

The points made above answer the questions posed earlier. Some speakers sound better when lying on the floor because the best additional axis is pointing downwards.

The time delay solution overcomes most of the problems above although obviously the vertical polar response will not be as good as the horizontal. The solution to this problem is to use a dual concentric. However at reasonable listening distances these effects are minimised and are no greater than other two or three way systems.

### Phase, Time Delay and Aural Perception

Olson, a very eminent acoustician states in various parts of his books that :

"The phase of a harmonic affects the threshold of perceptible distortion as well as the complex sound. This statement contradicts the so called Ohm's Auditory Law that the ear tends to analyse the compounds of a complex sound regardless of the phase relations."

3 references are given of experimental evidence to support this statement. Also on the subject of Auditory Localisation:

"The human hearing mechanism can localise sounds with great accuracy. This property is due to two effects, namely : the difference in intensity and the difference in phase between the two ears. The difference in phase between the sounds at the two ears is due to the difference in time arrival at the two ears. The difference in intensity at the two ears is due to diffraction".

Clearly to reproduce a sound field capable of fooling the ears we must take account of maintaining the time delays between different parts of the complex sound waveforms and also recreate an amplitude field both on and off axis which is equal to that at the original recording microphones.

Acoustic source alignment does just this by introducing a constant phase shift to align sources with the attendant benefits in off axis response, lack of time smear distortion and the creation of very real stereo effects.

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April 2, 1982