Complex communication: Receiver-sourced signals that regulate information flow during social recruitment

Gabriele Valentini\textsuperscript{1}, Nobuaki Mizumoto\textsuperscript{3}, Theodore P. Pavlic\textsuperscript{2,3,4}, Stephen C. Pratt\textsuperscript{3}, and Sara Imari Walker\textsuperscript{1}

\textsuperscript{1} School of Earth and Space Exploration, Arizona State University
\textsuperscript{2} School of Computing, Informatics, and Decision Systems Engineering, Arizona State University
\textsuperscript{3} School of Life Sciences, Arizona State University
\textsuperscript{4} School of Sustainability, Arizona State University

When recruiting colony members to a potential new home, pairs of Temnothorax rugatulus ants use tandem runs in which an informed ant that has found a candidate site leads a naive follower there. This behavior involves ritualized pauses that superficially appear to be terminated by contact between the follower and leader. We use information-theoretic tools to show that the pattern of pauses of each tandem run is better predicted by the behavior of the follower while the trajectory of the run is better predicted by the behavior of the leader. As a control, we perform the same analysis in two species of termites that use tandem running only to maintain close proximity between the pair. As predicted, the information-theoretic signatures in the termite data indicate that both the pair’s trajectory and its pauses are predictable by the leader behavior alone. This analysis is evidence of a separate follower-to-leader feedback signal in the ants that regulates information flow similar to acknowledgement-based flow control in Internet communication. To our knowledge, this is the first non-human example of signals whose strategic value is to modulate other signals.