Reviewing research about the evolution of complex cognition in birds

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So far, the majority of studies investigating brain functions and intelligence have been carried out either on humans or animals that are known to be most similar to humans, such as monkeys, apes, and other

mammals. Nonetheless, some avian species, including corvids and parrots, also have sophisticated and surprising cognitive skills, which are sometimes comparable to those of large-brained mammals.

Researchers at Queen Mary University of London and University of Cambridge have recently reviewed past findings related to the evolution of cognition in birds, focusing on a sophisticated cognitive tool kit that birds might share with humans and other mammals. This tool kit includes several processes, such as causal reasoning, behavioral flexibility, prospection (i.e., the production of mental representations about possible future scenarios) and imagination.

"We review experimental studies on corvids and parrots that tested complex cognitive processes within this tool kit," the researchers write in their paper. "We then provide experimental examples for the potential involvement of metacognitive skills in the expression of the cognitive tool kit."

For a long time, researchers assumed that most avian behavior is of an instinctual nature and that birds have primitive brains, and thus could only perform basic mental processes. As a result, past neuroscience research focusing on birds primarily examined simple aspects of cognition observed in both humans and other animals, such as associative learning and perception.

In the mid-1900s, however, research by British zoologist William Homan Thorpe showed that birds might be capable of cognitions that are far more intricate than what was originally anticipated. More specifically, Thorpe found that the chaffinch, a small and common passerine bird, trained by a live tutor or with a pre-recorded song, first learned the song and then gradually learned how to sing it.

Thorpe's work led to a series of new studies investigating how birds learn

to sing, ultimately unveiling parallels between some birds' song acquisition capabilities and how parrots learn to repeat sentences spoken by humans. The work of animal psychologist Irene Pepperberg was a further milestone in the study of bird cognition, as she was among the first to explore the possibility that birds are capable of advanced cognition, or, in her words, "exceptional learning."

In their paper, the researchers summarize developments in the study of avian brains that followed the works of Thorpe and Pepperberg, discussing the possibility that members of the corvid and parrot family are capable of complex cognitive processes. The specific mental processes they examine have been observed in a variety of different birds and mammals.

An interesting argument made by the researchers is that the advanced mental abilities observed in birds involve what is known as metacognition. Metacognition is the ability to understand and monitor internal states, such as thought processes. In other words, the researchers argue that the fact that some avian species are capable of advanced cognitive skills could be an indication that they have some level of self-awareness.

"We further expand the discussion of cognitive and metacognitive abilities in avian species, suggesting that an integrated assessment of these processes, together with revised and multiple tasks of mirror self-recognition, might shed light on one of the most highly debated topics in past literature—self-awareness in animals," the researchers write.

The mark test is an experiment in which animals are observed when in front of a mirror after a mark is placed on their body to see if they recognize themselves in the reflection and start touching/investigating the mark. On birds, the mark test has so far yielded disappointing results, which might suggest that the animals have little or no self-awareness.

According to the researchers, however, this test might not be ideal for testing self-awareness in animals that differ significantly from humans, as it does not account for possible differences in their body structures and sensory systems.

"It is indeed possible that the avian species tested simply do not recognize their own reflected image," they explain. "However, the few experiments that have investigated mirror use in parrots and corvids without making use of the mark test have demonstrated their ability to use mirrors and their reflected information in complex ways. It is either likely instead that the mark test is not methodologically well suited to use with avian subjects due to some morphological or behavioral peculiarity (e.g., absence of arms), or that the mark test alone is insufficient for detecting, with enough precision, the presence of self-awareness in birds."

The review paper authored by this team of researchers offers a useful summary of past research findings highlighting the possibility that avian species have sophisticated cognitive abilities. In addition, it reiterates the idea that more precise and species-specific tests are needed to evaluate the self-awareness of birds and other animals more effectively.

In the future, this work could be a useful guide and source of inspiration for researchers looking to investigate the cognitive processes of birds. The ideas presented in it, including the team's reservations about the effectiveness and generalizability of the mark test, could also inform the development of new techniques or procedures for testing self-awareness in animal species that differ most from humans.

More information: Luigi Baciadonna et al. Convergent evolution of complex cognition: Insights from the field of avian cognition into the study of self-awareness, *Learning & Behavior* (2020). DOI: 10.3758/s13420-020-00434-5