Subject: Making speakers "disappear"
Posted by Wayne_Parham on Tue, 10 Apr 2001 01:47:30 GMT
View Forum Message <> Reply to Message

Sometimes, I hear phrases like "prat," "soundstage" and this particular one - "making speakers disappear" - and I'm somewhat at a loss for what the person is trying to describe. Could be a lot of things, so I have to try and learn more about what they're experiencing or wanting to hear.

When I am asked what is required to make speakers "disappear" - my first thought is that I need to understand what it is the person asking considers to be acoustically "invisible." Is it that he wants the speakers to have flat response and low distortion, and thereby add very little to color the sound? Does he want envelopment, the illusion that sound surrounds him? Or does he want localization clues, imaging that seems to make each instrument originate in a different location in his listening room?

So when I was recently asked about "making speakers disappear," I set about asking questions, and listening to descriptions of what this person liked. At first, I thought he really didn't like the tilted up response of the loudspeakers he was talking about. But after a while, I realized that may be partially at fault, but what he was really craving was good stereo imaging. He wants a sensation that every instrument is coming from different locations in the room. After realizing that, I knew what direction to go.

Here's the deal. There are a couple of ways to do this in your listening room. One's a little more difficult, but moves closer and closer to recreating a sonic impression of realistic directional clues, and placing sound sources where they really are in the recording environment. The other easier method will not do this, but will give an impression of sounds coming from different places "on the soundstage" - depending upon all the variables of the interactions of phase relationships in the amplifiers, speakers and most importantly - in the listening environment, itself.

There are two things that contribute to form our aural positioning information. One is amplitude (volume loudness) and the other is phase. Both are related - a point source is heard by both ears, and there is a subtle amplitude and phase difference between them. If we're moving in the environment, there's a slightly different Doppler shift for each ear as well. So that's how we can distinguish the directions and distances of sound sources.

The most accurate way to create an impression of acoustic position, is to add point sources. If we run several microphones and then recreate the recorded sounds using several loudspeakers - as the home theater guys do - then we've generated more position information. If we're careful to match the microphone placement and the loudspeaker placement and directionality, we can really do good things with our "soundstage." And if we go to the trouble of minimizing reflections in the listening environment, we can go even further in this direction by reproducing the very subtle phase differences in the recorded signals.

Trouble is, that our listening environment smashes these kinds of clues with a sledgehammer. It's pretty difficult, really, to have such an "acoustically sterile" environment that it doesn't inject some of its own "soundstage components." We've got a lot of reflecting and absorbing and resonating surfaces. Children playing and dogs barking and the neighbor cutting his grass. In the theater, it's long walls and bunches of people chomping their popcorn and absorbing sound. So its hard to

be "acoustically sterile." But that shouldn't stop us from going in that direction.

When working with two channels, there's a positioning trick I learned a long time ago that works very well. It goes a long way towards equalizing the amplitude clues between channels and minimizing phase clutter in the form of early reflections. The idea is to cross the forward axis of the two speakers just in front of the listening area. This is the natural setup of the Pi cornerhorns, and it is also a good way to position other speakers too. But the speakers must generate uniform off axis sound for this to work, otherwise, off axis listening positions will have an unnatural tonal balance.

In fact, that's one of the things that sets apart the Pi cornerhorns from Klipsch. Klipsch speakers are all designed to be listened on axis, and movement from the forward axis causes problems with the frequency response. This prohibits them from being setup with axis crossed in front of the listener, and in fact, strictly limits their best listening spot to a certain point in the room. The Pi cornerhorn provides even coverage on axis and off, so the reverberent field is uniform providing tonal balance. Because of this, there's a wide listening area where the sound is balanced between speakers both in terms of amplitude and frequency spectrum, and also directed to minimize early reflections, giving properly phased aural clues to listeners in this areas.

If you are listening at the point where the speaker axes cross, then the only place where the two speakers provide the same amplitude is when you are directly between them. The further left or right of center, the more difference in level between the two speakers. If you're forward of the axis-crossing point, the difference is even greater. But if you are behind the axis-crossing point, then movement away from a speaker brings you more directly in line with its forward axis, and moves you further from the forward axis of the other speaker. This has a balancing effect on the amplitudes arriving from each channel, and makes the area where channels are balanced much wider. Of course, this requires speakers that produce uniform directivity, which is one of the benefit of Pi Speakers.

