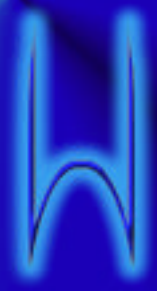

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AN ALLEN VIEW OF DOLBY STEREO

BY

JOHN F. ALLEN

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AN ALLEN VIEW OF DOLBY STEREO

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Cinema sound has come a long way from the days when "records" were run in "sync" with films. Yet sound systems in many theatres today are closer to the sound of yesteryear than to the modern high fidelity available now. The axiom that theatre sound systems are superior to home systems is seldom true anymore.

Early soundtracks and theatre sound Systems suffered from high distortion and limited bandwidth. That is to say there was little or no bass or treble, only midrange. As dialog largely exists within this limited range, the systems worked. As technology improved, systems capable of reproducing more bass and treble were possible. But if speakers of this ability were put into theatres the audiences could hear all the distortion and background noise of the optical soundtrack previously masked by the older speakers. While it was possible to reduce the noise of new films, the older soundtracks did not play satisfactorily with these better speakers. At the same time the studios were looking for a standard so they could know how their films would sound in actual theatres. As a result of this dilemma the industry adopted the so called "Academy Standard". Essentially this froze the state of the art for film sound at about the 1940 level. Newer sound systems were built to match the older ones. That way the early films would sound the same in every theatre, no matter when it was built.

Since then the frequency range or bandwidth heard by the audience has remained at about 200 Hertz (cycles per second) to 4000 Hertz, give or take a little. While adequate for voice, music and certain effects exist within the entire audible range from around 30 Hertz to 20000 Hertz.

Noise and/or background hiss is inherent in all recording processes and electronic devices. Modern electronics are quiet enough, but analog recording systems are not. The wider the bandwidth, the higher the noise. Also, the greater the dynamic: range and the lower the distortion you desire, the more noticeable the noise. The easiest noise to hear is hiss but low frequency noise is also a factor. The Academy Standard took care of hiss by diminishing the output of the speakers above 4000 Hertz.

A film soundtrack is made up of many different recordings mixed together and then duplicated. Each generation or rerecording stage adds noise. Without some method to control it, the noise level in theatres with high fidelity sound systems would be all too loud.

Today with producers wishing to make full fidelity sonic spectaculars and with audiences paying extra to hear them, noise control is necessary. The Dolby system and the cinema processors using it represent a comprehensive approach to the problems of noise, distortion and speaker theatre interface. Comprehensive because the process begins at the original recording stage and continues during every step, right up through the theatre's speaker system.

One way to mask noise is to compress, or reduce the dynamic range, and record at a higher average level. But large reductions in dynamic range are unnatural and the high recording levels increase distortion. The Dolby type A noise reduction system uses a process that increases the recording level but only while that level is relatively low. It does this after splitting the sound into four bands thus it processes high and low frequency noise separately. During playback it symmetrically undoes what was done during the recording stage. By reducing these low signals back to their original levels, the noise is also reduced, The result is a nearly noise free sound with better dynamic range and lower distortion.

The Dolby noise reduction system is a compression-expansion system. But since it works in four separate bands and only when levels are within the relatively low range, it avoids the "pumping" or modulation problems generally associated with compressors and expanders. Above or below this range, the Dolby circuit is linear. Which is to say it does not alter the signal. When it is altering the signal, it does so subtly. In most situations, the process is inaudible.

Perhaps the biggest reason for the success of Dolby Stereo is its compatibility with existing theatre systems. This has allowed film companies to lead the way and given theatre owners time to see if Dolby will stay or be just another sound gimmick for them to waste money on.

Only a complementary system working at both the record and playback stages could achieve this. Playback only noise reducers have appeared in various forms over the years. They have ranged from simple high frequency reduction filters to dynamic circuits that try to sense when a listener can hear hiss and then lowering the level of the frequencies involved during those times. Obviously these "add on" devices introduce distortions of

the sound that listeners can hear and as a result have been widely unaccepted.

With noise under control it is no longer necessary to limit the bandwidth of motion picture soundtracks. The Academy Standard can finally be retired.

Another plus in all of this is an end to the practice of artificially boosting the high frequencies during dialog recordings. This has been done over the years to overcome articulation losses found in many theatres and the limited ability of the entire cinema sound chain. Boosting high frequencies makes dialog sound unnaturally sibilant or "essey" and increases distortion. While this is a good technique for overcoming articulation losses, a better solution is the reduction of these losses in the first place. Increasing the bandwidth to 12000 or 20000 Hertz is only part of the solution. Sound system construction and room acoustics are just as important.

These are complicated issues made even more complex by each theatre's own acoustical characteristics. However, there are some general things to be found in large rooms. One is that the bass takes longer to die out. It builds on itself as sound from the speaker blends with what is still bouncing around the room. While this is going on, the high frequencies are dying out much faster but at different rates depending on the frequency Each theatre has different decay times and high frequency absorption properties. Invariably some of these properties are detrimental to sound reproduction.

Ideally theatres should be built so that listeners in every seat hear a flat, or at least the same, frequency response. This can be a hard thing to do. The idea that it can be accomplished by simply adjusting the frequency response of the speaker system is false. If one does adjust a system so that a listener in a selected seat hears a flat response, that may be the only position where flat response will occur.

