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Normal patterns of déjà experience in a healthy, blind male: Challenging optical pathway delay theory

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Abstract

We report the case of a 25-year-old healthy, blind male, MT, who experiences normal patterns of déjà vu. The optical pathway delay theory of déjà vu formation assumes that neuronal input from the optical pathways is necessary for the formation of the experience. Surprisingly, although the sensation of déjà vu is known to be experienced by blind individuals, we believe this to be the first reported application of this knowledge to the understanding of the phenomenon. Visual input is not present in MT, yet the experiences he describes are consistent with reports in the literature of déjà vu occurrence in sighted people. The fact that blind people can experience déjà vu challenges the optical pathway delay theory, and alternative causes are briefly discussed.
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1. Introduction

There has been a recent resurgence in interest in the déjà experience, in part due to a review (Brown, 2003) and the report of cases detailing subjective accounts and objective measures of various déjà phenomena (e.g., Taiminen & Jääskeläinen, 2001; Moulin, Conway, Thompson, James, & Jones, 2005). Déjà vu is defined as "[a] clash between two simultaneous and opposing mental evaluations: an objective assessment of unfamiliarity juxtaposed with a subjective evaluation of familiarity" (Brown, 2004, p. 2). It is characterised by a 'strange' sensation of inappropriate familiarity and has been found to occur in up to 96% of the population (Sno & Linszen, 1990). The sensation is most often reported with the connotation that an individual inappropriately recognises what they are currently *seeing*, possibly based on the literal translation, 'already seen.' Nevertheless, 84% of individuals who experience déjà vu report having had at least one such experience for auditory stimuli (Buck & Geers, 1967), indicating that the déjà experience is not always limited to the visual modality.

A number of variations in déjà terminology have been coined to convey the multitude of modalities and experiences for which a déjà vu can occur (Neppe, 1983). These include *déjà entendu* (already heard), *déjà senti* (already felt/smelt), *déjà pensé* (already thought) and *déjà visité* (already visited). Even so, the term déjà vu is still broadly used to encompass all of these sensations. More recently, the term déjà vecu has been used to describe the clinical manifestation of recurrent déjà vu associated with dementia and/or Alzheimer's disease (Moulin et al., 2006). It has been proposed that there is a neuropsychological dissociation between the everyday sensation of déjà vu and the more pathological déjà vecu, with the former resulting from an inappropriate sensation of 'familiarity' and the latter resulting from inappropriate 'remembering' (see Moulin et al., 2005, for a discussion of this distinction). In line with the 'cognitive feelings' framework, the introduction of the term déjà vecu and its dissociation from déjà vu have built on the assumption that déjà vu arises from the neurologically dissociated activation of the familiarity/remember-centres of the brain from the associated memory trace. This

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is supported by evidence for the location of the neural circuits for familiarity in the mesial temporal regions (Aggleton & Brown, 1999): déjà vu can be thought of as a dysfunctional activation of the temporal lobe (or other brain regions crucial to retrieval), giving rise to inappropriate sensations of familiarity and possibly déjà vu (e.g., Adachi et al., 1999). This theory of déjà vu formation has been supported by recent developments in neuroimaging and the above cases.

An alternative theory of déjà vu formation, the dual pathway theory, was made popular in the late 19th and early 20th Centuries. This theory is still frequently cited as the explanation of déjà vu formation, due to its intuitive plausibility and incorporation into popular novels such as 'Catch 22' (Heller, 1961). Broadly speaking, the dual pathway theory proposes that déjà vu is experienced when sensory signals which have been transmitted via various neuronal pathways do not converge on cortical areas at the same precise moment, thereby causing the brain to misinterpret a single encounter as a duplicated experience. As the gap between the input of the two pathways is only milliseconds in duration, the first neuronal experience is not encoded as an event in itself and is therefore not remembered, triggering a sensation of familiarity with an undefined past when the second neuronal experience is encountered. It has been proposed by some that this discombobulation originates in the nerves of the eyes, and that therefore déjà vu results from an optical pathway delay.

> …the supposed uneven action of the nerves supplying the eyes, one side of the brain thus receiving the image before the other, and causing the secondary image to appear as a familiar repetition of the first. (Osborn, 1884, p. 479–480).

Despite its popular appeal (e.g., Johnson, 2001), the optical pathway delay theory of déjà vu formation assumes that the optical pathways are necessary for the formation of the sensation, and surprisingly remains untested. However, if it can be established that an individual for whom the optic nerve is not a sensory input experiences déjà vu, and experiences it in the same way as a sighted individual, it will be possible to test the assumption of optical pathway delay theory and thus, test the theory itself.

Here, we report the case of a 25-year-old man, MT who, as a result of extreme microphthalmos, has been totally blind since birth. Microphthalmos is a congenital condition characterised by the eyes not developing to their normal size. Although many individuals with microphthalmos are able to see, albeit with visual impairment, MT has a severe form of the condition meaning that he has always been totally blind. Despite this, MT reported experiencing déjà vu regularly from the age of eight. To foreshadow the case description, this case makes a small, but critical contribution to the literature regarding the formation of déjà experiences. It details the as yet unreported occurrence of déjà vu in a blind individual; an occurrence that is inconsistent with the optical pathway delay theory of déjà vu formation.

2. Case report

A 25-year-old, right-handed, caucasian male administrator, MT, was recruited through the Royal National Institute of the Blind (RNIB). MT had been educated to Masters Level and did not have any psychiatric disorders or epilepsy. The nature of his blindness, caused by extreme microphthalmos, was such that he had been completely blind since birth: he has never been able to see and does not have any sense of vision when he dreams. To investigate the participant's lifetime tendency for dissociation, which has been associated with déjà vu experience, he completed the Dissociative Experiences Scale (DES, Bernstein & Putnam, 1986). His DES-score was 20.5[1] which is higher than the mean score in the general population (Bernstein & Putnam, 1986), though not abnormally so. The participant gave his written informed consent for the presentation of the case report.

