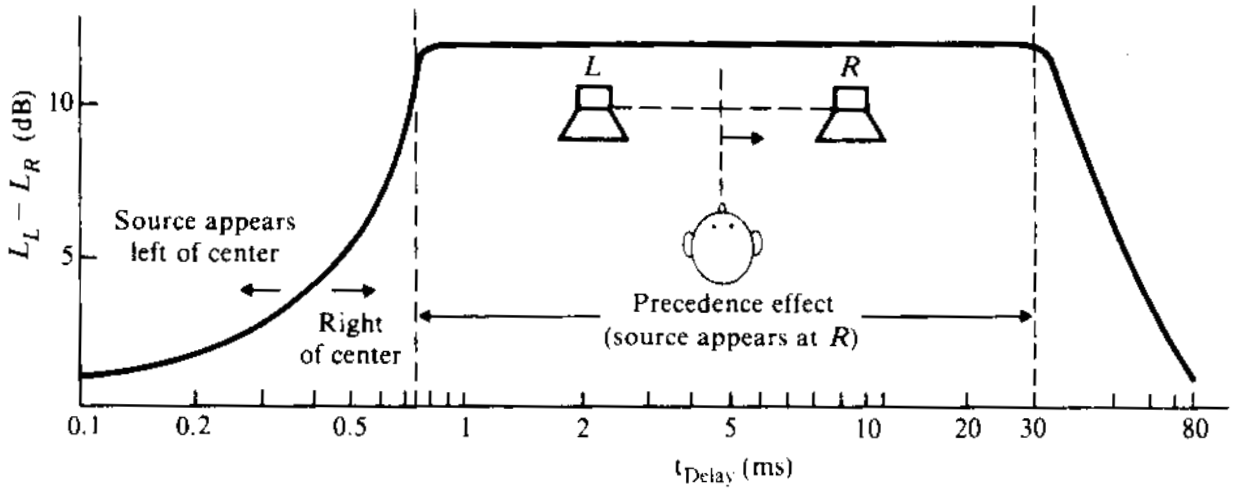

The horizontal axis is the time delay *e.g.* of a pulse to the LHS loudspeaker is delayed relative to the RHS loudspeaker. The vertical axis is the *L–R* difference in sound pressure level (*SPL*) due to the SPL of the LHS loudspeaker exceeding that from the RHS loudspeaker.

The ascending curve on the left-hand side of the graph indicates the approximate combinations of *L–R* time delay *vs. L–R SPL* difference that will center the source image at the median plane of the loudspeakers. Note that when $\Delta SPL\left(L\text{-}R\right) \equiv L_p^L - L_p^R \gtrsim 15\,dB$, it is impossible to compensate completely with <u>*any*</u> time delay, $t_{Delay}\left(L\text{-}R\right)$. Conversely, note that when the time delay $t_{Delay}\left(L\text{-}R\right) \gtrsim 1\,ms$, the <u>*precedence effect*</u> defeats time/intensity trading.

{A fun experiment that demonstrates the nature of the precedence effect associated with human hearing is for two people to go into a small, but "live" (*i.e.* highly-reverberant) room, close the door and have one person, located somewhere in the room close their eyes, while the other person walks slowly around the room, occasionally clapping his/her hands (once), to launch a sharp, short sound impulse into the room. The listener will have no problem localizing the sounds, due to his/her brain's ability to discern/process the inter-aural time difference sound information. If *e.g.* a single, continuous, sine-wave single-frequency type sound source is instead used, the listener will have a great deal of difficulty localizing such a sound source.}

Note that a listener seated only a distance of ~ 1 *ft* (~ 0.3 *m*) closer to the RHS loudspeaker would experience such a $t_{Delay}\left(L\text{-}R\right) \sim 1\,ms$ time delay – which has the unfortunate consequence that the stereophonic effect works best only within a limited region of space known as the "sweet spot", due to the constructive interference of the sound waves output from the two loudspeakers with each other.

If the <u>phase</u> <u>polarity</u> of one of the loudspeakers is <u>reversed</u> by 180º, if the listener is located on the median plane (as before) the sound "image" will move from position *A* at the nominal median plane to a position *B*, which can be inside, or in back of the listener's head, as shown in diagram (a) of the figure below: