Welcome to the /r/headphones Community Wiki, a Wiki created , and maintained by THE MODERATORS. If you would like to contribute to this Wiki, please comment on the side and your words will be taken into consideration. NOTE THAT THIS IS A WORK IN PROGRESS

HEADPHONES TYPES EXPLAINED

Earbuds

The most common type of headphones, the most popular and common example being the stock Apple Ear Pods. These headphones rest within your outer ear, but do not physically enter your ear canal.

IEMs

Otherwise known as in-ear monitors. These are headphones that go into your ear, similar to earbuds, but they go a step further by nesting in your ear canal. They will provide a higher level of isolation due to the deeper fit and a proper seal, which also helps bass response. The earphone tips (what you actually insert into your ear canal) come in a variety of sizes and shapes, such as silicone tri-flange and foam. Manufactures provide different sizes and designs. Highly suitable for portable use, especially when passive noise isolation is required.

Circumaural (Around-ear)

These can be open or closed headphones. The defining characteristic of these is that they will completely surround your ear inside the pad. The pad of the headphone generally won't touch the ear; rather, it will make a seal around the outside of the ear. Generally, these are considered to be the most comfortable headphones, but they also tend to be large and are generally not ideal for portable use. Most higher end headphones are full sized and circumaural.

Supra-aural (On-ear)

These can be open or closed headphones. The defining characteristic of these is that they sit on the ear, rather than cover your ear. Some users find this design to be uncomfortable due to the pressure applied on the ears. Closed back supra-aural headphones generally tend to be more suitable for portable use when IEMs are not personally favorable for the user.

Open vs. Closed

Simply put, **open headphones** are physically open (the driver housings are physically vented, particularly behind the driver); they "leak" sound out, as well as let outside sound in. Closed headphones are physically sealed (the entire headphone housing is solid). Open headphones will generally have a wider soundstage, giving the music more room to breathe and usually a more realistic presentation. It can be thought of as seeing a concert outdoors where the music has an air to it. This isn't always true, but it's one way to look at it. The downfall to open headphones is that they leak sound and let sound in. This makes them poor solutions for traveling, or in any environment and situation where the prevention of sound leakage and passive noise isolation are paramount. As a general rule of thumb, due to the soundstage advantages open back headphones exhibit versus closed back, an open back headphone will be preferable for gaming purposes. This is a key factor if specific sound positioning is of importance.

Closed headphones generally have a less diffuse and more intimate sound presentation. A good analogy would be to think of a full size orchestra vs. chamber music. Often, this is described as a more 'in the head' sound. Most closed back headphones also provide a level of passive noise isolation that varies from

different makes and models. There are exceptions to this design, as certain closed backs feature sond ventilation in the driver housing. Due to the enclosed nature of the driver housing with closed back headphones, the reflection of sound waves from the enclosure can cause resonance that can increase overall bass and treble quantity. This does not apply to all closed back headphones, and there are many exceptions.

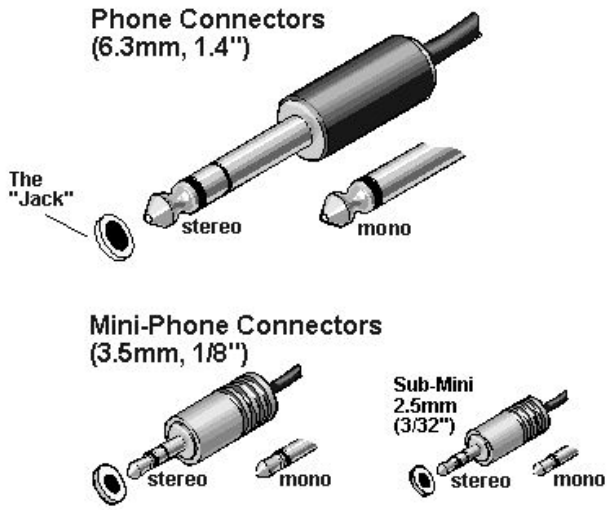
Some headphones are marketed as “semi-open”, and claim the benefits of both closed and open headphones. In real-world usage, however, all headphones either operate as closed or open headphones for purposes of noise isolation, with the majority of “semi-open” headphones attenuating so little sound as to be functionally open.

HEADPHONE DISSECTION

AUDIO CONNECTORS EXPLAINED

TRS Headphone Connectors

The following picture shows a few different variants of Tip-Ring-Sleeve (TRS) connectors. For delivering stereo audio, we want TRS connectors, not TS. TRS connectors are the most common type of headphone plugs that can be used with a variety of equipment. The smaller 3.5mm TRS connectors are used by mobile devices and portable hi-fi gear. The larger 6.3mm (¼ inch) TRS connector is more common on higher-end headphone models. The two sizes are electrically identical and (given proper amplification requirements) can be used interchangeably with the right adapters.

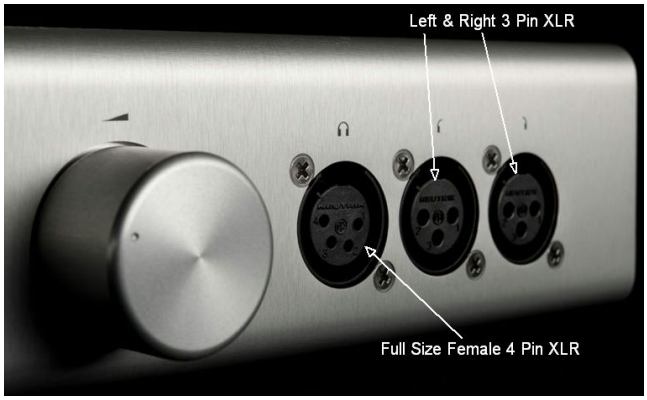


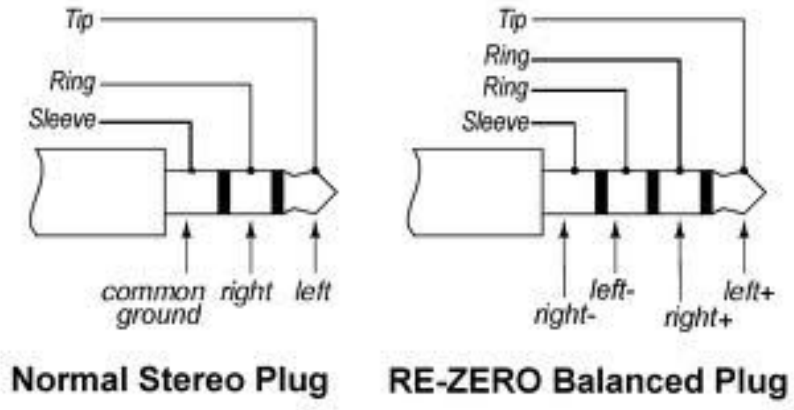
Audio Jacks

Phone and mini-phone sockets are the traditional audio jacks. Jacks are sockets, not plugs, and audio jacks are not much more than a hole in the case.

Balanced Headphone Connectors

Certain headphones make use of balanced connectors. The benefits of balanced connections and balanced electronics is explained in the “AMPLIFIER DESIGN BASICS” section. A balanced headphone connector can always be plugged into a TRS jack with the right adapter, but a **TRS connector is not necessarily compatible with a balanced output jack.** Check with the amplifier manufacturer to be certain that a TRS-to-4pin adapter is allowable.





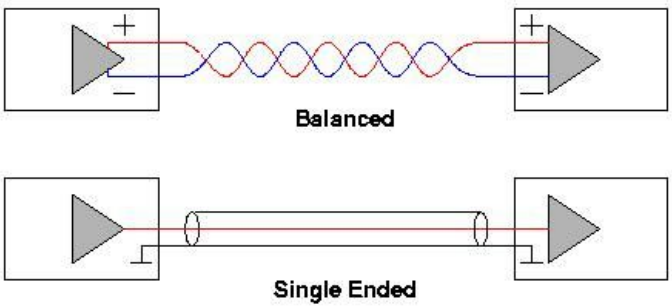
Line-Level Analog Audio Connections

RCA

RCA cables are the ubiquitous standard for transmitting audio signals between consumer grade components. RCA cables can deliver a single-ended signal from one component to another.

XLR

XLR connectors are more commonly found on pro-audio equipment and a reasonable amount of high-end audiophile equipment. XLR delivers a differential, balanced signal from one component to the next. A balanced XLR connection offers the benefit of being able to reject noise and hum that can be picked up along the cable line. Balanced connections also allow you to take advantage of certain circuit topologies that offer higher performance.



Digital Audio Connections

SPDIF

SPDIF is the standard for transmitting digital audio between components. SPDIF can be transmitted over **Coax** and **TOSLINK**. Coaxial cable is simply a metal conductor cable that is spec'd for transmitting high-speed signals. It is recommended that you use a dedicated coaxial cable rather than any RCA cable; although they share the same connectors, they are not electrically identical. TOSLINK is an optical transmission line that transmits the same signal format.

