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Songbirds prefer hi-fi recordings

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DURHAM -- Birdsong, one of life's free gifts, results from some hard work – by the birds. The swamp sparrow, for example, learns a sizable number of songs in its youth and intensely practices them, like an opera singer would, then winnows its repertoire down to three or four keepers.

Which songs make the cut depends in part on how much noise the birds must put up with when they practice, according to researchers at Duke University.

Duke biology professor Steve Nowicki and research associate Susan Peters conducted an experiment that confirmed a decades-old hypothesis: Birds learn songs that carry best through their local environment. The presence of trees, water and noise, such as nearby traffic, all can affect the acoustics that determine which songs a bird sings.

The results of the Duke experiments, recently published in Biology Letters, carry implications for how human activity can change ecosystems, and provide insight into how brains work, including our own.

To start the experiments, Nowicki and Peters gave record deals to 10 adult male swamp sparrows.

The sparrows sang in the lab equivalent of a recording studio. Some songs were then re-recorded from afar, creating a set of lower-quality recordings. It's like listening to the radio in the next room; you can still recognize songs and sing along, but it doesn't sound quite as clean.

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Raised in lab

They raised another host of male swamp sparrows in the lab from infancy. Once they were about 20 days old, the birds were intensively tutored, hearing eight clear songs and eight less-clear ones.

The young birds practiced, and after three months were ready for their debut. They each had a set of songs they kept, narrowed down from the original 16.

The team matched the tutored recordings to the kept songs by comparing sonograms of the sounds. Sonograms are much like sheet music, except that they allow for arbitrary rhythm and pitch.

The results

The birds consistently rejected the lower-quality recordings from their songbooks.

In nature, a clearer song would correspond to better transmission through the environment. So the birds neglect songs not suited for their habitat. Or from another angle, a diversity of habitat leads to a diversity of song, even within the same species.

The results themselves aren't particularly surprising, as the hypothesis they tested has been around for 30 years.

"What was really surprising was how clear-cut the results were," says Peters. "The fuzzy versions had all of the information they needed to reproduce those songs. But they (birds) don't even pay attention to those songs."

The difference between a high-fidelity and low-fidelity recording is subtle, but birds' brains seem to be keen to detect the difference. It's possible that evidence of a discriminating taste could be a sign of fitness in a mate, according to Nowicki.

Translates to humans

Humans are good at recognizing these subtle differences, too.

"It's like 'bat' versus 'pat'," says Nowicki. "Those words are ambiguous in their sound signal; they look the same in a sonogram. But our brains have no trouble distinguishing those words."

He speculates a single neural circuit could be responsible for this discriminating taste.

The hardest part of the experiment was raising the birds. Every half hour, they must be fed, dawn to dusk, requiring a "small army of undergraduates," as Nowicki puts it. Such a critical chore required a fail-safe measure: Once a student completed a shift, he could not leave the lab until the next worker showed up. A baton was ceremoniously passed, dubbed the "icon of responsibility," an object that changes from study to study. Peters and Nowicki recall the first icon: one of their son's toys.

The researchers

The pair have been married 25 years. They got into this field separately, but both were inspired by the intersection of music and biology. They met working in the same lab at Rockefeller University in New York.

Their current work provides an example of how human behavior can affect the natural order. Machinery, traffic and other human noises can influence which birdsongs are passed to the next generation. Since songs are learned behavior and not genetic, these changes can happen quickly.

Peters and Nowicki also underscore the importance of their work to humans. Birds are both auditory and visual

learners, just like humans, but humans are difficult to study. Bird brains are like simple models of ours.

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