

## FURTHER REFLECTIONS ON LOUDSPEAKERS

*by Irving "Bud" Fried*

This author has been around a long time—some may even say too long a time! Be that as it may, his experience in loudspeakers per se has been primarily from a European viewpoint, his early days in England (when it was commonly believed that all the real progress was British), later in the Scandinavian countries, primarily Denmark, where the semi-geniuses there first brought to the author's attention the subject of phase correct loudspeakers—first order networks, and later the somewhat mysterious "series" networks – which they informed me "sounded better" (they do, for reasons to be explained later on).

To recount a few, which many of you will recall—The Brociner "Transcendent," a modified Klipsch bass with a Lowther (from an English genius known as P.G.A.H. Voigt) top horn; The Lowthers themselves; the "AR-Janszen" (a bit of American deviation, occasioned by intimate connections with Cambridge MA, and a young semi genius at MIT); the glorious Quad (quickly adopted when Peter Walker let me distribute it); and a good riddance to the much less sophisticated AR-Janszen!

Then, involvement with the U.S. introductions of KEF, B&W, Celestion et al. And, then, the development and introduction of the "IMF" Monitor (yes, it was I, not someone else, who did that rather famous loudspeaker) (the full story may someday be told, but not here).

So, the lineage is established, the aim at all times to do the best available with the knowhow and materials available at the time of origin.

In 1980, having attained the venerable age of 60, I thought my ability to contribute further to the "accurate" loudspeaker was over. Someone, actually a magazine editor, suggested that I write an article on "accurate" loudspeakers (sometimes called "monitors").

And I did, titling it "What About Loudspeakers?" It was not the usual kind of article, in that it wasn't just my ideas, but a compendium of approaches and principles that highly educated and motivated "authorities" could agree on- if anything was controversial, it was clearly denoted as such.

Well, here we are, almost twenty years later- and it is as if most loudspeaker designers today have failed to note the classic principles set forth in my article! In the first part of the article, I even denoted classic principles of learning- ahem, from my college days in Cambridge, MA (but not MIT)- which had to do with asking the proper question, as a self-directing path to truth. The article covered drive systems ("minimum phase" drivers), crossovers (the most satisfactory being series networks- provided that "minimum phase" drivers of the proper quality could be obtained or developed), loading systems for the drivers, in order of quality, and as agreed to by all the authorities mentioned above; and the impact of various drive systems on the "loudspeaker- room relationship" (yes, indeed, a highly reactive bass reflex or air suspension system was much more sensitive than a "resistive" loudspeaker, to be explained later), etc.

How can it be that most modern day designers seem to have ignored the lessons of the past? Most apparent is expressed by a famous statement from a Harvard philosopher, George Santayana, to wit, "If you don't know history, you are bound to repeat its mistakes."

Nextly, as I have tried to explain countless times, to petitioners for the "TRUTH" (yes, they still manage to find me), it has to do with their education (I once told a very famous West Coast designer that, had he gone to a Cambridge, MA oriented university, his loudspeakers would have been quite different). (This same designer once told me that his designs, unlike mine, were not even intended to be "correct," rather, to be what people are prepared to buy!)

As a corollary- when these petitioners for the "truth" call me and report that another highly touted new design sounds "spectacular"- but "why don't these designs have anything to do with the sounds of the instruments of the orchestra?", my reply is twofold!

- 1) The design engineer's experience has little to do with real orchestras and real music; rather, his mental images are of smaller groups, jazz, folk, or test discs (I well remember getting a call from an opera singer, who was terribly aroused, he having just hung up from a talk with a Midwestern speaker designer, who told the opera singer, on request, that he had *never* attended a live operatic or symphonic performance).
- 2) The design engineer's background, education, and general approach was to design not for the "longhairs," but for the majority of the buying public, and for their musical preferences.

