

Neural synchronization with audiovisual speech relies on a sensitive period

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Proper sensory inputs at specific time windows are fundamental for shaping infants' development (Werker, Hensch, 2015). Temporary auditory deprivation in the first year of life can alter the ability to integrate audiovisual speech cues even if hearing is restored with cochlear implants (CI; Schorr et al., 2005).

Yet, it's unclear if neural circuitries responsible for audiovisual speech integration have a developmentally sensitive period in which auditory information is required. To investigate this issue, we measured the neural tracking of speech sound envelope (auditory-only) and associated lip movements (audiovisual) with EEG in children with congenital (CD) or acquired (AD) deafness and in hearing controls (HC). Because CD and AD groups crucially differed in their lack or presence of functional hearing in the first year of life, this allowed assessing the role of auditory experience within this phase of brain development.

Overall, lip-movement tracking was more evident in CI than in HC. Neural tracking benefited from audiovisual compared to auditory-only speech in HC and AD. The sound envelope tracking was anticipated when the speaker's face was visible at short timescales, ~30 –150 ms, indicative of early processing. This facilitatory effect was absent in the CD group, revealing that early acoustic deprivation hindered fast audiovisual integration. However, AD and CD groups showed comparable speech comprehension enhancements with audiovisual speech, highlighting that neural adaptations to different deafness onsets can lead to similar behavioral outcomes. Hence, early acoustic experience is fundamental for developing neural circuitries subtending automatic integration of low-level audiovisual speech signals.

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