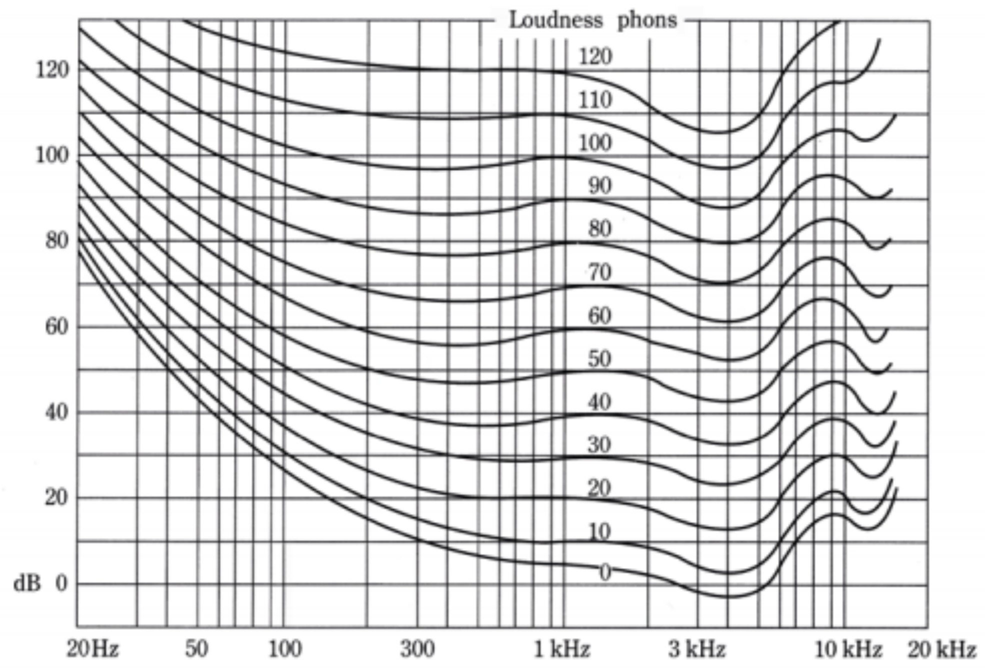
– To understand acoustics and acoustic phenomena and how we perceive / interpret sound, there are some things you must know and understand. It is about the physical reality, the functioning of the ears and psychoacoustics.



That article can help you figure out concepts and features Perception of sound Acoustics and sound belong to our physical foundations and this we cannot change. That we experience sound in different ways depends on perception, that is, what ours the senses interpret because of what we have learned through life. It is only when the sound waves reach through the ear the brain as the sound is interpreted. Perception is a psychological concept for the processes that are active in interpreting sensory impressions. How strongly a sound is perceived depends partly on the sound pressure and partly on the frequency composition of the sound. The human ear has a wide range of sensitivities and the auditory sense can perceive sound pressure from 20 µPa to 20 Pa. The loudest sound that a person can endure what is called a pain threshold. The pain threshold is a million times greater than that lowest sound (hearing threshold) that we can perceive. By hearing threshold is meant the faintest sound that a person with normal hearing can perceive.

Since the effect of a sound is affected by its frequency content, this means that hearing is not as sensitive to low frequencies as to high frequencies. A tone of, for example, 70 dB at 63 Hz is perceived therefore not as strong as a tone of 70 dB at 1,000 Hz. The ear is also most sensitive within the frequency range 2,000 - 4,000 Hz. This means that the ear, at lower and higher frequencies, respectively, is less sensitive. Normal hearing threshold level they indicate lowest levels as an average young person can hear at different frequencies. However, there may be deviations depending on, for example, age and other individual differences. Hearing is also linked to volume. It will say the stronger the sound pressures the more we hear in the bass and the treble. In the past, there was often a button to press on our stereo where it said Loudness. This feature raised the bass and treble a little more when we played at low volume. Feature was there to compensate for our listening. There was also something called physiological volume control that had about the same function. The above should also be considered in different sound context. It happens all too often that one increases the volume as the day goes on. When you come to the studio the next morning you wonder why it plays so loud. It is common to stealthily raises without noticing it. It has to do with the functions of the ear. The is a small muscle that closes to listening a bit when we are exposed to high sound pressures and it releases quite slowly. The quieter environment we have in our home when we sleep the better to be able to have a good listening ability.

