Birds found able to learn abstract grammatical structures

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A pair of Zebra finches at Bird Kingdom, Niagara Falls, Ontario, Canada. Credit: Wikipedia

(Phys.org)—A pair of researchers with Leiden University in The Netherlands has found via experimentation that at least two types of birds are able to learn the rules that define abstract grammatical structures. In their paper published in *Proceedings of the National Academy of Sciences*, Michelle Spierings and Carel ten Cate describe

experiments they carried out with two different species of song birds and what they found regarding their grammatical abilities.

Over the past half century, scientists have discovered that many abilities or traits that were once thought to be the province of humans exist also in some other animals, e.g. the ability to read the thoughts of other group members, using tools, having distinct personalities, feeling emotions, etc. In this new study, the research pair has found that two species of songbirds, zebra finches and budgerigars (more commonly known as budgies) are able to learn and use abstract grammatical structures in ways similar to that of human infants.

The experiments consisted of isolating individual birds in a chamber and then teaching them to recognize sentence triplets in the form of sounds that occurred in a certain pattern, such as XXY or XYX. After training, the birds were tested on their ability to use what they had learned, first by exposing them to the same sounds they had heard previously, but in a new environment, and then by exposing them to new sounds in the same pattern. To see if the birds were getting what the researchers were asking, they were set up with a system where they had to peck a certain key to get a food reward upon hearing sounds broadcast from a nearby speaker. Rewards were given for correct responses and withheld for those that were wrong.

In examining the results of their testing, the researchers found that both types of songbirds were able to recognize sentence structure, even when the sounds were in a different order. More interesting was that the budgies were found able to transfer what they had learned to new sounds, which suggested that they were able to understand what was happening with the sounds as whole—they got the underlying rules that were defining sentence structure, a trait that is very rarely seen in the animal kingdom.

More information: Budgerigars and zebra finches differ in how they generalize in an artificial grammar learning experiment, Michelle J. Spierings, *PNAS*, DOI: 10.1073/pnas.1600483113 , www.pnas.org/content/early/2016/06/16/1600483113

Abstract

The ability to abstract a regularity that underlies strings of sounds is a core mechanism of the language faculty but might not be specific to language learning or even to humans. It is unclear whether and to what extent nonhuman animals possess the ability to abstract regularities defining the relation among arbitrary auditory items in a string and to generalize this abstraction to strings of acoustically novel items. In this study we tested these abilities in a songbird (zebra finch) and a parrot species (budgerigar). Subjects were trained in a go/no-go design to discriminate between two sets of sound strings arranged in an XYX or an XXY structure. After this discrimination was acquired, each subject was tested with test strings that were structurally identical to the training strings but consisted of either new combinations of known elements or of novel elements belonging to other element categories. Both species learned to discriminate between the two stimulus sets. However, their responses to the test strings were strikingly different. Zebra finches categorized test stimuli with previously heard elements by the ordinal position that these elements occupied in the training strings, independent of string structure. In contrast, the budgerigars categorized both novel combinations of familiar elements as well as strings consisting of novel element types by their underlying structure. They thus abstracted the relation among items in the XYX and XXY structures, an ability similar to that shown by human infants and indicating a level of abstraction comparable to analogical reasoning.