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*This introductory issue of the **Audio Perfectionist Journal** will present the basic philosophies and precepts which will become the basis for all **Journal** articles. It will lay the foundation for the information that will be presented in future issues.*

*In this first **Journal** we'll discuss some of the misinformation that is rampant today and I'll offer logical arguments to refute this propaganda. As a prelude to the articles on speaker placement and room treatment that will be included in **Journal** #2, we'll lay out some specific goals for assembling an audio system that can provide lasting musical satisfaction and we'll discuss some of the problems that music lovers may encounter in their quest for that satisfaction.The series of **Journals** that follow will suggest solutions to the problems and provide information to help achieve the goals presented here.*

*The foundation of the **Audio Perfectionist Journal** is my high fidelity approach to home audio. This philosophical position is presented in the article titled "The High Fidelity Approach to Home Music Reproduction." All information in the **Journal** is based on the high fidelity approach which requires that a home audio system accurately reproduce the recorded signal. Proper system set-up is integral to the high fidelity approach and proper set-up starts with the preparation of the listening room.*

Your listening room is a fundamental element of your home audio system and the acoustics of your room must be considered even before you start to choose audio components to accurately reproduce the recorded signal in that room. Room acoustics cannot be corrected by electronic gadgets that alter the recorded signal and the response of the speakers. The sound from the speakers and the sound from the room must be considered separately.

The article *Equalization Can't Fix Your Room Acoustics* is the first in a series about getting the best sound from the components that you already own. It debunks the popular idea that all your acoustic problems can be electronically corrected and explains why room acoustics must be corrected acoustically. It lays the groundwork for future articles about both system components and room acoustics by explaining why these two major aspects of sound—system and environment—must be treated as separate entities.

There are two major elements of the sound that you hear from a home audio system: the sound that comes from the speakers—which is influenced by the quality of the system components—and the sound that comes from the environment in which the system resides—which is influenced by the room acoustics. These two major elements of sound can be further divided into two parts: bass frequencies up to about 140Hz and everything else. Speaker placement and room acoustics will be covered in future Journals but first we have to establish some fundamentals. Before I suggest where you should place your speakers, you need to know why they should be placed there. Before I suggest how you should treat your room, you should understand the goal.

You are wasting your time spending big money for small improvements in component performance before you've realized all the performance possible from the equipment you have now and the room in which that equipment is used. A screwed up system in an untreated room may prevent you from hearing

the improvement that an expensive component upgrade of fers. But when you insert a better-sounding component into an optimized system, a subtle sonic improvement becomes a significant advance in fidelity and satisfaction.

The article titled *The High Fidelity Approach to Home Theater* proposes that a high fidelity audio system that accurately reproduces the recorded signal can be effectively utilized for home theater, too. If you want to really hear what the filmmakers intended, you'll want to hear the signal just as they recorded it.

The popularity of home theater has been responsible for the biggest setback in the cause of high fidelity music reproduction since the introduction of the compact disc. That's because the marketeers decided to offer a false paradigm as the standard for home theater fidelity in order to license and sell more products.

The article *Home Theater Myths* describes this false paradigm and explains why it has caused a division in the ranks of audio enthusiasts that really makes no sense at all.

This article presents arguments that counter the many heavily promoted "truths" about home theater performance that go largely unchallenged today. If you love music and want an audio system that serves double duty for music and movies, this article is a must read.

Home theater is a lot of fun and there is no reason that music lovers have to be at war with home theater buffs. High fidelity sound is what the **Audio Perfectionist Journal** is all about. There is no caveat about what that sound has to represent, and there is no rule that says we have to use our hi-fi systems only for music. We can have it all if we get our priorities straight.

Future articles will describe how to use your high fidelity audio components for home theater sound without sacrificing musical performance in any way. We'll discuss the fidelity of film sound and I'll tell you how to add home theater capability to your audio system without wasting money on components that claim to deliver more than the film medium allows.

No Advertising

While the **Audio Perfectionist Journal** expresses opinions like a magazine, it is not funded by advertising. The importance of this distinction cannot be overemphasized. You've read far too much about products that are overpriced yet perform poorly and you've seen far too little information about those products that provide true, state-of-the-art performance and good value for money invested. This is largely due to the fact that the manufacturers of the overpriced products virtually control the magazines through advertising revenue and equipment loans. Selling new products is the sole aim of the industry and the publications that support it. Telling you how to get more performance from the equipment that you already own, or how to save money when you upgrade components, is considered subversive. It may seem to be subversive to the magazines which are supported by advertising but you'll find facts and unbiased opinions in the **Audio Perfectionist Journal** along with advice that is based on real-world experience.

What the Journal Won't Do

The **Audio Perfectionist Journal** won't profess that a product is superior just because it costs more. Many of the components that provide the best possible sound quality are fairly priced and many of the components that sell for a king's ransom are mediocre performers. Magazines that rely on advertising revenue generally assume that the most expensive components are the best. They can't risk insulting advertisers who make expensive products that are outperformed by components that cost less. The **Journal** doesn't rely on advertising revenue and can tell you the truth about performance and value.

The **Journal** won't assume that you already know how an audio system works or that you understand the meaning of technical terminology. The first 8 **Journals** will explain in the simplest terms possible how components work and how they function in an audio system. Terminology will be carefully explained.

Conversely, the **Journal** won't assume that you are an uncultured idiot and talk down to you from a lofty perch. I won't spend any time telling you that I can hear things you can't because I'm more "culturally sophisticated" than you are. I won't ask that you simply take my word on matters of sound quality. I'll tell you how to listen and decide for yourself.

What the Journal Will Do

I conceived the **Audio Perfectionist Journal** as an instructional guide in which I could share some of the things I've learned about making good sound in a home environment. I'll tell you about techniques that have worked for me and about things that I have tried that weren't successful. I'll offer opinions about the nature of things and arguments that support these opinions. Some of my views are very controversial but I never make a claim about sound that I can't demonstrate. Some of my explanations provide demonstrable facts and some are hypotheses. Before you condemn me as a nut case because my writing often flies in the face of conventional wisdom, try my suggestions. If you try it my way and the results aren't pleasing, your only loss is a little time and effort.

Most of the articles in the **Journal** will be an attempt to explain how components function and to suggest why products sound the way they do, not simply to express my opinions about how they sound, although I'll do that, too. Your tastes and mine might be diametrically opposed. If you find this to be true you may still benefit from my opinions; just do the opposite of what I suggest and we'll both be happy.

I don't want to be merely your trusted hi-fi guru. I want to stimulate your interest in music and the equipment that provides a satisfying musical experience in the home. I'll tell you how I have achieved that satisfaction without insinuating that my way is the only way, and you can take it from there.

This issue contains mostly arguments supporting my philosophical positions. These lay the groundwork for the articles about system set-up and room preparation that will constitute the bulk of the first few issues. When your current system is performing optimally you'll be able to hear the differences in components. Then I'll review specific products and we'll start to talk about component upgrades.

Accuracy

The **Journal** will advocate the high fidelity approach to home music reproduction. The high fidelity approach requires that the recorded signal be accurately reproduced by the playback system. An article in this issue explains the reasons for this approach.

It has been argued that an audio system should not simply reproduce the signal that is on the recording but should deliver sound that is reminiscent of live music. What difference does accuracy make if it sounds good—isn't lifelike sound what we are really after in the end? The answer to this question is yes and no.

We want the sound that we hear at home to be as much like a live musical performance as possible but there must be guidelines or disaster can ensue. When there are no standards for what is correct, the situation can quickly deteriorate into the mess that the high-end audio industry is in today. When engineering is ignored and only subjective judgments are considered useful, anybody can be a designer and everybody can be a critic.

We have people designing products who don't know what they're doing and people reviewing these products who know even less. We have loudspeakers that are so bright they can only be used with speaker cables that act as low-pass filters and reviewers who describe this phenomenon as detail.

Designing inaccurate speakers to seduce unknowledgeable reviewers is especially bad for consumers who may buy these speakers and be disappointed over the long term. Combining inaccurate speakers with inaccurate cables that err in a complementary fashion may deliver acceptable results in one specific circumstance, but what happens when something better comes along? Must you buy new speakers whenever you change speaker cables? This synergy-of-errors limits your choice of components. You are forced into using one flawed product with another flawed product or you will hear just how bad each one really is. How did this situation come about? It is a marketing strategy for selling goods of questionable value and nothing more.