When setup this way, the directional nature of the horns reduces early reflections. If angled inward enough, the horizontal pattern keeps the sound from being reflected off the nearest side wall. It's also best to sit away from the rear wall, if possible, and make it absorbent or diffuse. Bookshelves often work well.

That's one way to create the illusion of having the "speakers disappear." I think it's the best way, as it maintains the phase and amplitude relationships of the recorded material. Another way to do it is much simpler, but it makes no attempt to recreate the recorded soundstage. This method creates its own soundstage, which is not "accurate" if recreation of actual positions is important to you. It is, however, very pleasant and it does provide a sense of unique position for each instrument and sound that is generated.

Reflected energy, by its very nature, has a mix of phase relationships. The idea of the point source is that the loudest sound is presented directly from the transducer. Anything else has to travel further - to hit that wall or chair or cat - so it is greatly attenuated. This means that the components of the acoustic signal you hear the loudest, are the components that are generated by the speaker.

But the idea of reflected energy is that you don't know what you've got, but you know it has a

unique phase relationship with the source. It's difficult to know exactly what it is - because there is literally an infinite number of phase relations possible. Reflect an inch down the wall, and phase is a little different than it was an inch back. Two inches, more different still. And we've got lots of little half inches and sixteeth inches and sixty fourths of an inch to think about in our 25 by 18 by 8 foot room. After we examine all of those, we still have to look at the tables and chairs and cats and dogs.

Using a lot of refected energy pretty much ensures that we'll create our own soundstage. It has nothing whatsoever to do with the original soundstage, but it does give an impression of spaciousness and it is very satisfying. Stuff is coming from everywhere.

The guitar player may be right in front of you. The singer is two feet to his left. The guy with the very low voice seems to come from ten feet away. These aren't anything at all like where they were originally standing, unless you read the Hitchhikers Guide to the Galaxy while you listen to the stereo - in which case they will all be in exactly the same spot as they were recorded, except upside down. But your system - the room and chairs and cats - will have created a "soundstage" with its own positioning information caused by the phase and reflected amplitude relationships from the room itself.

So when I was recently asked how to make a pair of Klipsch Heresy's "disappear," I realized what was being asked was how to improve imaging. Since they don't provide uniform directivity, we can't set them up with forward axis crossed in front of the listener without creating a tonal imbalance. But it may be worth a try, to see if the improved imaging is worth the loss of spectral balance. Try pointing them inwards, about 45 degrees to the wall, and see if you like 'em. If not, try 20 to 30 degrees. You'll probably lose some treble, because HF droops off axis compared with on axis, and it the HF loss is greater at 45 degrees than it is at 20 or 30 degrees. But you may be able to find an orientation that sounds good and provides greater imaging.

If not, try using reflections to generate an artificial soundstage. Take those Klipsch Heresy's and point them at the walls. It will increase a sense of envelopment, and make it sound like things are coming from everywhere. As much as we all joke about the thing said of Paul Klipsch and Amar Bose - where Amar holds his hands to form a horn to his mouth and speaks to Paul (referencing his horn ideas), and then Paul turns his back on Amar to reply (referencing his direct/reflecting thing) - you'll find an interesting "artificial soundstage" is created by just pointing your Heresy's directly 45 degrees into the corner. I guess that's sort of like Paul and Amar shaking hands. Give it a try, see what you think.

