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Perception of ambiguous visual stimuli is driven by cross-modal associative learning under uncertainty

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Perception can be understood as inference combining sensory information with prior expectations. Here, we manipulate prior expectations by associative learning and investigate the effect of cue modality. In our experiment, participants (N=29) indicated the perceived direction of illusory motion of dot pairs (640 trials). A visuo-acoustic cue preceded the target stimulus and probabilistically predicted the direction of the motion. In 30% of the trials, motion direction was ambiguous, and in half of these trials, the auditory and the visual dimension of the cue predicted opposing directions. The impact of associative learning on perceptual decisions was evidenced by slower responses to less predictable, relative to more predictable non-ambiguous stimuli and by the increased rate of cue-congruent decisions on ambiguous trials. When the visual and the auditory dimensions of the cue predicted conflicting directions of motion on ambiguous trials, decisions were mostly congruent with the prediction of the acoustic dimension. In addition to the aggregated measures, we fitted the LATER model with various levels of complexity to reaction time data, where beliefs (e.g. cue-target associations) are represented as probability distributions. Overall, priors based on auditory information seem to have a stronger weight during the perception of illusory visual motion.

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