AES/EBU

AES/EBU digital is the standard for transmitting digital audio between professional-grade components. Despite a few technical differences, AES/EBU is virtually identical to the SPDIF format. The biggest difference is that AES/EBU transmits a balanced signal between components, allowing it to be used over longer distances, and with greater signal integrity.

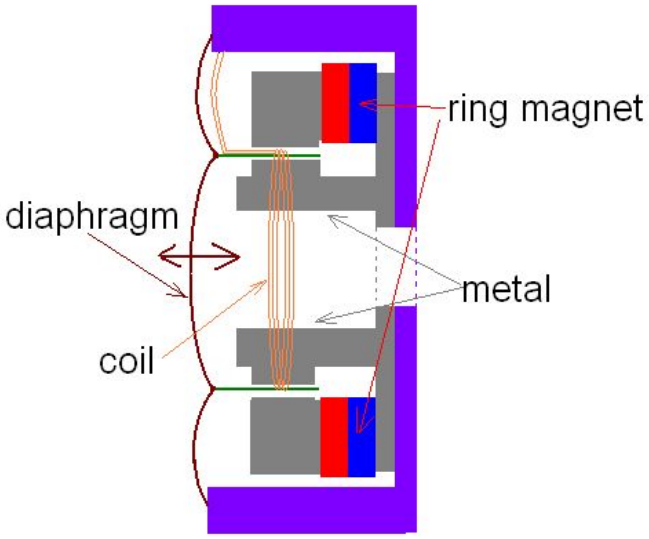
USB

USB Audio is not a dedicated audio transmission standard, but can be used to transmit audio from a computer to a DAC. Many of today's DACs are USB capable.

HEADPHONE TRANSDUCER TYPES EXPLAINED

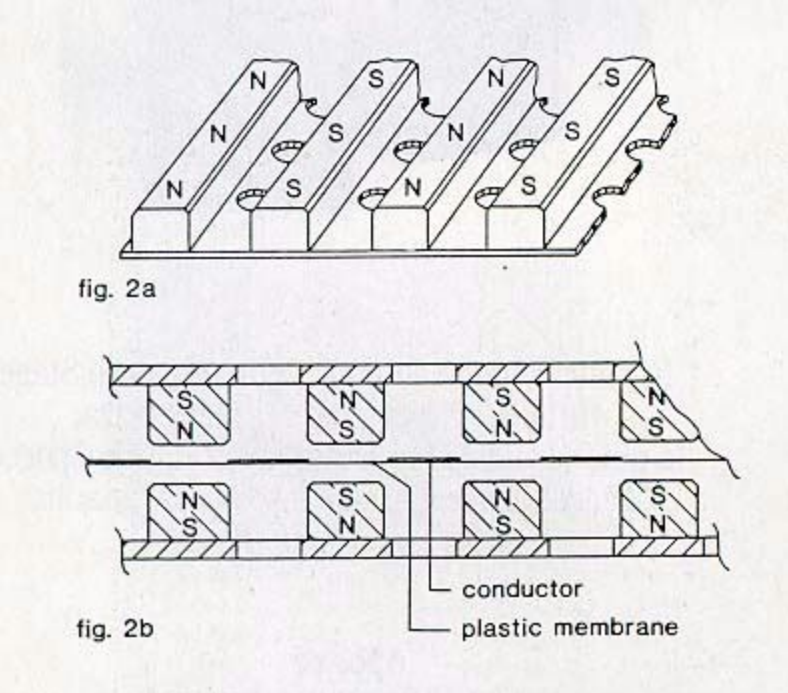
Dynamic

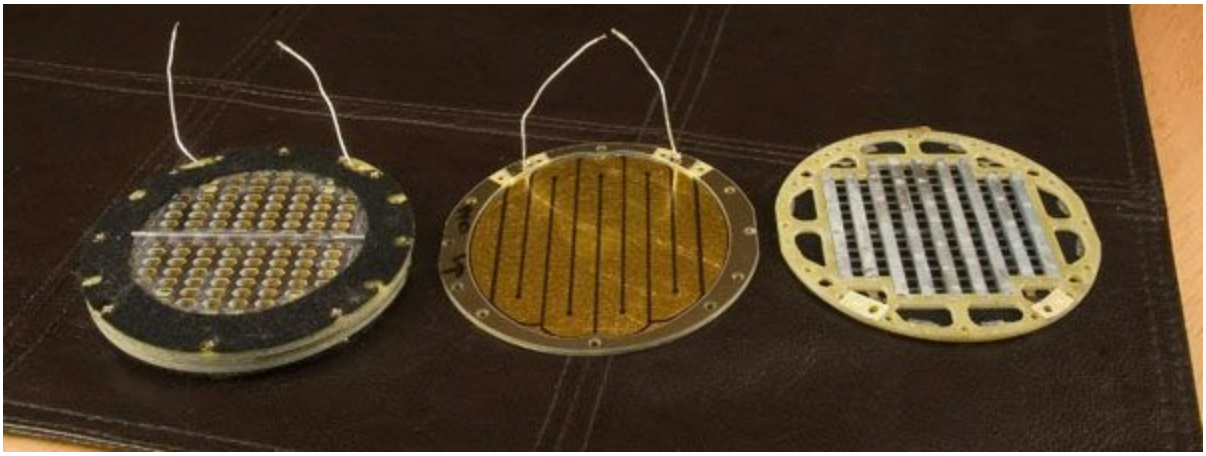
Dynamic is a very general term used to describe a broad selection of technologies and designs. The common characteristic between dynamic drivers is a moving voice-coil connected to a diaphragm. As the amplifier delivers current into the coil, the coil moves correspondingly, which vibrates the diaphragm and produces the sound you eventually hear.



Planar Magnetic / Orthodynamic

Planar magnetic, or orthodynamic, is another general term that groups many different types of designs. The common characteristic between orthos is a thin diaphragm that is set in a magnetic field. Here, the diaphragm itself has a series of conductive traces which the amplifier drives current through. As the current rises and falls, the conductive traces on the diaphragm are pulled back and forth which creates the sound you eventually hear.

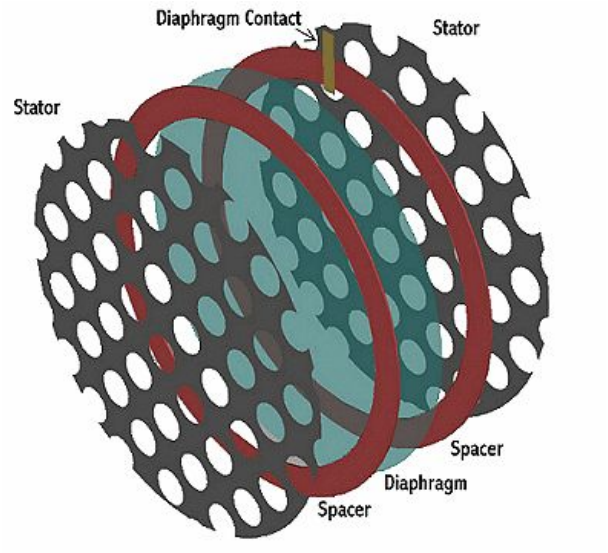


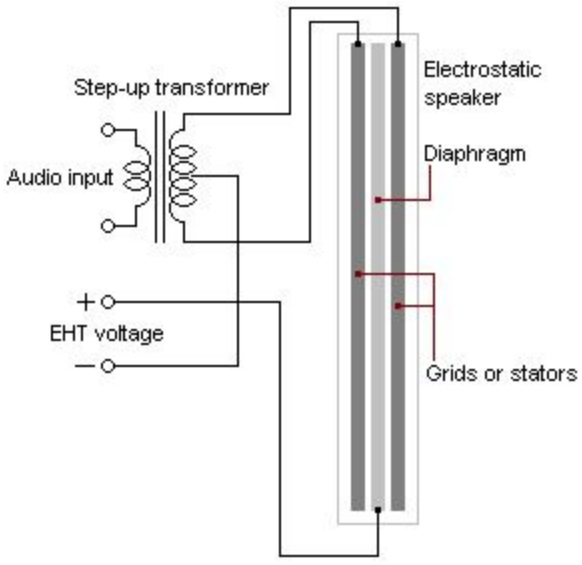


Electrostatic

Electrostatic headphones are unique from other technologies in a few ways. First is they require specialized amplification to operate (see: Electret for exception). Electrostatic headphone amplifiers aim to satisfy a very different set of constraints than your typical headphone amplifier. In acoustical terms, the electrostat is similar to the planar magnetic technology in that there is a thin diaphragm that vibrates to produce our final sound. However, the diaphragm is now immersed in an electric, rather than magnetic, field. The diaphragm needs to be charged to hundreds (!) of volts as provided by the amplifier. The amplifier will drive the stators with a large signal that will push and pull the diaphragm back and forth according to the law of electrostatics.

Note: Electrostatic headphones can also be referred to as “planar” because they operate on a similar drive mechanism.





