A

Q1 Barbara Shinn-Cunningham*
Center for Computational Neuroscience and Neural Technology, Boston University, Boston, MA, USA

Law of the first wavefront

DOI 10.1007/978-1-4614-7320-6_101-5

thought to be one of the reasons why listeners are relatively good at judging source location even when listening in rooms.

The precedence effect has been studied extensively with pairs of clicks (one leading and one lagging); for such brief stimuli, the precedence effect is strongest when the leading click precedes the lagging click by 1–5 ms and then rapidly becomes weaker (so that listeners start to hear the second click as a separate event and then begin to localize it with increasing accuracy; see Blauert 1997). For more "natural" sounds, like speech or music, the precedence effect persists for tens of ms. Many researchers argue that the precedence effect has a longer time course for ongoing signals because they can be thought of as containing multiple "onsets" due to local energy fluctuations, each of which can add to the precedence effect (e.g., see Zurek 1980).

Although the precedence effect is often discussed as a single psychophysical phenomenon, many different mechanisms likely contribute to the dominance of early spatial information on later-arriving information. For instance, the most peripheral portion of the auditory system, the auditory nerve, responds more vigorously at the onset of a sound than to later-arriving portions of a sound. This peripheral adaptation helps explain why a lagging sound that arrives within a few milliseconds of a leading sound does not convey strong spatial cues (Hartung and Trahiotis 2001). However, there are numerous studies that show that the perceptual dominance of the leading sound extends beyond very brief lead-lag delays that can be fully explained by peripheral adaptation. It is likely that microcircuitry in the brainstem contributes to the precedence effect at longer lead-lag delays through some type of inhibition triggered by the leading sound (Xia and Shinn-Cunningham 2011).

-

► Sound Localization and Experience-Dependent Learning
► Sound Localization in Mammals, Models

Allen JB, Berkley DA (1979) Image method for efficiently simulating small-room acoustics. J Acoust Soc Am 65:943–950

Blauert J (1997) Spatial hearing (2e). MIT Press, Cambridge, MA, pp 201–287

Brown AD, Stecker GC (2010) Temporal weighting of interaural time and level differences in high-rate click trains. J Acoust Soc Am 128:283–292

Hartung K, Trahiotis C (2001) Peripheral auditory processing and investigations of the "precedence effect" which utilize successive transient stimuli. J Acoust Soc Am 110:1505–1513

Litovsky RY, Colburn HS, Yost WA, Guzman SJ (1999) The precedence effect. J Acoust Soc Am 106:1633–1654

Schnupp J, Nelken I, King A (2010) Auditory neuroscience. MIT Press, Cambridge, MA, pp 177–222

Wallach H, Newman EB, Rosenzweig MR (1949) The precedence effect in sound localization. Am J Psychol 52:315–336

Xia J, Shinn-Cunningham BG (2011) Isolating mechanisms that influence measures of the precedence effect: theoretical predictions and behavioral tests. J Acoust Soc Am 130:866–882

DOI 10.1007/978-1-4614-7320-6_101-5

Zurek PM (1980) The precedence effect and its possible role in the avoidance of interaural ambiguities. J Acoust Soc Am 67:952–964

Zurek PM (1987) The precedence effect. In: Yost WA, Gourevitch GA (eds) Directional hearing. Springer, New York, pp 85–105