
Subject: Audibility of Phase

Posted by [Wayne Parham](#) on Mon, 30 Jun 2003 16:39:01 GMT

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Mike Baker sent me an excellent article today about the audibility of phase in loudspeakers, written by Rod Elliot. I had planned to make the next little tidbit be about push-pull woofers, 'cause they are on my mind these days. But I'll save that one for next time. This article is worth posting. I'll also accompany it with another that has a slightly different view, to round out the subject and make it as objective as possible. Audibility and Musical Understanding of Phase Distortion, by Andrew HonPhase, Time and Distortion in Loudspeakers, by Rod Elliott. Ever since I first thought about this issue, I've always come to the conclusion that phase is of limited concern except where it manifests itself as a frequency anomaly or as an audible echo. In a perfect world, our speakers would be point sources and this wouldn't be an issue. A future technology may one day be able to develop sound using an infinitely small radiating monopole. But until that time, we use technologies that generate sounds from various positions and through electronics with various phase shifts. This surrounds us with sound having infinite phase angles. What I think is really at issue is the obvious presence of marketing spin from at least two different "camps." One school of thought says time alignment is of paramount importance, and the other says it's a little more subtle. One group of advocates places a great deal of importance in loudspeaker time alignment. My view is that companies that focus heavily on time alignment are often those that use it as a marketing tool. The usual claim is of a product that preserves phase coming from multiple sound sources, usually by physical positioning of the sound sources. Most align so that voice coils are in the same plane, but others use more sophisticated methods. Still, all such methods can provide only approximate alignment, at best. The other camp believes that small phase shifts are of reduced importance in the illusion of reproduced sound accuracy. I think most audio manufacturers strive to make a product that duplicates a recorded event exactly the same as the original. But some also acknowledge the fact that phase movement is inevitable with current technologies. And the idea is that small phase shifts aren't audible as long as the phase shift isn't rapid, and doesn't cause a response anomaly or noticable echo. This view boils down to the idea that small phase differences are subtle and pretty far down on the list of important specifications. It's sort of like optical illusions where an absence of certain visual clues make something appear different than it really is - We just don't see them. In much the same way, we should understand that the illusion of audible accuracy involves some aspects more than others, and not be self-deceived either way. The two articles linked above describe some of the "hows and whys," what's important and what's not and some of the things that can be done about each of them. I think they give a pretty good feel for the issue, and will help anyone designing or building their own speakers to decide what they feel is important to do.

Subject: Re: Audibility of Phase

Posted by [Bill Martinelli](#) on Tue, 01 Jul 2003 10:57:03 GMT

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Wayne, Thanks to you and Mike for the links. I have read most of the piece by Rodd Elliott so far. Great article "study". You posting new material faster than I can get to it! I like the idea that time

alignment can help a speaker but I have never thought that carrying this out to the extreme was worth the extra effort. I have always believed and pushed for the fact that in room performance was more important than anything, since the room the system is in can make or break the sound. The Arezzo speaker I had with me at Midwest Audio Fest this year are a very good example. The way the crossover is set up, in two different room of my home they sounded different. So different in fact that I moved them out of one room because I couldn't listen to them. In the other room they sounded as I would expect a 12" two way to sound. At the hotel in Lima they sounded completely different still and I was quite surprised at the depth of bass there. Now they are in a store and sound different yet again. The 7 Pi corner horns you brought to Lima sounded very different there in the hotel from what they sounded like in my home also. My point is that it's not a hotel or a home that's better or worse. It's that all venues will be different and what works best for one person and setting could be quite different from another. As a builder its a difficult task to keep some of the people happy some of the time! Having said that, I don't see that the time alignment issue as one of the more prevalent factors. Definitely a worth while read and thanks for keeping us informed with various postings you have started. Bill

Subject: Re: Audibility of Phase

Posted by [Wayne Parham](#) on Tue, 01 Jul 2003 13:22:47 GMT

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I agree with you, 100%. The condition of rooms in most North American homes is such that a good quality loudspeaker will usually sound pretty good, but there is definitely more influence by the room than anything else. There are walls and tables and pets inside, so it's a reverberent chamber with lots of fill and plenty of oddly shaped reflective and absorbant surfaces. Having said that, most of the time I've found that a good quality loudspeaker will sound pretty good in most rooms. The exception for me are those that aren't on concrete slabs - raised hardwood floors always seem to really screw up the bass and and upstairs rooms do too in some cases. Compared to this, framed drywall construction on a concrete slab has always been pretty acoustically friendly. But there are definitely artifacts caused by the environment that are greater than those caused by the speaker or electronics. That's why it's tough to measure stuff in one room and use it to compare with somebody else's system in another room. If we're discussing rooms, that's one thing. But if we're discussing speakers, we have to find a reference environment, which is usually anechoic. Anyway, one of the best references is included in Andrew Hon's paper, and it is the link to a Master's thesis paper written by Daisuke Koya called "Aural phase distortion detection." Koya goes to great lengths to be objective and in so doing, is quick to point out the limitations of his test. In doing so, he really addresses the issue, in my opinion, and makes his work probably the most telling. It is neither a pronouncement of the importance of phase distortion, nor does it say that it is unimportant. It simply illustrates - and pretty accurately, I think - where people are most likely to notice phase distortion and why. I also believe he has done a good job of isolating purely time-related artifacts from those that are manifested in frequency response. That is very important because, for example, if there is 180o phase shift between two tightly coupled sound sources then you would expect audible cancellation which is not purely a time-related effect. In conclusion, Koya writes: "The human auditory system was found to be extremely tolerant of even gross phase distortion effects. Although the impulse test signals

were very revealing of the presence of phase distortion, more refined research utilizing an improved selection, broader frequency range, and various all-pass filtering implementations (wider range of phase distortion levels and Q) of test signals are necessary to ascertain more accurate permissible levels of audible phase distortion. Improved irradiation methods, such as the use of phase-equalized loudspeakers in an anechoic environment, may also aid in ascertaining more accurate permissible levels."

Subject: No one has ever really chimed in
Posted by [mikebake](#) on Wed, 02 Jul 2003 11:20:13 GMT
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on any of the various forums when I wax rhapsodic about setting up outdoors. You never have any of the room problems. It's a beautiful thing. That's why sound guys that set up in an indoor venue really have to work things out; outdoors they pretty much know what settings will work. The variables, other than distances and position to listeners, are the same. Screw the room, go outdoors!!! Another factor if you drag your stuff outdoors is that you will often be driving your system at a somewhat higher level; same spl at the listening position, but more realistic levels from the drivers. And it doesn't get uncomfortable because a room isn't reinforcing any freq. unnaturally. Ramble ramble.....

Subject: No doubt
Posted by [Wayne Parham](#) on Wed, 02 Jul 2003 11:51:10 GMT
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I agree with you on this deal. Sounds best outdoors, but you gotta have more power. Crown Microtech 2400 does pretty good in this duty and I expect your QSC amp is great too. Perfect for a block party! Or a nice, intimate backyard thing is just right...
