

# Stereo Imaging and Center channel in Car Audio

## How We Get Stereo Imaging

Very small timing differences between what our two ears hear allow us to judge from where sounds come. This incredible human ability is the basis for stereo sound imaging where we as listeners can “see” a complete sound stage of instruments and performers though the sound only comes from two speakers.

Stereo sound is composed of identical sounds (mono) and differences. The blend produces images when the listener completes what is known as the “stereo triangle” (see figure 1). To produce the illusion of instruments (or a helicopter) in the center, where there is no speaker, the same sound (mono) comes out of both speakers. In essence, the brain is tricked into “seeing” sound originate from a location where there is not a speaker.

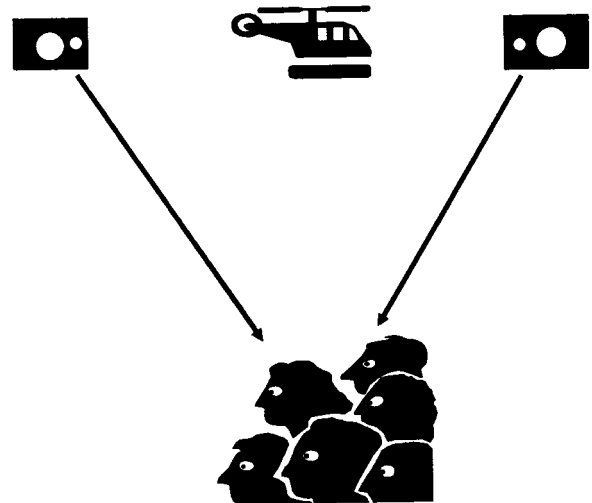


Figure 1  
The Stereo Triangle

## The Imaging Problem in Car Stereo

Because of the limitations of placement of speakers and the seating positions in car stereo, you cannot produce the “stereo triangle” easily (unless you take out the windshield and put the speakers on the front fenders!). The distance to the listener’s ears is much shorter from one channel’s speaker ( $D_1$ ) than the other channel’s ( $D_2$ ). So instead of the mono sound arriving at both ears from both speakers at the same time, it arrives at different times preventing a center image. That is, the listener is out of acoustic alignment.

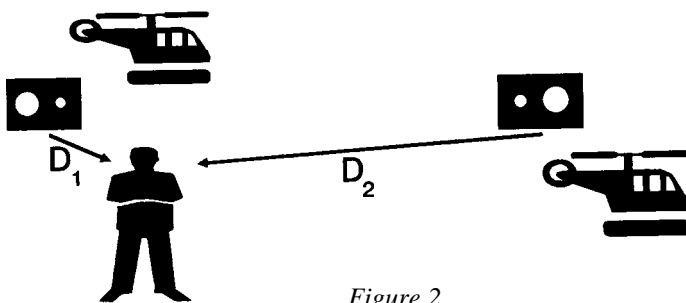


Figure 2  
Incorrect Acoustic Alignment

## The Center Channel Solution

Since physical limitations in auto sound prevent good center imaging with two channels, the solution is a third channel with the speaker physically placed in the center front of the listening space (see figure 3). With a center speaker, the center image is not derived but forced by only playing mono from that center speaker.

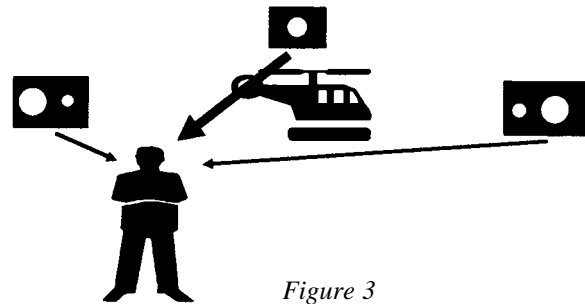


Figure 3  
*Clear Center Image*

## Why Not a Simple Mono Sum?

If you use a simple mono sum to drive the center channel, you will have mono in the center but also in the side speakers. That is, you will have twice as much mono! Then to hear the center, you will turn up the relative gain on that speaker to drown out the mono in the side resulting in lots on mono and a very weak and probably distorted stereo image (figure 4).

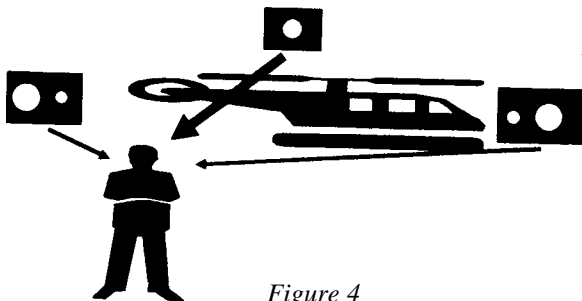


Figure 4  
*Too Much Mono*

## Why Not Delay?

You can put the speakers in acoustic alignment (refer to figure 2) by delaying sound from the closest speaker so that the sound arrives at both ears simultaneously. Unfortunately, this will only correct the problem for this one, single location and actually make the problem much worse for other listening positions!

## How The ESP-3 Solves the Problem

Patented circuitry in the ESP-3<sup>TM</sup> image amplifier not only directs the center image information to the center speaker but relieves it from the side speakers. This puts the correct sounds in the right places. The listener commands the center channel with a dash control and an additional control for a spatial (or sound space size) restoration circuit. The result is a very exciting and realistic sound stage imaging in a difficult acoustical environment.