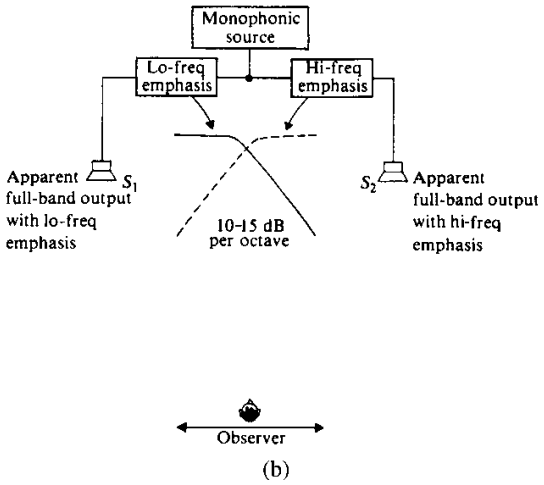
If however, the crossover between low-frequency/high-frequency emphasis between the LHS *vs*. RHS loudspeakers is abrupt (*i.e*. a roll-off of > 10-15 *dB*/octave), as shown in diagram (b) in the figure below, there <u>will</u> be a noticeable difference in the timbre of the two sound sources – *i.e*. while both speakers will have the <u>same</u> ***<u>apparent</u>*** output/loudness level, the LHS speaker will have noticeable low-frequency emphasis, whereas the RHS speaker will have noticeable high-frequency emphasis.



(b)

Other differences between two sound sources, other than the spectrum shape are also found to broaden the sound "image" perceived by a human listener. One effective way to achieve sound "image" broadening is to add reverberation to <u>one</u> of the two sound sources (*e.g*. the left channel), but <u>not</u> to the other source (!)

Thus, three important properties of sounds heard from multiple speakers, strongly influenced by differences in loudness level/SPL, arrival time difference/relative phase, spectral differences and asymmetry in reverberant sound are:

(1) The degree of fusion of the two separate sounds into a single sound "image"
(2) The broadening of the fused sound "image"
(3) The spatial displacement of the fused sound "image"