Subject: Favorite flavors
Posted by Wayne Parham on Fri, 21 Jan 2005 19:54:32 GMT
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I'm looking to get some opinions on favorites, specifically horn shapes and dispersion patterns. Or, for that matter, if your favorite configuration isn't a horn, I'd like to hear those opinions too. But more importantly, I'm looking for your reasons why you like that particular horn, shape or speaker configuration.My favorites are horns with fairly wide dispersion. I don't particularly care for horn setups (or any kind of speaker, for that matter) that requires the listener to be in a very small "sweet spot." When I listen to a system, I rarely sit exactly on-axis, and sometimes the owner will instruct me to move into the preferred spot. But I am actually sitting there because I judge a system by off-axis performance as much as any other attribute.To me, part of the goal is to make the system sound as good 10°, 20° and even 30° off-axis as it does on-axis. I am looking for a speaker that charges the reverberent field uniformly because it sounds far more natural than one that doesn't, in my opinion. If you have to sit in a half-meter wide sweet spot for the system to sound good, I'm not particularly impressed.I know that some, if not most, audiophiles expect the listener to be seated in that one "perfect spot." Why would someone settle for only having good imaging and proper tonal balance in a "sweet spot" when they can have that same kind of performance over a wider range? I expect this kind of thing from planars and soft domes, but from horns? I see it as a throw back to technologies of 50 years ago. A good horn system has directionality that controls the pattern and fills the room without excessive wall and floor reflections. Horns offer a possibility of creating a good field of sound instead of a good line of sound.So that's the flavor that gets my vote. I like horns, and I like them designed to cover the room. In addition to tonal balance and low distortion, a uniformly charged reverberent field is very important to me.

Subject: Chocolate
Posted by hurdy_gurdyman on Fri, 21 Jan 2005 22:31:00 GMT
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Subject: Re: Chocolate
Posted by Wayne Parham on Fri, 21 Jan 2005 22:57:09 GMT
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Subject: Re: Favorite flavors
Posted by Manualblock on Sat, 22 Jan 2005 02:19:09 GMT
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My single favorite aspect of Horn loaded designs; the singers are properly placed in the mix. I find with direct radiators they emphasize the vocals and soloists in an unnatural forward thrust that gets annoying. The Pi 4's arrange music in a much more realistic manner. I can't say exactly what the dispersion pattern is but one thing I notice is they even sound natural listening from another room.Can't say how many times people comment on that very fact.Some albums that sounded as if the singer was twenty feet into the room now attain their rightfull position on the stage.Another thing; pet peeve, is what the attraction is with single drivers. I don't get it. everything sounds like it is on one plane and the same hieght or position. My 2c.

Subject: Re: So true about single drivers, but....
Posted by BillEpstein on Sat, 22 Jan 2005 11:20:34 GMT
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.....one of the 2 things I like about them. So that's a flavor thing, too. I refer to the: "everything sounds like it is on one plane and the same hieght or position. My 2c."I liked the way the musical image floated between, away and around the FE104 speakers. Here's another FLAVOR: of those who have horns, how many, like me find the soundstage airier, deeper and more "realistic" with LP's rather than CD's? Not a subtle but a gross difference?Back on point, my own favorite horn flavor is the amazing clarity that results from low distortion and freedom from cabinet colorations. That, combined with the ability to faithfully portray dynamics makes horns sound so "Effortless".

Subject: Re: So true about single drivers, but....
Posted by Manualblock on Sat, 22 Jan 2005 13:29:30 GMT
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Tend to find everything airier and deeper and more realistic with LP's on every speaker type. True; much more dynamics and while it's hard to tell distortion products in a relatively small room, they do sound cleaner and more musical at low volume than many of the direct driver speakers have.

Subject: Id really love to try all at the same time!
Posted by Mike.e on Sat, 22 Jan 2005 14:01:14 GMT
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And just see what sounds best,and compare that to my knowledge of systems and how they are in theoretical terms and measurements!Until I build them myself however I wont be able to- my city/country has so little audio nuts like myself!-Perhaps when im finished studying and earning il be finally able to sort this out!CheersMike.e

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Subject: Re: amazing clarity...
Posted by wunhuanglo on Sat, 22 Jan 2005 19:59:35 GMT
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That's why I'm an open baffle convert.But I haven't heard a speaker that will do justice to everything. For instance, I like Khorns best for large orchestral music, but for “small” music they don’t seem very realistic. Since I listen to a lot of jazz combo, I like open baffles these days. Horn-over-reflex speakers (e.g. Pi speakers) seem to be the only thing for rock-n’-roll.If I were Bill Gates I’d have the same size house, but many different spaces with many different set-ups.

Subject: more realistic with LPs
Posted by wunhuanglo on Sat, 22 Jan 2005 20:05:05 GMT
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I have a commercial CD that was transcribed from a commercial issue LP. They say in the liner notes that there are no tapes available, so they got the best condition LP they could find and recorded the CD from that.The funny thing is that the CD sounds so LP - you'd swear you're listening to an LP.I have no idea what that effect is, but it made it clear to me that CD and LP can certainly sound the same if that's your objective.

Subject: Re: more realistic with LPs
Posted by Manualblock on Sat, 22 Jan 2005 20:27:25 GMT
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Yeah; the Mosaic Jazz series has that effect. Really don't know how or why but even trying comparisons between the same LP and CD they sound very close.

