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  Cue recruitment in visual perception

  From the early 1700s until fifty years ago, associative learning played a fundamental role in theories of perception. The focus of these theories was appearance: How does the system decide what percept to construct from the measured signals? After Pavlov it seemed clear that these theories made a testable prediction: the visual system should be trainable by means of paired association, such that an arbitrarily chosen new cue might come to influence an arbitrarily chosen perceptual attribute (Fieandt, 1936; Hebb, 1949; Brunswik, 1953, 1956; Smedslund, 1955). This prediction was not confirmed. Indeed, today perceptual learning is often defined as the refinement of discrimination ability that comes with practice, not change in the utilization of visual signals to construct appearance.

  Yet the modern view of perception as near-optimal inference also requires that the system be able to detect and use a new signal if it is useful for representing properties of the world, and correlation with trusted signals --learning by association--is the only way to do this. In retrospect, certain findings in the literature can only be understood this way. We tested this prediction and found robust associative learning. A new visual cue (object position, which specified the 3D rotation direction of a Necker Cube) traded perceptually against the long-trusted cue (stereo) that was used to train the new cue, and the new cue was equally effective (as measured in units of belief) whether or not the old cue was also present in the display. This means that by default the visual system treated the new cue and the training cue as conditionally independent. A Bayesian/ machine learning framework is sensible for interpreting the findings.

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