Driving and Response in Insect Swarms

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Abstract

Aggregations of social animals, such as flocks of birds, schools of fish, or swarms of insects, are beautiful, natural examples of self-organized behavior far from equilibrium. Because so many of these systems display large-scale ordered patterns and because quantitative data for real animals is still relatively uncommon, it has become the norm in modeling animal aggregations to focus on this order. Large-scale patterns alone, however, are not sufficient information to characterize an animal aggregation fully, and do not provide stringent enough conditions to benchmark models. We have therefore developed methods to drive a particular example of collective behavior—laboratory mating swarms of the non-biting midge Chironomus riparius—and measure the response at both the individual and the collective level. Our results allow us to begin to characterize the swarms in term of state variables and response functions, and point towards a more specific way to describe the collective behavior than simply the overall pattern.

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