Subject: Re: Favorite flavors
Posted by Earl Geddes on Sat, 22 Jan 2005 23:17:03 GMT

As much as I would love to comment extensively here, I am not sure that I will. Reading the other posts I note some things that I am never comfortable with - subjective terminology. I am never comfortable with terms like "warmth" and "clarity" because they have no accepted definition (they are not in Webster as subjective audio terms). How do I know what others mean by this term and that my meaning is the same as theirs. If they are not the same, how can we use them in a discussion? One thing that I would question is how can a good speaker NOT be good for all types of music. If "reproduction" is the goal then a speaker that reproduces well must do so on all signals no matter where they come from. My experience is that a good set of speakers sounds good for any sources. I admit that some problems with speakers are more evident with some program material than others, but the simple fact that a speaker does in fact sound better or worse with different source material is a clear indication that it has problems.I would ask Wayne what he means by "fairly wide" coverage (please can we not use the incorrect term "dispersion"). To me 90° is the maximum width that can be handled - in a small room - because wider than that will yield too many near field refections. I can actually live with 60 x 40 in a small room, its just that no mid frequency source can do this (not a reasoanble one that is) so this pattern cannot be combined with any LF source without coverage problems at the crossover.I think Wayne is quite correct in his comments about "sweet spot" as being an obsolete concept. It is easy to see why it is prefered for most speakers by just looking at their off axis response - its abominable. So few people look at or even care about off axis response - they simply measure and sit on axis. To me coverage patterns are all important, mainly because everything else is so easy to do. But just try and get a constant coverage in all directions above 500 Hz. thru to 10 kHz. THAT is not easy. And when you don't HAVE TO sit on axis you can do things with speaker placement that dramatically improves the small room near field reflection problem.I have been doing some studies of the subjective perception of minimum phase versus non-minimum phase resonances. I would prefer not to give out the results before they happen (due about June), but let me tell you there is a profound difference in the two. A non-minimum phase resonance occurs when the sound path to the listener is longer than the direct one, so it is delayed in time and hence non-minimum phase. Things like cabinet and waveguide edge diffraction and HOM (Higher Order Modes) in waveguides fall into this category. Minimum phase resonances are those like cone break-up, cabinet resonances etc. Historically these two things are considered the same by just looking at the frequency response, independent of the minimum non-minimum phase characteristics.This study came about as an attempt to define why a new design that I did sounded so good. It was better than expected and so I am trying to explain why. It has led me to whole other thinking about whats subjectively important in loudspeakers. We know now that nonlinar distortion is not - so what is?At any rate I would love to define how I did the design and what my design criteria is, but that would lead us too far into a commercial area. I initially just did this design for myself - for my own system. But, as I said, it sounded so good that I had to think about thecommercial aspects. That stops me from giving a detailed description.

Subject: Re: Favorite flavors
Posted by Wayne Parham on Sat, 22 Jan 2005 23:58:34 GMT

Hi Earl,I like using 90° flares in cornerhorns because the angle of the horn flare matches that of the walls. That's really an ideal solution because the low frequencies are directed by the walls and those higher up by their horns. Everything is matched and the reverberent field is charged uniformly.Of course, not everyone can use this placement, and when the speaker is placed out away from the walls, then there are reflections to deal with. If the coverage angle includes an incident wall, then early reflections might make narrow coverage a tempting solution. Some pull speakers away from walls, to reduce early reflections. But either way, I still don't like a narrow coverage pattern. Reflections are controlled, provided the horn isn't pointed at a wall or very nearly. But the listening area just becomes too small. The reverberent field is usually non-uniform too, since the highly directional nature of a narrow HF horn is very different than the non-directional LF energies produced by the speaker.By the way, why do you not like the term "dispersion"? I like staying away from subjective terms as much as you do, because they're just too ambiguous. But I don't see anything unclear about "dispersion", unless you want to be more specific as to what the cause is for the pattern. I did not, since I was looking for an open-ended discussion on high-efficiency speakers in general. Some might like slot devices, some might like constant-dispersion horns. Others will like round horns and some won't like horns at all.Wayne

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Subject: Re: Favorite flavors
Posted by Earl Geddes on Sun, 23 Jan 2005 03:09:14 GMT
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WayneThese two comments are not true."But the listening area just becomes too small. The reverberent field is usually non-uniform too, since the highly directional nature of a narrow HF horn is very different than the non-directional LF energies produced by the speaker"Even with a 60° coverage the listening area ten feet back is about ten feet wide. And the reverberant field is NEVER uniform all the way down in frequency - thats impossible. But its also not what one wants. I want the power response to rise at lower frequencies in my rooms because I design them to have a lot of low frequency absorption. The increased power response at LF is exactly compensated for by the increased absorption. Further, the ear is not sensitive to early reflections at frequencies below about 500 Hz due to the way it processes LF signals. So one does not need high directionality all the way down in frequency. But it is critical that the coverage change be smooth and that is very doable with careful design.The word dispersion, if looked up in a physics text, means a wave speed that changes with frequency. SO using it for polar pattern description is coloqial and misused. Hence I don't use it. This is particularly true since the HOM are truely dispersive - in the physics sense, variable wave speed - and hence the use of the term for polar pattern would truely get confusing. The use came about as a loose description for the way a speaker "disperses" the sound, which, as I say, is not a very scientific description.To me CD always meant "Constant Directivity" which I much prefer.I hate to be picky, but correct word usage in science is very important.

Subject: Re: Favorite flavors

Posted by Wayne Parham on Sun, 23 Jan 2005 05:20:49 GMT
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Sorry Earl, but I just don't agree. I like a lot of your ideas, but on this point, maybe we don't agree.Non-uniformity of off-axis response is not generally considered to be a plus. Some live with this defect, but I don't think anyone considers it to be a good thing. The whole point of CD horns is to develop a pattern that is constant with frequency.I do think that gradually narrowing directivity is preferable to having abrupt changes, but I think that uniform directivity is better still.

Subject: Re: Favorite flavors
Posted by Manualblock on Sun, 23 Jan 2005 12:49:52 GMT
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This may not be directly on topic but first I would like to thank both of you guys for this interesting debate. I have always found it easier to learn when there is a discussion involved than when one person explains a situation. The points left out in any explanation; or the personal bias's exposed by debate are more illuminating than a tutorial that focuses on one favored aspect of a subject.Would it be possible to have an elaboration on the actual effects of reverberant field in small rooms. Can uniform directivity be accomplished in the home setting? Dr. Geddes states that under 500 cy. the room reflections do not matter due to insensitivity of low frequency directionality. How does any speaker placement scheme overcome that process? I guess what I am asking is how can one compensate for early reflections by designing for a wide dispersion pattern? Forgive me if these questions are sophomoric. But what are the defining factors that dictate what will happen to the sound of speakers designed for maximum dispersion; if I use that word correctly, in a small room of average dimensions.I only ask because I have understood that there can be no possibility of uniform dispersion of sound with reflecting surfaces impacting the audible frequency response before the sound reaches the ear. That was always why speakers are diesigned for a narrow sweet spot, to ameliorate that problem. Obviously my understanding is incorrect. Thanks Both of you; J.R.

