The Interplay of Relevance, Sensory Uncertainty and Statistical Learning Influences Auditory Categorization

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Abstract

Auditory perception requires categorizing sound sequences, such as speech, into classes, such as syllables. Such categorization depends not only on the sequences' acoustic waveform, but also on the listener's sensory uncertainty, any individual sound's relevance to the task, and learning the temporal statistics of the acoustic environment. Although previous studies have explored the effects of these perceptual and cognitive factors in separation, whether and how their interplay shapes categorization is unknown. Here, we tested this interplay by measuring human participants' performance on a multi-tone categorization task. Using a Bayesian framework, we found that task-relevant tones contributed more to category choice than task-irrelevant tones, confirming that participants combined information about sensory features with task relevance. Conversely, poor estimates of tones' task relevance or high sensory uncertainty adversely impacted category choice. Learning temporal statistics of sound category also affected decisions – the magnitude of this effect correlated inversely with participants' relevance estimates. These results demonstrate that humans differentially weigh sensory uncertainty, task relevance and statistical learning, providing a novel understanding of sensory decision-making under real-life behavioral demands.

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