

CAT-egorical perceptual similarity does not explain memory organization of auditory sequences

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Background

Sound sequences perceived as a single stream vs. as discrete events may be stored differently in working memory. In a past study, listeners heard a sound sequence and, in two different tasks, judged whether 1) a subsequent sequence of the same elements was ordered identically or had two adjacent elements exchanged (“same/different,” SD task) and 2) an element was in the original sequence (“present/absent,” PA task). Listeners were relatively good at the SD task for tones compared to everyday sounds, but relatively good at the PA task for everyday sounds compared to tones. Here, we ask whether the perceptual similarity of elements in a sequence explains this reversal of perception. We conducted online experiments replicating the previous experiment, including a third stimulus set of sounds perceived as similar to one another, but heard as independent events when presented in a sequence.

Method

Three stimulus sets were tested: 1) broadband, complex tones differing only in pitch (semitones spanning C4 to D#5), everyday sounds (spectrotemporally dissimilar items from the ESC-50 dataset), and cat meows (from Noyce et al. 2017, *J. Neuro.*).

Study 1 included three experiments exploring the perceptual similarity across pairs of stimulus sets (e.g., tones and meows). Listeners (N=20 in each experiment) judged the perceptual similarity of all possible pairings of elements across the two tested sets. We used multidimensional scaling to compute the average within-set similarity of elements, then quantified the relative similarity *across* sets in each experiment.

Study 2 comprised two separate experiments in which listeners performed both SD and PA tasks for sequences (length four) from two stimulus sets: tones and everyday sounds (N=40, Experiment 2A) and tones and meows (N=41, Experiment 2B).

Results

Study 1 established that complex tones were most perceptually similar to one another, everyday sounds the least similar, and meows in between.

Both experiments in Study 2 revealed a significant interaction between stimulus set and task. Specifically, Experiment 2A replicated previous results: performance in the SD task was better for tones than everyday sounds, but performance in the PA task was better for everyday sounds than tones. In Experiment 2B, performance was similarly worse for meows than tones in the SD task, but better for meows than tones in the PA task.

Conclusion

We replicated previous results: it is easier to recall the order of a sequence of tones than of everyday sounds (SD task), but harder to access individual items for tones than everyday sounds (PA task). The fact that meows (which are quite similar to each other but heard as discrete events), produce results similar to everyday sounds suggests that perceptual similarity alone does not explain how items are organized and stored in memory.