Subject: Re: Favorite flavors
Posted by Earl Geddes on Sun, 23 Jan 2005 18:00:59 GMT
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WayneYou must have totally misunderstood my comments and obviuosly have not seen the plots on my web site. I don't know how you got what you claim I said from my post. I reread it and I never said anything about "Non-uniformity of off-axis response" being a "good thing". I said the exact opposite! "I think that uniform directivity is better still" - SO DO I! But to do this across the entire spectrum is simply impossible. I think that you call a corner a CD horn down to very low frequencies, but to that I do not agree. Since you cannot get the source at the corners apex, there will be some frequency at which this concept fails. And anyways, the entire concept of directivity

at low frequencies in a small room is ambiguous. Further a HF CD source placed in a corner is not in the proper plane (ear level) nor pointing in the correct direction (it points upward - or downward). So while this concept seems attrctive - in is not feasible.What I said was that the ideal for a small room - where a huge system is also not feasible - is to have the directivity narrow down (since at LF a monopole source has a very wide directivity) to the designed coverage angle starting at about 500 Hz. It should be at the design angle at about 800 - 1 kHz and remain constant from that point up. In a small room it would be virtually impossible to get any substantial directivity below 500 Hz. Using a dipole helps, but they have their own set of problems.I simply do not understand how you got the idea that I was promoting a varioable coverage angle with frequency.

Subject: Re: Favorite flavors
Posted by Wayne Parham on Sun, 23 Jan 2005 19:12:55 GMT
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I like systems that match directivity at the crossover point as you've described. It's an elegant way to address the problem. But an even better solution, in my opinion, is to use the corner as a large CD horn. You're right that there is a transition frequency where the sound source becomes too far away from the apex of the corner for it to act as a horn. But you crossover to another horn by that point, and pattern control is determined by its flare. There is no reason to use a tweeter horn loaded from the corner's apex since the tweeter's flare sets its directivity at high frequencies.

Subject: Re: Favorite flavors
Posted by Earl Geddes on Sun, 23 Jan 2005 19:44:21 GMT
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WayneWe will have to disagree on this one. I do not see the corner as a prefered solution because I don't believe that it will work as well as you claim. Do you have any measurements to support you belief?At what frequency do you cross over from LF to HF and how far away are these two sources? Obviuosly you would need more than a 2-way system to do this. Are the design details on you web site?You claim that you can get a constant directivity across the spectrum with this approach? Even at the crossover points?

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 narower. 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 sayng 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.

Subject: Re: Favorite flavors

Posted by Wayne Parham on Sun, 23 Jan 2005 20:09:50 GMT
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I'm not sure I understand your reluctance to see the features of the expansion of a room's corner.

radiation is equivalent to 9 DI, as expressed by Molloy's equation:DI = 10 log [180° / arcsin (sin

sound source is placed at the apex of a corner, then sound radiation is confined to eighth-space.

radiation pattern is fixed and defined by the wall angles. Because of this directionality, there is 9dB DI increase over omnidirectional radiation.Beyond that, I don't mean to be rude, but your

cornerhorn is 250Hz and the midrange is a straight-sided horn. Crossover to the tweeter is at 1.6kHz. As you can see, the wavelengths at the crossover points make it pretty easy to position adjacent radiators within a 1/4 wavelength of each other.Regarding directivity matching, the hardest range to control is the bass, which is bound by the room's walls. The midrange is placed close enough to the corner that the lowest edge of its range is aided by the walls, so where its directivity control begins to fail, the room walls begin to act as flare extensions. At higher frequencies, the horn flare alone sets its directivity. By using this approach, directivity throughout the audio spectrum is maintained within the range of 9 to 11
Measurements

Subject: Re: Favorite flavors
Posted by Manualblock on Sun, 23 Jan 2005 20:18:53 GMT
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Excellent explanation. Now I understand the benefit of off-axis. The concept of reflected energy constituting a similar frequency response to the on axis response nails it for me. Now how to explain the effect of nulls and standing waves and how those artifacts impact on off-axis and reflected sound. Thanks Wayne; good stuff. The best part of debate is someone will ask or discuss the questions I don't know enough to ask.

Subject: Re: Favorite flavors
Posted by Wayne Parham on Sun, 23 Jan 2005 20:37:56 GMT
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Standing waves, interference and the nulls they cause are a related but different issue. Here are some good papers that describe them:Sound System Design Reference Manual, George AugspurgerLoudspeakers and Rooms for Multichannel Audio Reproduction, Part 1, Floyd TooleLoudspeakers and Rooms for Multichannel Audio Reproduction, Part 2, Floyd TooleLoudspeakers and Rooms for Multichannel Audio Reproduction, Part 3, Floyd Toole

Subject: Re: amazing clarity...
Posted by Bill Martinelli on Mon, 24 Jan 2005 00:51:10 GMT
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yeah, I'd have the same house house Bill Gates has If I were him as well. Oh, and put my bid in for the Astro Dome for my garage. I want to be able to open up the roof on sunny days while I pick out what I'll be driving for the day.

