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Bat-elicious: The Rewards of Spying

by Patricia Waldron | April 2018

Bats live almost everywhere on the planet, except in the frigid polar regions, in areas above the tree line, and on some remote ocean islands. These denizens of the night have become incredibly successful, to the point where about a fifth of all mammals are bats. Scientists have speculated that bats are so widespread because they can perform echolocation. Bats' amazing ability to bounce high-pitched sounds off nearby objects enables them to fly and hunt at night, which opens up a whole new world of food opportunities for them. But echolocation isn't the only trick up some bats' furry sleeves.

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A new study finds that listening in on nearby hunters may be a strategy that at least one bat species uses to survive. Ecologists studied the interaction of fringe-lipped bats (top) and white-throated round-eared bats (bottom) as they hunted for food.

A new study finds that listening in on nearby hunters may be a strategy that at least one bat species uses to survive. Krista Patriquin, an ecologist studying bat behavior at the University of Toronto Mississauga, in Canada,

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and her colleagues, showed that the fringe-lipped bat (*Trachops cirrhosus*) picks up tips on finding new prey by spying on other bat species. Patriquin and her colleagues trained several fringe-lipped bats and white-throated round-eared bats (*Lophostoma silvicolum*) to go about finding a tasty treat by following a high-pitched noise. Fringe-lipped bats that had never heard the sound before learned the new cue from round-eared bats just as quickly as from members of their own species. This is the first time that scientists have observed one bat species learning from bats of another species, and they think that being flexible learners may help bats adapt to new and rapidly changing environments. The researchers report their findings in the journal *Science Advances*.

"From a purely scientific perspective it's interesting to understand how animals learn about the world around them," said Patriquin to the *Washington Post*. "But it also tells us how bats might learn to adapt to changes in the landscape."

Listening for Mating Calls

The fringe-lipped bat has a face that only a mother (or a devoted researcher) could love. It gets its name from the spiky, wart-like bumps that grow along its lips and chin. It also has giant ears and a single, fleshy horn called a nose leaf, which it uses for echolocation. Its furry, brown body is medium-sized for a bat–smaller than a person's palm.

Small groups of fringe-lipped bats roost in caves, hollow trees and buildings, and they can be found in lowland forests from southern Mexico down to southeastern Brazil. They are opportunistic eaters and consume a variety of insects, lizards and frogs, but will also eat fruits and seeds when available.

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Fringe-lipped bats are capable of tracking one of their favorite foods, coquí frogs, based on the frogs' mating calls. Even after the frog has quieted down, bats can use echolocation to detect ripples in water created by earlier movements of the frog's vocal sac.

These bats are also clever hunters. Previous studies had shown them capable of tracking one of their favorite foods, coquí frogs, based on the frogs' mating calls. Even after the frog has quieted down, bats can use echolocation to detect ripples in water created by earlier movements of the frog's vocal sac. Fringe-lipped bats even learn from other fringe-lipped bats which frogs are safe and which are poisonous by observing which frog mating calls those others pursue and what they eat. [See Frog-Eating Bats Are Discriminating Diners, July 2012.] "This is the only species of bat in the world known to eavesdrop on the calls of frogs," said Rachel Page of the Smithsonian Tropical Research Institute in Balboa Ancon, Panama, to

Smithsonian magazine. Page was a member of the teams that made the earlier discoveries, and she co-authored the recent study.

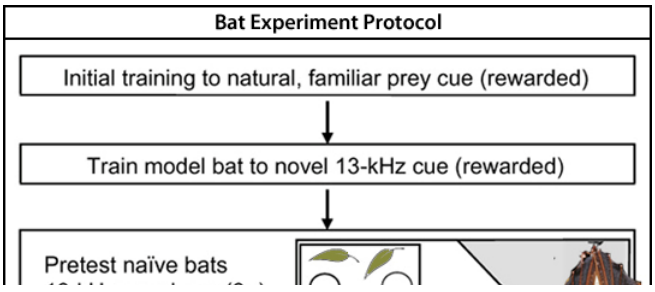
Merlin D. Tuttle/Bat Conservation International

