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Why 'whispers' among bees sometimes evolve into 'shouts'

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Let's say you're a bee and you've spotted a new and particularly lucrative source of nectar and pollen. What's the best way to communicate the location of this prize cache of food to the rest of your nestmates without revealing it to competitors, or "eavesdropping" spies, outside of the colony?



Many animals are thought to deter eavesdroppers by making their signals revealing the location or quality of

resources less conspicuous to outsiders. In essence, they've evolved "whispers" in their signals to counter eavesdropping.

But some species of bees in Brazil do the exact opposite. "Shouts" in their food-recruitment signals warn would-be competitors that their prime source of food will be fiercely defended if they show up to the site. It's a communication strategy that's bold and risky, yet remarkably successful in warding off competitors, according to a paper published in the July 7 issue of the journal *Current Biology*.

"It's a signal with honest aspects and the possibility of lies," explains James Nieh, a professor of biology at UC San Diego who oversaw the research study conducted in Brazil by Elinor Lichtenberg, a PhD student in his laboratory who is now a postdoctoral researcher at Washington State University. "It tells nestmates where to find good food and hints at a larger occupying force."

Lichtenberg says her discovery of this counterintuitive method of communication by bees suggests that eavesdroppers can alter the evolution of animal signals in ways that were previously not thought possible.

"Our study provides a new way of looking at how eavesdroppers affect the evolution of animal communication signals," she adds. "Until now, it was thought that eavesdroppers select against conspicuous signals, for example by more easily finding and eating prey that sings loudly. But our results show that eavesdroppers can help select for the same conspicuous signals that are easiest for intended recipients to detect and understand."

To Nieh, whose research has focused on the evolution of communication strategies among bees, "eavesdropping is part of the information web, the signals and cues that surround animals and play a key role in shaping ecosystems."

In the case of bees and other pollinators, he says, "a network of signals and cues shapes pollination, informing animals about where and when food is available. Researchers have in general thought about eavesdropping as a force that makes signals less conspicuous, leading to the evolution of 'whispers' to counter spying. However, we show that eavesdropping can also lead to 'shouts.' In this stingless bee system, with aggressive colonies jockeying for limited resources, more conspicuous food-recruitment signals indicate a higher likelihood that a resource will be harder to wrest away."

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Lichtenberg's study focused on stingless bees—including two from the genus *Trigona* that recruit nestmates to food sources with chemically distinct pheromones—that compete with one another for similar food sources. *Trigona hyalinata* spies that detect food sources marked by *Trigona spinipes* foragers will often displace *T. spinipes* from desirable sites in the wild if they can recruit sufficient nestmates. But Lichtenberg found in a controlled field study that the eavesdropping species will avoid desirable sources of food that have been visited frequently by *T. spinipes* (communicated by the larger number of pheromone markings at the site) to avoid being attacked. However, *T. hyalinata* foragers are attracted to food sources with fewer *T. spinipes* foragers.

The eavesdroppers could take over the highly visited sites by recruiting more of their nestmates or battling with *T. spinipes* bees, which show high levels of aggression toward intruders, but the risks and energy costs to the eavesdroppers apparently aren't worth the trouble.