Subject: Re: Favorite flavors
Posted by Earl Geddes on Mon, 24 Jan 2005 02:29:27 GMT
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WayneYou are falling into the common trap of assuming that waves follow the walls of a horn simply because you want them to. They don't. For instance at frequencies where the wavelength is comparable to the horn mouth the directivity is substantially smaller than the wall angles. It is only when the mouth is much larger than a wavelength that the device even begins to get CD. Thus for your mid horn to be CD it would have to be gigantic - about 8 ft. across at 250 Hz. Then this places the HF horn many wavelengths away - unless they are coaxial, which has a whole other set of problems - and there will be a great deal of polar lobing at 1.6 kHz - not CD. SO from where I sit this design is anything but CD.Unless you have data to support your contentions I will have to stick with my opinion that your hypothesis is unlikely.Mine claims, on the other hand, have substantial supporting measurements which I freely show on my web site.Sorry to disagree with you like this, but we don't see this issue eye to eye.

Subject: Re: Favorite flavors
Posted by Wayne Parham on Mon, 24 Jan 2005 02:58:27 GMT
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OK, Earl. Perhaps we don't see eye to eye. Or maybe there's more to it than that.There are

radiation defined by a room corner. It is a radiating pattern definition, not a hypothesis or a speculation about an acoustic device. I really think it's needlessly combative to even bring this matter into question.It is easy to hear the difference in output from corner loading. It's immediately noticeable. The DI formula illustrates the fact that there is increased power due to directionality. That wouldn't be the case if the corner weren't providing directionality. As you know, the equation was written by C.T. Molloy to quantify the directivity index.I imagine the data on your website is probably specific to your speakers, and from your position here, I don't think it has anything to do with using room corners. I guess that means your arguments must be based on intellectual skepticism. Maybe it's best to limit your comments to a description of your thoughts and ideas. Or maybe you can substantiate your remarks with measurements that are relevant to this

discussion. Don't hesitate to use formulas and include technical details. I'll do the same for you. Let me ask you:Do you believe that a horn's behavior is modified by the radiating space it is used in? Specifically, do you think a baffle mounted horn or one used in quarter-space or eighth-space can be made smaller than one used in freespace?Do you agree that a room corner produces 9dB DI over omnidirectional radiation?Since those things are accepted by most everyone in the industry, what measurements or other data might you have that suggest otherwise?

Subject: Re: Favorite flavors
Posted by Earl Geddes on Mon, 24 Jan 2005 04:04:53 GMT
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Since you won't accept my measurements why would you accept my arguments. I think that I'll bow out at this point.

Subject: Re: Favorite flavors
Posted by Wayne Parham on Mon, 24 Jan 2005 04:23:41 GMT
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You're a smart guy Earl, and I think that if you have a valid argument you can probably discuss it intelligently.So I ask you again, what do you attribute the 9dB DI power increase from

then maybe you'll consider taking advantage of that, combined with high frequency horns having

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Subject: Re: Favorite flavors
Posted by Rainer on Mon, 24 Jan 2005 10:13:49 GMT
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"I want the power response to rise at lower frequencies in my rooms because I design them to have a lot of low frequency absorption. The increased power response at LF is exactly compensated for by the increased absorption."What about typical rooms that don't have your special absorption? Won't room gain add to abnormally boost the bass? How does that jive with "the increased power response at LF" of your speakers?

Subject: Re: Favorite flavors

Posted by Manualblock on Mon, 24 Jan 2005 13:08:22 GMT
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Wayne; you scared him away. What is with you engineers; should be more like Lawyers. This was such a good debate too. What happens at NASA; do they walk out when they disagree? Leave the astronauts floating?

Subject: Re: Favorite flavors
Posted by Earl Geddes on Mon, 24 Jan 2005 15:14:20 GMT
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In the kind of room that you describe the bass from my speakers and any other speaker, will not sound very good. It will be boomy and resonant. I think that we are talking ideals here, not "How does one design speakers for bad rooms".And I continue to contend that it is inappropriate to talk about directivity or power response or any concept that requires thatthe space be acoustically difuse at LF (i.e. below about 200 Hz.) We ahve talked about this problem and the solution is lots of damping and several woofers. Directivity is not relavent.

Subject: Re: Favorite flavors
Posted by Earl Geddes on Mon, 24 Jan 2005 15:34:10 GMT
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The issue is not scared away. The issue is that one must accept the work of the other as valid or there can not be a level discussion. My only complaint is Wayne's cursory ellimination of my experimental evidence as invalid. The implication here is that I am incapable of making good measurements. I have been doin it for nearly thirty years and am perfectly capable of doing it well. There are things that I agree with in Wayne's argument, like corner gain at LF. What I manily disagree with is that he attributes this to directivity. Directivity really only has meaning in free space. Now a room acts like "free space" above a certain frequency know as the Schroeder Frequency. Below that it is modal and not at all like free space. So in the kind of rooms that we are talking about below about 200 Hz directivity should not be used in the discussion. This means that the corner gain is real, but I object to calling it directivity.Now above 200 Hz the corner will not really act like a horn because it is too wide and not symmetric and the driver cannot be placed at the apex. So to talk about the corner as acting like a horn above 200 Hz is also incorrect IMO.I think that there are points to what Wayne is saying, but I object to his supporting arguments as invalid. He objects to my arguments because I support them with my own data.Thats the jist of it as I see it.Where Wayne and I would agree is that above 200 Hz the directivity should be at or below 90°, remain as constant as possible and that the sources should point inward to avoid wall refectiions. Thats a lot of common ground.Where we disgaree is that the walls become part of the horn. This can be true only if the driver is placed in the apex of the wall corners, i.e. actuall outside of the room. Placing a horn in a corner where the driver is outside of the corner - even by

a small amount, and you simply have a horn placed in a corner. The corner does not affect the function of the horn except as the sound waves reflect off of the side walls. This is best pictured as placing four horns in a circle because this is what the walls will do. If the directivity is below 90° then they don't really influence on another. If the directivity is greater than 90° then they do influence one another, but because the acoustic centers are not coincident they will have lobing errors. Hence they will not be CD.So if the devices are less than 90° Wayne and I agree and do basically the same thing - but the walls don't enter into the picture. If the directivity is above 90° then I claim that the corner placement causes polar lobes from the wall refections interference and is not CD. I don't recommend this.

