuth's three chairs, the image is perceived in three levels: textual, pictorial, and spatial; it is like images in architecture. These three levels of perception are then interpreted in the fourth hidden level and are torn apart and turn into fragments in the chaos. Therefore an image took its place in the chaos of the mind and fragmented, derived, recalled, and superposed fragments that are different from the objects or the image initially perceived. Based on this phenomenon, this study elaborates on the rhizome concept that defines the relationship between fragments and structure. Deleuze and Guattari coined the term "rhizome" originally a term of biology and transferred it to the philosophy by defining a web of growing connection that is "[r]hizomes can reach another point by moving from any point, without any hierarchical correlation" (1990, p.9). Here, the rhizome concept suggests the relationship between elements of thought that seem unrelated to each other. That refers to a net of thoughts, experiences, and images that depart, transform, spread, evolve, grow, converge, coincide by constituting a net (Deleuze and Guattari, 2005, p.5). The diagram in Figure 3 illustrates the rhizome models. The red circles represent the image transfer into the mind's chaotic environment, while the yellow forms represent the selections that occur because of the intersection of the image perceived at the moment with accumulations of past experiences in mind. Through these selections, namely fragments continuously transform the image by creating new fragments.

Pallasma and Maurice Merleau Ponty consider the human body as the source of all experiences. (Merleau-Ponty, 1978, pp.158-408). Pallasma states:

> Our bodies and movements frequently interact with the environment, the world, and the self-inform and continuously redefine each other. The perception of the body and the world's image turns into one continuous existential experience; nobody is separate from its domicile in space, and there is no space unrelated to the unconscious image of the perceiving self. (2005, p.40).

So, creation/construct in mind is possible through images created by the perception of things and their fragmentations and transformations. Images of the houses lived in; schools attended, offices, streets, neighborhoods, cities, in short, experiences of life which architecture shape accumulate as fragments in the chaotic environment of the mind. Bachelard (1964) calls them "primitive images":

> [T]he houses in which we were born to have embedded various sitting (inhabiting). We are diagrams of sitting in that house; all other houses are merely variations on a basic theme. Habit is an over-worn word to describe the passionate bond between our unbridled bodies and an unforgettable home (p.15).

Accordingly, the world experienced subjectively create fragments go under continuous transformations and breakdowns and establish rhizomatic connections which are not static, not linear, not predetermined, uncoded. Fragments make semiotic chains as rhizomes in the chaos (Deleuze and Guattari, 2005, p.7). Through these rhizomatic associations, fragments constitute new structures that will break apart and be fragmented.

The Similitudes and The Structure

This study suggests that each design is a structure which is composed of fragments. The relationship between structure and fragments is an open-ended process that creates the design language of an architect. As an artist, Picasso insightfully perceives this complex mechanism of creation by saying that "every act of creation is above all an act of destruction." (Cited from Çağlar, Aksu, 2017, p.12). Perception, memory, and imagery interact continuously (Pallasma, 2005, p. 67). These actions do not occur in linear processes that have designated or accurate starts and ends. We cannot mark an absolute beginning or an inevitable end for design practice. As Alvaro Siza expresses, "0 point will never really be a zero point, it would not be wrong to say that neither will be an endpoint. This structural setup also includes a kind of reverse perspective, repetition. But "repeating is never a repeating" (2015, p. 21). In this regard, each fragment is a whole one, and each fragment is part of integrity. That relationship is similar to the movement of fragments in chaos (Figure 5). It is a spatial/structural installation consisting of vertical, horizontal, and non-linear, moving, and dynamic layers that rotate, transform, and hovers in between (Yılmaz, 2014, p. 17). Many architects have implied the fragments and structure relationships with different sentences. For example, Oswald Mathias Ungers, in an interview in 1991, explains the design as "[a]rchitecture is the arrangement of unrelated pieces. As an architect, you try to establish some principles to which those pieces can report as a meaningful whole." Also, in 1990, architect Thom Mayne describes it with the following sentence: "My nature is to take things apart and reinvent them." (Cited from Burmanje, 2012, p. 15)

Today, the design structure paradigm is not a repetition of what exists but also a fragmentation and restructure. Fragments come together to form a rhizomatic structure. How fragments are associated with each other can be explained through concepts like those defined by Foucault in four similitude concepts. In the book *The Order of Things*, Foucault discusses the ways of thinking and delves into four notions to figure out the conditions of resemblance between two things: convenientia, aemulatio, analogy, and sympathy. The word "convenientia" indicates the closeness of things in a place that approaches and relates to each other. In this way, they communicate; accordingly, a similarity emerges. The similarity of their characteristics defines the similitude. At each contact point, they present common characteristics (Foucault, 1986; 20). The figure below illustrates this type of similitude by contact points of two circles, where the first one ends and the second one begins or vice versa. The second form of similitude is aemulatio. The circles, which are broken and separated from each other, show the similarities. They are apart, yet they reflect each other. Here, things do not imitate but compete. From that, circles do not contact to form a chain of juxtaposition elements; instead, they form reflecting and competing rings (Foucault, 1986, p. 21). The third similitude is the analogy. Convenientia and aemulatio coincide in this comparison. Analogy includes similarities and the apparent but also more subtle created through comparison (Foucault, 1986; 24). Sympathies provide the fourth form of similarity. Sympathy can arise from a single contact. However, its influence generates an impulse moving one thing to the other. Sympathy can change the form of things. This opposition and coexistence situation is reconstructed in an infinite combination and creates other dualities (Foucault, 1986; 21-26).

