Using eye tracking data to compare models of numerical estimation

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Abstract: People accurately compare and estimate means without using formal calculations, however, little is known about the cognitive processes underlying these behaviors. We used objective, behavioral data (e.g., eye fixation patterns), which are compatible with multiple representations, to compare cognitive models. Specifically, we compared seven cognitive models including working memory activation (weighting values as a function of the number of and duration of fixations), working memory constraint (e.g., recency + primacy, last four), or Bayesian models (e.g., first fixation set as prior).

Our task presented sets of 5 to 10 3-digit numbers (framed as the result of a home run derby) and asked participants to predict how far the next ball would be hit. The same fixation data were loaded into each model to create a unique estimate, which was then compared to the participant's actual prediction. The difference between the model and actual was calculated to create an accuracy index.