Be that as it may, there are possibly a few other designers who want the "truth" in reproduction. How do we define the truth? I recall an editor of an eminent hi fi journal visiting me in Philadelphia over twenty-five years ago. He asked me how I would evaluate and review loudspeakers. I told him playing hundreds of records was not a very sensible thing to do, unless, and before, you had done the following: I took him to a "listening room" I maintained with samples of what I was working on at the time, along with samples of other loudspeakers considered significant at the time (such as several varieties of "air suspension" speakers both American and British, and other so called "advanced" designs sent to me as possible for American distribution). I showed him how, with a flick of the stylus, thus putting a pulse into each speaker, one could hear the characteristics of each immediately, and discard most of them

forthwith. This has later been termed the "Bud Fried Impulse Test." This particular editor went home; called me a week later to say that the "intellectual rigor" of the visit had put him to bed for a week. Incidentally, to date, this editor has never used that most simple test- as if he feared the "truth."

So, that test is one rough indication of the "truth." A more precise one is to inject a square wave into the speaker and view what comes out (on an oscilloscope). The reasoning is this; the square wave, or half square wave response, is the laboratory equivalent of music! Therefore, that loudspeaker whose output most resembles a square wave signal is that closest to the "truth." The author has seen and heard very few loudspeakers which can reproduce a square wave that appears as such. Among those which can are, of course, the glorious Quad- and any design of mine for the last ten years or so! (I remember a visit a few years back, to a design engineer's lab; he wanted to become a design engineer in the future of a company I was about to sell. The buyer and I had brought along an inexpensive design, and a fairly expensive transmission line loudspeaker (at least it seems expensive to me, but not anywhere near the megabuck speakers increasingly available). I suggested he inject square waves into both designs. When he saw recognizable square waves from each of them, he virtually had a fit. When I asked him what the square wave response of the speaker he was developing, and in the same room, was, he said it just couldn't come close- but did that matter?

Before we left, the designer played a pop record both on his design, which came out later at \$27,000 a pair, and the smaller of the two we had brought. As we got into our car, the buyer asked me whether it was possible that the smaller loudspeaker was crisper, cleaner, and had more dynamic range to boot- he had noted such. My answer to him was simply, yes, reproducing a

square wave leads to such phenomena as reproducing the music better!

What has happened to an industry which in earlier days was dedicated to "the truth"? Long, long ago, the great Percy Wilson (an Oxford man), taught me that all loudspeakers are either "reactive" (resonant) or "resistive"- the only two of which are the monster horns he had designed into English churches, and the transmission line! Percy was first technical editor of the eminent "Gramophone" (and also Secretary of the British Society for Psychic Research).

I have never forgotten that message – and have never found it wanting, or that any other designs could in truth be "resistive," and thus worthy of those who want the "truth" in reproduction.

I am sure all of you have seen impedance curves of loudspeakers which deviate greatly from a norm, particularly in the bass, and read that such are "normal." In truth, most of the deviations you have seen are reactive effects of the loading and enclosure system and the crossover (of which more, below). Reactive effects are just another way of describing resonances, and resonances in loudspeaker talk are bad events; because a resonance needs time to build up and time to decay and such time is generally harmonically and transiently unrelated to the musical input. In that article of 1980 I described a classic case of a loudspeaker with very flat frequency response, the flat response being a product of multiple resonances. Such a loudspeaker might test well on frequency, but sound atrocious!

It is submitted that "modern" trends in loudspeakers seem to involve using resonant effects. For example, since the popularization of "Thiele - Small" parameters, and the coming of computer programs to aid the development of loudspeakers, bass reflex systems, which for some years were out of favor, in favor being the "purity" of infinite air suspension baffle (what the

British call closed box), have been the basis of almost all new designs, even those going up into the many thousands of dollars. Rather than giving the theoretical basis of such, the author prefers to say that he has never heard one which is more than just a resonant "boom box." An example, in the "lounge" of an eminent British reviewer (equally famous in the U.S.), some several years ago, the reviewer wanted to let me hear his "reference" loudspeaker, which he had apparently given a "state of the art" review-and which I believe was costing £14,000 in England.

