Individual Differences Reveal Correlates of Hidden Hearing Deficits

Clinical audiometry has long focused on determining the detection thresholds for pure tones, which depend on intact cochlear mechanics and hair cell function. Yet many listeners with normal hearing thresholds complain of communication difficulties, and the causes for such problems are not well understood. Here, we explore whether normal-hearing listeners exhibit such suprathreshold deficits, affecting the fidelity with which subcortical areas encode the temporal structure of clearly audible sound. Using an array of measures, we evaluated a cohort of young adults with thresholds in the normal range to assess both cochlear mechanical function and temporal coding of suprathreshold sounds. Listeners differed widely in both electrophysiological and behavioral measures of temporal coding fidelity. These measures correlated significantly with each other. Conversely, these differences were unrelated to the modest variation in otoacoustic emissions, cochlear tuning, or the residual differences in hearing threshold present in our cohort. Electroencephalography revealed that listeners with poor subcortical encoding had poor cortical sensitivity to changes in interaural time differences, which are critical for localizing sound sources and analyzing complex scenes. These listeners also performed poorly when asked to direct selective attention to one of two competing speech streams, a task that mimics the challenges of many everyday listening environments. Together with previous animal and computational models, our results suggest that hidden hearing deficits, likely originating at the level of the cochlear nerve, are part of "normal hearing."

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