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# UCSB Scientists' Innovative Use of Videos Aids Study of Songbird Communication

It's a subject humans have been studying for centuries: Why do birds sing, and what are they trying to communicate? Two UC Santa Barbara scientists believe they have solved at least part of the mystery.

In a study funded by the National Science Foundation, Stephen Rothstein, professor of zoology, and Adrian O'Loghlen, a research scientist in the Department of Ecology, Evolution and Marine Biology, have documented how male brown-headed cowbirds use songs and physical displays to elicit responses from females. Their studies are the first to use video recordings of males to show that the visual components of singing behavior can influence the sexual responses of female songbirds.

"This is the kind of breakthrough that we've been trying to develop," O'Loghlen said. "We're able to communicate visual information to the female cowbirds. It's really good evidence that they're extracting visual information. There are so many questions we can ask in our studies using this technique. The potential for this research is mind-blowing."

There are thousands of researchers who study birds, according to the UCSB scientists. The study of birds remains one of the major areas of research in biology, due in part to the challenge of discovering how they learn their songs. "In humans,"

Rothstein said, "everyone knows that you can learn a new language much easier early in life. And with these songbirds, learning new songs is limited to an early period of life. It's either the first or second year."

"There are many parallels to language development in humans," O'Loghlen said. "The birds go through various stages that are very similar. Babies babble. Birds babble. Babies memorize a lot of sounds before they ever try to produce them. Birds do the same."

Many scientists believe that birdsong may be the best animal model for the study of cultural evolution that occurs in people. "It has a parallel with genetic evolution, where the structure within a species changes over time," Rothstein said. "Our lives are totally different than they were over a hundred years ago because of cultural changes, yet we have undergone little or no genetic evolution. The best example of cultural evolution within species in non-human animals is with these birds and their different song dialects. They clearly have evolved different cultures in different places."

For many years, a primary method used in studying how songbirds communicate was to use audio playback. A male cowbird would sing and the sounds were recorded and played back to the females –– or to other males –– to see how they would respond. Males sing to other males as a form of aggression, while males sing to females as part of the courting ritual.

"Until the work we've done recently, it looked like it was the same signal to the male and female," Rothstein said. "Just the receiver of the information knew it had different meanings. But what we found is that there is some difference in how the song is presented to a male by a male, and the way a male presents a song to a female."

When researchers previously attempted to use audiovisual recordings to observe the birds' behavior, the results were disappointing. The flickering of old cathode ray tube monitors was distracting to the birds. But when flat-screen, liquid crystal display (LCD) monitors came along, the possibility of adding video to birdsong experiments became a reality. The LCD monitors have a much faster refresh rate, which doesn't seem to bother the birds.

Rothstein and O'Loghlen built an audiovisual lab at the aviaries on the UCSB campus. By using two small cages placed side-by-side, with a webcam between the

cages, the researchers were able to record males directing songs at females or other males. They then used an LCD monitor and laptop computers to present these video recordings to females, and to record the females' responses.

The video recordings documented the songs of the males (like most songbirds, only male cowbirds sing) and the physical displays of both males and females. The males would spread their wings and bow deeply in a show of aggression when singing to other males, while the displays that accompanied songs directed at females always involved less extreme motions. The female cowbirds would react to the video playback by freezing, almost becoming rigid, in what the researchers call a copulation solicitation display. "She's actually saying, ‘Whoa, that's really sexy, you can mate with me,' " O'Loghlen said.

"We realized that the intensity of male-directed and female-directed physical displays was very different," O'Loghlen said. "We quantified the differences in these two types of displays –– the first time anyone had done this."

The results of their research were published earlier this year in the journal Animal Behaviour, and additional findings appeared more recently in The Condor, an international journal that publishes original research reports pertaining to the biology of wild bird species.

Rothstein, who has devoted most of his 38 years as a professor at UCSB to the study of birds, believes videos are the key to unlocking even more secrets about cowbirds and other species.

"Birds are both visual and auditory creatures," Rothstein said. "That's the way they perceive the world and the way they communicate with each other. We and other researchers have looked at the audio component –– a lot. With this video, it's much more natural. It's one of the reasons bird-watching is so popular, because people and birds see the world in the same way –– through sight and sound."

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†A still-frame from a video recording of a female brown-headed cowbird, left,doing a copulation solicitation display. Her head and bill are pointing up and her tail is also elevated. She has just finished viewing a recording of a male, seen on the monitor screen at right, singing a song and performing the bowing display that generally accompanies cowbird songs.

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Stephen Rothstein

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