Warning: "Please observe extreme caution after reading the White Paper/the Speculation paper don't play your audio system at low volume, drive an automobile or operate heavy machinery because the papers are going to be submitted to the FDA as a non-addictive treatment for insomnia. But you should feel free to read them when you're having difficulty falling asleep."

A Speculation Regarding Perception of Detail

I've observed that if an audio system sounds good, no single component of that system can be all that bad nor can the polarity of the recording be played inverted from the live performance. Reproduced music is in absolute polarity when its pressures and rarefactions match the pressures and rarefactions of the original performance.

I have come to this conclusion because I haven't been able to compensate for a bad component without causing some egregious sonic and musical tradeoffs. On the other hand, if a system really sounds awful it may only be a single component or the inverted polarity of the recording that's causing the problem. For example, simple as it may seem, a single component could degrade the sound if its power cord is plugged into the wall outlet in less than the best sounding orientation.

A great sounding system is the result of its creator's choice of components and musical judgment. The only true basis for their judgment is an understanding of music and a memory of unamplified acoustic instruments and voices in a reasonable acoustic venue and heard from an aesthetically correct distance.

I believe that every choice one makes in the design of an audio system involves tradeoffs, and the only question is which tradeoffs each of us finds acceptable. Around fifteen years ago, when I first became interested in the audibility and importance of absolute polarity, the speaker system that I'd created some ten years earlier and used for all my serious testing and musical enjoyment had second-order 12 dB Linkwitz-Riley crossovers. Despite its many advantages it also had one major disadvantage; it wasn't phase coherent. Without phase coherence it was impossible for me to discern polarity or to hear music purely in or out of absolute polarity because that crossover requires some of its drivers to always play in opposite relative polarities to each other. As a result that speaker system was inconsistent with the single absolute polarity of live music. I listened to each separate driver connected first in one polarity and then the other. It wasn't all that easy in the beginning to hear the differences, especially with my sealed back electrostatic tweeters. But since they crossed over at a relatively low 1.6 kHz I eventually decided that they, as well as all the other drivers, sounded better connected in absolute polarity. And next, with all the drivers playing in absolute polarity, I determined that I greatly preferred hearing music in absolute polarity. And from that day to this, I only find music played in absolute polarity to be truly emotionally satisfying and believe that the single most important sonic and musical aspect of a properly connected audio system is its ability to reproduce the polarity of live music.
Audio systems must at the very least satisfy the following three requirements to be suitable for rendering polarity judgments. 1. The playback polarity of the source is heard in the same polarity as the original recorded source. 2. The system is phase coherent and preferably minimum phase. In the analog domain the only classic crossover networks that permit a speaker to preserve the phase-polarity of the input signal are 6 dB first-order Butterworth. If you're not sure about your speaker system, you may use single driver headphones. 3. The system's frequency response deviates no more than +/- 3 dB from flat between 50 and 8 kHz which is an example of an application of the rule of 400 as defined in the first edition of the Audio Cyclopedia.

The gist of my speculation regarding the perception of detail and polarity is as follows: When one watches film, video or computer monitors the pictures are not seen as a series of separate still images and thank goodness! It's because the frames change or refresh fast enough, typically 24, 30 or 60 plus times per second respectively. The actual flash rate may be up to120 frames per second, depending upon the medium, which causes our eye-brain's persistence of vision to merge one still frame of a picture into the next.

Similarly, in audio, active noise-canceling headphones illustrate the ear-brain's persistence of hearing with regard to high frequencies. The way that active noise-canceling headphones work is by picking up ambient noise with built-in microphones and then generating a signal that's exactly out of phase to the ambient noise that, at least in principle, should cancel it completely. The specifications of active noise-canceling headphones indicate that

they cancel bass frequencies much more effectively than high frequencies. And perhaps that's true to some extent, but much of the reduction in their apparent effectiveness at higher frequencies may be the result of our ear-brain's persistence of hearing that merges the rapidly alternating relative phase of high frequencies into one sound that has no apparent phase/polarity. Thus two tweeters playing high frequencies out of relative phase aren't heard as canceling each other. Perhaps, this phenomena could be considered a corollary of the Fletcher-Munson effect whose curves describe the reduction of our ear's sensitivity at both frequency extremes. Well wouldn't it be great if noise-canceling headphones canceled the high frequencies as well as the bass frequencies? I'd surely like that and I bet you would too. So from Shakespeare – Julius Caesar, Cassius speaking, "The fault, dear Brutus, is not in our stars [equipment], but in ourselves…"

In my experience it's exceptionally difficult if not impossible to determine solely by ear the phase of a tweeter's electrical connection because the phase of the high frequency signal reverses too rapidly for our ear-brain to get a fix on it. In other words, when the highpass frequency of a tweeter is raised it eventually becomes so high that it exceeds our ear-brain's ability to distinguish the phase of its electrical connection, and its rapid phase reversals merges both phases into a single sonic impression that's without a discernable phase. For example, when two tweeters are playing a 10 kHz signal, if your head is a mere 3/10ths of an inch (a quarter wavelength) closer to one tweeter than the other, the signal from one tweeter arrives at your ears 180 degrees out of phase with the signal from the other tweeter. Although theoretically they should cancel each other perfectly, I believe most listeners will still hear the 10 kHz signal at full volume.

