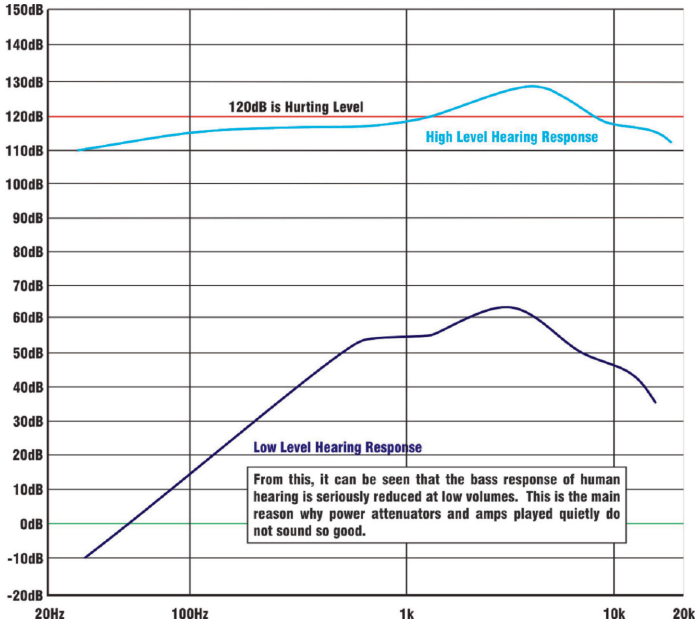
Answers for most volume related questions

Why does my guitar amp sound 'fatter' at high volume levels?

According to research carried out back in 1933 by scientists Fletcher and Munson, they discovered that the human hearing has a frequency response which altered according to the intensity of sound. Also that our hearing is disproportionately less sensitive to bass frequencies than higher frequencies, when music is played at a low level of volume!

I know this sounds a little dubious, but if you Google 'Fletcher and Munson' you can read lots about this affect. However, this article is just a simple explanation of the 'psycho-acoustic trickery' that is going on with your hearing caused by our brains.

Why would our hearing be like this then? Well, it has been said that the human hearing has evolved to reject unwanted sounds at very low sound volume levels, so that we could hear the sound of rustling leaves and snapping twigs more easily whilst hunting for food. Low frequency wind noises interfere with our hearing by masking many sounds. I believe this to be a very likely cause.



This graph can be used to help explain many 'amplifier' related fables, so you will see this graph above many times in my articles! It's called the 'Law Of Equal Loudness'

In a nutshell, the bass and treble are severely attenuated at low volumes. In particular, bass signals are attenuated by as much as 42dB in relation to the mid frequencies at very low volumes. Because dB (deciBels) is a logarithmic scale, that's a huge reduction by any imagination, when you realise that each 6dB reduction is half the volume!

Assuming that the mid frequencies have an average volume level represented by 1, then the bass is attenuated to only 1/128th of the mid frequency loudness! If you look at the difference between the bass plots on the graph opposite, you can see it all visually... but remember it's logarithmic, so a lot steeper than it appears.

In relation to guitar amplifiers, and any other amplifier for that matter, we all 'believe' an amplifier performs better at high volume, when in fact it does not! There may be some additional speaker distortions or amp distortion added, but the most significant contribution to the 'big 'n' fat' effect is the human brain and how it translates what we hear depending on the sound's loudness.

Try the radio test in your car. Turn down the volume until you can hardly hear the music. Listen… where has the bass gone? So, next time your favourite record is played on the radio and you reach out to 'pump up the volume', you know what is really happening!

Sorry if this blows away the myths surrounding guitar amps, but I can only tell you the truth... all of which is scientifically backed by much research.

The human hearing has a built in 'compressor'. No... you're joking me!

Yes, that's right. In order to help protect our hearing, our brains turn down the volume when it all gets too loud.

Eventually it runs out of control and pain is felt in your ear drums. This is when the sound level reaches 120dB.

