Researchers discovered excessive social interaction reduced collective response

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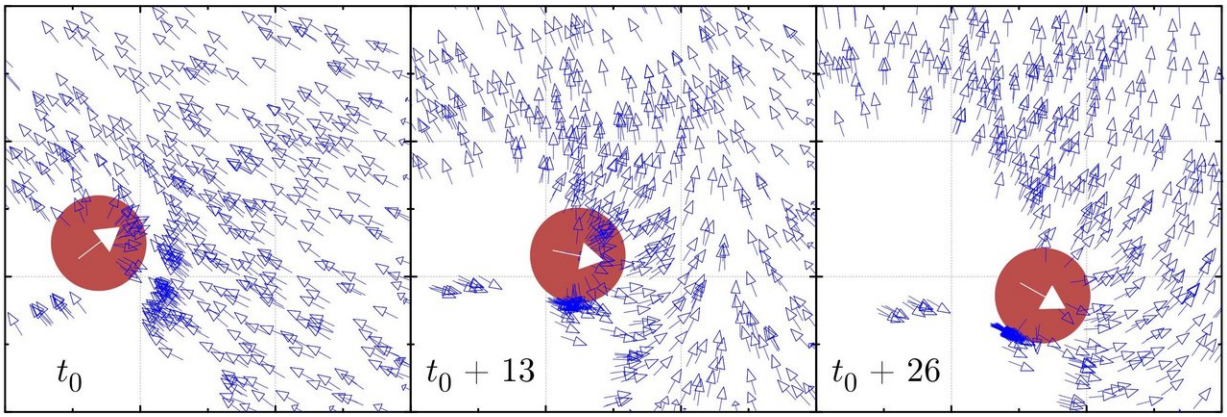

Simulation of a predator attack and the induced collective evasive action of the swarm. The members of the swarm (blue arrows) can only detect the predator (solid white arrow) when they are inside the red circle. But, thanks to the optimal cooperative social behavior, the whole swarm is able to react to the predator in time. Credit: Singapore University of Technology and Design (SUTD)

From schools of fish, to swarms of insects, to flocks of birds, many animals live and move in groups. They have no leader, no central coordinator, and yet manage to perform awe-inspiring coordinated displays of collective motion. These swarming behaviors are archetypal examples of how local coordination between nearby animals translates into an emerging global behavior. But how localized should this local coordination be? Is more interaction always better? Not all animal taxon

swarms, and observations of flocks of starlings show that they limit their interaction to their six-to-seven nearest neighbors.

New simulations of predators attacking a swarm help explain these observations. The simulations show that the group has a higher chance of survival when members limit the amount of individuals they interact with during their collective motion. This work reveals the clear parallel between collective evasive maneuvers and the spread of information in social networks.

If one thinks of the predator's presence as a "signal" that propagates through a network, it is expected that the earlier an individual receives this signal, the better its chances are of avoiding the predator. Using classical models of behavioral spread through complex networks, researchers from the Singapore University of Technology and Design (SUTD) observed that the propagation speed is radically increased when limiting the average number of connections allowed. Thus, the insights gathered from the behavior of swarming animals can be applied to many problems in engineering and social sciences: from increasing the flexibility of the power grid and designing responsive swarms of robots, to improving crowd mobility and optimizing information spreading on social networks.

For all the benefits that coordination and collective behavior yields to the members of a group, it seems that when it comes to social interaction there can be too much of a good thing.

Principal investigator, SUTD Assistant Professor Roland Bouffanais said: "For a long time, it was assumed that the performance of a group improves by making it more connected. This research shows the unexpected detrimental effects of having too many connections for both living and artificial systems."

More information: David Mateo et al, Effect of Correlations in Swarms on Collective Response, *Scientific Reports* (2017). DOI: 10.1038/s41598-017-09830-w