Meadowlark Audio

Eternity and Time Coherence -
How Nature Connects the Stars, Your Stereo and Your Soul

Once each second, somewhere in the universe, a star explodes. But in our rather ordinary sized home galaxy this spectacular event that we call a supernova, can be witnessed barely once each century - if we're lucky! Now, it isn't that the stars in our Milky Way are somehow spared their fate; no, it is simply that creation is so unimaginably vast, and galaxies like our own so nearly innumerable that even though the chances of any star exploding in any year are, quite literally one in a trillion, the heavens are nevertheless popping like veritable popcorn !

The truly amazing thing about the shocking scale and violence of a supernova is that the processes that so inevitably bring forth life - and ultimately conscious beings like ourselves - must first be preceded by the death of a star. For it is only there, during the last few crashing moments of destruction, that the heavier elements necessary to form the molecules of life itself are ever created.

The poetic expression "We are the stuff of stars" is very literally true. The material that our earth and our selves are made from is in fact the explosive remnants from, perhaps many, long-long expired suns.

This is an amazing thought to ponder, to be sure. But what rises as even more staggering is that the very same Nature that first arranged the processes that turned stars into the raw materials of life, has then gone on to spawn life itself in heavenly abundance and variation, and ultimately to Father conscious thought, and yes even the very genius to both examine and to understand the nature of Nature itself. But, even more precious and divine, the processes of our universe have gone still further to procreate the two pinnacles of human nature - love and, I think, music.

And so.... what has all this philosophical musing to do with audio equipment?

Simply this: that the very best audio gear combines the elements created by Nature with our most thoughtful science and engineering in a effort to recreate those magical, wonderful musical performances that touch our hearts.

So, the horrendous cataclysms of ancient stars are transformed, though it has taken many eons, into a fleeting wave of goosebumps.... or maybe a secretly shed tear.....
Or into the voice of a beloved musician who has since left this earth...
Whenever we wish....at the touch of a button.....in our living rooms.

It is from this admittedly unconventional perspective that I approach the design of loudspeakers: that it is the frontier of my craft and science to strive for the perception of reality in the reproduction of music, that it is my job and hope as a lowly technologist to convey that rare and delightful essence of the human soul that is music, and that in order to this I must build devices that conserve all three of the physical dimensions in which that music was created. Oh, yeah, and then they have to work in that living room!

So, we arrive at the pivotal questions: What is it that we 'record' when we record music? And what, then, does the speaker need to do to reproduce it?

In answer to the first question: As we all know, the 'music' that is made by musicians' voices and instruments is actually a three dimensional series of compressions and rarefactions of air called 'sound'. Ask any musician what the fundamental tools of his trade are, and you'll get an answer that , more or less, boils down to pitch, loudness and timing. It comes as no surprise at all that what we are actually recording as 'sound' is a representation of how the air at the performance moved in terms of frequency (pitch), amplitude (loudness) and time (timing).

That these are the three elements that are the essence of music comes almost as a matter of common sense. But the thing that strikes me most stunningly is that those musicians who stand above the rest as 'truly great' are possessed of an ability to employ timing in their performances that starkly sets them apart. You know, any decent musician can play all the notes, and get them in the right order. But compare the work of a good journeyman trumpet player with, say that of Louis Armstrong or Miles Davis, and you'll be left little doubt.....merely getting the notes right just isn't it at all. In their stunning performance of the Jazz standard "You Go To My Head", Armstrong's subtle timing liberties in both his singing and horn playing are set against a counterpoint of responsive timing shadings by pianist, Oscar Peterson. Though that performance is starkly simple and spare, the emotion conveyed

will take your breath away. In Jazz, the technical term for this is 'swing'. Ella's performances too were marked by her signature deviations from 'proper' timing; she often lagged by nearly a bar, then recovered nimbly, and with a chuckle of fun. Talk about poise! Ella was above it all. In fact, our greatest musical geniuses have always set themselves apart by their creative use of timing. Perhaps that is why the 5th symphony begins with a rest.

When music is recorded, the diaphragm of the microphone moves in the same way that a listener's eardrum would, but that movement is recorded electronically rather than converted into nerve responses. The idea is that, later, the information on that recording can be stored and copied, then 'played back', amplified, and ultimately to set the air in your listening room into the same motion that existed at the recording venue. If all goes well, your eardrums will move in about the same way as a listener's at that original performance. In fact, this, in a nutshell, is the whole objective of high end audio.