MT reported first experiencing déjà vu at the approximate age of eight or nine, although he was very aware that he may have experienced yet forgotten occurrences of déjà vu prior to this age. His memory of the first experiences of déjà vu is that they occurred approximately two or three times per week. Lasting between a few seconds and up to 30 seconds, these experiences occurred mostly when alone in the evenings and were characterised by a familiar 'coming together' of MT's sensory experiences. Here, MT describes his sensory experience of déjà vu:

> Hearing and touch and smell often seem to intermingle in the déjà vu experiences. It is almost like photographic memory, without sight obviously. It may be more accurate to say multi-dimensional memory, as if I was encountering a mini-recording in my head, but trying to think "Where have I come across that before?"

MT's subjective experience of the sensations was that they were "curious, in some cases enjoyable… and weird."

One particularly vivid déjà vu experience recalled by MT happened when he was 10 years old. During an afternoon meal at school, when asked if he would like some more food, MT felt his experience of the whole situation come together into a familiar sequence. MT describes the experience below:

> As it happened, it was from the point that I said "yes please", and felt the plate, and heard the retort from one of the members of staff to one of the other people on the table, that I suddenly thought "I'm sure I've done this before."

He reported that the experience felt like it lasted 30 s, but actually only lasted between 7 and 10 s. In addition to this experience, MT recalled a number of other déjà vu experi-

[1] If the three items which refer explicitly to the modality of sight are removed (items 8, 11, and 28), the participant's DES-score rises to 23.0. The DES has a possible range of scores from 0 to 100 with higher scores indicating a greater level of day-to-day dissociative experience.

ences of differing intensity and duration, beginning with different triggers, and involving a range of sensory modalities. For instance, he reported another experience of déjà vu encapsulating a sequence of events and sensory modalities (feeling for and undoing a jacket zip at the same time as hearing a particular sound on a cassette player), and a further experience of a single event involving only the sense of hearing (the sound of a car door closing), both of which he described as déjà vu experiences.

The incidence of déjà vu experienced by MT has decreased since his first experience of the sensation in childhood. At the time of interview, MT reported that he did still experience déjà vu, although its incidence has decreased to approximately once every 3 months. When questioned about his last déjà vu experience, he reported that he could not remember it.

3. Discussion

The characteristics of MT's déjà vu experiences are consistent with Brown's (2004) definition of déjà vu, and with findings on the nature of 'typical' déjà vu. The duration and precipitation of his experiences are representative of participants' responses regarding their own typical experiences in larger scale studies (e.g., Neppe, 1983). In addition, the robust finding that déjà vu incidence systematically declines with increasing age (Richardson & Winokur, 1967) was found to be represented by MT's personal reports of decreasing incidence frequency since childhood. Even MT's age of first déjà vu experience falls well within the typically reported age range of six to 10 years (Fukuda, 2002). There is nothing atypical about MT's experiences of déjà vu, other than the absence of sight from his experience.

Aware of the translation of déjà vu, MT had initially contacted us to discuss his experiences of what he termed 'déjà été', a term that he reports as characterising very well his personal sense of having been in the situation before. Nevertheless, the normal characteristics of MT's déjà vu experiences do not provide us with any reason to suppose that the neurological basis for MT's experiences are any different to those experienced in the wider, sighted population. It can therefore be assumed that neither the sense of sight, nor the input of the optical pathways, are necessary for the formation of the déjà vu experience. This case-report serves to challenge optical pathway delay theory, which does not appear capable of explaining the occurrence of déjà vu in the blind. One interpretation is that MTs experiences are due to non-optical pathways being delayed in order to produce the sensation. However, this would require that in sighted people there were as many causes of déjà experiences as there were putative sensory pathways. A more parsimonious interpretation is that a common factor lies behind déjà experiences in sighted and blind people. In fact, MT's phenomenological experience emphasises the fact that déjà experiences, when they occur, are multi-sensory phenomena.

If MT's déjà experiences are indeed the same as those experienced by sighted individuals then it is necessary to consider alternative theories, such as those emphasising the role of dysfunctional activation of the temporal lobe in déjà vu sensations (Adachi et al., 1999) or familiarity (Brown, 2003). The cognitive feelings framework (Moulin, Conway, Souchay, & O'Connor, in preparation) brings the dissociation between subjective sensation and objective reality to the forefront of research into subjective memory sensations. It is proposed that the dysfunctional temporal circuits responsible for erroneous familiarity in déjà vu (or remembering in déjà vecu, Moulin et al., 2006) bring to consciousness the subjective sensation that one is familiar with what one is in the process of encountering. Thus, the source of the sensory (or cognitive) stimulus is not important to the nature of a déjà vu experience; what is important is the way in which the stimulus is processed on both a conscious and unconscious level. A dissociation between the two processes will therefore give rise to a dissociative experience such as déjà vu (familiarity and the absence of memory trace) or jamais vu (unfamiliarity and the presence of memory trace). This explanation of dissociative experience is supported by neuroanatomical investigation (e.g., Bancaud, Brunet-Bourgin, Chauvel, & Halgren, 1994) and requires further empirical investigation. Given that current theory now favours a memory explanation for déjà vu, that we report déjà vu in a blind individual is, in itself, not a cause for surprise. What is surprising is that it has not been reported before, and that the application of this knowledge has not previously been used to further our understanding of déjà vu. However, the extrapolation and empirical interrogation of the optical pathway delay theory is an important step towards improving the scientific and lay-understandings of the true nature of the déjà vu experience.

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