Subject: Re: Making speakers "disappear"
Posted by Randy Bey on Tue, 10 Apr 2001 12:27:03 GMT
View Forum Message <> Reply to Message

My Klipschorns have a fairly unique quality that I have attributed to their "set in stone" placement. This is that when you close your eyes, the whole room falls away and there is nothing left but music. The K's point directly inward, and definitely have a "sweet spot" where even a foot one side or the other makes a big difference.When I listen to other more conventional hifi, with direct radiators facing straight ahead, I get the sensation, eyes closed or not, of speakers reproducing music. Maybe if I squint my "ears" I can grasp some sensation of soundstage, but the soundstage

is weenie, and transient.I think it is true that Klipschorns "beam" a lot, and this contributes both to their sweet spot and a reduction (opposite of what one would think) of room reflections. The direst room reflections being the ones closest to the listener, as the ones that are nearest in time to the "real" signal cause the most grief. The beaming effect sends 90% of the audio energy straight to the rear wall, where time effects reduce (but not eliminate!) it's effect.To address this beaming I have put acoustic panels (ala Jon Risch) on the rear walls exactly where a flashlight, sitting on my K's and aimed the same direction, hits the wall. A third directly between them on the forward wall. (Oh, and a pair of bass traps in the last remaining corner, floor to ceiling).But, let's talk about time and phase. I have heard "time coherent" speakers, Vandersteens, and have been unimpressed. The Ks, with their baffle mount tweeters and squawkers, not to mention the W folded horn, don't even pay lip service to time coherence, and blow the Vs away. However, I have an open mind and believe the concept of time coherence, and if you buy that, then phase coherence is the table you set it on.I don't know enough about impedance and capacitence and inductance other than remembering that signal phase undergoes 90 degree shifts one way or another depending on what characteristic is predominate. A good engineer can account for that stuff, but what happens to absolute phase? Isn't absolute phase a necessary corrolary of phase coherence?A signal with both high and low components to it gets split by a crossover (and it's caps and inductors) and gets generated by motors (with their own impedance). The absolute beginning of the sound, as it appears to both motors, may not be at the same moment in time, but at least in "phase" where a positive transition occurs at the same time on both motors.I've seen decay plots of speakers that look like hell, a square wave going in, and this ringing mess coming out. Interestingly enough, I imagine that many "good" speakers would have this ringing mess come out, but the results while playing music are still palatable.Wayne, I respect your experience and knowledge on this topic. Can you speak to these concepts of phase and time, and how they relate to soundstage or imaging?

Subject: Re: Making speakers "disappear"
Posted by Art J. on Tue, 10 Apr 2001 14:40:48 GMT
View Forum Message <> Reply to Message

Hello gang, My weekend was booked and couldn't continue my speaker work but please keep this topic alive, its great.Ill just add that the best way for a home test of speaker phasing problems is a real good set ofHeadphones.(I mean real good) You can compare your over-all system to your speakers. Even themost untrained ears can detect an unnatural quality in voices. The voice region is in the crossover range unfortunately.I knew I had a phasingproblem because voices had a very slight bass quality to them that weren't in the headphones.It was a mild case of listening to a normal persons stereo, who uses the base control on FM, and when the announcer comes on,he sounds like he is in a tube.(no base controls on my pre-amp he-he)Phase alignment solved the problem.(later post,cant wait) Ive heard alot about time alignment problems with Randys speakers in the past.If you pass the headphone test on voices, dont worry about it.WayneI'll include a click test too. (and I have a most unusural square wave generator)Art's ,Sticks and Stones Lab.

Subject: Re: Making speakers "disappear"
Posted by Scholl on Tue, 10 Apr 2001 14:59:06 GMT
View Forum Message <> Reply to Message

Third way to make speakers dissapear. Small widerange drivers mounted at ear level two feet away.Nice high back confy chair.Subwoofer behind chair.

Subject: Cool stuff!
Posted by Wayne_Parham on Tue, 10 Apr 2001 20:49:23 GMT
View Forum Message <> Reply to Message

Looking forward to your post.

Subject: Re: Making speakers "disappear"
Posted by Wayne_Parham on Tue, 10 Apr 2001 20:52:40 GMT
View Forum Message <> Reply to Message

There you go!

Subject: Speaker reflections and phase
Posted by Wayne_Parham on Tue, 10 Apr 2001 23:44:48 GMT
View Forum Message <> Reply to Message

Absolute phase has little or no meaning, since phase is an indicator of time difference between events, and is therefore, by definition, relative. The biggest thing that results from phase is interactions between sound sources which cause response irregularities. Nulls formed by destructive interference are what one should be concerned about.

