Cognition in physical spaces: A quorum-sensing mechanism for ants without sequential sampling

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The ability to estimate nestmate numbers plays a key role in insect colony organization. Many tasks 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. Sequential-sampling models (SSM) from cognitive psychology, like the drift-diffusion model, provide one plausible explanation for how an ant could integrate information over a long string of encounters to infer whether she is above or below a critical encounter rate. In fact, in experiments with \textit{Temnothorax rugatulus} ants in a quorum-sensing task within a cavity, measures of accuracy and decision latency match SSM predictions. However, honeybees that make similar inference in nectar-foraging tasks appear to do so using only a single encounter. Motivated by this honeybee phenomenon as well as classic studies of temporal discounting mechanisms in psychology, we show that the same latency and accuracy curves from laboratory data can be generated by an ant that is only sensitive to the time since her encounter with the exit and her most immediate encounter with another ant.