Speakers with substantial response errors—that only work with cables designed to compensate for this inadequate (or maybe well-planned) engineering—are common today. Unfortunately, some of the most expensive components available fall into this category. I reject products like this and you should, too.

Achieving a synergistic blend by interfacing components with complementary (though minor) colorations is an important part of system set-up, but we must start with individual components that are designed to be as accurate as possible. This assures us the freedom to select from a broad range of competing

products when we assemble a system, and makes it possible for us to change any component independently. It also guarantees good sound from a variety of recordings, not just a few special discs selected to complement a flawed system.

No audio component is completely free of coloration but each component should start with flat frequency response and low distortion within reasonable limits. Then the user can adjust for maximum "musicality" by combining products that work well together into a satisfying system.

"Art in audio component design should always be an addition to science, not a substitute for it."

Are flat frequency response and low distortion measurements the only factors that really matter? Unfortunately, the answer is no. Well-engineered products that produce flawless measurements can still sound different. There is quite a bit of art involved in the design of a satisfying audio component. I believe that we have to start with impeccable measured performance and go on from there. Art in audio component design should always be an addition to science, not a substitute for it.

Computers & Human Brains

Computers use the binary system to perform mathematical calculations. The binary system is a base-two numbering system. There are only two numbers in a base-two system: zero and one. In reality, computers aren't even aware of zeros and ones. A computer is just a huge array of switches. These switches are either open or closed—off or on. An engineer tracing a signal through a computer defines that signal as either high or low. That's it. Either state may represent a binary one or a binary zero or the answer to a Boolean logic question. Are the contents of register A equal to or greater than the contents of register B?

Everything that I have read about the human brain leads me to believe that it works in much the same way, only better. I can hear things that my computer-based measurement instruments can't identify.

I know from experience that we are far more sensitive to timing cues than to amplitude deviations and I know that certain measurement techniques offer a better correlation with my listening impressions than others. I find square wave testing and FFT analysis of impulse response to be very informative and I'm going to tell you why in detail. I believe that your brain performs what is essentially a Fourier transform as it converts the analog sound waves that enter your ears into the "digital" data that fires your neurons.

We'll talk about measurements and I'll tell you how to interpret those that get published and even how to perform some simple tests of your own in order to sort out those audio products that are poorly engineered. If you have a PC with an available card slot you can buy everything you need for semi-anechoic speaker testing and a variety of other acoustic measurements for about $1,000. If you're not interested in making your own measurements I'll tell you about the results of mine.

If I state that there are only three major brands of loudspeakers that can accurately reproduce an input waveform, and that all the rest will be made virtually obsolete by the new recording technologies that are coming to market now, you might be skeptical. If I tell you why and explain how you can measure this phenomenon for yourself you may be more intrigued.

Testing can help to determine which products are well-engineered and worthy of further consideration, but listening is the only way to proceed from there. Learning how to listen and determining and defining your own particular audio tastes are necessary requisites for success.

Product Reviews

I intend to do some product reviews but they will not be like the ones you've been reading elsewhere. Relying on reviews is a crutch that you should learn to do without. When you have firmly established your own sonic tastes you'll realize that someone else's subjective impressions of an audio component are useless to you.

The influence of product reviews is a primary reason that so many music lovers are frustrated with their audio systems. Seeking that magic component that will transform your system into a sonic wonderland is a futile pursuit.

Some audio components sound better than others but many people have systems that are so poorly set-up, in rooms that sound so bad, that the subtle differences between competing components will be all but inaudible. An inferior component may actually be preferred if it compensates for a flaw somewhere else in the system.

I have visited many rooms where the best components available were making the worst imaginable sound. Set-up is far more important than the choice of equipment. The sonic difference between a good component and a great one is subtle compared to the huge difference between a bare room and one with proper acoustic treatment.

Most of us have too much to do and far too little time in which to do it. We want to save energy by letting "experts" do some of the leg work. We want them to evaluate products and tell us which ones to buy. This may be helpful when choosing utilitarian devices like coffee makers and watches but it will never be a satisfactory way to select products where the primary goal is an emotional response, not simple function.

When seeking a soul mate to share your life, the opinion of an expert is worthless because no expert knows your soul's unique needs. Assembling a good hi-fi system is just as personal as choosing a spouse and a well-chosen hi-fi system is more likely to bring long-term satisfaction.

Manufacturers and magazines would have you believe that audio components are either great or they are garbage. And if you choose the great ones you are guaranteed great sound. This is seldom the case. There are many different audio components available that are of sufficient quality to be incorporated into a great-sounding system, if they are properly interfaced and the room is properly prepared. As your personal involvement with the system deepens, your developing tastes will narrow the field.

There is no shortcut to audio nirvana and there are no magical audio components. If you want to own a satisfying audio system, you must learn how to select components and tweak the system yourself. You don't have to study electronics and physics but you do need to know the sonic effect of various adjustments. Otherwise you're just shooting in the dark.

In Search of Better Sound

Before I try to describe why I think that a Levinson amplifier sounds slightly better than a Krell, we need to get the system that you already own up to speed. Then you'll be able to try these amps in your own home and see if I'm right. I'm an amplifier expert but I'm not an expert about your taste. You might like the Krell better, but if the sound of your system sucks you'll never really know.

The sonic consequences of poor speaker placement or a room with mediocre acoustics may swamp the audible difference between amplifiers that vary in price by thousands of dollars. Reading elaborate reviews of products that offer potential performance benefits will be of little value to those who haven't fully developed and identified their own audio tastes and sufficiently prepared their home audio systems in order to allow these potential benefits to be realized and appreciated. You need to know what to listen for, and you need a system that sounds good enough to enable you to hear it. The **Audio Perfectionist Journal** can help. Let's get started. APJ

the HIGH FIDELITY APPROACH *to…*

Home Music Reproduction

*The **Audio Perfectionist Journal** follows a clearly defined and proven method for evaluating audio systems and components that I call "the high fidelity approach to home music reproduction." If musical satisfaction is your goal, the high fidelity approach is the best way to evaluate and choose audio components and systems. Here's why.*

The high fidelity approach allows audio components and systems to be quickly evaluated with repeatable results. It helps us to avoid products that are designed to momentarily seduce by embellishing rather than accurately reproducing the recording, assuring lasting musical satisfaction from the components we choose. It allows us to choose from a broader range of components instead of seeking products with "synergistic" flaws. It allows us to enjoy a wide range of recordings, not just special "audiophile" discs.

The Reason For Accurate Music Reproduction

We start with these assumptions: Our goal is the emotional satisfaction that music can provide. A high fidelity audio system is a means to that goal. A more accurate and revealing audio system can facilitate a deeper and more satisfying connection with recorded music and allow us to enjoy a wider variety of music and recordings.

"Our goal is the emotional satisfaction that music can provide. A high fidelity audio system is a means to that goal."

We add these requisites: The basic building blocks of music—melody, rhythm and pace—must be accurately reproduced in order for the composer's message to be fully conveyed to the listener. We want instruments and voices to sound natural and lifelike and we need to assemble an audio system which can deliver a lifelike presentation from recorded music.
In order to choose the components for this system we have to think realistically about what an audio system does and the function of each of the components from which it is comprised.

Audio Systems Play Recordings

An audio system doesn't reproduce instruments or voices, it reproduces recordings of instruments and voices. We have no way of knowing what colorations a recording contains, which makes any individual recording a questionable tool for evaluating audio components. We may know how real instruments and voices sound but we don't know exactly how a recording should sound because we don't know how accurately the live performance has been captured by the recording.

While we have virtually no control over the quality of recordings, we can assure that recordings are reproduced accurately by choosing well-designed audio components and using them properly. Why should accurate reproduction of the recorded signal be our goal? Because it minimizes playback distortion, which is the only kind of distortion over which we have some control. Minimizing playback distortion by accurately reproducing the recording assures us that most recordings will provide acceptable sound and it provides us with a specific methodology for choosing components.

The Two Stages of Home Music Reproduction

There are two parts to an in-home musical experience: recording and playback. The live musical performance must be captured by microphones, converted to an electrical signal and stored on the recording medium. The recorded signal must then be retrieved from the recording medium and reproduced by the components in the home audio system.

