Subject: directivity
Posted by rcw on Wed, 01 Jun 2005 05:25:35 GMT
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I have Aes journal papers by Floyd Toole from 1986.In the May 1986 paper he reports that people prefered wider dispersion speakers for both mono and stereo reproduction, and speculates that this is due to the wider dispersion speakers exciting the reverbrant field in such a way as to give a more "spacious" feeling, coments from test participents confirmed this. There is a lot to be said for narrower preferably constant directivityfor multi channel surround systems as the "spacious" quality is supposed to come from the surround speakers, the front L and R speakers can then be designed to optimise image.I have built some speakers with close to constant directivity from 300Hz. upwards, and the image is very stable and lifelike, the major drawback is that they are big.

Subject: Re: directivity
Posted by Wayne Parham on Wed, 01 Jun 2005 15:41:57 GMT
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I have noticed the same thing. When there are few sound sources, some prefer creating their own ambience using reflections. When you have more sound sources, you can do a better job of recreating the ambience of the recording environment, using front side and rear channels.
Making speakers "disappear"

Subject: Re: directivity
Posted by Earl Geddes on Tue, 07 Jun 2005 12:41:32 GMT
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Could you give the reference to this papar. I recall the conclusion being different.At any rate, Floyd and JBL are moving towards a narrower directivity, which seems to contradict the conclusions that you state.And, the situation is more complex. The reverberant field depends on two factors, directivity or power response, which excites this field and the rooms reverberation time - absorbtion (I hate the concept of RT for small rooms, and its not too popular for big rooms either). I agree that people prefer a spatious sound, which can only come from a strong reverberant field, but that can be done with a directive speaker in a lively room just as well as a low directvity speaker in a deader room. The directive speaker however will have a far cleaner direct sound - early impulse response - and hence far better imaging, than the wider directivity speaker.You see, putting speakers in the same room and comparing them depends a lot on the room. In a dead room people probably will prfere a wider directivity, while in a lively room they will prefer the narrower directvity. But I would suspect that a comparison between the better dead room combination and the better live room combination would result in a strong prferernce for the more lively room with the narrower directivity.No tests of this nature have been done in a scientific

manner, but my personal experience strongly supports this belief. And people (clients) always seem to like my rooms.Finally, as I show in my white paper (see www.gedlee.com) constant directvity cannot be achieved in a small cabinet. Big is required for this to happen and I think that the current trend towards smaller systems is why even though the drivers are much better than ever, the sound is not any better and in many cases worse than the old days when "bigger is better" ruled.Did you measure the polar response of your system to insure that it is CD?

Subject: Your opinion on the LEDE concept, then, Dr. Geddes?
Posted by Todd W. White on Thu, 09 Jun 2005 22:42:47 GMT
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Overall, Dr. Geddes, I think we agree on a lot of things.After readin your comments, I'd be interested in your views on the LEDE idea...

Subject: Re: directivity
Posted by rcw on Mon, 08 Aug 2005 01:02:00 GMT
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I have not looked at this forum in a while so didn't see Earl Geddes reply to my post.Yes I have measured the directivity and in the horizonatal plane it is constant from around 350Hz. in the vertical from around 1200Hz.The idea behing this is that lateral early reflections are all right since they are processed bi laterally by the ears, but vertical reflections that arrive at the ears vitually simultaniously are difficult to differentiate, this is I am told the basis of the THX 40 degree vertical directivity spec, you seem to have a different opinion.The work I mentioned is from when Toole was an academic researcher, and is the result of double blind tests that he conducted, apparently in listening to loudspeaker systems with the same overall qualities in terms of linearity and distortion, people prefferd wider dispersion types, to a significant extent.

Subject: Re: directivity
Posted by Earl Geddes on Mon, 08 Aug 2005 14:15:52 GMT
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Thanks for the post - better late than never.First, CD from 350 Hz up at any reasonably narrow coverage is pretty much impossible. If you are talking about say 180 degree coverage, then I could believe it, as its pretty easy to get very wide CD coverage. The trick is CD coverage at about 90 degress or less, which is what is required to avoid early lateral reflections. This could almost never be done down to 350 Hz in a small room due to the source size. If you have data to show otherwise, I'd love to see it.I strongly disagree that "lateral early reflections are all right since

