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# How bats pick out their own calls when flying in enormous swarms

Researchers trained a hawk outfitted with microphones to fly through a swarm of 600,000 bats, revealing how they can hear their own voice in a crowd

By Rachel Berkowitz

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**A swarm of hundreds of thousands of bats roosts in the Jornada caves in New Mexico**
Laura Kloepper

A trained hawk carried sensors through a swarm of hundreds of thousands of bats, recording data that helped researchers figure out how the flying mammals manage to pick out their own high-pitched echoes from those of other chatty bats.

If you have ever carried on a conversation in a noisy crowd, you have solved what is known as the cocktail party problem 🔗 /article/mg21428613-800-cocktail-party-effect-identified-in-the-brain/, focusing on a single voice among many. This isn't just a human issue. For bats, which hunt and navigate by emitting ultrasonic calls and measuring the difference between what they sent out and what returns, detecting their own high-pitched echoes 🔗 /article/2276404-bats-dont-have-to-learn-the-speed-of-sound-theyre-born-knowing-it/ is a matter of survival.

Bats commonly live and hunt in groups of thousands. "They come out in swarms, and it's chaos," says Laura Kloepper 🔗 https://www.laurakloepper.net/ at the University of New Hampshire. So how does each animal recognise its own echo in a crowd?

One long-standing theory is a "jamming avoidance response", where an individual shifts its call to minimise interference from its neighbours. "While there is evidence in support of this response in bats, the adjustments in call features are variable," says Cynthia Moss 🔗 https://pbs.jhu.edu/directory/cynthia-moss/ at Johns Hopkins University in Maryland. Some researchers argue that call adjustments may instead be a more general reaction to other bats in the environment.

Some evidence for the jamming avoidance response comes from field recordings, as well as laboratory studies where researchers electronically manipulate echoes to determine what cues bats attend to. These experiments suggest that individuals shift their call frequencies or timing to avoid overlap with others. However, the studies involved tens of bats. "When there are thousands, that strategy breaks down," says Kloepper.

To find out how bats solve the cocktail party problem, she needed to observe a dense swarm, where obtaining audio-visual information poses a challenge. Stationary sensors provide only a limited view, and fast-flying drones 🔗 /article-topic/drones/ are noisy and threaten bats' delicate winged bodies. So Kloepper contacted a licensed falconer to propose a bird-borne

platform. A year later, the team had trained a captive-bred Harris's hawk 🔗 /article/dn28218-zoologger-the-only-raptor-known-to-hunt-in-cooperative-packs/ to fly through a swarm of bats while wearing a backpack equipped with tiny microphones and video cameras.

Guided by humans positioned along its path, the hawk flew 23 passes through 600,000 bats that emerged from Jornada caves, New Mexico, for their evening meal. Its backpack recorded the bats as they travelled down the middle of a canyon.

From these recordings, the researchers extracted characteristics of each bat's "voice". They teased out extremely small differences from one individual's call to the next and found that these tiny variations can drive enormous differences in the signal that returns to a bat. This makes it easier for each bat to compare a returning echo to the one it sent out and ignore the input that doesn't match. "Really subtle changes have a big impact on whether a bat accepts or rejects the return signal," says Kloepper.

**A Harris's hawk learned to carry sensors through a swarm of bats**
Laura Kloepper

Thejasvi Beleyur 🔗 https://www.ab.mpg.de/person/115292/2736 at the Max Planck Institute of Animal Behavior in Germany says it is a "very neat way" to record the soundscape in the middle of a dense swarm. Unlike capturing individual bats and tagging them with recorders, having "another animal trained to fly in various paths gives you far more control on how you want to sample the soundscape", he says.

"It's very novel to put the hawk in the mix," says Moss. "One question I have is whether the hawk affected the bats – if a predator is nearby, there may be effects that we can't really detect."

Kloepper notes that a gliding raptor offers silent

and mobile biomonitoring, but acknowledges that responsible falconry requires more resources than simply powering up electronic equipment. “It’s an alternative when drones are difficult to operate due to noise levels or the surrounding environment,” she says.

The work was presented at the 186th meeting of the Acoustical Society of America in Ottawa last month.