We have virtually no control over the recording process and virtually no way to objectively evaluate the recording. We can control the playback process and evaluate the quality of the playback system to ensure that we are hearing all there is to hear.

The Magic Can Be Lost in Recording or Playback

We can't control the recording process but we can strive to hear all that each recording has to offer. We can't prevent distortion that occurs during the recording process but we can minimize distortion during playback.

A high fidelity audio system should reveal the information stored on the recording with minimal loss and no additions. We hope that the recording is true to the original event but, if it is not, a high fidelity playback system won't romanticize the sound with complementary colorations or added effects. This point is philosophically critical. A high fidelity audio system should not attempt to make a recording sound better by altering the recorded signal in any way. Any alteration of the recorded signal is playback distortion. While some types of playback distortion may be complementary to some recordings, no type of distortion is complementary to all recordings.

Hear All There is to Hear & No More

Fidelity means faithfulness or adherence to the truth. High fidelity sound offers maximum truth or faithfulness to the original recording.

The source component (turntable, CD player, etc.) should retrieve all the recorded information. That information should be processed by the amplification components (preamplifier and amplifier) and reproduced by the speakers with minimal

loss and no added coloration or reverberation. The recording must be reproduced without embellishment because embellishment is distortion and no type of embellishment (distortion) will work for every recording.

Artifacts (distortion) added by the playback system which may seem to be complementary to one recording are likely to be detrimental to other recordings. System colorations that make some recordings sound better are likely to make other record ings sound worse.

Many Recordings Capture the Magic of Music

You can enjoy a wide range of music with an accurate audio system. The artists and technicians who create the recordings generally try to capture the live musical performance faithfully in order to offer a good-sounding, saleable product. They judge their results by listening to the recordings on a professional monitoring system which, while it may not sound as good as the systems in our homes, is likely to have reasonably accurate response.

A home playback system that is demonstrably accurate will provide acceptable sound from the vast majority of recordings and startlingly realistic sound from the best ones.

To assemble an accurate audio system we should choose components that can provide high fidelity performance and there is a sound methodology for doing this.

Two-Stage Evaluation Process

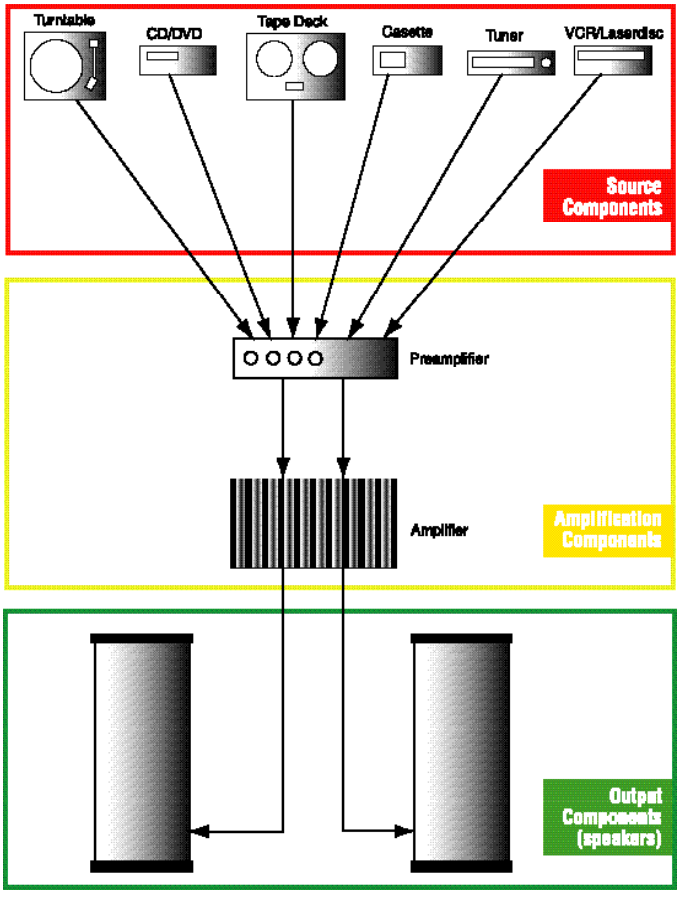
There are two parts to the evaluation process when using the high fidelity approach: assessing the integrity of the design to gauge the potential for accurate performance and listening to the product to determine actual resolution and sound quality.

If the design is scientifically sound and the specifications acceptable, the product is deemed to be capable of accurate reproduction. Choosing between capable products is done by listening and comparing the perceived sound quality using specific guidelines.

Choosing Components for High Fidelity Reproduction

A high fidelity audio system should be assembled from components which are designed to accurately reproduce the signal. The potential for accurate reproduction can be established by objective testing. Each component should be designed to retrieve and process as much of the recorded information as possible while adding as little noise and distortion as possible. After basic accuracy is assured by objective measurements, subjective evaluations by ear can begin.

Each component should be selected for accuracy, neutrality and transparency. It should not be necessary to combine a "dark" speaker cable with a "bright" amplifier to achieve a "synergistic" blend of colorations. Combining flawed components in a synergistic fashion is a slippery slope to mediocrity. Each component should be demonstrably accurate and audibly transparent to the component that precedes it in the signal path. Components that embellish the sound in some way will be less transparent than those that do not. Of course each component should also deliver good sound, and if a component is accurate, neutral and transparent it probably (though not absolutely) will. Listening will insure that the component is objectively and subjectively excellent.



Evaluating by Ear

This high fidelity approach to home music reproduction provides us with an objective method of evaluating audio components and systems by ear. You can judge a complete audio system by how easily you can hear the differences between recording types and recording quality. You can judge an individual audio component by how easily you can hear the component that precedes it in the signal path.

Better speakers will make it easier to hear the differences between amplifiers. A better amplifier will make it easier to hear the differences between preamps. A better preamp will make it easier to hear differences between source components. Better source components (turntable, CD player, etc.) will make it easier to hear differences between recordings.

A Wide Range of Music is Available to Enjoy

A truly transparent, accurate audio system will provide acceptable sound from a wide variety of recorded material and exceptional sound from the best recordings. If you choose accurate components and assemble them into a high fidelity audio system you won't have to limit your listening to "audiophile" recordings or a single type of music. You'll be able to enjoy the world's musical heritage and revel in the new creations of today's composers and those who will follow tomorrow. APJ

EQUALIZATION

…Can't Fix Your Room Acoustics

Getting good sound from your home entertainment system requires attention to set-up. You can choose the best equipment in the world and still be disappointed by the sonic results unless you devote some time to adjusting the system and the room that you put it in.

The contribution from the environment in which it resides can make or break the sound of a hi-fi system. Yes, your room is an important component and if it sounds bad, your potentially great-sounding system may be overwhelmed. Nothing I'm going to say in this article is meant to imply that the room is not an extremely important aspect of the total sound. What I am saying is that you can't fix a poor-sounding room with electronic equalization that alters the response of the speakers. You must fix poor room acoustics acoustically. Learning why you can't fix room acoustics by equalizing the speakers is important in order to understand how to do it correctly.

Please don't jump to any all-encompassing conclusions. I don't have a problem with equalization per se. Recordings are equalized to compensate for flaws in the equipment used to make them and play them back. Speakers can be equalized to correct response errors that should have been fixed in the original design. In fact, that's what well-designed crossover networks are supposed to do—equalize driver response errors. Using an equalizer as a tone control to tune your system to suit your specific tastes or to make poor recordings sound listenable is a reasonable concept, although I think that there are better ways to do this. I don't mean to condemn all forms of equalization—just so-called "room EQ," also incorrectly called "room tuning." I have a problem with the idea that you can compensate for poor room acoustics by altering the response of the loudspeakers to make them inaccurate in a complementary way. In a room where the speakers and the listeners are properly placed, well-away from the room boundaries, "room EQ" simply does not work.

As powerful digital signal processors become ever more economical, magic computer boxes designed to fix all your acoustic problems will be springing up like weeds. They work just like traditional room EQ. They falsely assume that the ear/brain mechanism can't distinguish between the sound from the source and the sound from the room. When we start to actually tune the room with acoustical treatment, you'll see that the sound from the speakers and the contributions from the room are separate entities.