It is the job of every link in the audio chain, from the mike, to the recording device, to the storage medium, to your player, to your preamp, and amplifier, and of course to your speakers, to preserve and reproduce the original musical signal.

But...and you knew this was coming....most speakers on the market today make no attempt, no attempt what-so-ever to preserve the precious timing information in the signal that you, and those who recorded it, have spent so much time, effort and expense to deliver to those rear terminals.

They are 'time in-coherent'.

Sure, they don't exactly advertise the fact. And, when pressed, most makers of time incoherent speakers will sidestep the issue in a way that will remind you of your least favorite politician. But think about this: if a mike, or a cable or a player, preamp or amp were to wipe out timing information in exactly the same way that most speakers do, they would not even be considered to be poor performers; they would be called 'broken'.

It is my view, and I hope to convince you of this, that timing liberties are the artistic province of musicians alone - and are certainly NOT to be taken by that box of wire, wood and metal that are your speakers.

Though the engineering concepts can get a bit involved, there are two basic ideas that combine to determine a speaker's performance in the time domain. These are: physical acoustic alignment of the drivers, and time domain perturbations induced by the crossover circuit. These concepts are discussed in detail our website - and you may end up having questions that are addressed there, but, for our purposes today, we will 'cut to the chase' and simply show you - via animation - what goes on in the often ignored, yet crucial time domain.

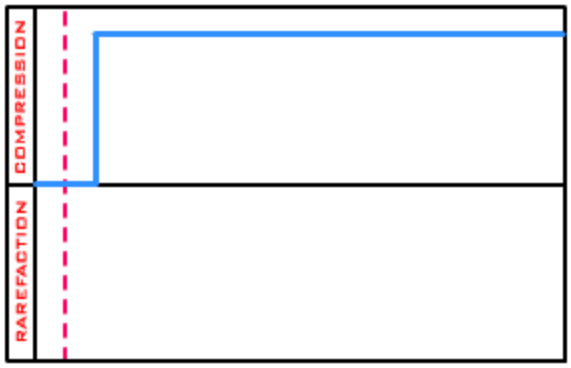
It is interesting to note that, while the audio world dotes upon specifications for frequency response, rarely does any information regarding a speaker's time performance ever see the light of day. But, there is hope: much to their credit, the editors of Stereophile Magazine have been publishing the critical data on each speaker that has been reviewed for the past few years - the 'step response'. Now, the step response tells you everything that you need to know about a speaker's timing fidelity, but - since most readers don't have any idea how to interpret the information - it's value has been more or less overlooked.

That's understandable. For years I, and a few others, have tried to explain this stuff with words that a non-engineer can quickly grasp. Unfortunately, our efforts have pretty much fallen flat.

But now, thanks to web animation, I can show you what's happening in the time domain in a way that will make things clear to you in a very few minutes.

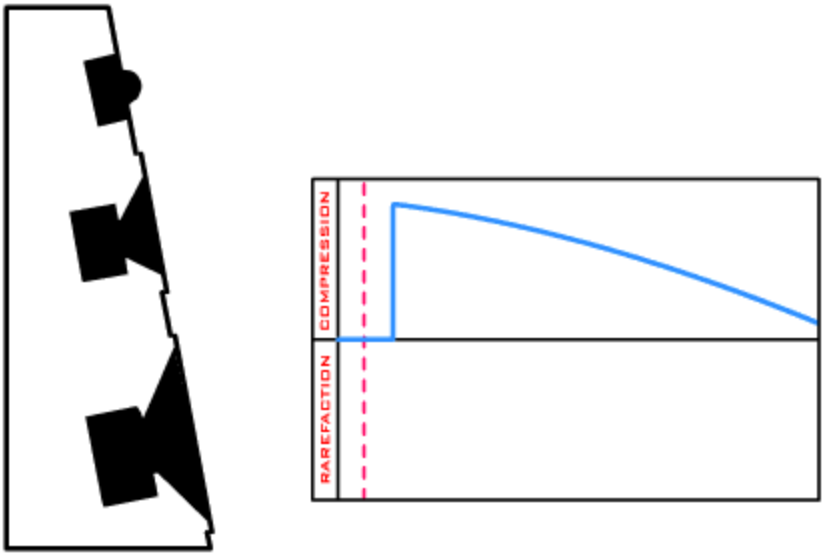
Please refer to the animated graph below that is labeled "Step Test Signal". Here you can see the very simple test signal that, when applied to a speaker, reveals all. Basically, we ask the speaker instantly to go from 'rest' to compression - and that's it!. Press the start button on the animation and watch the time cursor proceed. An easy way of looking at this simple test signal is that this is exactly the same thing as connecting a battery to the speaker - the input is merely a sudden DC current. You can see why the signal is called a 'step' - it looks like a 'step'.