Balanced armature

AMT

Piezo Electric

HEADPHONE SPECS EXPLAINED

Frequency Response (FR)

This is a measure of sound pressure levels (SPL) measured in dB plotted against the frequency range of reproduced sound. In terms of measurements, a frequency response charts plot serves as the primary indicator of a headphone's tonal balance. It serves to represent overall tonal signature (neutral, bassy, warm, dark, warm, V-shaped, etc.) as well as more subtle characteristics, such as uneven response in the midrange or treble. Note that measurements above 10 kHz tend to be erratic and unreliable due to limitations of currently available measurement techniques. For the purposes of defining frequency ranges, bass is typically defined as 20 hz - 250 Hz, midrange 250 Hz - 2 kHz, and treble 2 kHz - 20 kHz.

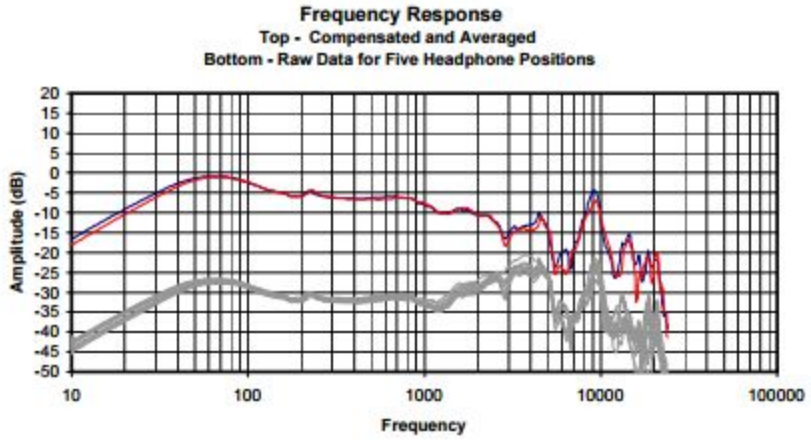


Image source: Innerfidelity

The above image shows the frequency response of the Philips Fidelio X2. The plot shows an overall clockwise tilt, indicating a warm tonal signature. The graph shows a relatively even response through the midrange, a mid-bass boost centered around 65 Hz, and a treble peak at 10 kHz extending beyond the midrange average. The bass rolls off after the peak, meaning bass extension is not optimal. The lower treble response is also recessed and uneven. Subjective impressions from various sources correlate with measurements - people hear the X2 as having strong bass emphasis and slightly rough treble, which can be described as a mild V-shape (bass and treble elevated relative to the midrange).

Total Harmonic Distortion (THD)

All electronic and acoustic devices have some residual distortion. We want to see minimal distortion for our playback components. Here's an example of excellent distortion performance:

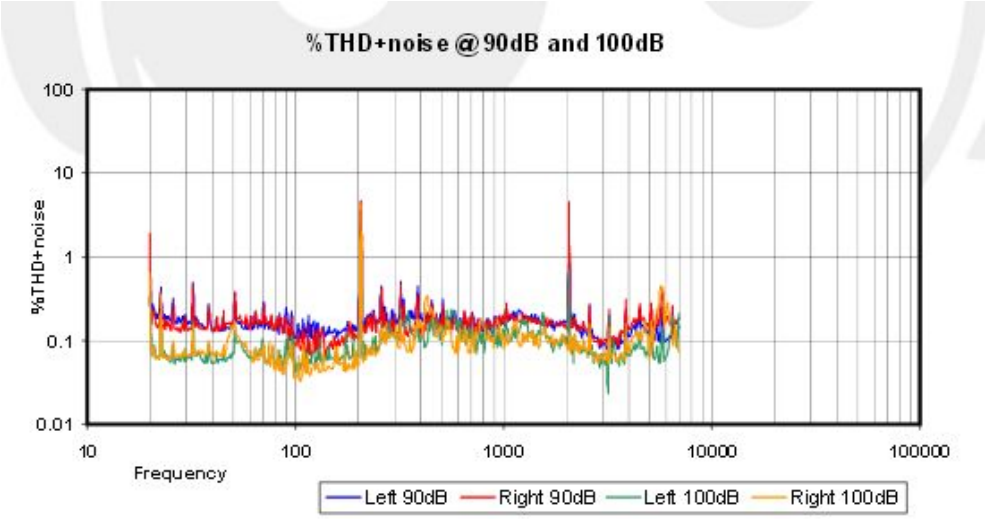


Image source: Innerfidelity

Distortion is low across the whole bandwidth and does not increase with higher sound levels.

Below is an example of less than ideal distortion performance:

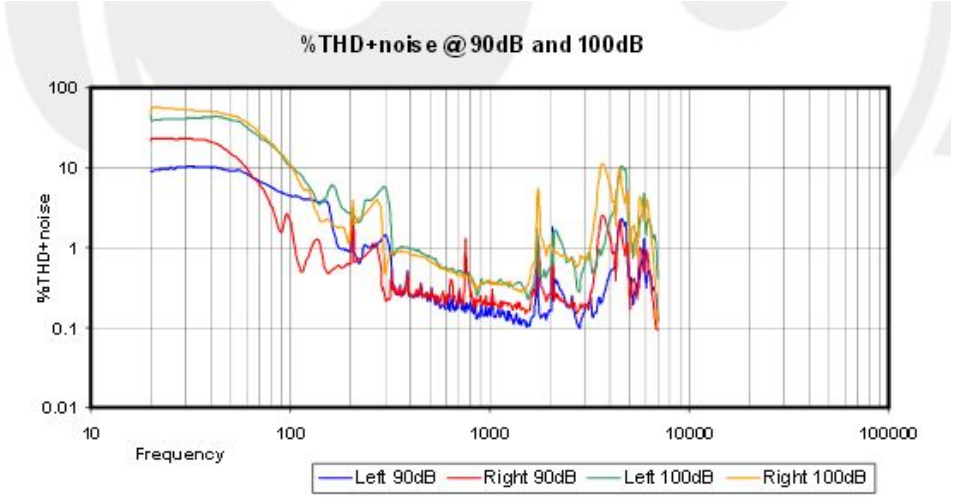


Image source: Innerfidelity

Here we see significant bass distortion, as well as a higher frequency distortion spike, which likely accompanies an enclosure resonance. We also see the distortion increasing with sound level, indicating poor power handling.

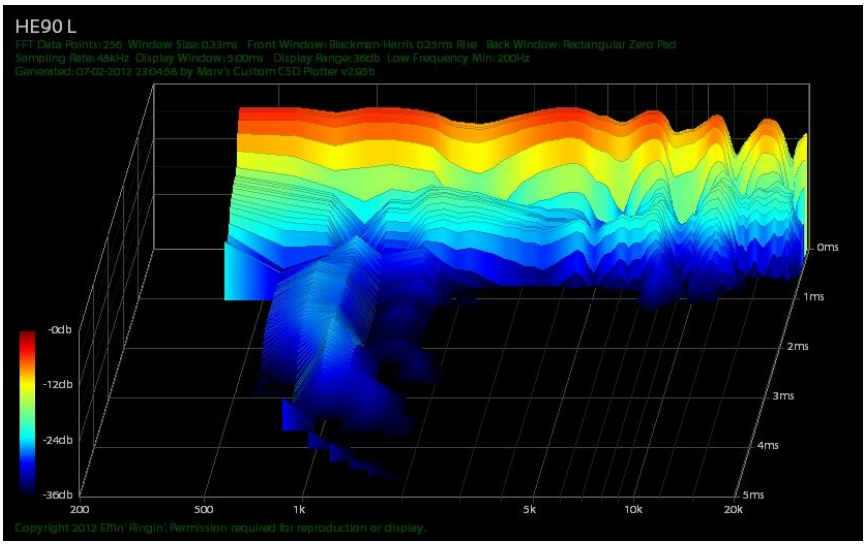
Distortion is measured by playing a pure tone at each individual frequency. Instead of plotting the pure SPL of the output signal like a frequency response graph, the source frequency is filtered out from what is

played. Then, the frequencies remaining are considered distortion. In simple terms, a headphone with high levels of distortion is playing different frequencies than it is supposed to, making it inaccurate.

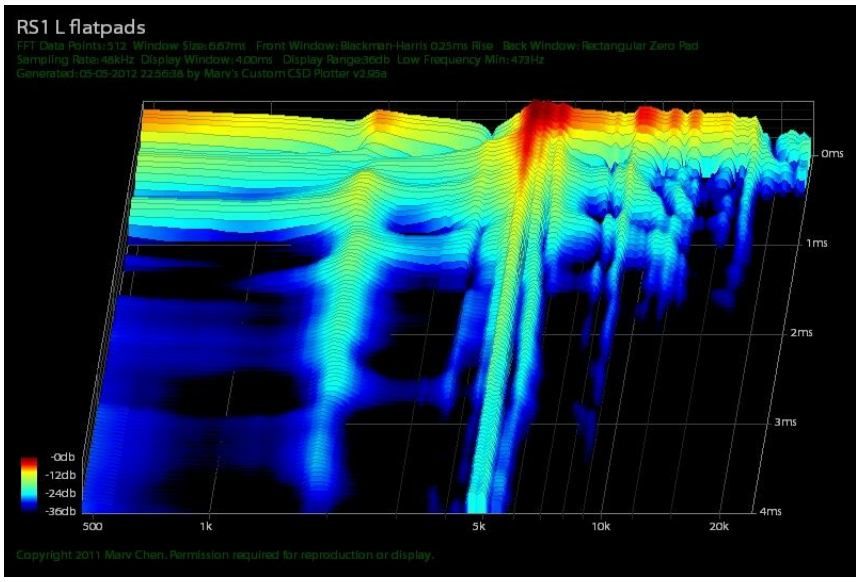
Cumulative Spectral Decay (CSD)

CSD's give us a representation of how the system excites energy and how that energy decays over time. The easiest way to think of CSD is a sort of "frequency response over time". A good CSD plot will be clean without any ridges that fail to decay into the noise floor. Below is a good example of what too look for.