Caveat

This article is about the silly concept of attempting to correct room acoustics by inversely screwing-up the response of the loudspeakers. It applies only to the important midrange frequencies starting at about 130Hz.

Below 130Hz or so, in a domestic living room, EQ may actually prove to be sonically beneficial but there are better ways of achieving smooth, detailed bass response and that's the subject of another article. At low frequencies the ear can't easily distinguish between the sound from the speakers and the contributions from the room, but I believe that you still need to prepare the room for the best sounding results.

Above the lower-midrange even the most lead-eared measurement freak has to recognize that there are huge differences between the way in which a single microphone captures sound and the way in which two moving ears attached to a thinking brain do it. Engineers refer to "standing waves" above 400Hz as "statistical" because they are so numerous and closely spaced that they can't be individually singled out with meaningful accuracy, even by a microphone.

Almost everyone agrees that there is a transition between a range of frequencies where we can't separate the sound of the room from the sound from the speakers and the range where we can. There is a big debate about the frequency range over which this transition occurs. I am convinced that it begins at the point where sounds start to become directional—perhaps as low as 60Hz—and is complete by 140Hz or so where the difference is quite clear. If this weren't the case, low male voices would become unrecognizable due to room acoustics.

From the midrange frequencies upward, room reverberation must be acoustically controlled and that is the subject of another article on preparing your room. Reducing higher-frequency output from the speakers simply reduces high frequency detail and has little effect on reverberation. EQ tames brightness at the expense of musical information. Fixing the room fixes the problem rather than covering it up.

Before we can discuss how to get good sound in a real room, we need to expose some concepts that don't work and examine the reasons why. You'll better understand the importance of this information as we build on it in future articles.

"In-room" Response

Room equalization is the process of measuring the sum of the amplitude response curve of the loudspeakers combined with the reflected energy from the room boundaries and then altering the response of the speakers to achieve a flat frequency response measurement from a test microphone placed at the listening position. A curve that is the inverse of the measured sum of room response and speaker response is applied to the signal entering the loudspeakers using analog filters, digital filters, or sophisticated DSP techniques. This is supposed to deliver error-free response "in the room." Regardless of how the correction is applied, room EQ doesn't work to improve sound quality.

Why doesn't this process, which sounds so logical, work? Because it is based on two false assumptions: that removing all sound contributed by the room during playback is desirable, and that the sound from the room boundaries and the sound from the speakers combine to become one undifferentiated signal. Let's use logic and empirical evidence to analyze this situation.

My Piano, the Reality Reference

I am very fond of my piano. It's not a fine-quality instrument and would have little monetary value if offered for sale, but it has been in my family for three generations and I have become quite attached to it. My grandparents bought it sometime around the turn of the century and my parents took possession

when I was a small child. I learned about music while taking piano lessons on this very instrument.

When I grew up and moved out on my own, I purchased a new baby grand that served my daughter well when she studied music, but I missed the feel and sound of my familiar old Brambach and arranged a trade with my mother. She got my newer piano and I got the old family heirloom. For the last twenty years or so this near-hundred-year-old piano has traveled with me from home to home like a loyal pet. Together we have experienced a variety of acoustic environments. In the home in which I now live, the piano has resided in three different rooms at various times.

If You Listen to a Guru, You Must EQ

Now if you listen to some of today's "audio experts," all the rooms in my house (and your house) are rife with dreaded "standing waves"—multiple resonances based on the dimensions of the room—and other unimaginable evils that only equalization can correct. To hear these "experts" talk, an audio system installed in these same rooms would sound awful without electronic equalization. Did my piano (a real live instrument) sound bad in these rooms? Should I have applied equalization to the piano to compensate for the room acoustics?

Equalizing the Piano

The argument for room equalization is that these room aberrations add to or subtract from the response of the loudspeakers at various frequencies necessitating that the speaker's response be modified from flat until it is the complement of the response of the room. Then the sum of the speaker's response and the additions from the room will produce a flat measured response curve and the sound supposedly will be more accurate. This appears to be reasonable if you don't look too closely at the facts.

If you were to measure the frequency response of my piano in a room with a single microphone and some kind of non time-based spectrum analyzer like the EQ gurus use, the amplitude response curve probably would have many peaks and dips when compared to a measurement taken outdoors, indicating substantial deviations from flat response. Even the presence of a coffee table in the room would produce measurable comb-filter effects. If all the keys were struck in sequence with the same force, some notes would measure louder than others due to room reinforcement or cancellation.

What if we could modify the felts on the hammers of the piano to make the softer notes louder and the louder notes softer until the measured response of the piano in the room was indeed flat? Would the sound be improved? Of course not. All we would accomplish by doing this is to completely ruin the sound of the piano. In fact the idea of modifying the piano for flat in-room response seems silly—but that's exactly what the EQ gurus recommend that you let them do to your speakers. They want to alter the frequency response of your speakers to make them less accurate.

Applying electronic equalization to your loudspeakers to compensate for room acoustics is just as silly as modifying the piano with the same goal and the idea is based on some complete misconceptions that have been repeated so many times that many people have come to believe that they are true.

Does the Piano Sound Different in Different Rooms?

My piano has been in many different rooms over the years. If I positioned the piano in a bare room and played it before placing other furnishings in this room, the sound of the room would be overly reverberant and the long decay time of this reverberation would blur and confuse the sound from the piano somewhat. However, when placed in a variety of normally furnished rooms with very different acoustic characteristics the sound from the piano remains exactly the same. The environment sounds different—you can certainly differentiate one room from another—but the piano sounds exactly the same. No one would ever confuse the sound of my piano with the sound of a Steinway or a Bösendorfer. And no one would ever confuse my playing with that of Chopin.

A familiar voice is another real-world example. My wife's voice is clearly identifiable whether she speaks to me in the kitchen or in the bedroom. When she shouts to me from the den, I can tell where she is by the sound of the room acoustic, but her voice remains clearly hers. Regardless of the acoustics of the room in which she speaks, her voice is easily recognizable. The room contributes to the overall sound of the experience but makes virtually no difference in the sound of the piano or of a human voice. Why is this? What about all those dreaded "standing waves"? If we need to electrically equalize our home audio systems to compensate for room acoustics, why do the piano and my wife's voice work just fine without EQ?

"A microphone integrates these signals but the ear/brain differentiates between them."

I'll give you a couple of good reasons: there is a big dif ference between our ear/brain mechanism and a microphone/spectrum analyzer, and there is a big difference between music and voices (or sound effects for that matter) and a continuous stimulus, whether it's a sine wave or pink noise. In simple terms, the

measurement system used for "room equalization" is completely bogus. The sound from the room and the sound from the speakers don't sum because these sounds originate in different places and they arrive at the listener at different times. A microphone integrates these signals but the ear/brain differentiates between them.

Is It Anechoic or Am I Stoic?

I recently read an article advocating room equalization and the writer made the statement that, sure, the speakers measured flat in an anechoic chamber, but in a real room their response would have to be radically modified for accurate reproduction. Is that true? Are speakers really measured in an artificial environment just to fool you? Does some self-proclaimed "authority" with a signal generator and a spectrum analyzer really know so much more about sound than the experienced engineers who worked so hard to make their speaker designs accurately reproduce the signal fed into them?

In fact, anechoic chambers were made nearly obsolete by modern time-oriented, computer-based measurement techniques. Although there are some anechoic chambers still in use for research, the vast majority of speaker manufacturers measure loudspeaker frequency response the same way that I do. We use a prescribed sequence of pseudo-random noise stimuli, known as a Maximum Length Sequence (MLS), which is correlated to an impulse from which we can derive full bandwidth amplitude response curves by Fast Fourier Transform (FFT) analysis utilizing a computer.

These measurements are made in a reverberant field. I measure speakers in my listening room. Yes, an accurate speaker delivers flat frequency response in a real room.

What about all those dreaded resonances and standing waves? They are excluded from the measurement by a simple technique known as "windowing" or "gating." In essence, the computer opens the microphone just long enough to receive the complete direct signal output from the speaker and turns off the mic before the first arrival of reflected energy from the room boundaries. Sound complicated? Maybe, but your brain has been doing virtually the same thing all along. In scientific circles it's known as the Haas effect. (The primary signal that arrives at the ear first gets preferential attention from the brain and a secondary signal that arrives at the ear delayed by a few milliseconds is perceived as an echo, or reverberant sound). That's why the piano sounds the same in different-sounding rooms. Mother Nature is a very crafty old broad.