they are processed bi laterally by the ears". First, if the lateral reflection arrives at the same ear as the direct sound, then no amount of auditory processing can affect it since the two waves are mixed before they even enter the ear canal. A lateral reflection to the opposite ear from the direct sound is less offensive because of processing as you say. But, the opposite ear situation is the lsees common in most situations. Vertical reflections cannot influence image since imaging is stricly a horizontal process. So the situation is this; vertical reflections mostly affect coloration and horizonal reflections mostly affect imaging, although they do also affect coloration. This is why I am of the opinion that horizontal reflections are the more damaging.THX would presumably spec a lower directivity in the vertical plane because virtually all small rooms have a lower ceiling to floor distance than sidewalls.In all my designs I correct for both, but it is my experinence that the lateral early reflections are the most critical.About the Toole work. First, I don't think that his paper did show a preference for wider dispersion types. Would you please quote the article if you think that this is so - I have read and poses them all. Second, Floyd's work at the NRC never involved music, only noise and impulses. So determining a preference for directivity on music would not have been possible.

Subject: Re: directivity
Posted by rcw on Wed, 10 Aug 2005 23:51:06 GMT
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The directivity I refered to is that of a 500mm. wide rectangular horn with a flared mouth, driven by a 5 inch cone driver, measured with a fourth order crossover connected, the measurement set up is admitedly crude.The paper by Toole can be found in the AES Journal Vol. 34, No. 5 of May 1986.On page 342, under the heading, "Strereo mono series II", Toole states"in the overall assesment of spatial quality the greatest differences were apparent in the monophonic tests, this problem was not so obvious in stereo listening",(the "problem", refering to the narrow directivity of speaker"BB"), after which he goes on to describe peoples comments."BB" a narrow directivity speaker, was said to be, "like being there but looking on," and for AA and E, "you are there", this is all when listening to jazz and choral works, the differenece being that both AA & E have wide frontal hemisphere directivity.On page 343 he goes on to comment upon work by Kuhl and Plantz about how people such as recording engineers prefer directional loudspeakers for work, but tend toward less directional ones in their home.The design criteria from which I took the directivity characteristics of my louspeaker system from come from Kates in the paper,"A perceptual criterion for loudspeaker evaluation", AES Journal Vol.32, No.12, 1984. On page 940 in the section "Floor reflection", he states as you do that a reflection coming from the same direction as the direct sound will have no binuaral echo suppresion, and shows that at typical listening distances will fall in the critical band and, "Thus we would expect floor reflection to be an important cause of colouration".Your loudspeaker system I note has 90 degree vertical directivity, in which case early vertical reflections will be a definite feature.

Subject: Re: directivity
Posted by Earl Geddes on Thu, 11 Aug 2005 19:43:07 GMT

I have posted a reply to this twice now and so far nothing has made it to the web. So this one will be brief.Thanks for actually supplying supporting data for your position. This is Soooo refreshing to see in a world dominated by hype and voodoo! Science and audio seem to be unrelated on these sites sometimes.For a 500 mm rectangle the lowest frequency for which the directvity could be 90° is 620 Hz. It will narrow above that. IMHO, to have CD from 350 Hz up with this source is not possible. At ;east not within the laws of physics as I know them.I have often heard CD claimed and have sometimes tested this claim. Never has it actually been shown to be true. I posted my measurements to prove my claim, as it is the first, and only, time that I have actually measured a true CD system (at least above 800 Hz). It is one thing to make the claim of CD because it "should be" or "I think it is" and quite another to actually achieve it. That is why I am always skeptical of this claim until it has been shown with actual measurements.The Toole references do not "prove" your point. They describe circumstantial evidence, but do not show a cause and effect relationship. Neither does the audio engineer reference. Perhaps the engineers can't afford high directivity speakers at home, and maybe there was something else in the speakers in Floyd's test that the listeners objected to. Who knows. Yes my speakers are 90°, and yes it would be nice to have a narrower vertical coverage. But then the coverage would not match between the woofer and the waveguide and the resulting system would not be CD and would not have a smooth pwer response. I choose CD. I recommend and use floor absorbtion and ceiling dispersion to alleviate the vertical reflections in short height rooms. My room has a clean 10 ms of direct sound before there are significant reflections. This has also been measured and is posted on my site.Thanks for the discussion.