Good:



Bad:



Sensitivity and Efficiency

For headphones, we are usually concerned with sensitivity rather efficiency. A sensitivity will be specified in terms of dB/V or dB/mW. A lower sensitivity means a larger signal needs to be applied to our headphone in order reach the given level. Think of sensitivity as how much you need to turn the volume knob on your amp up.

When we talk about efficiency, now we're bring power into the equation. An efficiency rating will be specified in dB/W or dB/mW. It also possible for a headphone to be more sensitive than another, but also less efficient. The lower the efficiency, the more power our amplifier needs to provide, which needs to be considered when choosing a "beefy" enough amplifier. Headphones overall do not require much power.

AMPLIFIER SPECS EXPLAINED

Frequency Response (or Bandwidth)

The bandwidth of your amplifier is similar to the frequency response of your headphones. Most amplifiers achieve excellent bandwidth quite easily. The deviations in response of your headphones will be orders of magnitude greater than your amplifier's bandwidth limitations, so don't worry about it too much.

Total Harmonic Distortion (THD)

All electronic components contribute some sort of non-linearity that can be seen as harmonic distortion, similar to headphones. For any given category of amplifier, we like to see reasonably low distortion. Generally the distortion of your headphone will be orders of magnitude greater than your amplifier, so don't worry about it too much.

Noise (or Signal-to-Noise ratio)

All electronic components generate some noise. This can be heard as hum or hiss when you plug in your headphones. These issues can also be introduced by the cable runs, the surrounding environment, or simply be inherent to the component.

When looking at a Signal-to-Noise ratio, it is important to realize that this spec can be misleading if the reference point of the "signal" is not known. For example, for simplicity sake, let's quantify 2 amplifiers as having 100 microVolts of noise. If Amplifier #1 manufacturer specs the component's SNR as referenced to 1V, the it would have 80dB of SNR. If Amplifier #2 references to 10V, then they could say their amplifier has 100dB of SNR. Both amplifiers actually have the same amount of noise nonetheless. How low is low enough? It's going to depend on the whole signal chain from source to headphone. It should be obvious that high sensitivity headphones and IEMs are going to be more prone toward picking up the noise floor of your electronic chain, so low noise is of particular importance with these products.

Output Impedance

From here: https://www.reddit.com/r/headphones/wiki/tech/output_impedance

We generally want our source output impedance to be significantly lower than the impedance of the headphones. This is due to 3 main reasons:

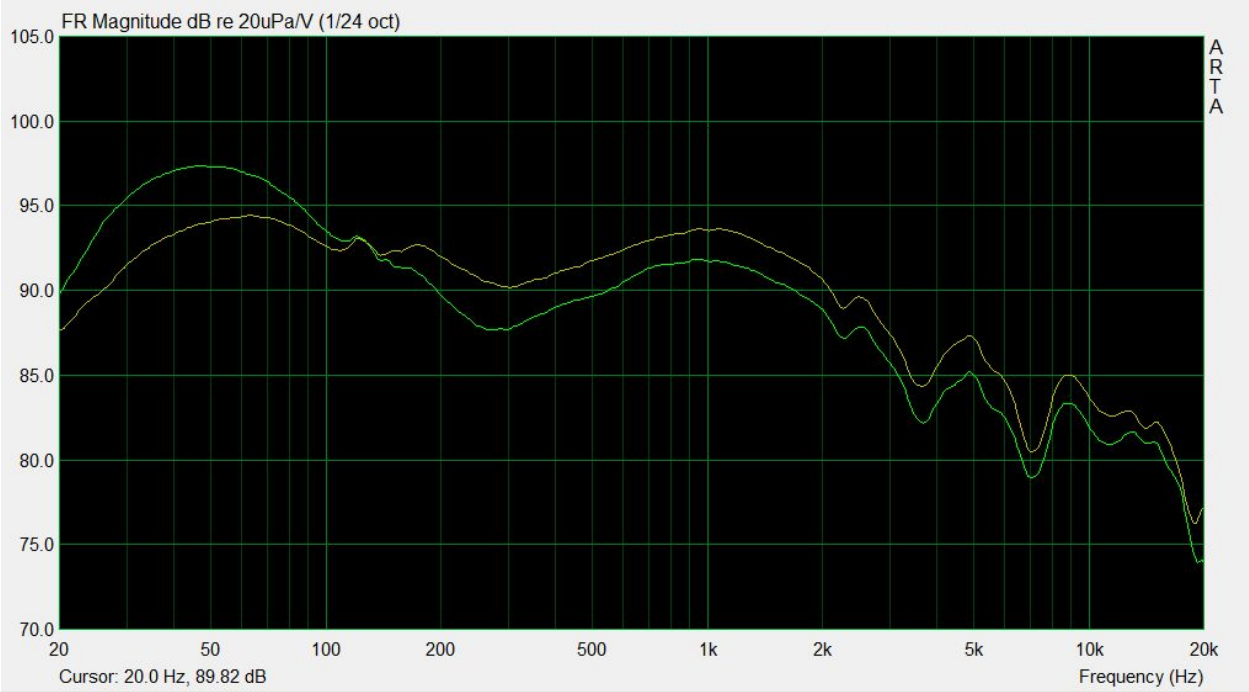
1. A large output impedance can attenuate the signal reaching the headphones, resulting in not enough volume output.
2. Headphones have different impedances at different frequencies. This is kind of an extrapolation of point 1 - we now have the signal attenuated in different amounts depending on frequency. This can result in dramatic changes in frequency response. Headphones with more varied impedance curves are affected more by this effect. This is because the headphone impedance and the output impedance of the amp form a voltage divider which varies by frequency. We will go into the math later. Note that planar magnetic headphones typically have very flat impedanc curves, and so don't suffer from frequency response shifts.
3. Electric damping factor is reduced as output impedance increases. A common rule of thumb is that the output impedance should not exceed 1/8th of the nominal impedance of the headphones. So, for 300 Ohm headphones, you'd want no more than 37.5 Ohms output impedance; for 16 Ohm headphones, no more than 2. This is just a rough guideline, as they are exceptions to the rule. One such exception are planar magnetic drivers. These seem not to require electrical damping in the same way as dynamic drivers.

Now look at the impedance curve of the Ultimate Ears UE700:
http://www.innerfidelity.com/images/UltimateEarUE700.pdf

The impedance varies between ~20 Ohms and ~80 ohms, with the big peak a bit under 2khz. Depending on the output impedance of the source, you can end up with a significant boost around 2 kHz, a very unpleasant colouration sonically. In dynamic full-sized headphones, a boomy bass boost around 100 Hz is a very common result of a too-high output impedance.

The Sennheiser HD598 is a good example of this:
http://www.innerfidelity.com/images/SennheiserHD598.pdf

Here is an example of a effect high output impedance to the frequency response of headphones.



Both of the graphs are measured from B&O H6 headphones with nominal impedance of 30 Ω. The yellow graph is measured using Gustard H10 amplifier with lower than 1Ω output impedance while the green graph is measured using the headphone output of Scarlett 2i2 USB interface specced at <10Ω. You can see that the higher output impedance causes significant positive gain on the bass frequencies and alters the intended frequency response on the headphones. [Ratio]

AMPLIFIERS AND DACS EXPLAINED

What is a Digital to Analog Converter or DAC? What is an Amp?

When you play any sounds out of your computer or phone or MP3 player, they are pure digital signals in the form of 0s and 1s. In order for headphones to listen to that signal, they need a device to convert it into an analog signal. This is a Digital-to-Analog Converter, or a DAC.

A DAC by itself, however, won't output a strong enough signal for headphones or speakers. This is where the amplifier comes in. It amplifies the analog signal from the DAC to a level where it can be audible on the headphones.

For example, all sound cards typically combine the DAC, amp, and recording parts all into a single unit. DAC standalone units have the DAC, but require an amp if they are to be used with headphones. Amp

standalone units will only take an analog signal from a DAC, or output from another amp, and amplify it. There are also many DAC/amp combo units, both for portable use and desk use.

Should I get a standalone DAC?

All modern computers have DACs and amps built into them, whether in the form of your speaker outputs on the back or the headphone audio ports. The issue is that these are typically not points where most computer companies focus on; they typically use cheap parts there.