The fact that a windowed measurement taken in a reverberant field produces a flat amplitude response curve from an accurate speaker proves that the sound contributed by the room is out of time and phase with the actual signal. It's not part of the signal; it is, in effect, distortion. Distortion that is delayed or out of phase with the desired signal is easy to deal with. You have all the tools necessary to exclude this distortion from the desired signal sitting just above your shoulders.

Suppose that a simple single-microphone measurement shows that the room boosts a certain signal at a certain frequency by twenty percent. Equalization is applied to the signal entering the speaker to reduce the speaker's output at that frequency by twenty percent. A simple non time-based measurement using a continuous stimulus shows an improved result with the sum of the speaker's output and the room's addition now equalized to measure flat. Is the resulting tone now 80% signal and 20% distortion? It actually would be if we heard things like a microphone does, but we don't. We can differentiate between the arrival times of the real signal, which comes directly from the speaker and the effects of the room, which arrive later and come from slightly different directions.

Before equalization our brain says, "Yes, that's a recording of the piano that I know so well and the room containing the audio system is fairly large and somewhat reverberant." After equalization our brain says, "That's a recording of a screwed-up piano being played in a fairly large, somewhat reverberant room."

The Ear/Brain Mechanism

A human being is like a time machine. The human hearing mechanism is more sensitive to time and phase than it is to pitch. We use inter-aural time differences (the tiny difference between the arrival time of a signal at one ear and the other) as one mechanism for determining the direction of origin of a sound. We use subtle shifts in phase to tell whether the source of the sound is approaching or departing.

You determine the direction of the sound from the breaking twig beneath the foot of the beast that's stalking you in the forest

primarily by inter-aural time delay. Amplitude differences add additional cues but a sound that is directly behind you or directly in front of you will offer little amplitude variation from one ear to the other.

"We can hear the difference between the sound of the piano and the sound of the room it's in..."

We are more sensitive to timing than to pitch. If something is sneaking up on you in the forest, it's much more evolutionarily expedient to know the direction from which the potential attack will come and how far away the attacker is than it is to be able to identify the call of the individual attacker so that you can recognize its exact species.

If there is equal energy across a one-third-octave band, most people can't hear deviations of ±5dB or more in individual frequencies within this band. But if you hear a projectile whiz by your head, the direction of origin and its trajectory are apparent—to most of the people most of the time. This is important for survival. The next one might not whiz by, it might find its mark. Knowing the exact frequency of the whizzing sound is less important for survival—an approximation will do. It's nice to know if what whizzed by was a rock or a pterodactyl, but either way you'd better be prepared to duck.

You have two ears. They are shaped to provide a specific pattern of sonic reception. This helps you to determine the direction of the origin of a sound. Both of your ears can't be in the same place at the same time. This fact alone eliminates most of the arguments regarding room standing waves at frequencies above 150Hz or so. Both ears probably won't be exposed to the same room aberration because they occupy different locations in that room and they are always moving. Nobody sits perfectly still like a test microphone.

Between those two ears is the world's most powerful computer. Mine may do more MIPs than yours but either of us can outreason any machine. And a machine can differentiate between the direct sound from an accurate speaker and the delayed energy reflected from the room boundaries.

We can hear the difference between the sound of the piano and the sound of the room it's in because there is a difference in the arrival time of these sounds and in the position from which they originate. We can hear the difference between the sound from our speakers and the sound of the room they're in because there is a difference in the arrival time of these sounds and in the position from which they originate.

If you are blindfolded and taken into a room that you have never seen, you can easily tell whether the room is large or small, furnished or bare, just by how things sound in there. And you could identify the sound of a friend's voice in any room regardless of the acoustics, at any time. The sound of the room and the sound of the voice are two distinct entities. Try it. What if a room sounds so bad that it detracts from the sounds that we want to hear? You have two choices: either don't go in there, or fix the acoustics of that room to make it sonically hospitable.

The Party Test

While visiting Scotland I asked my friend, Ivor Tiefenbrun, Managing Director of Linn Products, for his opinions about room acoustics. His advice was simple. "Throw a party and watch where people gather to converse," he said. "Put your hi-fi in that room."

We tend to add furniture to a room until it feels comfortable to be in there. Much of the feeling of comfort has to do with how the room sounds. A room that is too bare sounds cold and barren like a hallway at the courthouse. Too many furnishings make the room feel closed-in and dead. An anechoic chamber is not a comfortable place to be and neither is an over-damped custom home entertainment room.

Most domestic rooms that provide a comfortable place for conversation will also provide acceptable acoustics for a piano recital or for hi-fi listening. Some additional work may be necessary to achieve the very best possible sound. We'll get to that in upcoming articles.

Records & CDs Are Round but Speakers Should Be Flat

The first requisite for performance accuracy in a loudspeaker is flat frequency response. A speaker shouldn't have a tonal char-

acter of its own. If it emphasizes some frequencies and diminishes others it will color every sound that it reproduces with its own tonal aberrations. If the signal entering the speaker is modified to produce an output from the speaker that is the complement of the room acoustic, accuracy goes out the window. An equalized speaker will color every sound it reproduces with its new tonal aberrations. Equalizers also add noise, distortion, and frequency-dependent phase shift to the signal and depreciate transient response due to filter ringing, but that's another story.

The makers of accurate loudspeakers go to great lengths to design and build speakers that deliver frequency response curves with minimum deviation from the desired flat response. The best speakers are carefully matched to a reference standard and to each other. It is very important that the left and right speakers have closely matched frequency response curves if you want good imaging. Equalizing the signal that goes into the speaker undoes all this engineering and careful quality control and results in an inaccurate output. Putting a different EQ curve into just one speaker is the worst possible thing, in terms of sonic accuracy, that I can imagine. Yet that is exactly what will happen if you apply room EQ in anything other than a perfectly symmetrical room.

The following statement is a simple truth: If you start with a bad-sounding room and apply electronic equalization you will end up with bad-sounding speakers in a bad-sounding room. Don't take my word for it. Try it and hear for yourself. Don't let an EQ guru show you a graph and tell you how much better things sound. Listen to music and determine if an improvement has been made or if the change is just a change.

I have listened to dozens of systems in actual home environments before and after equalization. With equalization the sound is invariably worse. Some people will cling to and defend a supposedly objective measurement over what their own senses tell them even when that measurement is completely wrong. How else can you explain the persistence of the idea that room acoustics can be corrected by ruining the accuracy of the loudspeakers?

What If My Room Sounds Awful?

Remember, I'm not suggesting that the sound of a room can't be improved. I'm simply saying that electronic equalization that

makes the output from the loudspeakers inaccurate is not the way to do it. So what do you do if your room sounds bad? Fix it, of course. Acoustic problems need to be dealt with acoustically. Standing waves and room resonances at frequencies below 130Hz or so really can cause complications, but the situation is far more complex than accepted theory suggests, and the fix for virtually all these problems is far simpler. In a future article I will tell you how to get near-perfect bass in almost any room without rebuilding your house. When you hear just how easy it is, you'll wonder why all the propaganda you've read in the past was about building special rooms and using computer spread sheets to position speakers.

Reverberation time really is important. Proper speaker placement and simple room treatments can cope with most sonic difficulties that will be encountered in the home environment, and I'm going to tell you how to fix each one of these problems in future articles.

Different loudspeaker types require different room placement and treatment. One set of rules won't work for all speakers because of the differences in radiation patterns. We'll talk about planars, dipoles, bipoles, D'Apolito arrays and properly-designed speakers too.

I've achieved great sound in three rooms in my house without electronic equalization and you can have it too. (The RT-60 in my bathroom could be improved but I never sing for an audience in there.) You may be surprised to find that you can do it yourself for very little cost. No "gurus" required. APJ

the HIGH FIDELITY APPROACH *to…*

Home Theater Audio

*The **Audio Perfectionist Journal** follows a clearly defined and proven method for evaluating audio systems and components that I call "the high fidelity approach to home music reproduction." Contrary to popular belief, the high fidelity approach also works for home theater. In fact, an audio system that accurately reproduces the recorded signal works just as well for film sound as it does for music.*

The high fidelity approach to home theater allows us to utilize some of our expensive audio equipment for the enjoyment of movies without compromising musical performance in any way. If you want to enjoy the best possible sound from movies, and music, the high fidelity approach is for you. Here's why.