Subject: Re: directivity
Posted by rcw on Fri, 12 Aug 2005 02:54:34 GMT

I did not intend to "prove" anything by the references I quoted, merely pointing out that such testing had been done by a reputable academic researcher in a manner that is scientifically correct, and those being the findings.On the subject of directivity I would draw your attention to the paper by Johansen in the December 1994 AES Journal in which he shows that by placing two extra the conical sections at the mouth of a conical horn, you can in fact reduce the frequency at which waisting starts to occur by an amount that can be approximated by the simple average of the individual break frequecies of each section taken seperately, and you can then replace these two conical sections with a continuous curve.All I can tell you is that when fed from a suitable 1st. order high pass filter, measurements on axis and at 15, 30, and 45 degrees off axis show a curve that is identicle within plus and minus 3db. over the range 300-3000 Hz., and as far as I know that is the definition of constant directivity.

Subject: Re: directivity

Posted by Earl Geddes on Fri, 12 Aug 2005 13:20:10 GMT
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You offered up Toole as supporting evidence for your claim. You are quibling with semantics. Yes the Toole article was "a reputable academic researcher in a manner that is scientifically correct" but they did not claim what you claimed. That was my point.I would dearly love to see these measurements since your claim does test my credibility. But testing at 15° increments only up to 45° is only a very approximate test. To me the data should be at least 7.5° increments and cover the range +- 90°. If these measurements are as you claim then this would truely be a breakthrough as I have never, in more than 30 years, seen such good performance from a midrange horn.

Subject: Re: directivity
Posted by rcw on Fri, 12 Aug 2005 23:44:05 GMT
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The point is that the three loudspeaker systems in question were all rated in the highest catagory in other performance aspects, and as Toole pointed out the systems in that catagory are very close in aspects such as on axis frequency responce, the question then being why should they produce that result on music tests?.Toole concluded that it must be directivity since this is the single feature that stands out as different between the systems in question, the more narrow pattern excited the reverbrant field less and produced the subjective effect of "looking on" rather than being completely there.I looked at that data again and it was when I was trying to get speaker workshop to work properly, and the gating perhaps gives results that are inacurate at the low end, when I get around to it I will repeat all tests and report.rcw

Subject: Re: directivity
Posted by Earl Geddes on Sat, 13 Aug 2005 01:09:18 GMT
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I did not read the Toole paper as carefully as you seem to, but I would have to say that there is not enough data to make the conclusions that you say Floyd made. In fact, my experince, and some unpublished data, imply the opposite. But either way your original comments implied that Toole claimed a "preference" for wider directivity, but now it seems that it is only a difference in subjective effect. Perhaps I should reread the paper in more detail.I do appreciate the reference to the horn mouth paper. This is much like what I use in my text. I found some slightly different results and Johansen admits that it is known that the wavefronts do not adhere to the walls in many horns, but his analysis assumes that they do. This is a weak point in the paper.In my text I do not assume this adhernce since I do the calculations using higher order modes which accounts for this effect. I would thus claim a slightly higher accuracy to my analysis than Johansens.But I really am indebted to you for a coincidence that happened after I reviewed the Johansen paper.

The next article in that journal is about using woven cloth as a HT screen, which I had also recently concluded to be supperior to a commercial screen for all the same reasons as in the paper. My new screen cost me $10 (bed sheet) and replaced an inferior $1200 perforated vynal screen! Can you beat that!

Subject: Re: directivity
Posted by rcw on Sat, 13 Aug 2005 23:13:36 GMT
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It is always nice to find low cost options isn't it.Seeing that the waveshape at the throat is not ideal I do expect that the dispersion in the horn is more than is really desirable, but I went on the principle that at the low end mostly the priciple longitudonal mode will be evident and that since the horn is short it the wave front would still have a considerable lateral componet due to throat scattering, something like it seems to work for Genelec

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Subject: Re: directivity
Posted by Earl Geddes on Sun, 14 Aug 2005 01:13:59 GMT
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It is true that at the low end most of the wave propagated down a waveguide will be the pure longitudinal wave because all of the other modes are below cutoff. The higher order modes are dissipated away from the throat depending on distance. These modes are known as evinescent waves and decay exponentially with distance. In a short waveguide these modes have not decayed sufficiently at the mouth so as to be ignored. I have long been aware of this issue, but have never had a chance to study it in any detail. I suspect that this is a reason why short waveguides don't behave as anticipated. If the waveguide is folded or bent at all, then the higher order modes are created again at each bend and we get the problem starting a new.The thing about the screen that gets my attention is how much unnecessary hype there is now in Home Theater. Its the new "Monster Cable". Buy a multi thousand dollar screen if you want, I'll buy a bed sheet and a lot of DVD's instead.Nice talking with you.