A better DAC will have a cleaner more accurate sound that will be closer to the actual reproduction of the music, with less distortion, when compared to the stock DAC in most laptops and computers. As great as that sounds, this is typically one of the smallest returns for your money, unless your device has a poor DAC.

For example, a $300 laptop might have an audible buzzing noise when you use its headphone ports. The buzzing is loud enough that it can cover up details in the music that your headphones would otherwise pick up. In such a case, an easily discernable sound quality improvement can be attained using an external DAC.

Should I get a standalone amp?

Dedicated headphone amps are typically needed in one of three situations. If you fall under any of these three cases, you should consider buying an amp for your headphones.

1. The DAC does not have a built-in amplifier with headphone output.
2. The headphones are too quiet at high volume settings.
3. The output source (soundcard, MP3 player, receiver) has a very high output impedance which is causing frequency response deviations in the headphones. For example many dynamic headphones have a rise in impedance in the bass frequencies, and when the output impedance is high, those frequencies will be boosted causing the sound to become boomy over overly warm. Please see the **/r/headphones wiki on output impedance** for a more in-depth explanation.

How powerful of an amp do I need to pair with my headphones?

There actually is a lot of lovely math behind this. Long story short, this article explains it far better than I could do so here. [1] Typical mobile devices will have under 1V of output. Computers typically have about 1V of output, but this varies wildly. Budget portable amps have an output around 1 – 2V.

An entry level amp such as the $99 Schiit Magni [8.8V into 600 ohms] will power anything short of the extremely power hungry headphones (Hifiman HE-6 or AKG K1000) to a reasonable volume for almost anybody.

Types of Amplifiers

An amplifier is a device that changes the amplitude of a signal. However, "amplifier", when used alone, is a term that can be used to refer to different components in the chain, and usage may also differ between countries. Here are the devices:

Power amplifier

This is the component that takes a line-level signal and provides voltage and current gain suitable for driving a loudspeaker.

In pro audio circles the term amp used alone will most often refer to power amplifiers, while among musicians, the word "amp" is often taken to mean guitar amplifier.

Pre-amplifier OR line-level amplifier

In home audio terms, this is a device that connects in front of a power amp, and provides a number of functions: It provides multiple inputs, so you can connect, say, a CD player, a computer and a tape deck, and choose which source you want to listen to. It provides a volume control, and sometimes it has additional features, such as balance and tone controls, or a "loudness" button. **Preamplifiers are mostly a relic of old hi-fi systems. You do not need a preamp for your DAC to amp in a headphone system.**

Note that in pro audio and recording circles, "preamp" can also refer to a microphone preamplifier or tape-head preamp that brings the low level signal of a low-output device up to line level.

One type of specialized preamp is the **phono preamp.** Since the signal from a turntable is radically different from a regular component such as a CD player, it needs to be handled by a specialized preamplifier stage. The small signal output from the phono cartridge to needs a fair amount of voltage gain, and then equalization needs to be applied according to the RIAA equalization curve for playback. In the past, the phono stage was usually included in integrated amplifiers and receivers, but it is often missing from modern equipment. A phono preamp can also be referred to as a phono stage, or RIAA stage.

Integrated amplifier / Receiver

An **integrated amp** is simply a component where the pre- and power amp is included in the same device, and usually also with a shared power supply between the two. When a tuner (radio) is integrated as well into the device, it is known as a **receiver**. Traditionally, the tuner has been an AM/FM tuner, but these days, digital options, including satellite radio, Internet radio, and network playback, are also often included in these devices. In addition, an **A/V receiver** is a receiver meant for home cinema use, and typically has inputs/outputs for video in addition to audio, and also typically has five or more channels of amplification. Colloquially, people may use the term "receiver" to mean "AV receiver".

Headphone amplifier

The purpose of a headphone amplifier is to provide a suitable output for driving a pair of headphones.

All devices with a headphone output has a headphone amplifier built in (whether it is a smartphone, CD player, portable media player, or other device), so when the term "headphone amplifier" is used, it almost exclusively refers to a standalone headphone amplifier.

A standalone headphone amplifier may be used for a number of reasons, such as:

- Improved quality. The amp built into many devices, such as the headphone amp on your computer’s motherboard, is usually not of the highest quality because many compromises have to be made in order for the product to fit a certain form factor or price. A standalone amplifier typically focuses on one job, amplifying its input signal, and as a result is designed to do this as best as possible. Variations and methods of designing amps differ widely, and each has their own set of pros and cons, we’ll discuss this in more detail below.
- Increased power. Some headphones on the market require a much higher amount of power to operate due to the high resistance in their design. A small headphone amp like the one in your phone or on your motherboard may not be powerful enough to drive these types of headphones. By purchasing a suitable standalone amp, the user can provide enough power to their power hungry headphones.
- Attaining a certain sound signature. While the focus of many audio companies is on creating products which accurately replicate the sound of a recording, some people have grown to like a “flavored” sound. A particular amp may have a quality to it where it adds bass frequencies to its signal, or it may reduce the amount treble present in its signal. While these sounds may not be accurate, the sound can be found enjoyable to the end user.

Amplifier Design Basics

Single-ended

Balanced (differential)

Class A

Our output devices are always conducting current. This be single ended or push-pull. Class A amplifiers are the least efficient, as they consume significant amounts of power even when idle, which is lost to heat However, due to the lack of crossover distortion, they are highly regarded by audiophiles. Generally only produced in high end designs.

Class AB

The most common topology for audio amplifiers. Transistors are biased so that they are not both on continuously, but do overlap in their operation. Can be biased to differing amounts. More efficient than class A.

Class D

Switching amplifier. The output device is switched on and off very rapidly (in the MHz to GHz range) Signal is then fed through a low pass filter to reconstruct the original waveform. Very efficient (up to ~98%) and easy to build high power designs.

Other classes

Class G is a sub-type of Class AB with voltage rails that can switch to a higher voltage, boosting output power.

Class H is also a sub-type of Class AB with voltage rails that track the waveform above their normal voltage.

Class T is a proprietary implementation of Class D designed by Tripath.

MAKE MY HEADPHONES BETTER

(A CRASH COURSE ON HEADPHONE MODIFICATION, EQ, PROCESSING, etc.)

HEADPHONE MODDING

HEADPHONE EQUALIZATION

HEADPHONE PROCESSING AND EFFECTS

FREQUENTLY ASKED QUESTIONS

Q: What is burn in?

A: Many people believe that headphones and their components will perform better over time as the parts that carry the sound have had time to "settle in" in a way. There has been a lot of anecdotal evidence over the years, but only one man (to my knowledge) has approached this scientifically. Tyll over on InnerFidelity recorded measurements over time in a fantastic write-up.

Q: How do I burn in my headphones?

A: This question almost always follows the first question. Whether you believe it or not is entirely up to you. How to do it though? Well some people have some very interesting methods of burning in their headphones, but I think most people will agree that they can reach their full potential simply by listening to your music over time. Some people like to leave their music library running while they are away, some people like to use pink or brown noise. Whatever you choose, just understand that it is never necessary. It's up to the end user to decide.

Q: Do I need a dedicated amplifier?

A: Many people ask this when buying a headphone amplifier. Two important factors in the headphone specifications are impedance and sensitivity. To truly simplify things, a headphone with 80 ohms impedance or less and a sensitivity rating of 94 or higher would likely benefit very little from an amplifier since they are rather easy to drive. Now keep in mind that this is a very simplified version of how things work. There are certainly more factors in play here, such as your sources distortion levels, but you get the gist.

Q: Are Beats headphones REALLY that bad or good?

A: Beats have a specific sound signature (bass heavy/oriented) and have become a fashion statement/accessory. They are generally considered overpriced for the sound quality; recently, however, the sound quality has gotten better. If you are looking for well known headphones, that emphasize the bass, and don’t mind paying extra for the branding, then they are certainly fine. You can usually get a better all-round headphone for the money (or less!)

Q: What about Bose?

A: Bose is similar to Beats, in terms of brand perception and pricing. They generally don't sound as terrible as people would like you to believe, but, as before, you can usually find a better quality sound for cheaper. The one exception is their noise canceling headphones, those have been, and still are, some of the best noise canceling headphones on the market, and are especially useful for air travel.

Q: What are CIEMs? Why are they so expensive?

A: CIEM stands for "Custom In-ear Monitor". Essentially, a mold of your ear is taken, sent to a earphone company, and a pair of earphones are made for your specific ear. This results in the earphone making a very good seal in your ear (needed for optimal sound quality) as well as them being very comfortable. Due to the unique build process, and the customization aspect, (a pair made for you would literally not fit anyone else) these earphones are usually very expensive, usually bought by those wanting the epitome of earphones.

Q: Where can I be fitted for CIEMs?

A: Look in your area for an audiologist. Refer to the manufacturer to be certain. Expect to pay $50-100 for an appointment where they'll take an impression of your canal and send it to the manufacturer in question. Or, you canattend one of the major headphone meets, where most CIEM manufacturers will provide the service for free on the spot.

