

Humans, sparrows make sense of sounds in similar ways

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Upon hearing the song of another male in his territory, a male swamp sparrow vigorously waves one wing at a time as a warning signal to ward off a potential intruder. Credit: Robert Lachlan.

The song of the swamp sparrow—a grey-breasted bird found in wetlands throughout much of North America—is a simple melodious trill, repeated over and over again.

"It's kind of like a harmonious police whistle," said biologist Stephen Nowicki.

But according to a new study by Duke University scientists Nowicki and Robert Lachlan, swamp sparrows are capable of processing the notes that make up their simple songs in more sophisticated ways than previously realized—an ability that may help researchers better understand the perceptual building blocks that enable language in humans.

The study appears in the journal *Proceedings of the National Academy of Sciences*.

From the finite types of sounds that make up a stream of speech—such as the "c" sound in "cat" or the "b" sound in "boy"—humans are able to create and make sense of an almost infinite number of words and sentences about the present, past and future, unconsciously and automatically.

What's more, how humans perceive speech sounds is influenced by context, said Lachlan, now of Queen Mary University of London.

In American English, for example, listeners recognize that the "t" in "city" and the "d" in "ready" belong to different categories, even though they're frequently pronounced the same.

Lachlan and Nowicki wanted to know if this common aspect of understanding spoken language, called partial phonemic overlapping, is found in birds, too.

To find out, they recorded and analyzed the songs of 206 male swamp sparrows near Pymatuning Lake in Pennsylvania.

Statistical analysis revealed that the short repeated syllables that make up each song consist of subsets of roughly 10 types of notes.

In two experiments, the researchers compared males' territorial responses to songs in which either the first note or the last note of each syllable was substituted with a note of a different type—either short, intermediate or long.

How the birds perceived a particular note depended on where it fell in a snippet of [song](#).

The birds responded to the modified songs with an aggressive territorial display when the note substitution occurred in one position in the snippet,

but much more weakly or not at all when the same note was substituted in another position—indicating that the birds are able to assign the same sound to different categories of notes depending on the context in which it appears.

The study is part of a larger body of research aimed at understanding how language arose in humans by studying different forms of communication in animals.

Human language draws on a complex set of cognitive skills, some of which are also found in songbirds. That fact alone is not entirely surprising to scientists, especially in light of recent research led by Duke's Erich Jarvis showing that songbirds and humans rely on many of the same genes to sing and speak.

But what's exciting about their results, the researchers say, is it suggests that the ability to perceive speech sounds differently in different contexts—a critical skill necessary for the perception of human speech—could have arisen before, rather than after, other aspects of [human language](#) such as semantics and syntax came to be.

More information: "Context-dependent categorical perception in a songbird," Lachlan, R.F. and S. Nowicki. *PNAS*, Jan. 5, 2015.
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