Direction assessment the brain uses several factors to determine where a sound is coming from. The factors which are most important are: amplitude difference, time difference and frequency difference between ears. Distance assessment Factors that help us assess distance are: The relationship between direct sound and reverberation.

• The volume of the direct sound in relation to reverberation.

• The room's impact on direct sound and reverberation. • Frequency and transient content of sound. • The vision and expectations. Hearing is more connected to emotions than anything vision, therefore, a person's emotions are affected much more of sound. Reflexion When a sound wave hits a wall, for example, some of the incident sound energy will be reflected in the wall surface, some will be converted into heat energy, is absorbed by the wall, and some will pass through the wall. How much of the energy will be absorbed by the wall depends on what material the wall is built by? And to some extent also how stable the wall is mounted. Sound absorption the sound absorption factor of a material is defined as the ratio of the energy that absorbed or passes through the material. Ab Important acoustic concepts Psychoacoustics is the study of how the human ear, brain and senses perceive sound, (perception), so there is a difference between how different people perceive sound and how the sound sounds. It is many factors that make us perceive sound in one other than a linear measuring instrument.

Boundary effects Let us say a speaker is placed close to a surface then parts of the sound will be reflected and result in a bass increase of 6 dB per nearby surface. This allows if you place a speaker in one corner, the base increases by 18 db. This method can also be used in microphones to amplify low frequencies. Masking This is an effect that everyone has experienced. The phenomenon is about how a sound can mask one other sound. Imagine that you are sitting and talking a friend and right as it is it shows up two other friends who are going to watch a match TV. Now it is getting harder to hear what you and your friend is talking about. Then the others talk as well The TV sound simply overpowers / masks you dialogue. In the audio industry, masking is used including noise reduction and digital compression. This is also why you usually cut off frequencies in a mix before raises others to minimize the risks of getting one mix that sounds fuzzy.

Cocktail party effects It can be described as the brain's ability to focus on one audio source and ignore others at the same time. This is the brain's way of counteracting masking and the Haas effect. This effect can you practice and are a must as a sound engineer.

Binaural fusion this is the brain's ability to decide from which direction a sound is coming from. The brain compares information from each ear and translate then the differences to a merged view of where the sound came from.

Haas zones It occurs when two sounds come close enough next to each other. Then the brain will perceive these as a sound. The time for this is 0-50 milliseconds and is called the Haas zone. The sound which comes close to the first can be up to 10 dB stronger before the brain begins to perceive it as two separate sounds. Haas zone can, however, vary depending on the type of sound.

The Doppler effects This is a physical phenomenon. The frequency of an audio signal changes depending on whether the source approaches or moves away from the observer. The result is that the sound waves are compressed in the direction of the sound source. This leads to when the sound source approaches so compress the sound waves, and a pitch happens. When the sound source then disappears, the sound waves expand again, and a tone decrease happens. A typical example of the Doppler effect is when an emergency vehicle with sirens on drive past you. Harmonic distortion Describes how the ear begins to produce harmonics when exposed to strong sound levels. This happens at about 100 dB and up. These harmonics that the ear creates changes the brain's perception of the pitch of the sound.

Octave Illusion It is the brain's ability to recreate the absent basic tones. You can delete up to two basic tones and still know what the basic tone is.

Linear rendering Human hearing is not linear but non-linear. Sound that enters the ear is not perceived by the brain as it sounds. fletcher & Munson developed the curve ELC which stands for Equal Loudness Contours. This describes man hearing and how we perceive sounds at different sound intensities. Intermodulation distortion Is a description of the interaction between different frequencies. For example, if you play a tone at 500 Hz and one at 510 Hz then comes 10 Hz to occur. The two opposite frequencies must have a difference of about 1-30 Hz for the effect to take place.

The size of the rooms the dimensions of a room (height, width, length, and cubic volume) need to be processed in several computational algorithms to create good sound in a listening room. Height, length, and width in m^3 will determine the resonant frequencies of the room and I to a large extent also the placement of the speakers and the listener. Slightly simplified, you could say that room volume is an important criterion for choosing the speakers and amplifiers needed to apply a desired sound pressure. That means that one large room requires both larger monitors and more powerful amplifiers than a small room. The longest room dimension, is the diagonal of the room, determines the ability of the room to support low frequencies. A 20 Hz wavelength is 17 meters in length. Fortunately, we only need a quarter of that this dimension (4.25 m) to achieve adequate bass reproduction. Ideally, we would like a diagonal equal to or greater than the lowest the frequency that we want to generate in the room.