Truth Be Told . . .
The Step Response Reveals All!



Step Test Signal

Now, a perfect speaker should translate that 'step' into a simple, sudden compression of the air in the room. But, because all real world speakers have low frequency limitations, the ideal behavior will look like the graph below labeled "Acoustic Output of Time Coherent Speaker". Press the start button and you will see how the drivers move as they do a nice job of reproducing the step input signal. A simple first order crossover combines with proper acoustic alignment of the drivers via a slanted baffle to precisely recreate the input waveform.

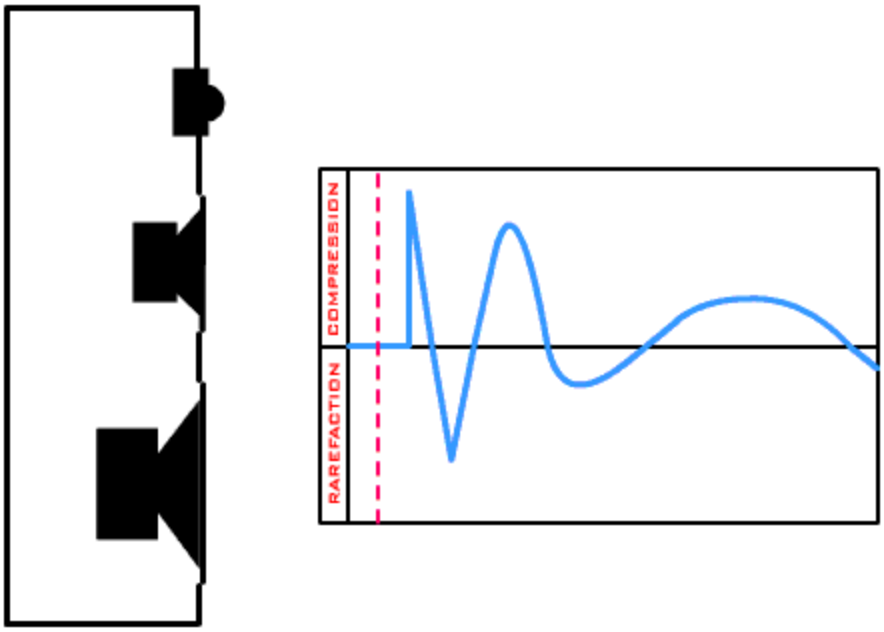


Acoustic Output of Time Coherent Speaker

This is the critical concept here: How well a speaker can track this simple transient waveform very elegantly reveals how well it will track the musical waveform that you will put into it.

Now take a look at the last animation called " Acoustic Output of Time Incoherent Speaker" Here, we have generalized the typical speaker that does not have acoustically aligned drivers, and that employs a second, third or fourth order crossover. Now, and here's the dirty little secret... These 'steep' crossovers by their very nature delay parts of the signal, and - and here's the worst part - even invert parts of the signal! That's how they work - for reasons that unavoidably descend from the basic physics of what happens in a crossover circuit.

Press the start button and watch the delays and inversions.



Acoustic Output of Time In-coherent Speaker

This is ugly, horrible stuff...so obviously wrong that you may find it hard to believe what I'm saying... and even worse, that most speakers actually do behave this way.

Well, I'm not making this stuff up...just pick up a Stereophile and see for yourself!

No other component is 'allowed' to do this - and I think you can see why.

But, the fact is that there are two classes of speakers out there: time coherent and time incoherent.

And when you consider, as we just have, the billions years that it has taken for nature, mind and heart to arrive at the time for music to play in your living room, why in the universe would you want a speaker that goofs it up in the last few moments?

It's your choice...but now you are armed with knowledge.