He turned on the loudspeaker, after giving me a lecture on his belief that amps all sound different (I wouldn't bite, he having told me that my beliefs on amps were with the minority-a minority I was happy to agree with, it consisting of David Hafler, Peter Walker, and myself!) Then he told me he had sold my IMF Monitors in England, and knew their worth – and seated me about two thirds of the way back in a large room, and proceeded to play an HDCD disc. After a minute or two, he asked my opinion. I replied that the entire 70Hz. region of the orchestra was a pile of mush- that which no live orchestra I had ever heard produced. He commented that I should move up six feet, and then listen. He replayed the same passage, and I commented that the region was now depressed, but that the region just above was now very mushy. He gave up on me.

And this loudspeaker was his reference – and he knew exactly what I was saying, and why it was true, and then dropped the issue. So much for that.

Another series of stories on what reactivity does in loudspeakers, and how otherwise intelligent people have grown to accept the effects:

- 1) It is 1994, and I am on the West Coast visiting a few "target" dealers with our sales people. Unbeknownst to me this dealer had samples of English

loudspeakers from a company headed by a former associate of mine, the speakers supposedly containing a new principle of bass propagation, not exactly a transmission line, more toward a reflex. So, the dealer insisted on switching a small loudspeaker employing my "aperiodic" design against this English "new principle" loudspeaker. The comparison was so much for my design that it was embarrassing, and I left the sales people there. One of the eager young employees, who obviously had heard of me, asked me to come into a separate room where a large loudspeaker from a Canadian company was sitting alone, the young employee asking me to give him a candid opinion, for his own sake. I consented. The young man, knowing me, put on a semi classical piece, and waited. Immediately obvious was the sort of cloying, resonant, mushy bass that some people accepted (the young man thought I would find it impressive, no doubt). Knowing this, I listened for a few minutes, hearing a far worse defect- whenever the music got into the midrange -where most of the music is. I looked at the young man and asked whether there was a crossover "around" 350Hz. He searched for the data sheets, found that there was a "fourth order" crossover at 385Hz. He still didn't understand what all this meant, I offering a short statement about "reactive" crossovers, and hastily left.

- 2) **It** is now 1996, and I am at the NY Stereo Hi Fi Show, with a business associate. He asked me to stop in with him at a room featuring a new British transmission line. We entered, and the young men demonstrating were introduced to me as a pioneer, etc. Then the music started. We listened for a few minutes, and left. I

commented to my business associate, asking him whether he heard the two enormous energy holes on peak passages. He told me that he certainly did- but not to upset the young men with the truth!

- 3) It is fifteen years or so earlier. A good friend and dealer near Philadelphia has lured my wife and me to a banquet, but before the people arrive, he wants my opinion on a new three way "monitoring" loudspeaker from England. He turns on the new loudspeaker, using opera discs, and turns to me. My first reaction- there is an enormous hole between woofer and mid, on musical peaks. I tell him so, and he replied "I was afraid you would hear that first of all." I asked him whether he heard it, and he replied affirmatively, but insisted that most of his customers just didn't notice!

These are the effects of sharp filter networks, which appear to amplifiers as highly resonant ("reactive") loads. We all know that amplifiers work properly into "resistive" loads, and more or less unpredictably into "reactive" loads, depending on phase angles, Nyquist plots, etc.

And yet these are the crossover networks being used on the most "advanced" designs of today, because they can cover over driver problems on a frequency basis (but not on transient basis).

Which brings up the subject of series networks. Back in 1975, following my Danish authority friends, I converted all my designs to "linear phase," 6db/octave networks. Yet-I kept hearing from my Danish authorities that series networks "sound better," with no explanation why. Meantime, several of my U.S. friends copied these networks, the 6db/octave types.



I kept experimenting, trying to find out how to design series networks, which link the drivers in a chain, and also the crossover components-and whether they "sound better" and what did that mean?

Next step- at a hi fi show in Chicago, around 1980 or so, we arrived with our 6db/octave production models, and a pre-production model of a new loudspeaker, with a series network inside! I played them alternately, to good press. Until a very dear friend, Norman Eisenberg, then audio editor of High Fidelity Magazine, came in. I played them alternately, the in production expensive 6db/octave loudspeakers and the less expensive new loudspeakers with the series networks (for the technically minded, quasi second order). Norman, who actually had a catholic knowledge of music, listened for a period, then turned to me puzzled, because, he said, he knew he shouldn't hear this as such, but the new loudspeaker (with the series network, not known to him) seemed closer to the sound of live instruments in concert. I agreed with him, and asked whether, if I explained to him the difference, he would remember and include it in his reviews. Well, I explained it to him, then went home and converted all our production to series networks!

