

# Home Theater Design: Optimum Speaker Placement

By David Thomas

The standard theater arrangement is of course a screen at one end of the room, with one central speaker, one speaker to each side of the screen, two speakers providing surround left and right, and sometimes a speaker providing surround rear. If you have your room arranged this way, chances are good that you call it your home theater, and speaker placement is fairly straightforward for you. The ideal placement has the front speakers at the same height from the ground, usually either slightly above or slightly below the display, and the surround speakers at least 60cm above the heads of the viewers.

The front center speaker should ideally be in the same position as the screen; the front left and right speakers should be placed approximately 25 degrees to the left and right of the direction the viewers face, and about the same distance from the viewers; the surround left and surround right speakers should be 90 degrees to the left and right of this direction, and, again, about the same distance from the viewers; and the surround rear, as its name suggests, should be directly behind the viewers. A subwoofer if used can theoretically be placed anywhere in the room.

For many people, and I include myself in this, the design of your home is such that it does not comfortably permit a room set up in this way. After all, unless you are very lucky, the chances are that the room that contains your home theater equipment doubles as your living room, and you will not want it to be dominated by a screen. You may not wish to call it your home theater as such. To solve this problem, you need to draw a scale diagram of your room. Add your intended screen placement to the drawing, along with the seating arrangements (your sofas and chairs), and identify where people will be sitting when they watch movies, and the direction in which they will be looking.

The next thing you need to do is to draw a line from each viewer directly to the screen, which shows the direction in which each viewer faces. Then draw a line angled 25 degrees to the left of the line you have just drawn from the viewer, for each viewer, until it meets the wall. If the speaker is placed anywhere along that line, then it will be at the correct angle for the appropriate viewer. You need to identify a point along the wall fairly close to the position at which these lines reach the wall. This will usually be somewhere near the middle of the collection of lines. You have then identified the optimum home theater placement for your front left speaker.

You now need to do the same thing, but angle the lines 25 degrees to the right of the direction in which the viewers face. With these lines you can identify the optimum home theater placement for the front right speaker.

Repeat for lines angled 90 degrees to the left, 90 degrees to the right, and 180 degrees (a continuation of the line from viewer to screen, but in reverse). With these lines, you can identify the optimum home theater placement for the surround left speaker, the surround right speaker, and the surround rear speaker.

Ideally, the front left and right speakers should be placed at the same distance from each viewer, as should the surround left and right speakers. This will normally not be possible to achieve, so it should be approximated. Far more important are the speaker placement angles for each viewer, which should ideally not be more than about 15 degrees away from the optimum position. Optimum home theater speaker placement depends on minimizing the angle error for each viewer.

Your subwoofer could be placed theoretically at any point in the room, because the ear cannot easily determine the direction of low-frequency sounds. However, you may find that positioning the subwoofer at different parts of the room change the sounds from the subwoofer; some frequencies may be amplified, while others may be reduced, especially if the subwoofer is placed near a wall or corner of the room. It is suggested that you experiment with the placement of your subwoofer until you find a position that you like.

Some other considerations may affect the position in which you place the speakers. You will not want your speakers in a position where they obstruct a path that is regularly walked through, e.g. too close to a doorway. Also, if you do not have magnetically-shielded front speakers, they should not be placed too close to a cathode ray tube (old-style) TV, because they will cause the color purity of the display to be affected. This does not apply to LCD or plasma televisions. Using this approach, you can successfully place your speakers in such a way that you can be proud of your home theater and of your living room at the same time!

Always remember that the idea behind home theater is to set your system up so that you can enjoy movies to the fullest. Some people lose sight of this goal. Whatever you do with your home theater design, don't fall into the trap of over-analyzing your results. Start enjoying those movies!

David Thomas was a design engineer in an acoustic field for nine years. Why not visit his site about home theater design today?

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