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Subject: Re: Favorite flavors

Posted by [Wayne Parham](#) on Sun, 23 Jan 2005 20:01:58 GMT

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There is some debate as to whether reflections are good or bad. Reflected energies give ambience to the sound, albeit an artificially generated ambience. On the other hand, reflections cause intelligibility problems and response anomalies, so too much of them is probably not a good thing. Uniform directivity is the holy grail of CD horn designers. It was once only an issue for prosound, where coverage of large areas requires the use of multiple horns, and you want even coverage without overlap. Interactions from overlap cause response anomalies, so the idea is to cover an exact pattern with an even and uniform field, then have an abrupt pattern stop and handoff to another horn that covers another area. But even in home use, what I've noticed is that speakers with uniform directivity fill the room better. I think they just sound better. Take for example, a horn with extreme collapsing directivity. This horn has a long necked throat that curves out to a wide mouth. On axis, the sound can be made to have flat response. This is determined by all the factors involved, the radiating diaphragm, it's motor, the crossover, amplifier and any EQ involved. But when you put it all together, the sound should be flat on-axis. Such a horn has collapsing directivity. As frequency rises, the pattern becomes narrower and narrower. If you move off axis, the high frequency response drops rapidly. What this means is that there is a lot more low frequency energy in the room than there is high frequency energy. High frequency energy is focused to a very small point, so not much is required to sound right on-axis. But if you increased high frequency energy enough to make response good 20° off-axis, then the on-axis response would be ear-splitting. Way too much high frequency energy on-axis. Now take another example. This is a three-way horn loudspeaker system, with each of the three horns having a curved wall flare. What you see then is that the bass horn is nearly omnidirectional but starts become directional as it is run up into the lower midrange. Then as sound is handed off to the midrange horn, the pattern widens up again. As frequency rises, the pattern narrows and begins to beam. Then it is handed off to the tweeter and the pattern widens a second time. But at high frequencies it narrows once again. On-axis, and outdoors or in a very dead room, this loudspeaker may sound just fine. But if response is good on-axis, then it will be poor off-axis. There will be low bass and some midrange, but upper midrange and treble will not be present. The energy distribution in the room will have wide peaks and valleys. This is an example of an uneven reverberent field. On-axis sounds very different than off-axis. The sound far way is uneven as a result. Basically, it's just another way of saying the tonal balance is off. If you listen to a speaker like this, it may sound OK right on axis in the "sweet spot" but if you move out of that zone, it sounds bad. Movement in the room sounds like you're passing through a phase shifter. Balance is poor unless you're right in line with the speakers. The reflections from the room have poor balance too, so people with speakers like this are usually obsessive about room treatment. That's because any reflections have poor tonal balance, even in places where there are no nulls from interactions. So owners of speakers with poor off-axis performance are usually very fussy about placement and wall treatments. Their speakers sound only sound good anechoic and directly on-axis. Being in an open space and listening on-axis is always good, but a speaker with good directional characteristics isn't as adversely affected when heard off-axis. When indoors, reflected energies are more balanced and not as unnatural sounding. It really contributes a lot to the overall sound, so I think that's an important part of the design. If the speaker sounds balanced off-axis, then that means the energy developed is fairly equal throughout the spectrum. The room is filled with sound. Bass and midrange won't be over-represented and the "sweet spot" becomes

a large part of the room.

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