The point at where this happens is down to the size of the space where the sound is happening. Many guitar players believe that their little 15 watt amp is as loud as a 100W amp… in the living room! Nonsense of course, it's just due to your brain acting as a limiter/compressor in a confined space or room! Put the two amps in a field 100 yards/metres away and see which will be the loudest amp! The 100W amp's sound will be far louder than the 15 watt amp... Fact.

Why does my amp sounds quieter in a small room

Because of the circumstances mentioned in the last topic about the human hearing's compression effect! It is not uncommon for guitarists to play through their amps in a small room, turn up the volume until everything is shaking and the cabinet is vibrating and believe the amp is not very loud for its rated power!

Well, this is because our hearing, again, is turning down the volume to protect our hearing. Of course, playing very loud, although you don't think it's loud, can cause permanent damage to your hearing. Tinnitus is the most common

damage complaint caused to guitarists hearing.

Whilst the action of compression does make very noise bearable, within the brain, it is still a fact for concern that the eardrums and associated components, are still exposed to high levels of shock and vibration, which is not a good situation for the long term life expectancy of those hearing components.

Sadly, there is no way that our hearing's compression effects can be overcome. You must just turn down the volume and persuade your other band members to play more quietly too. I know it's not very rock and roll, but that's the way it is… no arguments please. Just accept it!

Are valve/tube watts really louder than transistor watts?

No, that is not true! A transistor watt and a valve/tube watt are exactly the same. Calculated by $Vrms^2/R$ or I^2/R or Vrms x I. There **cannot** be any difference. Any claims that it is, is just plain bull!

However, many transistor amps have their power ratings way over stated and employ inefficient speakers. This would definitely contribute to such an occurrence.

As an example: A 'Big Name' British 40W combo is, on the test bench running into a resistive 8 Ohm dummy load, only 28 watts at the onset of clipping (distortion). It also has a speaker with a tiny magnet. That's why it's not so loud! The fact that it's a transistor amplifier has nothing to do with it at all!

Any amp with an output transformer, commonly a tube amp, demonstrates a unique phenomena. Many very early transistor amplifiers had an output transformer too and sounded very close to a valve amp. In later years transistor amps became transformerless as designs became more sophisticated. This was a large cost saving over valve amps and adopted very quickly.

Now, because only valve/tube amps have an output transformer, it causes valve amps to have a 'high output impedance.' This '**under damps**' the speaker's movements and allows the speaker to travel further backwards and forwards before changing direction helped by the cone's inertia. This is 'cone overshoot'. The amount of overshoot can vary from amp design to amp design. But it is present in all amps with an output transformer.

'Overshoot' of this kind is translated as extra volume by our hearing, because the cone has travelled further back and forth than it should have done and moved more air. This is a form of distortion, as the speaker is not following exactly the signal the amplifier is feeding to the speaker. This is the only reason a tube amp 'can' sound louder than a transistor amp design.

Incidentally, this situation also leads to something called 'cone breakup', where the cone is allowed to add harmonics and distortion to the acoustic output of the speaker which IS NOT created by the amp itself, or the valves and other components… only the speaker. Cone Breakup is an effect loved by guitarists and is responsible for most of the distortion tones that make us all weak at the knees… but this is another story for later.

As it happens, modern transistor amplifiers are now mostly equipped with 'constant current drive' which produces the same performance as having an output transformer. This allows transistor amps to sound identical to a valve amp, and provides the amp with the 'overshoot' ability as well. So modern transistor amplifiers can compete with almost any tube amp for loudness and tone if both have the same output power.

I play at gigs and use a 22 Watt (Constant Current) transistor Session 'BluesBaby 22', fitted with a 98db Celestion 'V-Type' speaker. It can compete with any similarly rated tube amp fitted with the same speaker model. My 1963 Tele sounds gorgeous and very loud through it! I find that it can stand up to most drummers too. I use an 'on-the-edge' type of blues/ country set-up on the amp and it works for me just fine.

Hope you find this of value in understanding why everyday electric guitar sound the way they do!

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Guitar amp designer since 1967