This phenomenon exists throughout nature though, and our brains can adapt to a non-flat sound. This is fortunate. Were it otherwise, we would have to attend films and concerts one at a time. And who is to say that everyone's hearing is flat? Sounds like there may be room for compromise.

Good engineering is the art of choosing the most elegant compromise. Audio is no exception. When designing their room or speaker equalization circuit, Dolby recognized that speaker equalization is not the solution to a room's acoustical problems. But they wanted to take maximum advantage of the benefits such adjustments do offer. The first step is to fix the room itself as much as possible. The second is to select the best speaker system: one that is flat to begin with; one with high efficiency and low distortion (don't

forget it has to "punch" through the screen) and one with the proper coverage pattern for the room it's being used in.

As mentioned, sound reflects off the wall and ceiling surfaces and mixes with direct sound from the speaker. When this happens to speech it inhibits the listener's ability to understand the words. In severe situations, these reverberations can make dialog completely unintelligible. Covering the offending surfaces with absorptive material is a common approach. Non parallel surfaces avoid standing echoes or sound bouncing back and forth between two points. But it isn't that simple. One needing help in this area should consult an experienced acoustical engineer.

New tools are contributing a great deal towards the understanding of acoustical phenomenon. Time Delay Spectrometry and Energy Time Curves made with the aid of a computer are helping make solutions to room problems easier and less expensive.

Speakers that direct their energy primarily towards the audience and not the walls or ceiling are of great help in reducing reflections. Well designed horn type speaker systems, along with being best for nearly everything else, are best for this as well. They function like a car's headlight and can be aimed. The beamwidth or coverage angle you want is determined by the room's shape and reverberation time.

Only after all this is done does speaker equalization properly come into the picture. It is a way of fine tuning speaker systems for different rooms. A "tone control" is provided for each 1/3 of the nine octaves. That's 27 tone or equalization controls and a lot of electronics. Imagine having to adjust ten or fifteen controls just to turn up the treble. Yet that is just what these so called graphic equalizers require. All that circuitry invariably adds some distortion and coloration of the sound. Indeed these are some of the main complaints with these devices.

For theatres exhibiting 35 mm films, Dolby offers their CP-50 Cinema Processor. These units contain three separate one-third octave equalizers, one each for the left, center and right channels. Their third octave controls are out of the circuit when they are not needed and are left in their flat (normal) positions. In addition, Dolby provides conventional bass and treble controls for overall adjustments. The result is an equalization adjustment with a minimum of circuitry involved.

In December, Christie Electric Corporation will introduce their Dimension 4 Cinema Processor. Complete with Dolby's own noise reduction circuit cards to ensure proper decoding, this processor includes two separate and redundant power supplies, automatic

stereo detection, a separate mono bypass for use in case of a preamplifier failure, monitoring facilities and a different kind of speaker equalization. Like Dolby's, Christie's equalizers (supplied for all four channels) have bass and treble controls for overall adjustments. But instead of a control for each third of each octave which can be adjusted up or down, Christie provides a down only control for each full octave. Fewer controls mean less circuitry. The cut, or down, only feature prevents an inexperienced installer from introducing audible problems by trying to make gross corrections with the additional range of a 1/3 octave boost and cut equalizer.

With every theatre's sound system adjusted to the same standard frequency balance, audiences will hear the sound the producer heard more closely than ever before. The only drawback to the improved soundtracks that the Dolby system makes possible is that the majority of theatres remain equipped with speaker systems incapable of fully reproducing the sound. Even new theatres are suffering when two-way systems with bass reflex woofers are installed. Refer to the article on loudspeakers in the June 9, 1980 issue of BOXOFFICE for details on more appropriate theatre speaker systems.

Some theatres are having difficulty with projectors that are not able to keep the film properly aligned with the sound pickup. This can be audible as the alignment is very critical. If the projector's soundhead cannot be fixed, it should be replaced.

One final item: Where will Dolby be when digital recording comes to motion picture sound? Digital recording is virtually noiseless, but its biggest plus is the fact that recordings can be duplicated time and time again (maybe cloned is a better description) without degradation and noise buildup. Undoubtedly, digital recording will prove advantageous to film mastering as it is beginning to in the record industry. The technology for placing a digital soundtrack on a release print is now under development, raising the possibility for film-goers to hear "live" quality sound for the first time.

This and other so called "A" chain (sound pickup and processing) improvements will come along from time to time. But digital soundtracks on release prints are some time off. It will take a long time for any significant number of theatres to become equipped. So for some time to come the current analog soundtracks (which can now be played in every theatre in the world) are here to stay.

The important thing to remember is that no matter what types of recording formats might be used in the future, the improvements in the "B" chain (equalizers, amplifiers, speakers and room acoustics) brought about with a Dolby Stereo installation will remain a worthy investment. As long as analog recordings are played back in theatres, the Dolby noise

reduction process will not become obsolete and audiences will continue to appreciate it.

John F. Allen is the founder and president of High Performance Stereo in Newton, Mass. He is also the inventor of the HPS-4000® cinema sound system and in 1984 was the first to bring digital sound to the cinema. John Allen can be reached by E-mail at JohnFAllen@aol.com.