I kept searching for why they "sounded better," more revealing, fresher, etc. Then, I came upon a divine revelation. Using a fast acting program meter, I discovered that the series connection produced an average increase .of musical peaks of some 6db – and this is what my Danish friends said "sounded better"-as it does, since, back to my 1980 article, the great Peter Walker is quoted as saying that dynamic range still separates live from "reproduced."

Soon thereafter, on invitation from the NY Audio Society, I showed up with a pair of the new loudspeakers, which had been specially prepared. I had installed a switch, which permitted

operation on the heretofore standard 6db/octave filtering (that which I had brought from Denmark to the U.S.); or, alternately, with a complete series network, quasi 12db/octave.

I played a range of program material, let the audience hear the difference, showed the difference in peak levels with a "real time analyzer."

Of several hundred there, all profound students of the art, I presume, only a tiny minority understood what was going on. The rest had a sullen silence- as if I had cursed their God. They heard the difference, saw the difference on the meters- but couldn't accept it, because, if they did, they had to consider junking their beloved speakers!

I explained why it was- better coupling between the drivers on peak passages. They listened but did not respond. I was challenging their preconceptions. One person persisted in describing his twenty-year-old "movie" loudspeaker as about the same.

Later that year, on a hi fi show (radio) in Los Angeles, I described the same phenomenon, why series networks "sounded better"- only to find the host angrily protesting that it might not hold true for all loudspeakers (he was defending his "truth," so to speak).

And that is how I find the industry today- defending outworn catechisms. I have often asked why (of my associates) other manufacturers don't move ahead. His answer is simple: They don't know whom to copy, so they do what virtually all others do, install various drivers in a box, interconnect them with sharp filters to show a smooth response, and write literature.

How did the industry happen to be in the position I stated, at end of part one, seeming to depart strangely from the "truth?" I mentioned a number of reasons why this might have happened- all revolving around lack of knowledge of what had gone before (shades of George Santayana!).

One of the prime sources for what had gone before, and lessons to be observed in- , the

future, are the rather famous "BBC Researches," contained in Wireless World, April, May, and September (I believe), 1961. In those papers, it is pointed out that there should be no crossovers whatsoever over 250Hz and below 2.5Khz, this being the midrange, where the human ear is most sensitive to phase anomalies and aberrations. Yet, if you recall some of the examples cited previously, various designers had inserted "reactive" crossovers right in the midrange!

Like everyone else, I have read about the virtues of sharp filters - as I once humorously commented, they do tend to protect the drivers from those nasty electrical signals that are the equivalent of music, and permit the designer to show a smooth response from the drivers at hand.

However, the smooth response is illusory, since the various driver problems, cone breakup, "edge hole distortion," peak resonance, et al are covered up -but they still "sound" and color the response, both harmonically as well as in the time domain (in which music exists). I well recall from the past some design engineers who showed me how their ingenious "nulling" circuits took the peaks out of a driver, and made it look smooth. When I commented that the sharp nulling circuits could now be heard in music (they upset the time domain, obviously), these design engineers professed ignorance - as well they are, since they did not have the knowledge of music harmonics and fundamentals, and how they occur in real life- in short, their education was faulty.

So, knowing that sharp crossovers are not the answer for the musically conscious, I launched a lifelong research project, to find drivers which worked properly in the musically proper first order and the superior series "quasi second order" networks. A few examples of actual occurrences might be enlightening:

A German company sent out literature espousing the virtues of their Kevlar layered cones; the

literature showed the drivers with the ideal curves, the gradual roll offs beloved of text writers.

Naturally, I got samples. They were terrible, and I so reported to their U.S. representative. Just after the fourth of July, a few years back, I turned around, to find their U.S. rep and their international marketing director in my office. I asked why, the marketing director telling me he had reports that his drivers were "defective," and besides, he wanted to meet me because I was "famous"!

