Frequency tuning in the behaving mouse: different bandwidths for discrimination and generalization.

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Abstract:

When faced with sensory stimuli, an organism may be required to detect very small differences in a physical parameter (discrimination), while in other situations it may have to generalize over many possible values of the same physical parameter. This decision may be based both on learned information and on sensory aspects of perception. In the present study we describe frequency processing in the behaving mouse using both discrimination and generalization as two key aspects of behaviour. We used a novel naturalistic behavioural apparatus designed for mice, the Audiobox, and paradigm contingencies that were identical for both auditory discrimination and generalization, the latter measured using latent inhibition. Mice learned to discriminate between frequencies that were an octave apart in a single trial. They showed significant discrimination between tone frequencies that were as close as 4-7%, and had d' of about 1 for F of around 10%. In contrast, pre-exposure frequencies that were half an octave or less below the conditioned tone elicited latent inhibition, showing a generalization bandwidth of at least half an octave. Thus, in the same apparatus and using the same general memory paradigm, mice showed generalization gradients that were considerably wider than their discrimination threshold, indicating that environmental requirements and previous experience can determine whether the same two frequencies will be considered same or different. Remarkably, generalization gradients paralleled the typical bandwidths established in the auditory periphery and midbrain, suggesting that frequencies may be considered similar when falling within the same critical band.

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