Hear What the Filmmakers Recorded

The high fidelity approach to home theater requires that the recorded signal be accurately reproduced without alteration or addition. This assures that we will hear every nuance of the soundtrack as recorded on the DVD or other home theater medium. We hear what the filmmakers recorded, not what someone else feels the "filmmakers intended." A high fidelity audio system doesn't arbitrarily impose certain characteristics (like a diffuse surround field) upon the artists and technicians who create the soundtracks.

The high fidelity approach allows us to utilize our home entertainment systems for music and movies without compromise. The high fidelity approach allows audio components and systems to be quickly evaluated with repeatable results. It helps us to avoid products that are designed to momentarily seduce by embellishing rather than accurately reproducing the recording or soundtrack, assuring lasting satisfaction from the components we choose. It allows us to choose from a broader range of components instead of being limited to products with "special" home theater characteristics or attributes. It allows us to enjoy a wide range of films and music recordings, not just effects-laden action movies or "audiophile" selections.

The False Paradigm

If you find the local Cineplex to be a paradigm of good sound then you may want to assemble a home theater system that sounds as much like a commercial movie theater as possible. If you want better sound than what you hear in a commercial movie theater then you need to establish a higher standard as a reference.

If you want a home theater system that can also provide a satisfying in-home musical experience you'll definitely need better sound than what the horn-loaded PA system in a commercial movie theater can offer. The high fidelity approach to home theater guarantees better sound by applying the same standards to a home theater audio system that we use to evaluate a home music system. Those standards require that the recorded signal be accurately reproduced—not modified to emulate a movie theater or another arbitrary standard of quality such as a dubbing stage.

Propaganda has led many to believe that a high-fidelity audio system can't provide the best movie sound. We've been told that the recorded signal on a DVD must be radically altered, both electronically and acoustically, in order to deliver "the sound the filmmakers intended."

The mandated electronic alterations include bass management, re-equalization, timber matching and decorrelation of the surround signals. The mandated acoustic alterations include the use of limited-range satellite speakers with modified vertical dispersion characteristics and bass redirected to a mono subwoofer; dipole surround speakers placed so that the listener sits in the null region and hears only reflected sound from the room boundaries; and mono subwoofers capable of high output at around 35Hz, which usually means reduced output at real sub-bass frequencies.

We've been told that altering the recorded signal in these ways will make our living rooms sound just like a dubbing stage or a commercial movie theater. We've been told that this should be our ultimate goal in order to "hear what the filmmakers intended."

What we've been told is not a matter of fact but an opinion. It's one way of doing things—and not a very good way if accurate reproduction and the best possible sound is our goal. The article titled *Home Theater Myths* in this Issue explains why. There is, of course, another way to reproduce home theater sound—the high fidelity approach. Here's why it is a better way to enjoy movies at home.

The Reason For Accurate Soundtrack Reproduction

We start with these assumptions: Our goal is to utilize our high fidelity audio systems for home theater as well as music without compromising performance in any way. A more accurate and revealing audio system can facilitate a deeper and more satisfying connection with film art as well as recorded music and allow us to enjoy both to the fullest.

We add these requisites: Every nuance of the soundtrack must be accurately reproduced in order for the filmmakers' message to be fully conveyed to the viewer. Dialog must be intelligible and sound effects must be realistically loud and involving. Effects and voices must sound natural and lifelike and we need to assemble an audio system which can deliver all this without compromising music reproduction.

In order to choose the additional components that we'll need to add to our stereo systems we have to think realistically about what a home theater system does and the function of each of the components from which it is comprised.

Audio Systems Play Recordings

An audio system for home theater is just like an audio system for music. It reproduces recordings of music, sound effects and voices. Our best hope of hearing what the filmmakers intended is to strive to hear exactly what they recorded—without alteration.

We can't assume that the filmmakers intended for us to hear a diffuse surround field and impose that assumed intention on those filmmakers who actually wanted us to hear sounds focused in positions towards the sides and rear. We can't assume that the DVD we just purchased contains a soundtrack with theatrical EQ that must be re-equalized for home playback. In fact, we can't assume that a DVD contains a movie. It may be a music video!

We can assure that soundtracks on DVD, or other home theater media, are reproduced accurately by choosing well-designed audio components and using them properly. Why should accurate reproduction of the recorded signal be our goal? Because it minimizes playback distortion, which is the only kind of distortion over which we have some control. Minimizing playback distortion by accurately reproducing the recording assures us that most recordings will provide acceptable sound and it provides us with a specific methodology for choosing components.

We can control the playback process and evaluate the quality of the playback system to ensure that we are hearing all there is to hear from home theater media.

The Filmmakers Should Decide

The filmmakers should decide how the audio palette will be used, not the playback system. An audio system that alters the recorded signal imposes its characteristics upon the artists instead of revealing what they have created.

We can't control the creative process or make assumptions about what the filmmakers intended but we can strive to hear all that each soundtrack has to offer. We can't prevent distortion that occurs during the recording process but we can minimize distortion during playback.

A high fidelity audio system should reveal the information stored on the recording with minimal loss and no additions. A high fidelity playback system won't romanticize the sound with complementary colorations or added effects and it won't try to make your living room sound like a commercial movie theater. Any alteration of the recorded signal is playback distortion. An audio system that imposes its characteristics on the soundtrack may conceal rather than reveal the filmmakers' intent.

Hear All There is to Hear & No More

Fidelity means faithfulness or adherence to the truth. High fidelity sound offers maximum truth or faithfulness to the original recording, whether that recording contains music or a film soundtrack.

The source component (DVD player, VCR, etc) should retrieve all the recorded information. That information should be processed by the amplification components (surround proces-

sor and amplifier) and reproduced by the speakers with minimal loss and no added coloration or reverberation.

The recording must be reproduced without embellishment because embellishment is distortion and no type of embellishment (distortion) will work for every recording. Artifacts (distortion) added by the playback system which may seem to complement the style of one filmmaker are likely to be detrimental to the styles of others.

Many Soundtracks are Remarkably Realistic

The artists and technicians who create the film soundtracks try to draw the viewer into the screen image with realistic sound effects and dialog. The soundtracks they create are equalized when a film is prepared for theatrical exhibition and re-equalized or re-recorded for home distribution on DVD and tape. A home audio system that is demonstrably accurate will provide acceptable sound from the vast majority of DVDs and startlingly realistic sound from the best ones.

To expand an accurate audio system for home theater use we should choose additional components that can provide high fidelity performance and there is a sound methodology for doing this.

Two-Stage Evaluation Process

There are two parts to the evaluation process when using the high fidelity approach: assessing the integrity of the design to gauge the potential for accurate performance and listening to the product to determine actual resolution and sound quality. If the design is scientifically sound and the specifications acceptable, the product is deemed to be capable of accurate reproduction. Choosing between capable products is done by listening and comparing the perceived sound quality using specific guidelines.

Choosing Components for High Fidelity Home Theater

A high fidelity audio system for home theater should be assembled from components which are designed to accurately reproduce the signal. An accurate stereo system can be utilized for home theater by adding additional channels. The components necessary to expand an accurate audio system into a home theater system should be chosen in the same way as the components for the stereo system that is the basis of the home theater system. The added components should accurately reproduce the recorded signal and match the characteristics of the stereo components.

The potential for accurate reproduction can be established by objective testing. Each component should be designed to retrieve and process as much of the recorded information as possible while adding as little noise and distortion as possible. After basic accuracy is assured by objective measurements, subjective evaluations by ear can begin.

Each component should be selected for accuracy, neutrality and transparency. It will be necessary to add center channel and surround speakers that are designed to sound like the stereo speakers when used in the locations where they will actually be used. Each component should be demonstrably accurate and audibly transparent to the component that precedes it in the signal path. Components that embellish the sound in some way will be less transparent than those that do not. Of course each component should also deliver good sound, and if a component is accurate, neutral and transparent it probably (though not absolutely) will. Listening will insure that the component is objectively and subjectively excellent.