He asked me what was wrong: I took him back to my lab, put on an oscillator, and let him hear the breakup distortions, telling him that Wagner would not want to hear his operas through these drivers! I asked him how they got out; his reply was most simple- the engineers never listen to them on music. He freely admitted they were not very good for that- and suggested that a crossover could cover over the outrageous "EDGE HOLE" distortion and peak -like everyone else (he never suggested that would make Wagner or himself (he was also a conductor) or me happy- just that many "state of the art" designers over here were using the drivers! He then suggested his company would engineer special drivers for me that would be "BEITER." They did engineer such drivers, but they were only better by a small margin. The result- by being honest with me, he lost his marketing job with the German Company!

A French company sent me samples of their Kevlar composite drivers, with factory frequency plots that showed high frequency peaks of only 2 or 3db. I found them almost as bad as the German drivers- again, the American rep told me they could make them "better"- if I bought enough! I had frequency curves made here of the "better" samples, showing peaks of some 8 to 12db, sent them to the head of the company, whom I had known for some years (from my work in France and England), saying "You can do better!" I never got a reply!

Another French company provided me samples of their latest drivers, which, interestingly,

came with curves that we corroborated -,i.e., the curves were honest. However, the drivers had been designed for "bass reflex" (boom box) speakers, with high "Q's" and not ideal for transmission lines. They regretted that their magnet structures and their frames could not be modified for my uses. However, these drivers have shown up since in several of the little "boxes" that come from England- and they are better there than what went before.

This French company had a newsletter, with a "consultant" listed, a man I had known thirty years, from my "IMF" days. I called him, told him I was "going crazy" - with all these super European drivers- they all seemed more or less "defective" to me. This gentleman, who had a serious list of consultancies to his name (he was not a "hi-fier"), assured me I was not "going crazy"- that all the drivers I mentioned were indeed completely defective. He then told me the rationale- to wit, most of the purchasers of these drivers did not know the difference,- and it would not pay these companies to make drivers that the "two or three people" like me would accept!

So, I decided, along with several engineering associates, whose list of past associations was indeed impressive, to make our own drivers, over here! We proceeded to do that, using new cones, new techniques, etc. And we got some cones that looked right- after coating them with special compounds, etc.

Until, one of the engineering associates informed me that the final, very smooth curves had been faked! And yet, they were still better than the imports! So, of course, we had more work to do- after we had detached the faker- he protesting all the while that "everyone did it," including his past companies!

Well, three years later, working with one of the "honest" people I had discovered, we were able to develop drivers with the right "Q's", the right cones, the right frequency parameters. And so,

we were able to maintain our series networks - and make the speakers better.

I recite this, to illustrate how difficult it becomes, when one is adamant about musical values, and insists on developing drivers and networks that are right for music- and not just for advertising.

Nextly, enclosures that are correct for music: You will recall my "IMF" monitor of 1968, which became a notorious design. New most people thought it was so well received just because it had transmission line bass. When, in point of fact, the loudspeaker was much more sophisticated, in that it had a low crossover point from bass to mid-range, and a mid-unit that was loaded by a second transmission line - because the usual box enclosures for mid-range were just "boxy." I well recall the long hours spent on getting the line behind the mid driver just right, with "variable damping," "flow through" techniques, using pink noise to get the least amount of coloration. I will also recall the problems in keeping production standard- my English associates told me the variations were because of "sabotage" in the "works" -each one had to be checked and repaired over here! And woe to those who bought them in England! (I could tell you stories, but to what avail?)

Interestingly, few other manufacturers seem to share our feeling, that the consumer deserves what he is paying for- musical reproduction of the highest order. Until- in 1994 we were exhibiting at an audio show in Florida- next to the B & W presentation of the "Nautilus" loudspeaker, a gargantuan beast that just happened to be transmission line loaded in both bass and midrange -like our IMF Monitor of 1968! Naturally, we talked, and useful data went back and forth. It seems B & W, with their research lab, had discovered that a driver exhibited much less breakup effects, and the typical breakup sound of the driver, when used in a terminated line rather than in the conventional box.

And so, some thirty years after, B & W has adopted the virtues of the mid band transmission line- thirty years after the IMF Monitor!