Structure and Fragment

By examining the works of Daniel Libeskind and Tadao Ando as its examples, this study observes a rhizomatic relationship between fragments that constitute the architectural language of these two designers. Libeskind's Ground Zero and the Jewish Museum are profound commemoration works that mark two deep and violent cracks in world history. Libeskind's practice is selected as a case study in this study because Libeskind perceives his works as fragmental. He directly refers to this phenomenon as "fragments" in design practice (Ventzislavov, 2012). Stanley Meisler says that Libeskind is an architect who takes the basic rectangle of a building, divides it into pieces, and then reassembles the pieces in an entirely different way. He believes that this fragmented structure is also a conceptual transformation of fragments of ideas:

> In a kind of architectural alchemy, Libeskind gathers ideas about the social and historical context of a project, blends in his thoughts, and transforms them all into a physical structure. This is not just technical problems. It is a humanist discipline based on history and tradition, and this date and traditions must be vital parts of the design (Meisler, 2003)

Referring to Ground Zero (Figure 6), the experiential, emotional, and physical fragmentation left by a tragic terrorist attack were brought together. Indeed, all Libeskind's works, his architectural practice, have the past and present fragmentations' rhizomatic relationships. For instance, in the holocaust tower he designed, he reflects tragedy by structuring light's effect. The single and thin slit on the façade stands as the split in humanity's memory and compassion. Access to the extension to the Jewish Museum (Figure 7) is through an underground passage with its entrance at the old museum. Here, Libeskind underlines that Jewish history and tragedy are part of Berlin's history and connected (Maden and Şengel, 2009, p. 52). It is possible to associate the similarity between these two structures (design practices) with Foucault's concept of the *aemulatio*. Although the Jewish Museum and Ground Zero are two different design products, they present a contactless resemblance by reproducing similar contextual and sensational fragments. These two monumental structures contain a twinness/reflection of their fragments. That fragment is the feeling, images, and recalling of the absence. For example, the cracks on the Jewish Museum and large holes of the Ground zero convey the absence, the great tragedy of the lost. Moreover, the sound is another fragment that is inherent in these memorials. For example, regarding Ground Zero, there is a dominant water element in the design. The water (Figure 6) rapidly flows down from the "0" point as the waterfall, creating the sound that recalls the collapse of the twin towers and voices of the people who lost their lives during the terrorist attack. A similar situation exists in the Jewish Museum. The iron faces covering the entire floor of the Holocaust tower (Figure 8) make a sound when stepped on. The sound refers to the voices of hundreds of thousands of Jews murdered. This similar fragment is so powerful that; it proves itself most dominantly. Aemulatio defines the rhizomatic relationship of these two works, fragments that are similar and reflect each other.

Analysis of the architectural practice of Tadao Ando manifests different fragments and structures. It is possible to interpret Ando's architectural approach through Foucault's *analogy concept* to understand their constituting fragments' relationship. Duality and the dual nature of existence resolve Ando's architecture. It is structured by contrasting and contacting fragments of tectonic elements and immaterial concepts, solid/void, light/dark, moving/still, secular/spiritual, nature/built environment. In the Church of Light (Figure 9), light reaches the church from the space on the east façade from early morning to midday, transforming the concrete interior into a lighted box from a dark volume. Here, the fragments' relationship is different from the Libeskind example because the opposites are in contact and transformation. They contact each other where the one ends; the other begins by contrasting each other. Other projects of Ando also display duality; for instance, in Azuma House, the open courtyard is a place exposed to nature inside the house implies that humans need a shelter to protect from it.

Epilogue

Briefly, this study suggests a method/way to understand today's architecture through the relationship between the product and its images. Exploring the fragment structure relationship considers the fragment as a defining and descriptive concept in contemporary architectural practices. Like rhizomes, fragments and structures are formed and transformed by coincidence and by different and unpredictable coalescence in the designer's mind, like the soil's roots. How fragments are associated with each other can be explained through concepts similar to those defined by Foucault in four similitude concepts. Based on the examples presented, in today's architectural practice, it is observed that the different productions of an architect share some common elements and sensitivities and thus have a common language. However, this study does not claim that the relations defined here can be generalized to reveal architectural practice's structure fragment relation. In order to understand constructing relations between fragments-structure, this study explores a way among many possible ones.