Reverberation time the reverberation is characterized by how long it is takes before the sound has dropped below the noise threshold (ambient sound) after the sound source has been muted. One usual acoustic measure of reverberation is to indicate how long it takes before the sound intensity has decreased by 60 dB since the sound source has stopped generating sound. An easy way to get an idea if the reverberation in a room is to make a distinct hand clap and then listen to the fading the sound of reflected sound - the reverberation. If we record in a very subdued room then we get a far too short reverberation time and we lose the small fine treble waves. Relationships the country between bass / treble then becomes predominant base. If only one value of the reverberation time stated, this usually refers to an average value above frequency band 500 - 2,000 Hz or 250 - 4,000 Hz. A room can be considered to have a diffused sound field if the mutual dimensions (length, width, and height) have a deviation from each other. Further if strong sound-absorbing surfaces are evenly distributed in the room. In large rooms with unevenly distributed absorption and in rooms with strongly deviating mutual dimensions (eq corridors), the reverberation time is measured or calculated using of computer simulation. When they started using so-called Isoroom as a result, the reverberation time became shorter for the recorded material than that of the listening room reverberation.

As a result, small speakers were placed (Auratone) on the mixer table so-called near field monitors so that eliminate much of it experienced the reverberation in the control room. The construction of the room the room in which the sound reproduction takes place has one especially important on how a sound. The effect of the room on the sound is much bigger than you think. The listening room (control room) is one space where you want to be able to reproduce many sounds with a wide dynamic and frequency range. Because must the listening room adapted to many different types of sound as in principle means that the room within reasonable limits should contribute so as little as possible with its own timbre.

Therefore, is it being important that the listening room is acoustically neutral. The reverberation of the listening room (T60) must be shorter to be able to distinguish what was recorded the material.

The wall construction of the room is of great importance for the basic absorption of the room. In professional listening rooms and studios, the walls are often built up of several layers of plaster or plywood boards that are mounted on joists. The air gap formed between the layers is filled with some type of porous absorbent. This wall construction forms a so-called membrane absorbent (a type of resonant absorber). The losses in the resonance system are achieved through a combination of mechanical losses in the membrane (gypsum, plywood board) and porous absorbents in the air gap. The walls of the listening room can stand for it most of the absorption at frequencies below 100 Hz if the correct type of construction and material is selected.

Each room also has its own resonant frequencies that create so-called room nodes and room mother (reinforcements and extinctions) in certain places in the room. The total total volume of absorbent material in the room is also of utmost importance. The reverberation time varies with the frequency of the sound because the room absorption is different at different frequencies.

A Helmholtz absorber is an acoustic pulp spring system. It can be mentioned that in several large churches in southern Europe (Greece, Italy, Egypt etc.) there are often several large bottles of 100 – 300 liters built into the walls to reduce the reverberation in the bass register. It consists of an enclosed air volume and a connected neck, which connects the system to the environment. The resonant frequency of the system is determined of the air volume and the length and diameter of the neck. The closed air volume acts as a spring and the air in the throat is a reactive mass. Volume can be filled with different amounts of a porous absorbent to obtain the correct damping value. The sound absorption takes place at the resonant frequency of the absorbent, its Q-value depends on the system friction losses. smiles along and in walls where many of the room fashions have their pressure

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An accurate reconciliation and placement of the Helmholtz resonator is required for that a desired result can be achieved. Split panels a slit panel is a type of Helmholtz absorber and is usually made up of lying boards at a certain distance from each other. The air mass in the gaps between the boards react with the resilient air volume and form a resonant system. The resonant frequency is controlled by the air volume behind the panel and the thickness of the boards and width.

The system's Q value can be adjusted by add different amounts of porous absorbent material behind the panel. Slit panel is mainly used for damping of frequencies in the range 100 - 300 Hz but can tuned for absorption further down in frequency. The absorption area at the resonant frequency of the slit panel is usually in the same order of magnitude as its surface.

Several column panels with different tuning frequencies can be combined. That way absorption is obtained over a wider frequency range.

Slit angels as well as other resonant absorbers must be placed along walls, corners, or ceilings where many room modes have their sound pressure maximum. –