

Research on Bird Song Could Lead to a Refinement of a Darwinian Theory

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For Williams College biology professor Heather Williams, the songs birds sing are more than a pleasant part of a spring day. They are a window into how communication works in the natural world. A birdsong is more than just an encapsulated package of information, it is "a behavior frozen in time."

One of her projects is to record and map out the songs of Savannah sparrows that spend the warmer months on a small Canadian island, Kent Island, in the Bay of Fundy. With the help of microphones, binoculars, and a well-documented set of individual birds, her research is beginning to create a richer view of how birdsong moves from neighbor to neighbor and generation to generation in the wild. And it could lead to a refined way of looking at how communication fits into evolutionary theory.

Using sound to communicate is common to many animal species, but learning different ways to use the tools physiology gave them to create more complex means of communication is rare. Human language is the most obvious example, but we alone among primates are capable of vocal learning (though other kinds of mammals including dolphins, whales, and a few species of bats and seals do learn their vocalizations). On the other hand, over 5,000 species of birds learn their songs.

Previous generations of birdsong researchers have shown that birds learn their songs in ways very similar to the ways human infants learn language. They start with a period of close listening, followed by a

"subsong" phase akin to human "babbling," as they work out the phonemes they can physically make and map the sounds to the motor skills it takes to make them, "to calibrate the vocal instrument," as Prof. Williams puts it. After that comes the "plastic song" phase, when they begin to put the parts together in imitation of models they've heard, and a "crystallization" period when they settle on a tune that works.

Since 2004, Prof. Williams has made several trips to Kent Island, about an eight-hour drive, followed by a two-hour ferry ride to Grand Manan Island. From there it takes another hour on a lobster boat to reach the island. The island is managed as a scientific research station by Bowdoin College, and has been a protected area for more than 70 years. Many researchers use it as an open-air laboratory to study the island's flora and fauna.

One ongoing research effort begun by Nathaniel Wheelwright of Bowdoin College is to catalog the life stories of a broad sample of the Savannah sparrows that summer on the island. Since 1987, thousands of the little birds have been caught, tagged with bands on their legs, and had their blood sampled. The result is a rich census of the island's sparrow population, with detailed information about the birds' life-span, mating habits, and territorial awareness.

"There are other multi-year studies of birds," Williams said. "But not many have accumulated this kind of longevity and this breadth of approaches."

In some ways, it can seem like a very complicated episode of "Melrose Place." One particular long-lived male is known as "S.RN," so-called because his left leg has a striped band, and his right leg a red band over a navy blue one. In 2004, he mated with five different females, and raised 20 nestlings. Subsequent blood work revealed that only 16 of them were actually his offspring (he didn't lose much overall, because he fathered at

least five that hatched in other males' nests). More importantly, four of his offspring returned to breed the next year -- a good result as usually only one in ten return.

Starting from such a broad and ever-growing inventory, Prof. Williams has set about trying to match specific songs to specific individuals. With binoculars, a good microphone, and a little patience, she has been able to match hundreds of song samples to their singers, despite challenges like stiff ocean winds that often make recording impossible, and birds that sometimes stubbornly refuse to present their leg bands in plain view.

Male Savannah sparrows sing a single, individually distinct song their entire lives, which they appear to learn from other males. It is a high-pitched song that lasts two to four seconds and is in four basic parts: an introduction of three to eight high-pitched notes, a portion made up of sharp staccato notes and whistles, then a long broad-frequency buzz, and finally a quick series of notes called the terminal trill.

Prof. Williams takes the recordings of the songs and views them as a spectrogram, which plots pitch against time. With hundreds of samples gathered from hundreds of individual birds, she is patching together an amazingly detailed schematic representation of how their songs vary according to calendar year, age, and location (males stake out specific territories for themselves). It maps out the subtle variations in the songs between older and younger birds, as well as differences between nearby locations.

From what she has gathered so far, she says that "singing doesn't seem to be the basis of mate choice by females." There doesn't seem to be a particular kind of song that appeals particularly well to females, nor does seem to matter how well or how cleanly a male sings his song.

The way singing functions in bird society "doesn't seem to be simple,"

Prof. Williams said. It raises the question: What is the point of singing in the first place? If further research confirms these early observations, she believes it may lead to a refinement of Charles Darwin's theory of sexual selection. Darwin wrote that that the differences between the sexes in a species evolved either to compete for or to attract mates. But that idea has had to be expanded more recently to account for research on cooperative behavior. Prof. Williams notes that in some bird species, males share a common territory where they make elaborate displays to impress females, even though only a few get mates.

"Several lines of research are leading towards another extension that focuses on coalitions of subordinate males," Williams said. For the Savannah sparrows, the song may serve yet another purpose. "I'm looking for evidence that song is used in forming what I might call 'cultural coalitions' that allow a group of males that would not normally be prominent - perhaps because of age or status - to gain prominence by banding together under a learned 'cultural' trait," she said.

Provided by Williams College

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