Before I state the conclusion of my theory you need to know something about the use of test equipment to determine polarity. The measurements of spectral content, frequency balance, dynamic range, distortion made on components playing music are the same regardless of the polarity of its playback. Were it otherwise, I wouldn't have written this think piece about how music played out of absolute polarity affects our perception of detail. According to "The Wood Effect" many listeners can detect the polarity of asymmetrical musical signals even though test equipment and computer programs can't. Therefore it shouldn't seem so contrary to common sense, scientific analysis or the least bit mysterious that measurements frequently don't correlate well with subjective listening tests. But on the other hand, perhaps some measurements will be more relevant to the way we hear when equipment is played in absolute polarity!

Now it follows, although the cutoff threshold may vary among individual listeners, as the sound's frequency increases, above some point all listeners will perceive the music's high frequencies as equally loud regardless of their actual polarity. But when music is heard out of absolute polarity, the midrange, bass, and even the high frequencies below some frequency, all tend to sound somewhat recessed, rather dry, and bleached out. Thus psycho-acoustically against a background of a sucked out and a papery dry sounding midrange, and a sucked out dry sounding bass, the high frequencies are heard in bold relief and sound a bit harsh, which also makes the bass and mid-range seem more detailed with faster transients, although they are not. And that can make the bass sound as if its attacks are quicker because what's heard as the leading edge of its transients are really the sound of its harmonics which are actually reproduced by the mid-range and tweeter not the woofer. The result gives the impression of a greatly degraded stereo image that's rather two-dimensional with a soundstage that's vaguely focused and somewhat confused. That also contributes to the false impression that one is hearing more of the performance venue's space because there seems to be more reverberation when the mid-range is less prominent. But those effects are really only psychoacoustic artifacts of the music being played out of absolute polarity and not how acoustic instruments and voices sound live!

Here are some other examples of how the psychoacoustics of audio affects our perceptions, which sometimes seems counter intuitive, but nevertheless may resonate with some listeners. I believe when you add a subwoofer to a system it doesn't necessarily sound as if you've added more bass, but more often than not, it sounds as if the highs have been reduced. Similarly, add a super tweeter to a system and it may sound as if there's less bass not more highs. And if you turn off the bass/mid-bass altogether or reduce your mid-range, the sound seems more detailed when it's not.

Music played out of phase coherence or out of absolute polarity may cause some listeners to wrongly attribute the low fidelity unpleasant sound to solid state devices or the digital process in general. This causes some listeners to prefer what they think is the more tuneful, full bodied, and rounded sound that they associate with

tube equipment or vinyl records which they believe sounds more like a live performance, when in point of fact, all they really need to hear is music played in absolute polarity. High-fidelity equipment, tube or solid state, shouldn't impose a sonic character of its own on the musical signal; its only tasks are to amplify the signal without distortion and control the speakers! How much tweaking and component swapping in our systems are only musically misinformed attempts to correct for music played out of absolute polarity that in Absolute Reality are bound to fail the test of high-fidelity? Does this suggest that the conclusions of some prior listening tests should be reevaluated and repeated with music that we know for sure is played in absolute polarity? I definitely think so, and that should include recordings as well, but each of you may answer that question for yourselves.

The Louis Objective Test of the Audibility of Relative Polarity

Someone, other than the test subject, compiles a 72-minute test CD-R or CD of 72 one-minute music tracks as follows: The first track will be a one-minute excerpt from a CD, record or tape recording of a two microphone stereo recording selected for its musical value but without regard to its actual polarity. The second track will be the same one-minute excerpt as the first track, but it will be recorded in the same polarity as the first track or in the opposite relative polarity to the first track as determined by the toss of a coin, heads the same and tails in the opposite polarity. The same procedure is followed for tracks 3 and 4 with different music and repeated again until 36 pairs of identical music tracks have been recorded to the CD for a total of 72-minutes. The person making the disc memorializes the polarity of each of the even numbered tracks relative to its odd numbered counterpart, and thus he has created a test CD for The Louis Objective Test of the Audibility of Relative Polarity. The playback system should use single driver headphones or at least a speaker system with consistent polarity, i.e. all drivers move in the same relative phase to each other. The actual polarity of any track or the playback system doesn't affect the validity of the test because it's only a test of the audibility of relative polarity not absolute polarity. A test of a person's ability to discern the actual polarity isn't necessary if they can't pass the relative polarity test. If the polarity of the first track of each pair of tracks is randomly selected, then the test CD can also be used as a test of the ability to discern absolute polarity. Test subjects who discern absolute polarity would by definition have also passed the relative polarity test.

The standard way to scientifically compare component A against component B is by double blind ABX testing. In order to make ABX testing a bit easier I've added non-X that allows the test subject to hear non-X but only knowing that it's non-X. When the purpose of the test is to find whether component A or B is preferred, I have a more direct protocol. Component A and component B are played alternately double blind first one and then the other as many times as needed to state a preference. Then the sequence is repeated with the order of A and B chosen at random for the next set of alternating comparisons. The protocol is repeated until the results are statistically significant. This single test will determine directly both the test subject's ability to distinguish A from B as well as preference.

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