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Guessing reveals internal models of perceptual precision

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Abstract

When observers lack sufficient information to support a confident response, they guess. Guessing is pervasive in perception and memory, yet standard mixture models treat it as uniform lapse noise. We measured guessing directly in continuous report using (E1) extreme-load, ultra-brief trials and (E2) backward-masked stimulus-absent trials in which no stimulus appeared but observers believed one had. Across both experiments, we found that that guess responses are systematic, observer-specific, and inversely related to feature-specific precision. We then introduce a new empirically-informed computational model that replaces the standard uniform lapse term with each observer's measured guess distribution. Critically, the model introduces no additional free parameters, yet yields improved fits and recovers guessing from stimulus-present trials via trial-level posterior inference. This framework reconceptualizes guessing as the complement of perceptual precision and provides a principled alternative to uniform lapse assumptions. More broadly, it demonstrates how latent internal models can be inferred by measuring guesses.