But the bass line remains inviolate- I am told by others that it is an "unnecessary expense" to use it in speakers costing megabucks - that "reflex" or "infinite baffle" ("air suspension") are just as good.

Which may or may not be true- except those who like the "sound of the strings," the "celli,"etc. Some apologists for bass reflex claim it is "really the same thing." Which it really is not. Remember the great Percy Wilson with his "REACTIVE" vs. "resistive" terminology? That hasn't changed.

A transmission line is defined, generically, as that system which adds mass to the diaphragm of a driver placed into it, therefore lowering the resonance of the driver below that of the driver in free air. Bass reflex and /or air suspension systems almost invariably raise the resonance of the driver- above its free air resonance.

Now, if the resonance is lowered, it means that a large air mass is in parallel with the driver; this air mass both increasing the piston size of the driver, and serving to reduce reflections back at the driver (just as in the mid lines described above). And so the transmission line, properly designed, and with the proper drivers, affords a completely non resonant bass effect- that which is unique to resistive systems. As Professor Bailey said in his famous article, *Wireless World*, a quality of reproduction which is most appreciated by those who are familiar with the sound of live music!

Now for those who cannot accommodate to transmission lines, but who still like real music. What to do? Well, there is an answer, again brought over from Denmark- the "aperiodic (non-resonant) loudspeaker': Without getting too enmeshed in technical stuff, an enclosure can be converted from its natural "reactive" nature by a judicious application of "flow throw damping" (much like that used in the modern transmission line) and applying carefully a "R" (resistance) across the "L" of a

controlled opening from inside to outside. This resistance is relatively non critical, but tuned approximately so that the total peak of the cabinet is held at 3db. Voila, the "cabinet" sound is gone!

In effect, the "aperiodic" enclosure is almost as effective as a true line in getting rid of unwanted rear resonance effects. What it lacks is the air coupling at low frequencies of the modem line. But (see below), all is not lost. And, incidentally, this system also came from the semi geniuses in Denmark!

Back in 1947, if I recall correctly, Ed Villchur, the inventor of the "air suspension" loudspeaker (Percy Wilson always claimed that he and other Englishmen had tried the same in 1939, and discarded it because it was "unmusical") wrote an article, which appeared in a popular hi fi publication, showing the effects of moving an air suspension speaker around a room. Very small movements produced amazing differences in room interactions and resonances.

This is to be expected, from a "spherical source" loudspeaker (all the bass going in all directions), with large reactive elements in it, thus mixing with all sorts of room eigen tones. After reading the article, I couldn't understand why anyone would tolerate "air suspension!" But others obviously couldn't or didn't read- and so such loudspeakers still exist in the marketplace!

Well, what to do? The answer is very simple. First, dispense with highly reactive loudspeakers, in favor of resistive loudspeakers- transmission line and, to a lesser degree, "aperiodic," loudspeakers. In addition to their lesser propensities to "take off" and intermingle their resonances with room eigen tones (which "box" speakers do), the following occurs:

- 1) Transmission lines: By their nature, as described in a 1970 article written in "Hi Fi News" by an English associate and myself, lines appear in rooms as planar sources, with much less energy going randomly to the walls (as in "spherical source" loudspeakers). Thus, there is much less



room interaction with lines, and purer response no matter where situated in the room.

2) With aperiodic enclosures, some of the same effect, but, more importantly, because they are inherently non resonant (as contrasted with the "omni" speakers), they do not mix as much with the room. In addition, because the total bass impedance rise is limited to 3db in the speaker, the aperiodic speaker gets into "room gain" so that the bass response is improved, as the listening spot is removed from the speaker. I have often amazed auditioner by playing and reproducing organ pedal tones convincingly, some distance away from small "aperiodic" loudspeakers.

And so, at least for now, this discourse on "resistive" loudspeakers will end. Their value is evident whenever the need is for accurate reproduction of "real" music, i.e., music containing complex strands and live instruments. Indeed, the quality of reproduction from "resistive" loudspeakers, as defined a long time ago by the great Percy Wilson, is quite a bit different than that from the current crop of "reactive" loudspeakers. So much so, in fact, that some believers in "the truth" have been known to characterize all "reactive" loudspeakers as candidates for "P.A."(public address), no matter how pretty and expensive they may be. Indeed, the author, getting on in years, sends his disciples out to hear the latest and most expensive creations of the hi fi press -it is possible that someone has learned how to change the laws of physics and acoustics, and discovered new ways of how we relate to live music vs. recorded (psycho acoustics).

