RULE LEARNING IN BIRDS: ZEBRA FINCHES GENERALIZE BY ITEM POSITION, BUDGERIGARS BY STRUCTURE

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The ability to abstract a rule that defines the structure of strings of sounds is a core mechanism underlying the language faculty, but might not be specific to language learning or even to humans. Up until now, it is unclear whether and to what extent non-human animals possess the ability to abstract a rule defining the relationship among arbitrary auditory items in a string and to generalize this rule to strings of acoustically novel items (ten Cate & Okanoya, 2012; ten Cate, 2014). In this study we tested both a songbird (zebra finch) as well as a parrot species (budgerigar) on these rule learning abilities. Subjects were trained in a go/no-go design to discriminate between two sets of sound strings that corresponded to either an XYX or an XXY structure. After this discrimination was acquired, each subject received a number of test strings (mixed with the training strings) that followed the same structural rules, but consisted of either new combinations of known elements or of novel elements belonging to other categories. If the animals payed attention to sound-specific features of the training strings, their responses would differ between the test strings with known sounds and the strings with novel sounds. If, however, the birds learned the structure of the strings, independent of the sounds, they should respond similarly to all test strings. Both species learned to discriminate

between the two stimulus sets during training. However, their responses to the test strings were strikingly different. Zebra finches categorized test stimuli with known elements by the positions that these elements occupied in the training strings. A subsequent experiment with artificially created sound elements showed that this was independent of whether the strings consisted of conspecific or unknown sounds. In contrast, the budgerigars categorized both novel combinations of familiar elements as well as strings consisting of novel elements by their underlying structure. They thus abstracted the relationship among items in the XYX and XXY structures, indicating a level of abstraction comparable to analogical reasoning, a cognitive ability long thought to be unique for humans and thus far only known from great apes and crows (Thompson & Oden 2000; Smirnova et al; 2015). Our study is the first clear indication that abstract rule learning in auditory strings is not specific to language or to humans.

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