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Subject: Computer Simulation of Room Acoustics

Posted by [Wayne Parham](#) on Tue, 21 Mar 2006 19:39:33 GMT

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I recently purchased a software package for modeling room acoustics. On initial inspection, it's pretty impressive. I am setting up a study of several speaker setups in various rooms, sort of duplicating the Welti study but adding a few more configurations and room types. I also wanted a graphic representation of the room energy, which is an option that the CARA program is capable of doing.

Part of what prompted this is I wanted to test Dr. Geddes suggestion of asymmetrical random subwoofer placement. Welti published a study a few years ago that indicated there were symmetrical placements that worked better than random placement of the same number of subwoofers. Geddes maintains that Welti was wrong, and that he failed to try Geddes specific configuration, so I wanted to test Geddes suggestion for myself. To be specific, Geddes suggests the following conditions: Subwoofers should be placed asymmetrically, one should be in the apex of a room corner, one should be above mid-height of the room and at least one more should be placed in a random position in the room.

Geddes preferred implementation requires at least three woofers. Welti suggests four, one at each room midpoint or one in each corner. He also found that a pair of subs at opposing wall midpoints worked pretty well. But the point is that you can arrange four subwoofers in either a Welti or Geddes arrangement, so it isn't a matter of cost, only of placement. Other considerations may also apply, such as compatibility with room decor and integration with mains, but we're basically talking about where to place the same number of speakers to get the best results.

I could accept either conclusion, whatever the facts indicate. But to be honest, I was skeptical of Geddes conclusion mostly because I thought that Welti had already considered it and thrown it out. But to be fair, Welti did not test Geddes exact placement, so I thought it was worth seeing for myself.

Dr. Geddes and I have discussed this offline, and he proposed a wager. If I would bet him \$500.00 that Welti was right, he'd prove me wrong. I immediately jumped at this, because to get the expertise of a man so accomplished for just five hundred bucks is a real bargain, either way it works out. I told him I'd even be willing to run some of the sims. He proposes a series of MathCAD simulations, which is the natural choice for a study of this sort. So we're still talking about the particulars, and what would be required to run the tests.

In the meantime, I suggest to each of you interested in room acoustics to purchase a modeling tool like CARA. Setup a room and see for yourself how it acts. I think once you see the room energy distribution graphically, this whole exercise becomes self-explanitory. Look at the low frequency room modes, and how the pockets of energy form at various bass and lower midrange frequencies. Then look at how reflections cause interactions at higher frequencies too. And even odd-shaped rooms and furniture can be simulated, so the study doesn't have to be limited to simplified rooms.

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