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Detecting interaural incoherence based on variations in the hemispheric balance.

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Abstract

Human listener demonstrate a remarkable sensitivity in detecting even slight incoherences within signals presented at the two ears. These interaural decoherences can also be described as time and frequency dependent variations in both the interaural phase and level difference which are important cues for sound localization. Traditionally, the ability to detect interaural incoherences is explained using delay line models where the incoherence results in a reduction in the maximum of the cross-correlation function. Conversely, by analyzing single-cell recordings from neurons in the inferior colliculus of anesthetized guinea pigs, this study finds that interaural incoherence cannot be reliably detected when applying this mechanism. Instead, an alternative detection mechanism based on a hemispheric balance model is proposed, where stimulus power fluctuations result in covariant fluctuations in the two hemispheres so that the balance remains unchanged, while fluctuations in interaural differences result in opposing fluctuations. The proposed mechanism thus considers the disturbances in the hemispheric balance. By re-analyzing the recorded neuronal responses for variations in the hemispheric balance, it is shown that this approach considerably improves the performance of detecting interaural incoherence.