IMAGES, CHARTS OR GRAPHIC LEGENDS

Figure 1: Intensity of the wind (Scenes from *The Turin House* (2011). Directed by Béla Tarr, Agnes Hranitzky)

Figure 2: Joseph Kosuth, One and Three Chairs, 1965, wood folding chair, mounted photograph of a chair, and mounted photographic enlargement of the dictionary definition of "chair."
(Source: https://www.moma.org/audio/playlist/1/49. Retrieved on 28.10.2020).

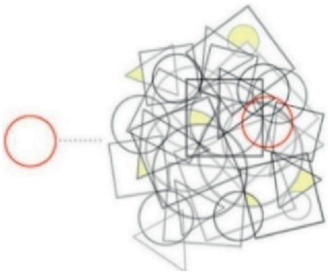

Figure 3: The place of rhizomes in the chaotic environment. (Drawn by İlkiz Atabek Çelikli).

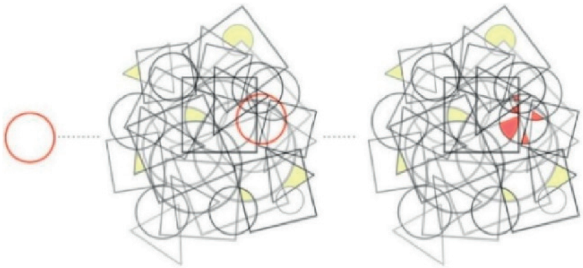

Figure 4: Fragments in the chaos and rhizomes as formed fragments. (Drawn by İlkiz Atabek Çelikli).

Figure 5: Fragment rhizomes and structure in chaos. (Drawn by İlkiz Atabek Çelikli).

Figure 6: A Photo of Ground Zero. (Photo by Sibel Acar).

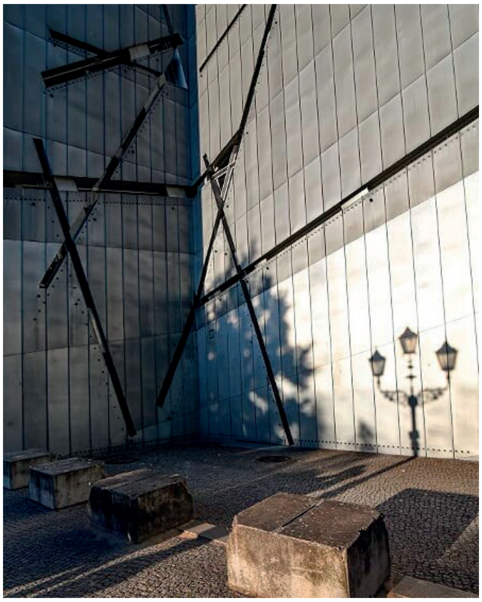

Figure 7: A Photo of Jewish Museum. (Photo by Sibel Acar).

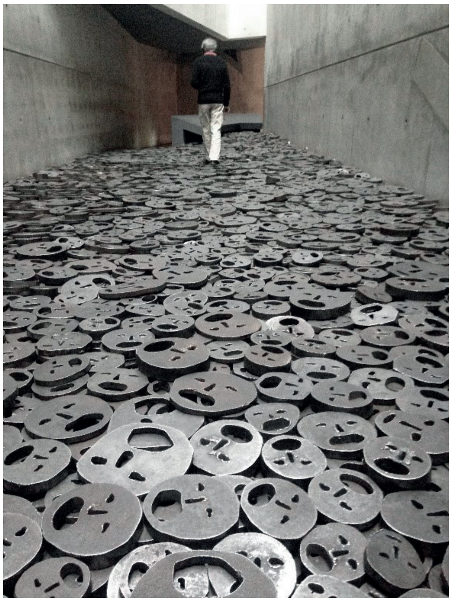

Figure 8: A Photo of Holocaust Tower of Jewish Museum. (Photo by İlkiz Atabek Çelikli).

Figure 9: Tadao Ando's "Church of the Light.
(Source: https://commons.wikimedia.org/wiki/File:Ibaraki_Kasugaoka_Church_light_cross.jpg. Retrieved on 28.10.2020).

NOTES

1 This paper is based on the master thesis by İlkiz Atabek Çelikli, co-advisor Asst. Prof Dr. Sibel Acar and advisor Prof. Dr. Nur Çağlar at the TOBB-ETU Graduate School of Engineering and Science, Department of Architecture.

2 For further discussion on the concept of pairs, please see Ekiztepe, Aslı. "An Experimental Approach to the Understanding of Architecture through Concept-Pairs," Master Thesis, TOBB ETU, 2017; Nur Çağlar and Adnan Aksu also argues that pair relations between images and concepts create a versatile interpretation. For more information, please see Çağlar, N. and Aksu, A. Diptych I. Architecture and Diptych. https://www.materiart.org/glossary-dptiychI;DiptychII.Description.https://www.materiart.org/glossarydiptych-ii; Diptych III. Associations https://www.materiart.org/glossary-diptych-iii

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