It may be self-serving, but to date no report has reached me re the repeal of the laws of physics and acoustics, and psycho acoustics by any of the elegantly expensive new "state of the art" loudspeakers! Or, as Barnum said, "You can fool some of the people some of the time, but you can't fool all the people all of the time!"

Where does that leave us? Well, we are on the edge of another revolution in the art of musical

reproduction. The great Raymond Cook told me just a few weeks before his sadly lamented demise) that "We must go into space, because that is our last frontier!" Until his death, Raymond was working with various interests in England, toward the reproduction of space in recording and reproduction.

We must go back in history just a bit. In October 1973, as the author walked into the Hi Fi Show at London Airport, Raymond (then chairman of the Federation of British Audio) accosted me saying that my company (IMF) had taken over the show. As well it had, because the entire entering foyer, as well as several rooms upstairs, had various of my designs being used in the first public demonstrations of "Ambisonic," a carefully reasoned, mathematically designed system which put the space around the performance into the reproducing equation.

I listened to the demonstrations, which were indeed impressive (the most startling being the reproduction of a great cathedral organ- the effect was chilling!). Then I was introduced to Michael Gerzon, who, along with his associate Peter Fellgut, had designed and executed the systems. There ensued a delightful two days of talk, because Michael was not a dippy eyed hi fier, rather, a professor of mathematics at Oxford! Having attended an equally prestigious university in the U.S., and accustomed to great minds, Michael and I talked easily (he told me my English associates, who had attended "red brick" universities, were not quite so easy to relate to).

Near the end of the two days, I asked Michael why he was using only my designs. He suggested to me that they were by far the best available, and did I not know that? My reply was, yes, of course, but how did he know that? His answer- "We are not unintelligent at Oxford, Mr. Fried!"

Be that as it may, finally, and with the evolution of the DVD player, we are about to "go into space" (in the words of the great Raymond E. Coe, with some evolution of playback akin to Ambisonic.

Now, these systems, which are not "Home Theater," with its booms and bangs, but serious approaches to the idea of making for more realistic reproduction, the sense that you are there (not so much in a night club as in one of the great halls of the world that led to the great orchestras, from Vienna down to the West Coast newcomers) are phase based, i.e., they depend on how the human system reacts to stimuli suggested space.

Of utmost import, it then follows, the loudspeakers used in the selected spots must be phase correct- in order to handle the phase effects that make up the mathematically derived "space" of Michael Gerzon.

Now, it becomes clear why the random phase loudspeakers that have dominated the world "high end" market in recent years - the loudspeakers that this article has criticized as emanating from the lower depths of musical realization, rather than from the beauties of the great musical ensembles that Michael seemed (he, too, has sadly left us) to love- are just all wrong.

Let us say that "home theater" might employ them (no one knows precisely what to do with phase in "home theater"). But for the replication of space, the experience of attendance at a live musical event, proper loudspeakers as defined in this article- are mandatory!

Long ago, in his newsletters, the author described his first reactions to the nascent art of the transmission line. He told of hearing a vast space, from which the instruments of the orchestra appeared in bass relief - a unique experience. He was describing the sound of his "IMF Monitor," as compared to the various box speakers of that day- the sound that induced Michael Gerzon and his associates to use them at the first demonstrations and later.

Well, to use the French, "Plus que change, c'est la mem chose." (More than change, everything stays the same.) The art of the transmission line and its companion "aperiodic," described above, has

advanced mightily since 1973. So that, with the coming of Ambisonic derived systems, the aural illusion will be even more stupefyingly real than that at those demonstrations of 1973!

With the hope that perhaps a few more of you will be able to shuck the blandishments of the overpriced, under engineered "random phase" loudspeakers of today; and go to a more realistic and less expensive and more rational space replication in the future, this article ends.