Multisensory Context Warps Time Perception

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Presentation Abstract Summary How the brain processes timing information from multiple senses remains poorly understood. Here, we explore how audition and touch interact in the time domain. We tested how the duration of ignored sounds influences the perceived duration of co-occurring tactile events. Distractor sounds exerted systematic attractive and repulsive biasing effects on tactile duration judgments that were consistent across multiple timing ranges. We developed a two-step observer model to explain these results. First, the observer decides to bind or separate the auditory and tactile duration cues using causal inference. Subsequently, the observer computes a Bayesian estimate of duration using either a coupling or decoupling prior depending on the decision to bind or to separate cues, respectively. While existing cue combination models comparably predict attractive perceptual biases, the two-step model, owing to its conditional decoupling prior, is the only model that also accounts for large repulsive biases. Critically, the model predicts that increased sensory uncertainty shifts repulsive biases toward attraction, which we validated in separate experiments. These results imply multisensory computations are conditioned on probabilistic decisions to bind or to separate sensory cues. Our model provides a unified framework for understanding the extensive and flexible perceptual outcomes that result from multisensory cue interactions.

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