

## **Home Theatre acoustic treatment and layout is reasonably easy if you can follow a few very practical rules and keep in mind what the objective is –**

Home theatre owners invest considerable time and money on this very popular entertainment, and expect to enjoy a specific kind of experience. Quite simply, the massive range of setups out there that get called “home theatre” means that they can’t all be enjoying the same thing and at least some of them, if not many, are not delivering the desired experience. Certainly they won’t be getting the cinema experience as intended by the producer.

It’s important to remember how the sound for home theatre is made. It is done in an acoustically treated room. Home theatre sound is precisely designed to provide clear dialogue, impactful effects and a sense of being in the action. Rooms without acoustic treatment will almost never give a reasonable reproduction of the soundtrack, and commonly make it a negative experience. Home theatre owners often complain that the bass is uneven around the room and boomy in places, dialogue and loud effects are so vastly different in level that constant volume adjustments are made, and listening at anything above moderate levels becomes tiring quickly. These kinds of problems are not experienced in a correctly setup and acoustically treated home theatre. Home Theatre acoustic treatment and layout is reasonably easy if you can follow a few very practical rules and bear in mind what the objective is.....

1. Symmetry – there just is no alternative! Our ears are symmetrical about our head and you should do everything you can to be in a room that is symmetrical left to right
2. Don’t worry about reverb time until the end. Firstly, RT60 is very hard to measure in the sorts of rooms we are talking about, mostly because they are small. The best approach is to get the key acoustical issues sorted out and then if RT60 is a bit high, or more to the point it sounds a bright, get some more absorption or diffusion in place.
3. Start with the bass. Broadband bass traps are the only practical option. Resonant devices like Helmholtz and membrane absorbers are extremely hard to get tuned right and very inefficient. Without doing all the calculations, you just can’t get enough resonant devices in a room to treat the low end. In fact, you would need dozens of times the surface area of the room to actually treat the low end this way. The reason is that in the average small room there will be lots of modes, easily 50 or more, and each resonant device is tuned to one mode! If you severely damp them (lots of insulation inside) to try and make them cover a few modes they become highly inefficient (absorption coefficients as low as .2 at the most at the tuned frequency\*). They would only be used if you had one or two specific modes left to remove at the end. Broadband bass traps on the other hand take the mathematics out of it. You can treat all but the very lowest frequencies with one simple lightweight device. You should get the front room corners full of bass traps and the rear corners too if you can. They can even go in the wall/ceiling corners if you want but practicality usually means using Low/Mid traps up there.

4. The listening position should be put in a place where room modes are stacked up on each other as little as possible. This occurs at 0.33 and 0.38 of the length of the room from the front and back walls. You won't be able to avoid being in the middle of the room side to side, but if you can, try not to be in the middle of the room top to bottom (which often happens in a 2.4m high room as our ears when sitting down are about 1.2m from the floor). The same 0.33 and 0.38 factors work, so ceiling heights of 3.6m and 3.15m would be good respectively. Otherwise a low chair or a platform can help.
5. Next step is to get the main front speakers in the right place. Remember that you want them at about 30 degrees out from centre and roughly in an equilateral triangle from you. Since the seating position was set in step 4, all you do now is move the speakers back and forward along the 30 degree line to get a reasonable spread without going too close to the walls. Having said that, remember that the further out from the walls you are, the lower in frequency the first comb filter dip starts! If you keep them at about 600mm from front and side walls, the comb filter lowest frequency will be treatable with a standard acoustic foam tile or acoustic panel.
6. The centre speaker obviously goes in the centre and the surrounds are best placed just behind the main listening position and just above head height. This is how the soundtrack was recorded and mastered and hence the way you will get closest to hearing how it was meant to sound (more on this at <http://soundproofingandacoustics.blogspot.com/> )
7. Subwoofers are always a challenge since most rooms are rectangular and fairly reflective. Bass will always improve with the use of broadband bass traps. As the walls are made more solid for more soundproofing, the reflected sound causes more interference and worse bass performance. The easy solution to this is Green Glue – the walls prevent sound leaving the room with damping rather than mass. The real beauty of this is that they dissipate the sound energy as loss or heat in the walls so it doesn't escape the room OR reflect back – so your room becomes a soundproof broadband bass trap!
8. The other method for getting more even and more accurate bass is to use many smaller subwoofers as has been tried, proven and published over the last few years.
9. Now that we have fixed positions for speaker and listener, the points for acoustic treatment are easy to find – yes, the mirror trick. For this purpose, the sound can be thought of like light. Just use a mirror (and a friend) to locate the points on the side walls and the ceiling where you can see the tweeter of each speaker in the mirror when you are sitting in the listening position. Mark these spots and place acoustic tiles or acoustic panels there. You want at least one square metre at each of these points and a bit bigger is usually good (unless you are in a very small room). The size and shape can be made to look good as long as at least one metre square.
10. Low/Mid traps should be placed in the wall/ceiling corners in the front centre of the room and on the sides where a reflection would go speaker>wall>ceiling>listener. The side ones take a bit of experimenting but the results are obvious when done. If you have enough, one or two in the rear wall/ceiling corner work great as well.
11. If there are flutter echoes or reflections from the back wall, diffusers will cure these. Just place them on the surfaces with flutter or spaced about 120mm apart on the rear wall.
12. The room should be fairly balanced now and if it is quite small it may even be too dead. If it is too dead, start placing thin plastic, like disposable drop sheets, over the rear bass traps and see how it sounds. They still work as bass traps this way but don't absorb the highs. If it isn't dead enough, you can place more acoustic tiles or acoustic panels around the room basically where they look good or where

you want. Rugs, furniture etc can also be used to marginally modify the feel of the room at this point. Interestingly we haven't measured RT60 or even mentioned modes yet. With some listening tests and a bit of thought about the process just gone through, you will easily be able to get the last few tweaks done. You may move things around a tiny bit at this stage but it is likely to be a very good listening space already. It will be light years ahead of the untreated room and allow you to hear the sound a lot like it was intended. In fact, without acoustic treatment, you have no chance of getting the whole cinema experience.