Subject: Re: Favorite flavors
Posted by Manualblock on Mon, 24 Jan 2005 15:59:21 GMT
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Thank you ; If my post seemed harsh; please excuse it. These types of debates are very meaningfull for us lay persons; please accept that we appreciate them. J.R.I have learned much just from this short thread.

Subject: Re: Favorite flavors
Posted by Earl Geddes on Mon, 24 Jan 2005 17:38:04 GMT
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Waynes response is fine but I have some things to add.Reflections - good or bad? - depends on a lot of factors.First is the time of arrival of a reflection. This is because of the integration time of the ear. Refelections less than 10 ms are integrated with the direct sound (first arrivalk) to form a single impression in the brain. For lateral reflections, these delayed signals cause everthing from coloration to a muddyness in the sound and a loss of image focus or transperency. All these things are basically subjective terms for the same thing. Since our ears are lateral they react to lateral reflections differently than vertical ones. Vertical reflection can only cause coloration, not image shifts since they arrive at both ears at the same time. But they have strong coloration problems.In the region between 10 and 20 ms. the ear is begining to desensitize to the reflection as a problem. And this too is frequency dependent. The ear is not at all sensitive to image shifts for LF reflections and only marginally sensitive to coloration efects at LF. So refections are primarily a mid to HF issue. We don't localize on LF's. Above 20 ms, reflections are perceived as a seperate auditory events which we subjectively call reverberation. If these reflections are difuse - arrive from many directions - then they create a sensory effect know as spatiousness - a very good thing almost critical in a small room.There is one other consideration, an that is if the early refections arrive at the same ear as the direct sound or the opposite one. In other words a refcetion from the right for the speaker on the right is far worse than a reflection from the left for the speaker on the right.So in a nut shell - we don't want ANY early refections, but we want as many later refections as we can get. If there must be some early refections, i.e. the room is small,

then these should be adjusted to be from the opposite wall not the near wall. This is the crux of the room acoustics problem.The normal small room solution is to put sound damping everywhere. This may help reduce the early reflections, but it simply kills the later reflections and so there is no spatiousness to the room at all. The direct field versus reverberant field situation cannot be cured with room treatmnet alone. SOmething must be done in the loudspeakers themselves to help to control this problem.Now (and this is a part where I may disagree with Wayne, but he may have also mistated his point) the ear perceives both the direct (sometimes called axial, but only if one is actually on axis) and the rverberant field. Wayne stated ("On-axis, this loudspeker may sound just fine.") which I think would be better said as "This speakers will sound best on-axis". But I would contend that there will still be a perceived problem with the sound since the reverberant field is not flat. This speaker would only sound "fine" only in a reflection free environment, but then it would also sound dead - no spatiousness at all. Some contend that we get "spatiousness" from the recording, but this is not true. Why? because the reverberation in the recording is not difuse - it does not arrive at the ear from different directions. This is what multi-channel sound is trying to create - a more diffuse reverberant sound field from a recording. But the CORRECT way to get spatiuosness is with proper room acoustics. A non-flat reverberant field will always color the sound but in a different way than an early reflection. I don't think that Wayne and I disagee, but we might say things differently.Finally, and this is a aspect that is seldom appreciated and that is: the higher the directivity of the source in a small room, the slower will be the build up of the reverberant field. You have to think about this a bit to see why. An omni directional source has a reverberant field that builds almost immediately because it has a flurry of very early reflections off of all nearby walls etc. A narrow directivity source has fewer early reflections and it takes a much longer time for the sound field to build into reverberation. This slower rise time of the reverbeant field is subjectively very important because it allows time for the ear to process the direct field unencumbered by the reverberant field.These are all immensely complex factors when one takes the ear into account, because, quite frankly, the ear is immensly complicated. It is nonlinear in frequency, time and level - it couldn't be any more complicated. In fact it even works differently at LF and HF with a continuous blend in between.Designing good audio requires a design that works best with the ear. These designs are inherently more complicated, but inherently better sounding. On this point both Watne and I agree. We are still having some disputes on the finer points however.

Subject: Re: Favorite flavors
Posted by Wayne Parham on Mon, 24 Jan 2005 19:28:25 GMT
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The issue isn't whether you are capable of conducting good experiments or not; Rather, it is whether they are relevant to your argument or not. I just don't see that you have any data or reasoning to support your position, which is why I said I thought you were being argumentative.Eighth-space radiation is defined as having directivity factor of 8, which corresponds to directivity index of 9dB. To me, it's a no-brainer that the room's walls confine sound within them. One can quantify this by describing the radiating angle. There are other things that occur in an enclosed room also, but we're talking specifically about directivity here. I don't see any reason why you would disagree that a room corner defines its maximum radiating angle, and that bass frequencies are therefore limited by this radiating angle.

Subject: Re: Favorite flavors
Posted by Wayne Parham on Mon, 24 Jan 2005 20:02:30 GMT
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I'm not sure where Earl's coming from. Look at Chapter 3 in the manual below, and see what it says about the directivity and angular coverage. Eighth-space is defined as having 8 times the

observation, one that is easily quantified.
 Sound System Design Reference Manual

Subject: To Earl and Wayne
Posted by Duke on Mon, 24 Jan 2005 20:16:27 GMT
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Earl and Wayne, I have thoroughly enjoyed listening in on your conversations here, and must say that Wayne's post two levels up (http://audioroundtable.com/HighEfficiencySpeakers/messages/1684.html) and Earl's reply above are music to my ears.I've been crying the blasphemy of "the reverberant field matters" and spreading the abomination of "reflections can be our friends" over at Audiogon and the Asylum, and it sure is welcoming to read your posts on the subject here. By the way Earl, a couple of years ago I heard one of Wayne's systems at an audio show in Ohio. As I approached the room, I was immediately struck by how natural the music sounded. I paused just to listen from out there, as this was in stark and welcome contrast to the way almost everything else sounded from out in the hall. Well I walked into the room... and didn't see any speakers! I had to walk across the room and look around yet another corner to see them - a pair of 7 Pi's in the corners. From around two 90 degree bends, they had sounded quite natural and relaxing - which speaks well for their power response. And then in the normal listening area they were not the least bit bright or edgy, which indicated the on-axis response wasn't tipped up to get the power response right. The degree of consistency in the tonal balance from the "sweet spot" to outside the room was amazing. This was among the two or three most enjoyable systems I heard at that show, and the other two were also systems that did a good job with the reverberant field, though probably not as good a job as Wayne's did. Just for the record (not being a regular poster here and not wanting to violate the etiquette), I'm an audio dealer. Duke