Q: Is sound signature important when choosing headphones? Can't you just EQ it to what you want?

A: A headphone's sound signature is determined by the properties of the driver and its interaction with the housing. The driver and the housing create resonances at certain frequencies that cannot be changed through equalization. Headphones will tend towards their physically determined characteristics and often a 4dB change in Equalization will not yield a 4dB change in the sound of the headphones. Overzealous equalization can also introduce unwanted distortion. EQ has its limitations and though it has its uses, you cannot sculpt one pair of headphones into another. There are also sonic qualities that only the best headphones can provide you with, which cannot be added with any upstream manipulation.

Q: I've seen some manufacturers offer the same headphone with different Ohm ratings. Why do they do that? (for example: Beyerdynamic DT series 32, 80, 250, and 600 ohm headphones)**?**

A: Generally speaking, the higher impedance versions of Beyerdynamic headphones perform marginally better. The increase in impedance also comes with a decrease in sensitivity, requiring an increase in gain to reach sufficient volume. Although even the 600 ohm version is not terribly power hungry, a dedicated amplifier is recommended with 250 ohm models and often necessary for the 600 ohm models.

Q: I have purchased my first pair of good headphones and an amp/DAC. How do I make the most of them?

A: You can make the most of them by listening to your favorite music and enjoying the memories that go along with them.

Q: I just bought new headphones based on suggestions by /r/headphones, but I'm really disappointed with the sound. Is there something wrong with my ears?

A: /r/headphones is populated by a lot of aficionados who have spent a lot of time critical listening. As a beginner, a lot of the talk on the forum might seem like hyperbole or hogwash. For beginners, picking out the differences between a top-tier system and an entry-level one can be tough at first. Critical listening really is a skill that needs to be learned and refined over time

We recommend spending some more time with your new toys to see if you can appreciate it. Often times a negative or backwards step is more noticeable than a positive one. Listen solely to your "better" headphone/system for a week, and then go back to your previous one.

Q: Can you recommend me a song to test my headphone's sound quality?

A: It's generally recommended that you use music that you are intimately familiar with. However, this can often be a trap since a lot of your favorite music might sound like crap (which is ok, but might not be the best test when judging sonics). See the /r/headphones test track thread.

Q: Do I need different headphones for different musical genres?

A: Many enthusiasts do have different headphones for different purposes. No headphone is without flaws, so it makes sense to have different models to complement one another. Other users are satisfied by single headphone for all their musical listening, whether it be more or less colored.

Q: Will an amp give me more bass?

A: A good electronic chain will ensure your headphone of choice is driven to its full potential. Sometimes this means tightening up the bass and giving more dynamic impact. Sometimes this means cleaning up the mids and removing treble problems induced by lesser equipment. But in terms of providing "more" bass, this is not typically done unless the amplifier has a dedicated bass boost feature. If more bass is what you seek, your best option is to attempt strategic equalization or go for a different headphone altogether.

Q: What about wireless Bluetooth headphones?

A: Bluetooth audio has come a long way, but as Bluetooth was never designed for streaming audio; it remains a compromise solution. In order to make streaming over Bluetooth feasible, the audio signal needs to be compressed using a lossy codec; no lossless solution is currently possible due to bandwidth constraints. In addition, it requires that \both digital to analog conversion and amplification take place after the data has been streamed over Bluetooth, meaning a radio receiver, a DAC, and an amplifier need to be integrated into the headphones. This further compromises the attainable level of fidelity.

Q: Are active noise-canceling headphones any good?

A: Active noise-cancelling (ANC) by definition cannot make your headphones higher fidelity. You may find a decent quality ANC headphone, but they are generally not recommended by the enthusiast community. Before you set your mind on ANC headphones, decide whether a headphone or IEM that excels in noise ISOLATION is more suitable for your application.

Q: Why aren't there more headphones that plug directly into my USB port?

A: Your USB port by definition does not have the ability to drive a headphone directly. USB outputs a digital data format which must be converted to an analog signal, and then amplified and buffered to drive a headphone. Essentially, this is the reason why we have DACs and amplifiers in the first place. There is no way around this, so that means that if a headphone is able to be used directly with a USB port, it is doing the digital to analog conversion and amplification internally. The small space and limited power of a USB port are not conducive towards creating a highly quality signal chain, and it is likely that any such headphone is severely limited in overall sound quality.

Q: Should I use surround sound headphones? What about surround sound processing?

A: Surround sound headphones are generally very low quality products, aimed toward the gamer market under the false pretense of "better" audio positioning. Surround sound headphones or headsets are not recommended by the enthusiast community. Many headphone enthusiasts prefer to use their hi-fi headphones to game, as they are more transparent to the signal output by your game's audio software.

The topic of surround sound emulation is a different matter, covered in the "*HEADPHONE PROCESSING AND EFFECTS*" section.

Q: Are gaming headsets any good?

A: Gaming headsets are generally very low quality products. Most gaming headsets are marked by cheap disposable plastic frames, cheap pad quality, low fidelity drivers, low fidelity microphones, and overall poor sound quality. As mentioned above, gaming headphones or headsets are not recommended by the enthusiast community. Many headphone enthusiasts prefer to use their hi-fi headphones to game, as they are more transparent to the signal output by your game's audio software. Look for headphones that are manufactured by larger established audio companies (Sennheiser, Audio Technica, etc.) that are experienced with audio technology, rather than companies that specialize in computer peripherals.

Q: I have X amount of dollars to spend on headphones/amps/DACs. How should I divide up my spending?

A: There is no easy formula to answer this question. The relationship between headphone quality and price does not move in a linear fashion, and neither does the amplifier or source functions. When you add the question of a headphone's unique characteristics that may require special power/synergy requirements, it becomes very difficult. For the majority of entry or middle level systems, most agree that the majority of the budget should be spent on the headphone, while saving enough of the budget for quality but cost-effective electronics. As you move into higher end systems and become more experienced at critical listening, you may find the ratio changes drastically.

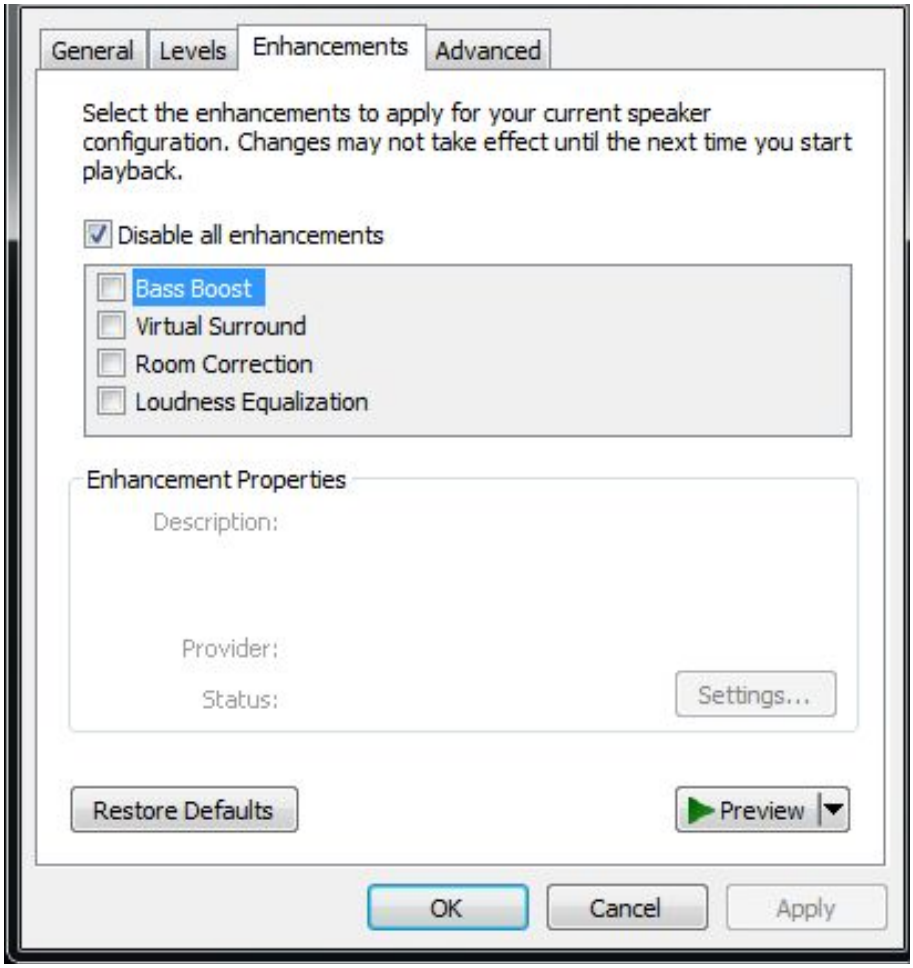
Q: Can measurements tell me everything I need to know about an audio device?

A: Measurements, when interpreted correctly, can tell you a lot about an audio component. But there are more than a few aspects of reproduced sound that simply cannot be captured by traditional measurement techniques. A lot of times we have to fall back on our ears to understand sound. If you are looking for an

audio component, we recommend doing all the research you can. That includes looking at both measurements and reviews/impressions from reliable ears.

