Bayesian inference underlies the contraction bias in delayed comparison tasks.

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Ashourian, Paymon, and Loewenstein Yonatan. 2011.

Abstract:

Delayed comparison tasks are widely used in the study of working memory and perception in psychology and neuroscience. It has long been known, however, that decisions in these tasks are biased. When the two stimuli in a delayed comparison trial are small in magnitude, subjects tend to report that the first stimulus is larger than the second stimulus. In contrast, subjects tend to report that the second stimulus is larger than the first when the stimuli are relatively large. Here we study the computational principles underlying this bias, also known as the contraction bias. We propose that the contraction bias results from a Bayesian computation in which a noisy representation of a magnitude is combined with a-priori information about the distribution of magnitudes to optimize performance. We test our hypothesis on choice behavior in a visual delayed comparison experiment by studying the effect of (i) changing the prior distribution and (ii) changing the uncertainty in the memorized stimulus. We show that choice behavior in both manipulations is consistent with the performance of an observer who uses a Bayesian inference in order to improve performance. Moreover, our results suggest that the contraction bias arises during memory retrieval/decision making and not during memory encoding. These results support the notion that the contraction bias illusion can be understood as resulting from optimality considerations.

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