ROOM ACOUSTICS

Most audiophiles make big mistake by not paying any attention to room acoustics or giving it a little thought. All discussions deal with the components, CD or analog technology, tubes or transistors, compression or bass reflex, transmission or horns, copper or silver cables, which plugs etc. No one tackles the real problem.

The interference of room acoustics is enormous and mostly negative. There is no component that will improve the sound of your system as much as bad room acoustics can ruin it. A superb system worth a fortune will sound cheap in a room with bad acoustics. It is wiser to invest a certain amount of money in improving room acoustics than in let's say cables. It is always possible to find a compromise and at least eliminate the biggest problem in the room. Main side effects of listening to music in a room are reflections and standing waves. The sound picture that you are getting could be so degraded that you would not be able to use more than 30 percent of the real quality of your system. This does not mean that you should turn your space into a recording studio. There are a lot of living spaces of minimalist design, with spacious empty flat surfaces. Often whole walls are made of glass. And there you have ideal conditions to diminish the sound quality of your not so cheap system. Strong reflections flowing into direct sound have effects such as reduction of depth, width and height of the sound picture and inability to precisely localize instruments and vocals in the space. Everything sounds louder than it should and is blurred. Due to reflections in the bass range, you have an oversized, ill-defined, heavy bass that quickly tires you so that you tend to turn down the volume. It often happens that no improvement of the system gives appropriate results. In fact, all the while you have been looking for the problem in the wrong place. Of course you cannot influence structure resonance of your walls, floors and ceilings which have been defined by their dimensions, type and thickness of the materials and by their design. These resonances are in the range of very low frequencies (from 30Hz to 150Hz) while their harmonics spread much farther. They create the main tone color of your space. Most other problems you will be able to solve.

Many of you have been disappointed upon discovering after some time that the loudspeakers that sounded great in the showroom sound pathetic in your own room. Subsequently, of course, you fall into another trap, blaming it on other components of your system, not on the room. It is a fact that it is much easier to replace any of the components, however costly they may be, than to tackle the problem of improving your room. That is when the never ending troubles start. Listening to different systems in different rooms and frequent replacement of the components will lead you nowhere. It is much more practical to start dealing with your room, so your system can have at least improved if not optimal working conditions, thus finally giving your ears some listening pleasure.

It is important to realize that there is no general solution. There are only basic principles for solving room acoustics problem, still every room is a different story.

REFLECTIONS

Out of the whole sound energy that your ears receive, some 80 percent is reflected sound energy. This 80 percent determine two very important qualities of the sound – colour and loudness. Every wall and every object in our environment has their own sound wave absorption ratio. If this ratio is 0, it means that the surface is completely sound-reflective (marble, concrete, glass). If the ratio is 1, it means that the surface is completely sound-absorbing (the surface of an open window, deaf chamber). All other materials have absorption ratios between these two values.

When it reaches the obstacle, the emitted sound energy is divided into three parts. One part is reflected back to the space, one part passes through the obstacle and one part stays in the obstacle turning into warming energy. The part of the sound energy that has passed through the obstacle can be heard in the adjoining room. The part that has been reflected back into the space spoils the reproduction of the sound. With every further reflection from an obstacle, sound waves lose part of their energy. To explain this phenomenon more accurately, the term "reverberation time" has been introduced.

REVERBERATION TIME

Reverberation time is the time needed for sound to be reduced to one millionth part of its initial energy after the emission has stopped, i.e. to be reduced by 60 db. You yourself can very easily observe this phenomenon in the room. Clap your hands and you will hear a short, clear sound if you do it out in the open, or you will hear echoing if you do it in the empty underground garage. Or, more likely, you will hear something in between these two extremes. This indicates that the longer the reverberation time, the more reflected sound is there and the whole sound will be louder. And vice versa, the less reflected sound, the whole sound will be quieter. It is not uncommon that the total sound level in a room is 10 db higher than the optimum which is practically 10 times stronger. It is as if the amplifier supplies the loudspeakers with 100 W instead of 10 W.

So what is the optimal reverberation time for a certain room? There are of course precise methods to measure and determine this time, but the point is to reach the acceptable solution for your space as easy as possible.

One way is to position as much obstacles on the path of sound waves as you can. These objects could be decorations, paintings, plants. Shelves of different sizes can help a lot, as well as pieces of furniture placed in a room. Of course, that leaves you with one big flat reflecting surface – the ceiling. Here it is hard to apply the above mentioned advice. It would improve conditions a lot if you could put diffusion panels on the ceiling. The space would keep the liveliness, while the main culprit for strong reflections would be eliminated.

STANDING WAVES

In a room, standing waves form between two paralel surfaces as a result of bordering two reflecting sound waves with equal wave lenght, same or inverse phase, and in the areas where there are basic wall resonance frequencies and their harmonics. The smaller the room, the more standing waves are formed. There are areas in the room in which bass sounds louder and longer than in the actual recording. Bordering sound waves have the same phase and they add up. These areas are the peaks of the standing waves. On the other hand there are areas in which bass is quieter and shorter than in the recording. The bordering sound waves have different phase and they annul each other. These areas are the dips of the standing waves. There are also areas where everything is as it should be.

Play a track with a lot of bass and move slowly around the room. You will hear that in certain areas, especially in the corners, the sound is blurred and the bass range extremely loud, tiring and aggressive. Stay away from these areas when positioning the loudspeakers and choosing the listening position as well. To reduce negative effects of standing waves, you can try using thick carpets on the floors, heavy furniture placed in corners and along the walls. Much more effective method is absorbent panels specially designed for these purposes to have the biggest absorption for a specific part of frequency range.

Sound reflecting objects like LCD and Plasma TV should not be placed between loudspeakers or near front wall (the wall that you are facing from the listening position). If the front wall is mainly or entirely glass surface, than the only thing to do is to cover this surface with mobile absorbent screens. These extremely reflective surfaces drastically diminish the depth perception of your sound stage. The sound picture will be shallow, everything will be happening in one plane.

The back wall should not be sound reflecting either. The absorption would be helpful here as well, at least in the area directly behind you.

If the floor is tiled with ceramic, porcelain or marble tiles, a very thick carpet that will cover at least 50 percent of the surface between you and the loudspeakers would be helpful.

These are only some of the solutions for room acoustics problem that should be of some help in dealing with this complex matter.