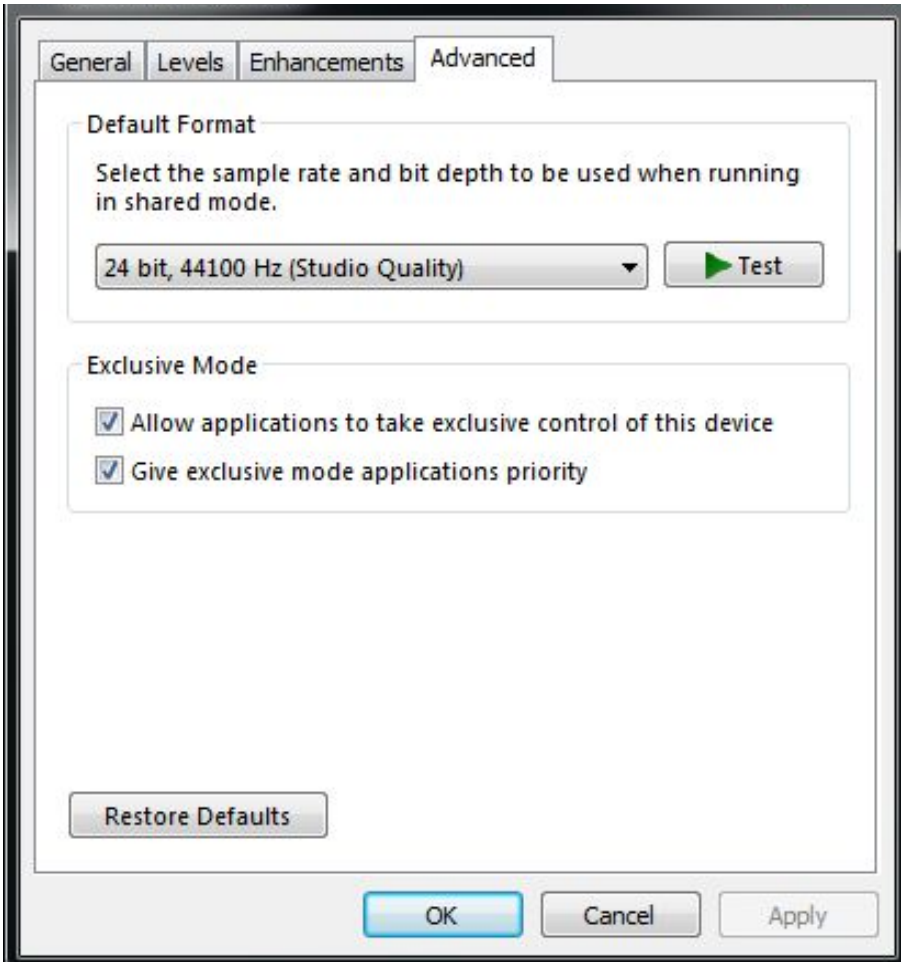
Q: I just bought some new IEMs on the advice of you guys, and they suck! Why did you guys lie to me?
A: The sound coming out of your IEMs is heavily dependent on the seal that they make with your ear canal. Usually folks who are new to IEMs are not getting good enough results are not seating the IEM in their ear canal and wearing it like an earbud. You need to find the right tips that not only suit your own ear canal, but produce the right sound for your ear canal. Tip "rolling," or trying a variety of different tips (including aftermarket tips), is worth looking into.

UNDERSTANDING COMPUTER AUDIO



Enhancements, Disabled

When we want the highest fidelity audio out of our digital machine, we want to remove any sort of processing, effects, emulators, plug-ins from the output stream. Disabling the enhancements here will make sure Windows isn't doing any overt weirdness.



24 bit, 44100 Hz set to avoid resampling.What is resampling? Read on.

Resampling can be a cause of signal distortion, and although resampling is a “digital” process, not all resamplers are created equally. Ideally, you want the setting above to match that of audio source. For many platforms, from Spotify to FLAC audio, the source format will be at 44100. The sample rate you set here will make sure any Windows audio is output at the stated rate. Keep in mind even with this value selected, certain software or media players can still take control and output a different sample rate to your device.

Additionally, it is recommend that you avoid the default Windows output, DirectSound, within your software music player. Take advantage of your DAC’s ASIO driver if available. WASAPI and Kernel streaming are also effective.

BUYING GUIDE

Entry Level Recommendations(<$100)

IEMS: M6 Pro, Soundmagic E10, RHA S500, MEE M7p (gym), MEE M9 Classic, Brainwavz Delta, Carbo Tenore, Xiaomi Piston 3, Hifiman RE-400, Etymotic MC5

Closed over-ear: ATH-M40x, Tascam TH02, CAL! 1, UE6000**,**

Open Over-ear: Superlux HD681, Philips SHP9500, Senn HD558, AKG K240S

Closed On-ear: Noontec Zoro 2, AKG K518 (modded)

Open On-ear: Koss PortaPro, KSC-75, ATH-EP700**,** Grado SR60e

Mid-Level Recommendations ($100-300)

IEMS: RHA MA750, MEE Pinnacle P1,d IM02, ER4S, DN1000

Closed over-ear: ATH-MSR7, DT770, V-moda M100, ATH-M50x**,** ATH-M70x, K553, Sennheiser Momentum

Open over-ear: Sennheiser HD598**,** AKGK7XX**,** Sennheiser HD600/650**,** AD900X, DT880

Closed on-ear: V-moda XS, Beyerdynamic DT1350**,** Sennheiser HD25-1 II

IEMS: Etymotic ER4

Closed over-ear: Fostex TH-X00, ZMF x Vibro MKII, ZMF Blackwood

Open over-ear: HD650, HD600, HE400i,

Summit-fi Recommendations

IEM:

Ultimate Ears UERM
JH Audio JH13
Noble Audio K10
Campfire Audio Jupiter/Lyra

Full-sized:
Sennheiser HD800
Audeze LCD2/3/X
Stax SR009/SR007/Lambda series
Hifiman HE560
Koss ESP950
Fostex TH900
Hifiman HE-6

DIY/Repair

http://diyaudio.com

http://www.amb.org/audio/

https://www.passdiy.com/

http://headwize.com/ ← headwize is dead :(:(:(Maybe a wayback machine link?

http://linkwitzlab.com/

Directory of Manufacturers

Reddit /r/audiophile directory

GLOSSARY OF COMMONLY USED TERMS

Aggressive - Forward and bright sonic character.

Airy - Spacious. Open. Instruments sound like they are surrounded by a large reflective space full of air.

Good reproduction of high frequency reflections. High frequency response extends to 15 or 20 kHz.

Ambience - Impression of an acoustic space, such as the performing hall in which a recording was made.

Analytical - Highly detailed.

Articulate - Intelligibility of voice(s) and instruments and the interactions between them.

Attack - The leading edge of a note and the ability of a system to reproduce the attack transients in music.

Balance - essentially tonal balance, the degree to which one aspect of the sonic spectrum is emphasized above the rest. Also channel balance, the relative level of the left and right stereo channels.

Bass - The audio frequencies between about 20Hz and 250Hz.

Bassy - Emphasized bass.

Blanketed - Weak highs, as if a blanket were put over the speakers.

Bloated - Excessive upper bass around 250 Hz. Poorly damped low frequencies, low frequency resonances. See tubby.

Blurred - Poor transient response. Vague stereo imaging not focused.

Body - Fullness of sound, with particular emphasis on upper bass. Opposite of thin.

Boomy - Excessive bass around 125 Hz. Poorly damped low frequencies or low frequency resonances.

Boxy - Having resonances as if the music were enclosed in a box. Sometimes an emphasis around 250 to 500 Hz.

Breathy - Audible breath sounds in woodwinds and reeds such as flute or sax. Good response in the upper mids or highs.

Bright - A sound that emphasizes the upper midrange/lower treble. Harmonics are strong relative to fundamentals.

Brilliance - The 6kHz to 16kHz range controls the brilliance and clarity of sounds. Too much emphasis in this range can produce sibilance on the vocals.

Cable microphonics - The noise heard due to the movement of a headphone or in-ear-monitor's cable rubbing against an object (ie. a shirt).

Chesty - Too much emphasis on chest resonance in vocals. A bump in the low frequency response around 125 to 250 Hz.

Clear - See Transparent.

Closed - A closed-in sound lacking in openness, delicacy, air, and fine detail usually caused by Roll-off above 10kHz; in contrast to Open.

Congested- Smeared, confused, muddy, and flat; lacking transparency.

Colored / coloration - Having timbres that are not true to life. Non flat response; peaks or dips.

Cool - Moderately deficient in body and warmth, due to progressive attenuation of frequencies below about 150Hz.

Crisp - Extended high frequency response, especially with cymbals.

Dark - A tonal balance that tilts downwards with increasing frequency. Opposite of bright. Weak high frequencies.

Decay - The fadeout of a note, it follows the attack.