Subject: Re: To Earl and Wayne
Posted by Manualblock on Mon, 24 Jan 2005 21:03:58 GMT
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Funny; posting above I expressed the same effect; that the Pi speakers maintain a musicality even outside the listening room. It is something people seem to notice when they enter my home. And they comment on that effect regularly.

Subject: Re: Favorite flavors
Posted by Manualblock on Tue, 25 Jan 2005 01:03:19 GMT
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Understand I personally cannot comment since I am not schooled adequately. But you guys keep this up and I will be. The design manual will have to wait for the pre-amp build. I'm looking at transformer theory. Lot more than just a hunk of steel.Seriously this back and forth in lieu of debate is not only real interesting but it draws a crowd. If you catch my drift.

Subject: Re: Favorite flavors
Posted by Wayne Parham on Tue, 25 Jan 2005 05:58:31 GMT
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On this matter, we agree completely.

Subject: Re: Favorite flavors
Posted by Rainer on Tue, 25 Jan 2005 11:30:08 GMT
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I am not talking about "bad rooms" but untreated ones. You said you designed your rooms "to have a lot of low frequency absorbtion". You went on to say your speakers "increased power response at LF is exactly compensated for by the increased absorption". What I am wondering is whether your speakers will sound boomy in a good room without your increased low frequency absorbtion, say like a recording studio.Say, maybe you could use a switch to reduce low frequency power when not in your specially prepared room? What kind of crossover do you use? What are the crossover points? Very interesting, I must say.

Subject: Re: Favorite flavors
Posted by Earl Geddes on Tue, 25 Jan 2005 13:01:00 GMT
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My speakers like any monopole speakers, have a rising free field power response at LF. Hence they will not be any more boomy than any other speaker in a lively room. My point is that when placed in an optimum room they will have a flat(er) power response - just as any other monopole speaker would have. At low frequencies this is just the way virtually ALL speakers work - except dipoles, they are different, for better or worse.

Subject: Re: Favorite flavors
Posted by Earl Geddes on Tue, 25 Jan 2005 13:03:37 GMT
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Forgot to mentionThe crossovers are third order but not a typical alignment since they both EQ and filter at the same time. The crossover point is selected where the LF driver and the HF driver have the same polar pattern - 90° at about 900 Hz.

Subject: Re: To Earl and Wayne
Posted by pickle on Tue, 25 Jan 2005 17:49:45 GMT
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I happen to discuss this with Wayne in his room and on his site as well, as I noticed it also, and also found it both somewhat rare and having appeal. My Maggies had an appealing nature this way, too, sounding natural and good in other rooms. Live music does this too, of course.

Subject: Re: To Earl and Wayne
Posted by rnhood on Wed, 26 Jan 2005 01:46:17 GMT
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I too value the reverberant field. It is always exciting and brings on great anticipation approaching the listening area when a speaker system with a strong reverberant soundfield is filling the air. Now tell me, how did those Pi-7's image from the sweet spot? Anyway close to the Maggie's by chance? I am not as familiar with these high efficiency horn type speakers but, I am interested in the Pi-7 because I have a near perfect room for these. And, they are affordably priced.

Subject: Re: Favorite flavors
Posted by Rainer on Wed, 26 Jan 2005 10:13:20 GMT
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Thank you

Subject: Re: Favorite flavors

Posted by Adam on Wed, 26 Jan 2005 14:47:41 GMT
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What? Who is speculating here?How does one distinguish directionality from room modes?If the room is small, room modes will dominate. There is no way to get around that I can see. The only way to get a clean measurement is in a very large room or open area with a corner. That is a textbook 1/8th space.Tell how you measured this or if it is just speculation on your part.Adam

Subject: Re: Favorite flavors
Posted by Earl Geddes on Wed, 26 Jan 2005 15:50:23 GMT
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Correct Wayne - you don't understand where I am coming from. Your comments clearly suggest that you did not follow my discussion as you keep saying I said things that I did not. And you continue to do so.

Subject: Re: Favorite flavors
Posted by Earl Geddes on Wed, 26 Jan 2005 16:08:15 GMT
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I am not speculating.Directionality, to me, implies that sound waves are free to propagate in any direction and a sources directionality defines the level of sound waves that propagate in an arbitrary but particular direction.Room modes are quite different in that they can only propagate in a single specific direction. A sound wave that is exciting a mode does not travel freely but is fixed in the direction defined by the mode. To talk about the directionality of sound waves in the modal situation is a misnomer IMO. At a mode ALL sources, monpoles, dipoles, horns, whatever, have the exactly the same directionality. Does it make any sense to talk about directionality of the source in this case?"If the room is small, room modes will dominate." True in ALL rooms at some frequency. The room modes dominate up at and somewhat past the Schroeder Frequency (if you don't know that term look it up). Above that ALL rooms act the same and modes are no longer relavent. This is fundamental room acoustics (See Kutruff "Room Acoustics" or my own texts).I can get a clean measurement in any room, above a frequency defined by the first reflection. The smaller the room the higher the frequency. In fact, some recent studies have shown that it is possible to go much lower in frequency than this traditional limit implies, but that is another topic. But at no time can one use a corner for a "clean" measurement. 1/2 space is sometimes used but this too has its problems. The only really clean measurement is a gated free field one, which can be done, within limits, in any room.Are you trying to learn something here or is this just a challenge? I will attempt to educate, but I will not accept a challenge.

