Role of sound-------------------------------

Sound is inherently a temporal and sequential signal. Experience with sound therefore may help bootstrap – i.e., provide a kind of “scaffolding” for – the development of general cognitive abilities related to representing temporal or sequential patterns. Accordingly, the absence of sound early in development may result in disturbances to these sequencing skills. In support of this hypothesis we present two types of findings. First, normal-hearing adults do best on sequencing tasks when the sense of hearing, rather than vision, can be used. Second, recent findings suggest that deaf children have disturbances on exactly these same kinds of tasks that involve learning and manipulation of serial order information. We suggest that sound provides an “auditory scaffolding” for time and serial order behavior, possibly mediated through neural connections between the temporal and frontal lobes of the brain. Under conditions of auditory deprivation, auditory scaffolding is absent, resulting in neural reorganization and a disturbance to cognitive sequencing abilities.

**Keywords:**sound, deafness, sequence learning, language, prefrontal cortex

It is customary to consider sound as being the province of auditory perception alone. However, recent findings and theory have emphasized the interactive nature of the sensory modalities as well as the ways in which sensory processing underlies higher cognition. For example, multisensory processing, in which multiple senses (vision, audition, touch) are used in concert, is beginning to be regarded as the norm, not the exception to perception. Furthermore, “embodied cognition” theories, that stress the close coupling of brain, body, and sensory systems, emphasize the importance of understanding how the dynamics of modality-specific constraints affect higher level cognition such as learning and memory. To put it another way: because the brain is an integrated functional system, sensory processing (and, by extension, the effects of sensory deprivation) are not completely independent from the rest of neurocognition and thus may have secondary effects on the brain and cognition as a whole.

Sound in particular is a temporal and sequential signal, one in which time and serial order are of primary importance ([Hirsh, 1967](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2923391/#R13)). Because of this quality of sound, we argue that hearing provides vital exposure to serially ordered events, bootstrapping the development of sequential processing and behavior. Sound thus provides a “scaffolding” – a supporting framework – which organisms use to learn how to interpret and process sequential information. The auditory scaffolding hypothesis is backed by two lines of evidence: modality-specific constraints in hearing populations, and non-auditory sequencing abilities in the congenitally deaf.