



One Expert's Rhyme & Reason **of** **SPEAKER PLACEMENT**

Norman Varney, founder & CEO of the acoustical design firm A/V Room Service, offers tips to facilitate good sound in nearly any home environment.
by Robert Archer

FOR YEARS THE DEBATE among audio enthusiasts was usually what sounded better — analog or digital. But recently, the argument over room acoustics' importance may have unseated the analog vs. digital issue as the top hot-button topic within audiophile circles.

Driven by the educational efforts of groups such as THX, the Home Acoustics Alliance (HAA), the Custom Electronic Design and Installation Association (CEDIA), the Consumer Electronics Association (CEA), and to a lesser extent in the consumer realm the Audio Engineering Society (AES), room acoustics has become a greater point of emphasis for custom electronics installers.

Beyond the measurement and treatment solutions that are available to installers as part of a complete acoustics package, a major component of the room acoustics equation is the placement of loudspeakers within a small room environment.

THE CHALLENGE OF HOME ACOUSTICS

Norman Varney, founder and CEO of A/V Room Service, Ltd., is one of the top acoustical engineers in the custom electronics market, and he says the problems of residential acoustics run deep. "Small rooms are containers of sound energy. Most of the sound waves are not allowed to pass by, they return by various means," he says. "Typical U.S. shell construction materials and methods allow some energy to pass through — mostly low frequencies — some to be absorbed, some to reflect and some to resonate back into the room.

"Often the room is too small to support the lowest frequencies," he continues. "Standing waves exist and they cause nonlinear frequency response below 250Hz. [The] proximity of speakers and listeners to room boundaries cause reflections to interfere with direct signals causing tonal and spatial distortion. These reflections also cause [the] masking of low-level resolution and limit dynamic range. Flutter echo due to parallel surfaces can be a problem in small rooms [too]."

Varney says the typical residential room presents installers with an environment that sounds slow, muddy and compressed, which in his opinion adds up to an uninspiring listening experience. "A controlled environment presents a very fast, articulate, big and dynamic sound that is very captivating," he asserts. "It is the difference between disorganized and organized sound."

SPEAKER PLACEMENT IS CRITICAL

Varney says the reason speaker location is important is that it enables the accurate portrayal of a musical image and timbre. "In a typical room, most of the sound energy perceived is from the room and not the speakers," says Varney.

Speaker Placement

Explaining the keys to achieving correct timbre, Varney points out that if speakers are located too close to walls, it is possible that certain low frequencies will become exaggerated and these frequencies will be dictated by a room's dimensions. Conversely, he continues, if a listener is located in between these room modes (a null) that listener will have a hard time hearing the related frequency. Moreover, if speakers are placed too close to large surfaces, mid and high frequencies will reflect and they will interfere with the sound coming directly from the speakers.

Spatial cues that are a part of a stereo image add to those elements, Varney says. Reflections off of large objects and walls cause the brain to miscalculate a sound's point of origination, Varney notes. "As reflected sound interferes with the direct sound later in time, our brain fusses their sum and positions the sound incorrectly in space," he says. "Reflections can also cause changes to the perceived sized of the recorded space and size of individual instruments, depending on our distance [from the point of origin], the frequency and its amplitude."

As a result, he says, these reflections and standing waves interfere with the recorded signal to distort the original tonality and spatial cues of audio content. "Time, energy and frequency are all affected by the room's dimension, construction and furnishings," he points out. "Room modes can easily cause 30dB deviations in the low-frequency range. Mid- and high-frequency room reflections can cause tone colorations and image distortions."

AUDIOPHILE TRICKS DELIVER THE GOODS

Years ago, many music enthusiasts set their systems up by using the "golden triangle" rule, which said a listener's seat should be equidistant apart from his speakers. Varney says that rule is a good starting point even today for a quality two-channel listening experience.

Speakers that are too close together in relation to the listener narrow the system's soundstage, while speakers placed too far apart aren't able to create a cohesive soundstage, but Varney says there is some personal interpretation that can be employed within this base guideline.

"Depending on the specific speaker dispersion pattern, room acoustics and customer preferences, you can control the soundstage perspective from a very intimate 'in-the-band' type of presentation, to more relaxed, 'row S' perspective," he suggests. "I personally find the best listening location is often a bit farther distance from the speakers than they are from each other. Toe-in

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also plays a role in soundstage presentation."

Toe-in is a method in which speakers are aimed in a manner to create a stereo image. Varney says speakers are toed in to ensure tonal and spatial balance, but the process to achieve these traits can be tricky. "Usually, it's a balancing act between the two; as you toe-in for more precise spatial imaging, you end up with too much treble. As you point the speakers straight ahead for more spaciousness or less intimacy, you may not have enough treble. Toeing in speakers also results in less energy in the mid-range and treble range reflecting from sidewalls," he states.

"Non-toe-in is typically where I'll start and then subjectively compare by aiming them in at my ears. I'm listening to the soundstage and the timbre differences in order to find the optimum of both. Sometimes you dial it in to the client's preference, be it brightness, soundstage width and depth, or image precision. Depending on the speaker, the customer and the room, you might aim them anywhere between straight ahead, to about two feet in front of the listener."

TOOLS OF THE TRADE

In the field carpenters use hammers, plumbers use pipe wrenches ... custom installers use their ears. Varney says that once it's been determined that an audio system is physically set up to work properly; the ears are the final arbiter that determines the sound quality. Varney says that he'll use various familiar recordings to determine how an audio system interacts with its surroundings.

Prior to his personal listening tests, however, the veteran acoustical engineer says that he employs tools such as a sound pressure level (SPL) meter, a real-time analyzer (RTA), and advanced testing products such as Music Articulation Test Tone (MATT) equipment and Time Energy Frequency (TEF) equipment. Varney explains that he uses the RTA at a flat/slow 1/12th octave setting to establish a baseline for the subwoofer crossover and output, and an SPL meter (type 1) to match a system's SPL

Speaker Placement



Varney says the “ultimate arbiter” in speaker positioning is the human ear, which is why he says integrators need to “train their ears.”

readings to within 1dB or less.

In addition, he uses a proprietary software program that estimates the placement of speakers and seating positions within a room to avoid room-mode issues. “Once on site, I check the room for ‘squareness’ and I figure out where my center line is and use a tape measure to get me in the ball park for speaker/listener locations. I sometimes use the MATT equipment to assess the articulation between the speakers and the room, but typically I use familiar recordings. I want to establish optimal bass response before working on the mids and highs. I determine the listening position first and

then move to the speakers. I mark with masking tape to play with fine tuning from inches to around ¼-inch. I use the TEF equipment to set up the time alignment of speaker drivers within a cabinet[s] to the client’s ear distance and height, when applicable.”

From there he begins the toe-in process by using white noise to approximate toe-in positioning before finalizing everything. “I use a bubble level to level and plumb the speakers and a laser to match their toe-in within a fraction of an inch by aiming to the back of the room or some point well behind the listener. Most of these tasks interact with each other, and require going back and forth, starting with course movements at first and progressively becoming finer,” he warns.

REFLECTION, ROOM MODE & SOUND SYMMETRY

It’s impossible to boil the science of room acoustics and speaker placement into a few key talking points, but Varney says it is important to remember that room modes and reflections have a tangible influence on the placement of speakers and where a homeowner should sit. Varney emphasizes that sound symmetry is important, and that in-wall and on-wall speakers typically cannot offer as deep an image as freestanding speakers.

Varney recommends to dealers interested in developing their audio system installation skills to train their ears and learn to identify and address first-reflection problems. Lastly, he says an RTA can help installers to identify problematic room mode locations. **CE Pro**

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