Subject: Re: Favorite flavors
Posted by Adam on Wed, 26 Jan 2005 18:38:09 GMT
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Just as I thought, you have no measurements. You define a challenge then back away. Room modes screw the pooch. Put a reflector in front of any horn and see what happens, ey?

Subject: Re: Favorite flavors
Posted by Wayne Parham on Thu, 27 Jan 2005 01:41:18 GMT
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What I meant is that I don't see why you persist in saying that eighth-space radiation isn't tantamount to directivity, especially when it is defined as having a directivity factor of 8 and a directivity index of 9.I think this discussion went down an unproductive path from early on. No one questoned your assessment of room modes and their significance. I generally agree with your reasoning where that is concerned.What I disagree with you about is the room corner, itself. You make assumptions about the room that I don't make. Where I see our difference is that you attach an arbitrary generalized room to the launch corner when you discuss it, and I consider the launch

boundaries, but you only see an averaged and therefore generalized field of modal vibrations.The room is a variable, so I don't think it is appropriate to lump it in, because that causes you to make generalized statements that aren't necessarily true. The size and shape of the room and the stiffness and absorbency of its boundaries determine how it acts. A very large room acts a lot differently than a small one does, as does one with angled ceilings, peculiar shapes or open areas. So I prefer to see the room modes as a separate matter from the radiating angle of the launch corner.

Subject: Re: Favorite flavors
Posted by Earl Geddes on Thu, 27 Jan 2005 02:36:00 GMT
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First, never once did I disgaree with 1/8 space and 9 dB - WHERE IT IS APPLICABLE.So your rooms DON'T have four walls, a floor and a ceiling? I simply don't see how you can simply exclude these factors just to make your point. Yes, this is where we differ. My rooms are all fully enclosed because thats th only kind of "room" that I know of.But if you do what you are saying outdoors where there are only three intersecting planes then I agree with what you are saying. The corner will add 9 dB to the free field response and it will direct the sound along the walls - so long as the source is within 1/4 wavelength of the corner.But with the other walls present the situation is completely different.

Subject: Re: Favorite flavors
Posted by Wayne Parham on Thu, 27 Jan 2005 02:54:45 GMT
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We have come to an agreement. I agree with your last post completely.
The larger the room, the more its corners act like a pure eighth-space. That's why I would look at room modes and launch boundary separately.At any rate, this has been a lively discussion and I appreciate your input.I had hoped to have a discussion about various speakers and horn flare types, not so much a debate about room corners. We could look at monopoles, dipoles and horns. We could look at simple horns like round megaphones with conical, exponential or tractrix flares. We could look at radial shapes and early CD's like the Manta-Ray. We could also look at more modern CD's like Peavey's Quadratic throat horn and some of the things you're doing too. Maybe we'll have to start a new thread and talk about those things.This discussion tended to get stuck on the energy patterns caused by room modes. So maybe it would be nice to start a thread about room layout. That would be a good topic for the Studio Room forum, since it's really a matter of room acoustics. We could discuss radiator placement and the use of acoustic devices like bass traps. Or maybe better yet, talk about the use of multiple radiators to combat nulls. So one of these times soon, lets start a thread in the Studio Room forum to discuss these kinds of things and offer some concrete solutions instead of minutia.Again, it's been a good talk and I appreciate your comments.

Subject: Re: Favorite flavors
Posted by Rainer on Thu, 27 Jan 2005 10:20:13 GMT
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After seeing Wayne's message below about the quadratic throat horn, I did some searches and found the web page of Charlie Hughes, its designer. Here's what he says:"By changing the crossover filters to a 2nd order Butterworth lowpass at 900 Hz for the woofer and a 3rd order Bessel highpass at 1,300 Hz for the horn, the combined response is decisively better."Is this along the lines of what you're doing?
 Using Crossovers in the Real World

Subject: Re: Favorite flavors
Posted by Earl Geddes on Thu, 27 Jan 2005 13:04:55 GMT
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Well not exactly.I have a computer model of the crossover that I manipulate that uses the actual polar measurements to predict the total field response. I adjust the component values to get the best overall response - the flatest response in the sound field from +30 to -30° across the entire audio band. The resulting filter is highly unlikely to be a "Bessel" or "Butterworth" or any other name brand filter. They are both 3rd order and are definately not tuned to the same frequency.

Subject: Re: Favorite flavors
Posted by Manualblock on Thu, 27 Jan 2005 19:01:48 GMT
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Let's all calm down; you catch more flies with honey than you do with vinegar. Mr. Geddes do not abandon us now, your input is much appreciated.

Subject: converging horn arrays
Posted by kloss on Sat, 05 Feb 2005 14:01:03 GMT
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Little late but .I wanted a horn system that can do both sound wondeful off axis or even behind loudspeaker and a detailed sweet spot for audiophool listening .I wanted to be able to hear quality sound even right in front of 1 loudspeaker ,most horns I have owned either sound great threw out the room with little sweet spot image.Or ones than image but you have to sit exactly in the center,When you move image and trebile all go bye bye.I have owned AvantGard, Dukane, Altec, oris, yamamura, pedal horns, getting azuras soon.Arraying and converging horns realy works .Comb filtering is realy not a problem.I love the even sound pressure threw out my home.Even far off axis the image stays centered.And so far I perfer tactrix horns.
http://steinman.mesls.org/stereo/J%20Kalinoski%20Loudspeakers%20101.jpg