Evaluating by Ear

This high fidelity approach to home theater duplicates the high fidelity approach to home music reproduction in that it provides us with an objective method for evaluating audio components and systems by ear. You can judge a complete audio system by how easily you can hear the differences between recording types and recording quality. You can judge an individual audio component by how easily you can hear the component that precedes it in the signal path.

Better speakers will make it easier to hear the differences between amplifiers. A better amplifier will make it easier to hear the differences between preamps or surround sound processors. A better preamp or surround sound processor will make it easier to hear differences between source components. Better source components (DVD player, etc.) will make it easier to hear differences between recordings or film soundtracks.

A Wide Range of Art is Available to Enjoy

A truly transparent, accurate audio system will provide acceptable sound from a wide variety of films and music videos on

DVD and exceptional sound from the best recordings. If you choose accurate components and assemble them into a high fidelity audio system you won't have to compromise your musical enjoyment in order to enjoy films at home. You'll be able to explore the world's film art and fully experience the world's musical heritage, too. APJ

Home Theater Myths

I'm a serious music listener and audiophile but I also enjoy movies as a creative art form and I like to watch them in the comfort of my own home. Great sound adds to my enjoyment of cinema just as it adds to my enjoyment of music. Since I have a substantial investment in high-end audio equipment, it makes sense for me to use some of that equipment to provide the audio for movies, too. What's that? Home theater and high fidelity are two completely different things, you say. Why should that be true? Maybe the people who told you that story had something other than your best interests in mind.

*While satisfying music reproduction is the subject of primary concern for the **Audio Perfectionist Journal**, future articles will deal with home theater and how to get good sound from DVDs and laser discs. Since few of us can afford the expense or the floor space to have more than one high-end home entertainment system, and we all want to get the most enjoyment from our investments, it makes sense to consider home theater as we proceed in our discussion of home audio system performance. Before we can talk about how to get the best audio performance from film soundtracks recorded on home media we have to decide what constitutes the best performance.*

Hi-Fi Versus Home Theater

The **Audio Perfectionist Journal** is devoted to the hobbyist seeking high fidelity sound for the home. High fidelity sound is accurate sound, regardless of the original source, but we've been told that home theater is a completely different animal and that high fidelity and home theater are mutually exclusive. If you visit the average custom home theater store and listen to the systems that are demonstrated there, you might get the impression that this is true. Reading THX propaganda or listening to the evangelists who were trained at Skywalker Ranch will further reinforce this message. The purveyors of home theater want you to believe that film sound has a different standard of accuracy.

So what do we do if we want to enjoy a film now and then—build a redundant system just for movies? Does a home theater system have to offer low fidelity sound to deliver "what the filmmaker intended"?

A False Paradigm

Most myths about home theater are based on the assumption that we should strive to make our home entertainment systems sound as much like a commercial movie theater as possible. That seems logical at first. Why not emulate the sound of the public address systems at the local cineplex if you want movies at home to sound just like they sound at the movies. But is that really what we want? Do we want our home systems to sound like commercial theater systems? Are these PA systems really that good, or are they sonically compromised because they were designed to do a completely different job?

Maybe we have been offered the wrong paradigm. If you start with a false premise you will likely come to some false conclusions.

The Cineplex as a Standard

Who is it that started the notion that the goal of home theater is to sound like the commercial movie theater down the street? (Hint: it's Tom Holman, the former guru of THX.) When I see birds on the screen I want to hear chirps from the soundtrack that sound like real birds, not squawks that sound like a horn-loaded compression driver from the PA speaker in a commercial movie house. How about you?

I want dialog that sounds like people talking. I want music that sounds like real instruments playing. I never hear that in a commercial movie theater. I hear "honking," horn-loaded speakers and boomy, poorly defined bass. I hear screechy dialog that is frequently harsh and painfully loud.

Why would I want to emulate that? Shouldn't the movie theater be trying to imitate the sound from my home hi-fi system, which is so much better, instead of the other way around?

Different Tools For Different Jobs

The sound system in the commercial movie theater and the sound system in your home do different jobs. The commercial sound system needs to fill a large space with loud sound, and the one in your home needs to sound good up close.

A commercial movie theater is a big place. Hundreds or perhaps thousands of people can sit in one. Nearly everyone will be seated in a less-than-ideal position to hear the best sound. Many in the audience will be far off-axis from the center and some of them will be seated near the sides or at the rear of the auditorium. A very few people will be seated in the middle about one third of the way back from the screen, properly positioned in relationship to the speakers.

Every ticket for every seat at the local cineplex costs the same. There can't be any "sweet spot" or the customers who didn't get to sit in it would complain. Making the sound uniform throughout the theater assumes the highest priority. The quality of sound is reduced to the lowest common denominator in an attempt to make it nearly the same everywhere. Every seat must sound just as good (or bad) as every other seat.

The sound system in a commercial theater must be capable of playing very loudly to fill this large room with high-level sound effects and intelligible dialog, whether there are many absorbent bodies in the audience or just a few. Dialog intelligibility is valued above all else and loud bass and sound effects come next. Sound quality is considered last. The system must operate with modest amplifier power for extended periods of time, run cool and be extremely reliable. The word "imaging" simply doesn't apply in a commercial theater. The words "smooth" and "natural" are seldom heard either.

The speaker system in a commercial movie theater is not meant to offer flat frequency response. The three front speakers fire through perforations in the screen, the walls are covered with lots of sound absorbent material and high frequencies are further attenuated by the great distances between the speakers and the audience. A standard equalization curve, called the X curve, is applied to the soundtrack to boost midrange and high frequencies. Horn-loaded compression drivers are nasty-sounding things anyway, and feeding them a hot signal exacerbates the problem.

At home we can properly position ourselves between the speakers in the sweet spot. We can trade-off some of the high efficiency of the commercial horn-loaded speakers that are necessary in the big movie houses for less efficient but more accurate speakers designed for home use. We can use direct-radiating surround speakers and have imaging at the sides and across the rear as well as in the front. We can use subwoofers in sealed enclosures that offer good transient response, as opposed to the vented boom-boxes that are necessary to deliver the high sound pressure levels needed in the theater. In short, the fidelity that is achievable at home can be so much higher than that offered in a commercial movie theater that to suggest that we try to emulate the latter is simply ludicrous. As you might have guessed, this is leading up to one of my famous analogies.

The Porsche & the Dump Truck—An Analogy

A Porsche is built low to the ground using light-weight materials. Its sleek, aerodynamic lines minimize wind resistance. It is fast and it goes around corners like it's on rails.

A dump truck is built with lots of ground clearance and has extremely stiff springs. It is made of the strongest materials because it is used to haul gravel. It accelerates slowly and it won't corner worth a damn.

Is the Porsche better than the dump truck? Well that depends on whether your afternoon plans include a lap around Willow Springs Raceway or a journey to the gravel quarry. You could enter the dump truck in a race at the track but you would surely lose and it's possible to haul gravel in the trunk of the Porsche but you'd have to make many trips.

Both vehicles are expensive and each is extremely effective at performing the specific tasks for which it was designed. Each one could conceivably do the job of the other—but not very well. Just like the commercial theater's low-fi sound reinforcement system and the high fidelity audio system in your home, the Porsche and the dump truck were built to do different jobs. It would be virtually impossible to build a sound system in a commercial movie theater that could equal the fidelity of even a modest home audio system. You could design a home system to sound nearly identical to a commercial theater system, but why would you want to?

Yesteryear

Early high fidelity systems were based on the theater sound systems of the day. The whole hi-fi industry started out with JBL horns or Altec Voice of the Theater speakers. We quickly learned that we could do much, much better in the home, and we did. Modern high-end hi-fi systems offer natural sound reproduction that is light years beyond the fidelity of the PA systems used in commercial movie theaters.

With the advent of home theater, a new myth was created. It proposed that we should go back to the days of primitive audio systems so that we could "accurately replicate the sound of the dubbing stage" where the film soundtracks were created. Making our home audio systems sound as bad as a dubbing stage is supposed to deliver sound that "the filmmaker intended."

Don't buy this false premise if you want good sound in your home. Real sounds are the true standard for fidelity, not the sound from the PA system used in the dubbing theater. An audio playback system should not be required to alter the recorded signal to suit a recording that was equalized for theatrical exhibition. Laser discs and DVDs are strictly for home theater use. It is the filmmaker's responsibility to put the sound that he or she "intends" to be heard on the laserdisc or DVD so that an accurate home playback system can reproduce it without alteration.