Resolution - The ability of a component to reveal the subtle information within a recording

Depth - A sense of distance (near to far) of different instruments.

Detail - The most delicate elements of the original sound and those which are the first to disappear with lesser equipment.

Detailed - Easy to hear tiny details in the music; articulate. Adequate high frequency response, sharp and quick transient response.

Dry - Lack of reverberation or delay as produced by a damped environment. May comes across as fine grained and lean. Opposite of Wet.

Dull - See Dark.

Dynamic - The suggestion of energy and wide dynamic. Related to perceived speed as well as contrasts in volume both large and small.

Edgy - Too much high frequency response. Trebly. Harmonics are too strong relative to the fundamentals. Distorted, having unwanted harmonics that add an edge or raspiness.

Fast - Good reproduction of rapid transients which increase the sense of realism and "snap".

Fat - See Full and Warm. Or, spatially diffuse; a sound is panned to one channel, delayed, and then the delayed sound is panned to the other channel. Or, slightly distorted with analogue tape distortion or tube distortion.

Focus - A strong, precise sense of image projection.

Forward(ness) - Similar to an aggressive sound, a sense of image being projected in front of the speakers and of music being forced upon the listener. Compare "Laid-back".

Full - Strong fundamentals relative to harmonics. Good low frequency response, not necessarily extended, but with adequate level around 100 to 300 Hz. Male voices are full around 125 Hz; female voices and violins are full around 250 Hz; sax is full around 250 to 400 Hz. Opposite of thin.

Fun - Ambiguous, but generally in reference to a V-shaped sound siganture

Gentle - Opposite of edgy. The harmonics (of the highs and upper mids) are not exaggerated, or may even be weak.

Grainy - A slightly raw, exposed sound which lacks finesse. Not liquid or fluid.

Grip - A sense of control and sturdiness in the bass and throughout the spectrum

Hard - Too much upper midrange, usually around 3 kHz. Or, good transient response, as if the sound is hitting you hard. Uncomfortable, forward, aggressive sound with a metallic tinge.

Harsh - Grating, abrasive. Too much lower treble. Peaks in the frequency response between 2 and 6 kHz. Or, excessive phase shift in a digital recorder's low pass filter.

Headstage - The perception of the soundstage while listening to headphones.

Highs - See treble.

High Midrange (High Mids, Upper Mids) - See upper midrange.

Hollow - Recessed midrange coloration

Honky - Like cupping your hands around your mouth. A bump in the response around 500 to 700 Hz.

Imaging - The sense that a voice or instrument is in a particular place in the room.

Juicy - Sound that has joie de vivre, energy and life.

Laid-back - Recessed, distant-sounding, having exaggerated depth, usually because of a dished midrange. Compare "Forward".

Liquid - Textureless sound.

Low level detail - The quietest sounds in a recording.

Lowermidrange (Low mids) - The audio frequencies between about 250Hz and 500? 1000?Hz.

Lush - Very rich/full sound. Often associated with generous bass and lower midrange.

Mellow - Reduced high frequencies, not Edgy.

Midrange (Mids) - The audio frequencies between about 250 Hz and 2 kHz.

Muddy - Not clear. Weak harmonics, smeared time response, I.M. distortion.

Muffled - Sounds like it is covered with a blanket. Weak highs or weak upper mids.

Musical (or musicality) - A sense of cohesion and subjective "rightness" in the sound.

Nasal - Honky, a bump in the response around 600 Hz.

Naturalness - Realism.

Opaque - Unclear, lacking Transparency.

Open - Sound which has height and "air", relates to clean upper midrange and treble.

Pace - Often assoc. with rhythm, a strong sense of timing and beat.

Piercing - Strident, hard on the ears, screechy. Having sharp, narrow peaks in the response around 3 to 10 kHz.

PRaT - Pace, Rhythm and Timing

Presence - The presence range between 4kHz and 6kHz is responsible for the clarity and definition of voices and instruments. Increasing this range can make the music seem closer to the listener. Adequate or emphasized response around 5 kHz for most instruments, or around 2 to 5 kHz for kick drum and bass. Reducing the 5kHz content makes the sound more distant and transparent.

Puffy - A bump in the response around 500 Hz.

Punchy - Good reproduction of dynamics. Good transient response, with strong impact. Sometimes a bump around 5 kHz or 200 Hz.

Range - The distance between the lowest and highest tones.

Resolution (or Resolving) - See Definition

Reverberation - Tthe persistence of sound in a particular space after the original sound is removed. A reverberation, or reverb, is created when a sound is produced in an enclosed space causing a large number of echoes to build up and then slowly decay as the sound is absorbed by the walls and air.

Rich - See Full. Also, having euphonic distortion made of even order harmonics.

Roll-off (Rolloff) - The gradual attenuation that occurs at the lower or upper frequency range of a driver, network, or system. The roll-off frequency (or corner frequency) is usually defined as the frequency where response is reduced by 3 dB.

Round - High frequency rolloff or dip. Not edgy.

Rhythm - The controlled movement of sounds in time.

Saturation - The point at which a magnetic tape is fully magnetized and will accept no more magnetization.

Seismic - Very low bass (i.e. sub-bass) that you feel rather than hear.

Shrill - Strident, Steely.

Sibilant (or Sibilance) - "Essy", exaggerated "s" or "sh" sounds in vocals. Sibilant sounds carry most of their energy through the 4Khz to 8Khz range, but can extend to 10kHz, depending on the individual. Sibilance is often heard on radio.

Sizzly - See Sibilant. Also, too much highs on cymbals.

Smeared - Lacking detail. Poor transient response, too much leakage between microphones. Poorly focused images.

Smooth - Easy on the ears, not harsh. Flat frequency response, especially in the midrange. Lack of peaks and dips in the response.

Snap - A system with good speed and transient response can deliver the immediacy or "snap" of live instruments.

Soundstage - The area between two speakers that appears to the listener to be occupied by sonic images. Like a real stage, a soundstage should have width, depth, and height.

Sound Signature - The general sound of a headphone as a result of its frequency response (e.g. bassy, treblely, neutral, etc.).

Spacious - Conveying a sense of space, ambiance, or room around the instruments. Stereo reverb. Early reflections.

Speed - A fast system with good pace gives the impression of being right on the money in its timing.

Steely - Emphasized upper mids around 3 to 6 kHz. Peaky, non flat high frequency response. See Harsh, Edgy.

Strident - See Harsh, Edgy.

Sturdy - Solid, powerful, robust sound.

Sub-bass - The audio frequencies between about 20Hz and 80Hz.

Sweet - Not strident or piercing. Delicate. Flat high frequency response, low distortion. Lack of peaks in the response. Highs are extended to 15 or 20 kHz, but they are not bumped up. Often used when referring to cymbals, percussion, strings, and sibilant sounds.

Telephone-like - See Tinny.

Texture - A perceptible pattern or structure in reproduced sound.

Thick - A lack of articulation and clarity in the bass.

Thin - Fundamentals are weak relative to harmonics. Bass light.

Tight - Good low frequency transient response and detail.

Timbre - The tonal character of an instrument

Timing - A sense of precision in tempo.

Tinny - Narrowband, weak lows, peaky mids. The music sounds like it is coming through a telephone or tin can.

Tone - The sound of definite pitch.

Transient - The leading edge of a percussive sound. Good transient response makes the sound as a whole more live and realistic.

Treble: Frequencies above 2khz.

Transparent - Easy to hear into the music, detailed, clear, not muddy. Wide flat frequency response, sharp time response, very low distortion and noise. A hear through quality that is akin to clarity and reveals all aspects of detail.

Tubby - Having low frequency resonances as if you're singing in a bathtub. See bloated.

Upper midrange (Upper mids, High mids) - The audio frequencies between 1 kHz and 2 kHz.

V-Shaped - The description of a frequency response curve for a speaker or headphone. In layman's terms it means more prominent lows and highs with a recessed mid-range, hence the "V" shape formed from such a sound signature. Similar to a "U" shaped response curve but is generally used to describe a more dramatic difference.

Veiled - Like a silk veil is over the speakers. Slight noise or distortion or slightly weak high frequencies. Loss of detail due to limited transparency.

Warm - Good bass, adequate low frequencies, adequate fundamentals relative to harmonics. Not thin. Also excessive bass or mid bass. Also, pleasantly spacious, with adequate reverberation at low frequencies. Also see Rich, Round. Warm highs means sweet highs.

Wet - A reverberant sound, something with decay. Opposite of Dry.

Weighty - Good low frequency response below about 50 Hz. A sense of substance and underpinning produced by deep, controlled bass. Suggesting an object of great weight or power, like a diesel locomotive.

Woolly - Loose, ill-defined bass.

Sources:

Head-Fi Describing a Sound Glossary

Sounds Like? An Audio Glossary

USEFUL LINKS

/r/headphones Purchase Advice Thread

/r/headphones list of recommended headphones

Guide to DACs and headphone amplifiers

Directory of headphone manufacturers and products

Directory of headphone stores

Audio Settings. An introduction to computer audio

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