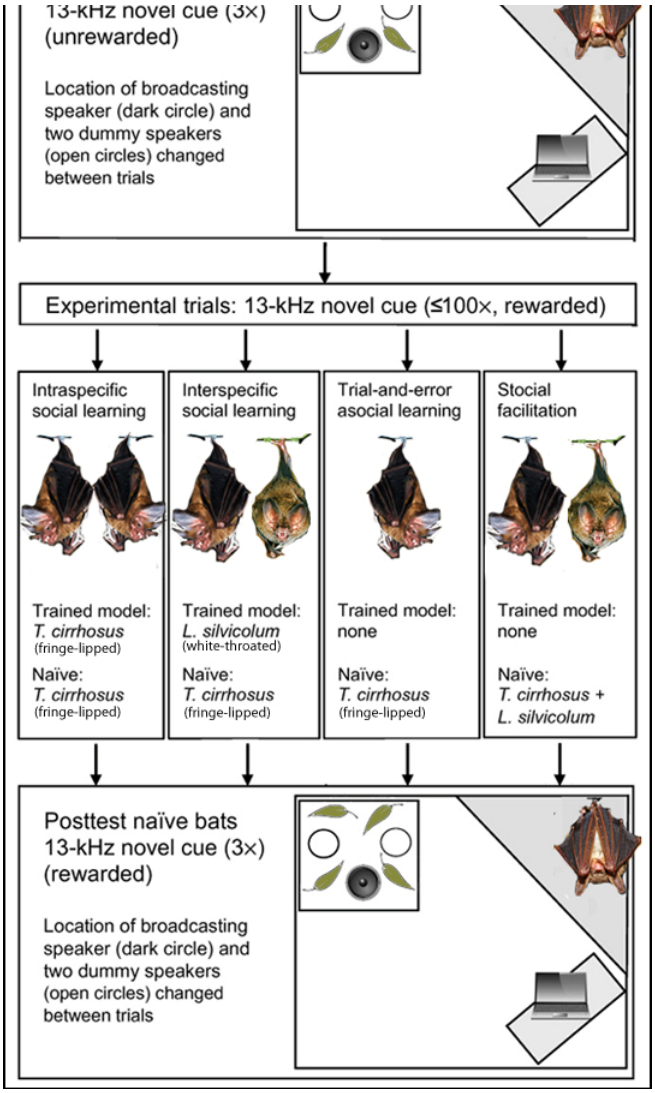
Another favorite food of bats is katydids—grasshoppers with thick green bodies, long hind legs and a familiar chirp.

Clearly, fringe-lipped bats can learn from other members of their species, or their "conspecifics," but Page, Patriquin and their colleagues wanted to know whether these bats could also learn from members of other bat species, called "heterospecifics." Several types of bats live in groups that include more than one species. If two species eat similar prey, then spying on each other may help steer members of both species to new food sources. A bat that learns new behaviors from other bats, whether conspecific or heterospecific, may save both time and energy because it no longer has to find prey through trial and error. This strategy can also prevent deadly mistakes, such as eating a poisonous frog.

Learning New Signals

Patriquin and her colleagues spent six months at the Smithsonian Tropical Research Institute in Gamboa, Panama, to test whether fringe-lipped bats could learn to recognize a new mating call by observing the hunting behavior of the white-throated round-eared bat. Working at night inside a large, metal flight cage, the researchers taught several white-throated bats a new, highly unpleasant sound signaling a delicious snack. To acclimate the bats, the researchers first played the familiar chirp of the katydid, a favorite food of theirs. When the bats approached the speakers, they were rewarded with katydids, so they learned to associate the meal with the sound cue. Then the researchers switched from the familiar cue to a completely new, obnoxious one, doing so gradually so that the bats would respond reliably to the new sound. They used a similar training process with several fringe-lipped bats as well. But instead of katydid chirps, they initially used the call of a highly sought-after frog to attract the bats and rewarded them with a small fish (the frogs are a protected species).