The Dubbing Stage & the Intentions of the Filmmaker

I've heard it said over and over again that we must strive to duplicate the sound heard on the dubbing stage with our home theater systems. It is said that if we try to improve on this sound, we won't hear what "the filmmaker intended." Do you really think that any filmmaker would intend for you to hear bad sound? They want you to hear the best, most natural sound possible—in the theater and at home. They want you to like their movies, and good sound plays an important part in that .

In the past, when theatrical exhibition was the primary source of revenue for the film studios, large dubbing stages were exclusively used to create the film sound mix because these stages replicated the compromised sound of the movie theater and allowed the filmmaker to do the best possible job of producing sound for those venues. Now that home theater produces more income for the studios than theatrical exhibition, the Hollywood studios are rapidly moving to home theater-style mixing rooms to create special sound mixes when films are transferred to home theater media like DVD. Some soundtracks are first created in a home-like environment and then altered for theatrical exhibition. In the past, discs were sold containing soundtracks equalized for theatrical exhibition. Modern DVDs have soundtracks designed for home use and usually don't require re-equalization.

Dubbing stages are fine for creating sound mixes for commercial cinemas because both are designed to sound the same but home theater sound can be a lot better than that. Many filmmakers already know this and all of them soon will.

Timbre Matching

Timbre is a musical term that describes the distinctive quality of the sound of a musical instrument or voice having to do with the mixture and intensity of harmonic overtones, which sets it apart from another sound with the same pitch and volume. If a component in a home entertainment system produces distinctive overtones the phenomenon is correctly called harmonic distortion. A good speaker doesn't have timbre. In my opinion, this term should not be used when discussing components designed to accurately reproduce a recorded signal unless you're talking about a characteristic that these components shouldn't have. We should be trying to eliminate timbre from our speakers, not trying to match it.

Another mythical concept is that sound arriving from the side is somehow changed in tonality and needs to be EQed to match sound arriving from the front. Sit down in front of your stereo speakers and listen to a musical selection. Or have a friend speak to you continuously. Turn your head 90° or more to one side or the other while continuing to listen. If you hear any difference at all in the tonality of the sound, your head is wired very differently from mine.

Of course, no amount of equalization can make indirect sound from dipole surround speakers match the direct sound from the left front and right front speakers because much more than frequency response is involved.

Remember, just because some "expert" makes a proclamation doesn't make it so. Test everything yourself. Alot of the advice you've been getting from self-proclaimed authorities is simply wrong.

The Center Channel Is The Most Important?

I'm going to make some very bold statements here. Center channel speakers depreciate spatial effect. I've never heard a surround sound system that didn't sound better with the center channel speaker turned off. The only purpose for a center channel is to anchor film dialog at the screen for listeners sitting well off-axis. Why sit off-axis in your home?

Here we are, back where we started—talking about the different requirements for a commercial movie theater and a home theater. In a commercial theater, some members of the audience will be seated well off-axis. Some may even be to the left of the left front speaker, or to the right of the right front speaker. A center channel speaker is a necessity in a commercial theater to anchor dialog to the screen. Is a center channel speaker necessary in your home?

This is subjective and you may disagree, but give this a try: Tell your home theater processor that there is no center channel speaker. It will now mix center channel information into the left front and right front speakers. Sit centered between your front speakers and listen to familiar material. Don't you hear an image with greater depth and dimension, and dialog that is better integrated with the acoustics of the scene? When you turn the center channel speaker on, you hear monophonic voices coming directly from that speaker, don't you? Those voices often sound disassociated from the acoustics of the scene on the screen because they were actually recorded on an ADR stage, not at the time that the film was made.

Center channel information is not lost when no center channel speaker is used. The center channel sound is remixed into the left and right front speakers by the surround processor. Mono signals sound better when reproduced by two sources and a "phantom" image sounds better than voices-in-a-box. Try it for yourself.

Of course, if you or some of your guests must sit so far off-axis that sounds tend to pull to one or the other of the front speakers, you need a center channel for movie sound. But is it the most important channel? I don't think so. I'd call it a sometimes necessary evil.

Dipole Surround Speakers

If re-radiated room sound is a delayed, out-of-phase distortion of the original signal, does it make any sense to use dipole surround speakers positioned so that the listener sits in the null area insuring that all he hears is reflected sound off the room boundaries? This idea comes from the ridiculous assumption that we should be trying to duplicate the mediocre sound of the local commercial cinema instead of striving for the highest fidelity possible in the home.

In a commercial movie theater there are arrays of surround speakers at each side of the auditorium to provide a diffuse sound field. This is not done because diffuse sound is somehow desirable. It is done in order to provide a similar (albeit mediocre) experience for those seated in less desirable positions relative to the speakers. Movie theater sound is always adjusted to the lowest common denominator. Why would you want diffuse, unfocused sound in the rear of your room at home? Wouldn't it be better to have clear, precise sound at the rear that matches the sound at the front of the room? Don't use THX-style dipole surround speakers if you want the best possible sound. It's just that simple.

High SPL Subwoofers

The notion that subwoofers for home theater need to play at levels of 105dB SPL or more presents a problem for an audio purist. An occasional gunshot at near-realistic levels or an explosion that lifts you out of your chair can be really fun, but this capability is dangerous.

Long-term exposure to sound levels over 90dB will cause permanent hearing damage and the belief that "bass can't hurt you" is absolutely false. In fact, bass can be insidious.

We have a facial muscle on each side of our head that pulls on one of the three bones in our middle ears to act as a sort of compander (compressor/expander)—extending the dynamic range of our hearing. When there is a sudden, loud sound this muscle provides mechanical compression to limit stress on the nerves in the inner ear. It can become fatigued from overuse in the presence of loud, repetitive bass sounds. The use of intoxicants, which have a numbing effect, can exacerbate this problem. A fatigued muscle won't mechanically compress loud transients quite as well, increasing the chances for nerve damage in the inner ear. Occasional loud bass probably won't hurt you, but be careful.

Speaking of nerve damage, what about those action films with extended periods of extremely loud sound effects? Must we listen to those at the levels the filmmaker intended?

Reference Level

Home theater fanatics always listen at "reference level." They believe that this allows them to experience the film as the filmmaker intended.

Paula T. Hardesty Publisher
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With the exception of some quiet, dialog-driven films, reference level is too loud. Much too loud. Long term exposure to sound pressure levels of 90dB SPL or higher will cause permanent hearing damage. A high fidelity sound system won't do you any good when you're deaf. Don't watch films at reference level if you care about your health. Read that last sentence again.

High Fidelity for You & Me

The electrical signal that is retrieved from the recording medium is either accurately reproduced by the playback system or it isn't. No component in your system knows what this signal is supposed to represent. Your amplifiers and speakers don't care if the signal is a simulated gunshot or the sound of a solo violin. The playback system should accurately reproduce the recording—nothing more, nothing less.

The gunshot will be somewhat more difficult to accurately replicate because it will be a lot louder but, as long as the maximum sound pressure levels are kept to a limit that is safe for your hearing, a high fidelity loudspeaker with broad bandwidth and sufficient dynamic range will perform very well. A speaker with compromised fidelity that was designed to simulate the PA system at the local cineplex will fail miserably when trying to reproduce the sound of the violin (or any other natural sound).

We shouldn't have to correct a soundtrack that was equalized for a movie theater in order to watch a film at home using an accurate sound system. We should demand that they include accurate soundtracks, engineered for home theater playback, on home theater media. (Until everyone in the film industry gets that message you may have to use equalization to make some soundtracks tolerable. Virtually all surround decoders include some form of EQ for this purpose.)

I use my high-end reference stereo system as the left front and right front channels for my home theater system. It sounds great when playing recent movies from DVD. On rare occasions I have to tame an overly-bright soundtrack with EQ but that doesn't happen much anymore. A high fidelity sound system works just fine as the front half of a home theater system and I'll tell you all about that in future articles.

We won't get the highest fidelity by emulating outmoded standards set for commercial cinemas. We will get it by assembling systems from the highest quality components that we can afford, positioning our speakers properly and making our rooms sound as good as we can. For maximum enjoyment we should strive for the highest fidelity sound possible from our home entertainment systems—for music listening and film watching. APJ

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