

Songbirds' elaborate cries for food show first signs of vocal learning

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(PhysOrg.com) -- Only a handful of social animals -- songbirds, some marine mammals, some bats and humans -- learn to actively style their vocal communications. Babies, for instance, start by babbling, their first chance to experiment with sounds. Now, new research in songbirds shows that vocal experimentation may begin with their earliest vocalizations -- food begging calls -- and perhaps for a more devious reason than previously believed. The findings could change the way we think about the evolution of vocal learning.

“It may have started as cheating,” says Fernando Nottebohm, head of the Laboratory of Animal Behavior at The Rockefeller University. “By generating a diversity of calls, young birds may trick their parents into losing track of whom they last fed, in effect creating the impression of several individuals.” In this scenario, the most agile vocal dissembler would get more than its fair share of food at the expense of its siblings.

Nottebohm and Wan-chun Liu, a research assistant professor who made the original observations, are quick to say that the interpretation remains speculative for now, but if true, it would complicate the conventional wisdom that vocal learning evolved as an adjunct to reproductive behavior. In temperate climates, most often only male songbirds sing. The message conveyed by song is simple: I am a male robin, mature, single and ready to breed; females are welcome, males stay away. Depending on the listener, song is a lure or a threat. By imitating the song of established seniors with whom they would have to compete, young breeders presumably gained an advantage in courtship and

territorial defense.

The vocal imitation expressed by adults, however, is a complex behavior requiring sophisticated underlying [brain circuits](#), Nottebohm says. How would birds with only innate, genetically foreordained vocal repertoires have evolved the ability? One part of a plausible explanation is that vocal learning emerged initially as a vehicle for creating variability in juveniles before territory and mate are an issue, according to Nottebohm. Such a development would require a simpler beginning brain circuit, which could later become part of the complex brain architecture required for imitation.

The new research is compatible with the idea that vocal learning first emerged outside the context of reproductive pressures. It suggests that the auditory guidance of vocal development — a key sign of vocal learning — originally appeared in the context of food begging and later evolved into vocal imitation used in territorial defense and courtship.

The food begging calls of songbirds were previously thought to be innate, partly because of their simplicity and because they preceded what was believed to be the first stage of vocal learning — subsong. Subsong is a soft, rambling and variable collection of sounds produced in a noncommunicative context. It has often been described as the avian equivalent of babbling in infants. Mature birdsong, by contrast, combines improvisation — as in subsong — with imitation of the song of other adults.

Liu found that while the food begging calls of young males vary considerably from moment to moment and between individuals, those of young females are very stereotyped and all alike. Deafening altered the food begging calls of male juveniles, but not those of females, suggesting that in males, but not females, the food begging calls are already part of a vocal development that relies on intact hearing. Males

producing food begging calls also showed an increased expression of c-fos, a neural activity marker in a section of the forebrain known as the robust nucleus, which later plays a role in the control of learned song. Male sparrows without a robust nucleus still make begging calls, but with less variation, so that they are similar to those of females.

Published last month in PLoS One, these observations strongly suggest that vocal learning in male chipping sparrows starts with their food begging calls, and that in this process improvisation preceded imitation. “The evolution of vocal learning is a deep philosophical problem, and we don’t know the answer yet,” Nottebohm says. “But studies like this help us imagine how it might have come to be.”

More information: *PLoS One* [4\(6\): e5929 \(June 16, 2009\)](#), Variable food begging calls are harbingers of vocal learning, Wan-chun Liu, Kazuhiro Wada and Fernando Nottebohm

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