Subject: Re: Favorite flavors
Posted by Eric Mainardi on Wed, 23 Feb 2005 19:05:48 GMT
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Hello everybody,Very interesting debate, even if a little bit "harsh" for the average audiophile like me.Being currently involved in the pursuit of perfection with my future horn system, I would kindly say that WAYNE's interesting question is closer to a pro sound consideration that to an audiophile problem.Here are my reasons (I only consider here listening music)1) WAYNE, how many times a year do you really listen to music for your pleasure with somebody beside you ? Personnally very seldom because listening music is something very selfish. Your wife (or anybody else) is not obliged to appreciate the same record in the same time as you for many reasons. So I consider that most of audiophiles use to seat and listen their system ALONE and consequently naturally seat in the best position possible very close to the famous sweet spot.2) I hope you will agree with me if I say that your question concerns mainly the medium range due to ear sensitivity (LF and HF are accessories here)...3)...so I think that audiophile horns are necessary directing to get the most natural song, because any discontinuity in the flare may cause distortion, standing waves, reactance, etc. That's a conclusion you can find after reading the test reports from different audiophile forums. And that's why, IMHO, EDGAR's system is so appreciated.4) CD horns were designed to solve this problem at lowest cost possible, but require an EQ which is OK for pro sound but not good for audiophile reason5) To my knowledge from the numberless and endless

opinions expressed among the forums about horns, the only horn to match your wish would be something like the ALTEC 1505B multicellular horn, specially designed to solve the directivity problem with eventually real audiophile qualities but apparently overtaken by a well designed tractrix horn6) Now maybe the compromise here will afford a solution :http://aa.peavey.com/downloads/pdf/qwp1.pdfBut once again it is a pro sound consideration. Never seen any "audiophile" test report with such horn.I hope you understand my opinion. I always try to stay in the simpliest way to get the most natural sound. Any complication is not good for sound reproduction.Your comments are welcome.With best regards,ERIC
http://aa.peavey.com/downloads/pdf/qwp1.pdf

Subject: Re: Favorite flavors
Posted by Wayne Parham on Wed, 23 Feb 2005 20:57:16 GMT
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Very good points. Good points indeed.But I will be very honest. I think the attraction of some of the round horn designs of the last ten years or so is mainly hype. I think some of them are attractive in an eclectic way, sort of retro looking and cool. But I don't really like the way they sound. They're just not for me.Don't get me wrong - I don't dislike them either, any more than I dislike a nice pair of planars with good amplification or any other system that is done with care. Each technology has something to offer. If you are right in one spot on-axis and the room cooperates, they can sound very good.But when you move around the room, they fall apart. They just don't sound good except in a very tight area. And even when sitting perfectly on-axis, since the reverberent field is non-uniform, room reflections send energies back to the listener that are unnatural. So I just don't like the way they sound.About equalization, it is important to realize that it's the compression drivers that need EQ, not the horns. Horn shapes that provide collapsing directivity provide equalization acoustically rather than electrically, that's all. Basshorns are a different matter. Even though they're physically large, they're usually undersized compared to wavelength. Because of that, they need EQ to smooth response peaks and augment the deepest bass. In this case, equalization is needed for the horn and not because of the driver.A horn with collapsing directivity provides equalization just as surely as an electrical circuit does. But a speaker that uses horns with acoustic EQ doesn't account for the power response and only compensates for response on-axis. It's not too bad if DI is matched at the crossover point, but if it isn't, it really messes up the tonal balance of the reverberent field. So whatever energy is reflected from the room back to the listener is wrong, tonally unbalanced and very unnatural sounding to me.This isn't a prosound issue. Certainly pattern and coverage are important in prosound, but I would argue that it is just as important in the home. Maybe even more so.Large sound reinforcement installations with lots of speakers have special needs that make pattern and coverage very important. But most prosound setups have less than a dozen speakers in a fairly large environment. That makes coverage pretty easy, really. In that kind of an environment, you can pretty much just point your speakers where you want. Sure, there are a few things to avoid, but the typical installation is pretty easy.Home systems are usually in rooms that are smaller and where the room really becomes part of the sound system. You can treat the room all you want, but the fact is that the directionality of the speaker becomes just as much a part of its sound character as does any of its other attributes. Room reflections sort of voice the speaker, so the speaker's directional characteristics are a big deal. Some like a lot of ambience, some prefer

more of a headphone sound. So preference is a factor too. But no matter how you look at it, the directionality and the quality of the reverberent field are a big part of the sound character, especially in a relatively small room.There is also the matter of appearance. You didn't mention it, and it has nothing to do with sound. But I think appearance is important. While some designs using round horns make an art form of the shapes, some are not so attractive. I've seen some really cool looking speakers based on round horns, but some of the others look awkward, even ugly. I just can't get excited about those.That's my take on it. I like the sound and appearance of other loudspeaker systems much better than those containing round horns. I've seen and heard some that were very good, but I can show you some that I think blow them away both in terms of sound quality and appearance.I'm sometimes blessed with a lot of free time to enjoy listening to music and sometimes not. This month, I haven't had much free time. It's a sad fact that the few times I've had free, I've mostly watched movies, and I seem to nod off even during those. But the audio system where I'm watching is pretty good, and sometimes the soundtrack really knocks me over. That's pretty cool too.Sometimes I am able to listen a lot, usually during the day while working. I am blessed to be able to play nice music while working, and sometmes find myself distracted enough by it to take a break and pay attention. If I have to concentrate, I better turn it down because it will grab me and take me away.I have a couple of critical listening modes in addition to just background listening. One critical listening mode is when I'm listening to the equipment. The other is when I am listening to the music. When listening to the equipment, what I mean is that I am evaluating the performance of a system. It's usually after a prototype is built. After all the design and measurements are done, I will just listen to key passages that I use to compare with. Sometimes I will put a known system side-by-side with a new prototype. Sometimes I wil have two exact same systems side-by-side but with different drivers. So when I am listening to the equipment, I am not hearing the music so much as I am listening for sound quality, artifacts and other anomalies.The other critical listening mode is when I am just listening to a performance for the music's sake. That's the normal mode for me. When a system is done and in use on a regular basis, it disappears for me. I give it no more thought. Some of my loudspeaker designs have been around for years, decades even. With them, I haven't "listened to the box" for years. I just listen to the music. So when I purchase a new record or CD and listen, I am hearing only the performance. This is the most enjoyable thing for me. I like to put the design away in my mind forever, and just listen to the music.