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Sequential-sampling models of quorum detection in house-hunting ants

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The ability to estimate nestmate numbers plays a key role in insect colony organization. Task allocation, defensive strategies, and collective nest site selection all depend on individual workers responding appropriately to the number of insects around them. How they do so remains unknown, but research has implicated encounter rates as a key source of information. Here we show how sequential-sampling models from psychology provide a cognitively plausible mechanism for an ant to decide whether a critical nestmate density has been achieved. In these models, an individual chooses between two alternatives on the basis of evidence for each one that accumulates over time until a threshold condition is reached. We developed a similar model for quorum sensing by nest site scouts of *Temnothorax* ants. These ants use encounters with nestmates in a candidate site to judge whether a threshold population has been reached, triggering full commitment to the site as the colony's new home. In psychological experiments, the accumulation of evidence cannot be quantitatively observed directly, but it can be inferred by fitting stochastic parameters to statistics from empirical data. In the ant experiments, encounters with other ants are the source of evidence and can thus be observed directly. Hence our model of decision-making takes an encounter rate as an input and predicts the distribution of choices and decision times. This model accounts for rate-dependent choices and decision times observed in *Temnothorax* recruitment experiments.