Patriquin, Krista J., et al./Science Advances/M. Bank

The researchers spent six months at the Smithsonian Tropical Research Institute in Gamboa, Panama, testing whether fringe-lipped bats could learn to recognize a new mating call by observing the hunting behavior of the white-throated round-eared bat. They found that the fringe-lipped bats were quick learners—learning equally well from white-throated bats as from members of their own species.

The new cue was especially obnoxious because the researchers had to be certain that none of the bats had heard anything like it before. "Each pulse was a high-pitched 'Eeee, eeee,'" Patriquin commented to the *Washington Post*. She said that the bats clearly hated the noise. "You could visibly see they were not happy, because they would shake their heads in response to the sound."

Next, the researchers placed a trained bat into the flight cage along with an untrained fringe-lipped bat to determine how quickly the latter could pick up the new cue. The fringe-lipped bats were quick learners. On average it took them about 18 repetitions to learn that the screeching noise meant food. They learned equally well from white-throated bats as they did from members of their own species.

When a fringe-lipped bat had to learn the cue on its own without help from a trained bat, it was far less successful. Most of the time, the researchers had to end the experiment before the bat had learned to associate the noise with food. Only about a third of the fringe-lipped bats ultimately learned the cue through trial and error, and it took them about three times longer compared

to trials in which they were aided by a trained bat. "Our findings demonstrate that [the fringe-lipped bat] is a consummate learner, capable of acquiring new information about novel, potential prey from conspecifics and heterospecifics alike," the authors write.

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Many bats roost together with members of other species, so it is possible that spying on the eating habits of neighboring bats belonging to a different species is a common practice that deserves greater study. In future experiments, the researchers also plan to explore the role of echolocation in identifying new food cues. It's likely that bats use echolocation to detect another bat's hunting movements, as well as the vibrations from its chewing noises after a successful kill. The added input from echolocation may help cement the link in a bat's brain between hearing a particular food cue and eating tasty prey.

A Lifetime of Observation

While this is the first time that researchers have observed bats taking cues from another species, the practice of learning from heterospecifics is not uncommon in the animal world. Certain lizards can learn to find ripe figs from fig-eating birds, for example, and small African antelopes called dik-diks will stop grazing and take shelter when they hear the alarm cries of white-bellied go-away birds. Our hunter-gatherer ancestors also learned what was good for dinner by observing the eating habits of other animals.

Merlin D. Tuttle/Science Photo Library

The ability to rapidly identify new prey by spying on other species may have helped bats spread and adapt to new environments.

The ability to rapidly identify new prey by spying on other species may have helped bats spread and adapt to new environments. Once they found a new habitat, "bats may have persisted through a combination of individual and social learning, taking cues from heterospecifics already familiar with available food in new environments," the authors write. "New behaviors could then spread rapidly and faithfully across individuals" within the same species.

Today and in the future, being quick learners may help fringe-lipped bats adjust to both climate- and human-related challenges. Because it is widely distributed across Central and South America, and because its habitat includes several protected regions, the fringe-lipped bat is not currently an endangered species. But as human activities swallow up more of the fringe-lipped bat's habitat and as warming temperatures affect prey availability, the bat may need to find new sources of food. If it can pick up a few pointers from other bat species with overlapping ranges, it may be able to weather the changing landscape.

Discussion Questions

What kinds of advantages does echolocation give bats?

Do modern humans learn from conspecifics and heterospecifics? If so, give an example of both types of learning.

If you were a coquí frog in the wild, how could you alter your mating behavior to evade hungry bats?

Journal Abstracts and Articles

(Researchers' own descriptions of their work, summary or full-text, on scientific journal websites.)

Patriquin, Krista J., et al. "Bats without borders: Predators learn novel prey cues from other predatory species." *Science Advances* (March 21, 2018) [accessed March 30, 2018]: http://doi.org/10.1126/sciadv.aaq0579.

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