

## The role of audiovisual temporal coherence in auditory scene analysis

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### ABSTRACT

Perception is seamlessly multisensory, and interpreting an object through multiple modalities offers advantages over unisensory processing. We have recently demonstrated that audiovisual temporal coherence can modulate the performance of human listeners in an auditory selective attention task (1) (Maddox et al., 2015). When the radius of a visual stimulus changed in time with the intensity fluctuations of a target stream, listeners were better able to detect brief pitch or timbre perturbations than when the visual stimulus was temporally coherent with the to-be-ignored stream. Importantly, the timing or presence of the pitch / timbre perturbations were not predicted by the changes in the size of the visual stimulus.

Recording neural activity in the auditory cortex of ferrets in response to similar stimuli revealed a single neuron correlate of this effect, with the visual stimulus dictating which sound neurons represented within a mixture (2). Therefore by using stimuli that consisted of independently amplitude modulated acoustic streams and a radius (for human psychophysics) or intensity (for recordings in ferrets) modulated visual stimulus we were able to demonstrate preferential processing for sounds that were temporally coherent with the visual stimulus. In these studies the coherent changes in visual size/luminance and auditory amplitude bound information across modalities. However, the perceptual / neural benefits we observed extended to non-binding features of the sound – auditory pitch and timbre- consistent with the formation of an audiovisual object (3). Ongoing work is exploring the parameters over which these effects extend by manipulating onset asynchronies across modalities and the extent of the temporal coherence.

Human listeners varied in their ability to benefit from audiovisual temporal coherence (1). We therefore conducted a training study in which participants performed 5 short training sessions learning to either detect audiovisual temporal coherence, or were exposed to temporally coherent audiovisual stimuli while performing a rate discrimination task, or only completed the pre and post-test tasks. Both pre and post-tests included the auditory selective attention task used in (1) and an audiovisual temporal coherence detection threshold task. Both trained groups improved their performance on the auditory selective attention task from pre-test to post-test. However, only listeners who improved their ability to discriminate audiovisual temporal coherence altered the way in which they were able to benefit from audiovisual temporal coherence, such that temporal coherence between both target and masker sounds was advantageous when compared to performance with an independently modulated visual stream (4).

Keywords: Audiovisual, Multisensory, Auditory Cortex

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