Subject: Thanks!
Posted by Randy Bey on Wed, 11 Apr 2001 13:39:41 GMT

View Forum Message <> Reply to Message

This is great stuff. I am getting pumped about building these Pi's myself.May have to sell my K's and use the proceeds to build a pair for myself, with my friends help since I can't even lick an envelope right most of the time.

Subject: Turning my Heresys toward the rear corners
Posted by J Harris on Sat, 14 Apr 2001 22:19:23 GMT
View Forum Message <> Reply to Message

Amazing! You are absolutely right! Sudden ambience, mid-bass warmth, detail without sharpness, presence... everything you predicted! Only problem: the right speaker now blocks the front door to the apartment!So this is what I'd get from a cornerhorn but even better, huh Wayne? But I can't use a cornerhorn because I don't have a right corner! What if I built a baffle for it of some kind?Amazing, off-the-beaten-path advice. Who would have dreamed? J!

Subject: Re: Turning my Heresys toward the rear corners
Posted by Wayne_Parham on Sun, 15 Apr 2001 10:13:15 GMT
View Forum Message <> Reply to Message

I have a couple of suggestions that might work for you. You may want to modify your crossovers, and do a little bit of response shaping, to tame some of the midrange and treble harshness, and then position the speakers in corners without quite so much toe-in. Another thing that may help with tonal balance is to add a subwoofer. These suggestions might allow you to aim the speakers how they work best for energizing the room, without having to also depend on aiming them to set the tonal balance.

Subject: And now a response to your post
Posted by J Harris on Sun, 15 Apr 2001 17:17:05 GMT
View Forum Message <> Reply to Message

Wayne,Thanks for all the considered suggestions! One issue is that I have already done MAJOR mods to the Heresys... upgraded the crossover caps, rewired most of the crossover and the drivers, replaced the backs, added binding posts, fully damped the horns and woofer basket, lined the interiors with fiberglass and loosely stuffed them, and braced them with 2" dowels.It's

interesting, but I wonder whether I should just go with a new speaker instead! I've put SO much work into the Heresys, and as much as I like them, I think the real problem is that they don't mate with my room very well.What do you think of me using Pi cornerhorns with rear baffles?Thanks again Wayne -- you give advice way beyond the demand of duty!All the best,J!

Subject: Yes - Build some Pi speakers!
Posted by Wayne_Parham on Mon, 16 Apr 2001 04:08:18 GMT
View Forum Message <> Reply to Message

I wouldn't modify the Heresy's if you're happy with them, but if the mids and tweeters are still a bit hot - then yes, I would. But if you have corners, I think you be happy with Pi cornerhorns and if not, maybe consider one of the other Pi designs instead.

Subject: Thank you so much for this post...
Posted by NickR on Sun, 22 Apr 2001 13:46:00 GMT
View Forum Message <> Reply to Message

There are times when I point my speakers at strange angles - away from me into the wall or placing the speakers close together with a toe-out of 45 degrees.I have slowly learned that I can trust my own experience despite the huge wall of grief I get from the 'audiophile' community.I think audio is amazingly subtle and complex and it's easy to think you've got it nailed when in reality you haven't a clue. A lot of 'audiphile' posters fall into this catagory.Thanks for providing some validation!

Subject: Another possible definition
Posted by NickR on Sun, 22 Apr 2001 14:15:34 GMT
View Forum Message <> Reply to Message

I have heard people use the 'disappear' word in relation to being unable to locate the position of the physical speakers.Sometimes there can be a 'soundstage' but you are also aware of sound being sourced at the physical speaker location.I don't know if this is a speaker issue or a room accoustics issue but I know I seem to be sensitive to this effect. Sometimes I sit quite far away from the speakers to 'make them go away'.

Subject: Re: Another possible definition
Posted by Wayne_Parham on Sun, 22 Apr 2001 19:39:31 GMT
View Forum Message <> Reply to Message

Yes, I think you're right. I think it's kind of the same thing, but I think you're right.

Subject: "Audiophiles"
Posted by Wayne_Parham on Sun, 22 Apr 2001 22:02:26 GMT
View Forum Message <> Reply to Message

I think usually the term "audiophile" is used sort of like "connoisseur." But sometimes "audiophile" is more like "alchemist."