INTELLEGENCE OVER TIME: THE EVOLUTION OF INTELLIGENCE IN CORVIDS AND APES

BY KATIE SANKO

Kitty, a New Caledonian crow, became famous when National Geographic highlighted her ability to solve a puzzle that bewildered many five-year-old children.[5] In order to obtain a small piece of meat floating in a tube of water, Kitty placed rocks in a seemingly unrelated tube, causing the water to rise and the meat to float to the top.[5] Kitty and her fellow crows possess remarkable cognitive ability, prompting many to wonder what could be behind the evolution of such intelligence. Animal intelligence is tricky to define, despite the efforts of numerous researchers over the years. A quantitative measure of animal intelligence has yet to be agreed upon. It is often assumed that as brain size (both absolute and relative) increases, so does intelligence. However, both of these measures have been ruled out by bascresearch. For example, cetaceans (whales and dolphins) have a larger absolute brain size than humans,[10] yet humans are considered far more intelligent. Similarly, the shrew's brain contains 10% of its body mass while a human's contains only 2%. Generally, the definition of intelligence involves the performance of complex behaviors and the use of novel solutions to problems.[10]
Humans are not alone in the possession of great intelligence. In fact, advanced cognition has evolved in many taxa.[9] While the intelligence of primates such as chimpanzees has been widely publicized, it has also been found that birds in the group of corvids (crows, jays, ravens, ect.) have cognitive abilities comparable to apes.[4] Examples of higher cognition in both primates and corvids include object permanence (memory for objects that cannot be seen by the organism),[4] the delay of gratification (control of impulsivity),[4] and mental time travel (memory for past events and planning for future events)[4] and tool making.[1,13]
Although the brains of these organisms are structuredof these organisms are structured differently,[4] their intellectual abilities are remarkably similar,[4] thus making the evolution of intelligence in these groups particularly fascinating.
The evolution of intelligence in crows and apes can be described as convergent evolution. Convergent evolution is the development of similar traits in organisms that are not closely related. Although mammals and birds share a common ancestor with all vertebrates, approximately 300 million years separate them from their closest relative, indicating that their advanced cognition must have evolved separately.[4]
Currently, there are several hypotheses for the factors behind this convergent evolution. These factors mainly fall under the broad categories of dietary and social. Apes rely on a diet of tropical fruit, and one hypothesis behind their advanced cognition is centered on this diet. Many plants only bear ripe fruit at certain times of the year, and these plants were widely dispersed throughout the habitats of early primates11. Because these primates were often required to travel large distances to forage for food, larger brains and more complex cognition allowed for the primates to travel the most energy-efficient routesw.

Corvids, however, do not rely on ripe fruit. Instead, many corvids "cache" food, and cognitive evolution would have aided their common ancestor in remembering the location of its caches3. Furthermore, corvids such as the Western scrub jay know when the food in their cache is going to spoil and become inedible3. Similarly, many corvids steal from the caches of other birds and employ complex strategies to prevent their ownyear, and these plants were widely dispersed throughout the habitats of early primates.[11] Because these primates were often required to travel large

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Along with dietary quandaries, apes' common ancestor commonly faced many social challenges that promoted the evolution of intelligence.[13] Firstly, primates that live in groups are often subject to amongst one another. As apes are polygamous, males are often in competition for mating rights13. Many primates keep up numerous relationships with others in their species. For example, male chimpanzees will compete for "alpha" status and therefore mating rights, requiring the formation of complex relationships with many individuals. Meanwhile, females often collaborate to protect their young from violent males. amongst one another. As apes are polygamous, males are often in competition for mating rights.[13] Many primates keep up numerous relationships with others in their species. For example, male chimpanzees will compete for "alpha" status and therefore mating rights, requiring the formation of complex relationships with many individuals.[13] Meanwhile, females often collaborate to protect their young from violent males.[13]

Contrastingly, many corvids are monogamous and do not experience as much competition for mates as apes do.[13] Therefore, it was unlikely that competition for mates encouraged cognitive evolution in corvids.[13] In this way, the differences in mating represent an example of a hypothesis that applies to one of the taxonomic groups but not the other.[13]

Along with competition, hypotheses behind the intelligence of these groups also revolve around cooperation within these species. Social learning has great evolutionary benefits as individuals that can learn from others expend less energy and time learning by themselves13. Both corvids and apes have shown to learn from watching others, indicating that social-cooperation within these species. Social learning has great evolutionary benefits as individuals that can learn from others expend less energy and time learning by themselves.[13] Both corvids and apes have shown to learn from watching others, indicating that social
is important to their survival.[13]

Such social complexity, along with the capacity for social learning, requires a large amount of cognitive ability, thus encouraging the selection for intelligence.

Interestingly, the brain structures of birds and mammals differ. Mammal brains contain a structure known as the neocortex, which was considered to be the part for many mammals' advanced cognition.[4] Since birds did not possess a neocortex, it was thought that intelligence in birds was impossible[4]. However, as experimental

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evidence indicating that corvid birds are capable of cognitive feats comparable to apes increased, researchers realized that the neocortex is not a requirement for advanced intelligence.[4]

In conclusion, the convergent evolution of intelligence in corvid birds and apes reveals that this area of study is complex and requires more research. The surprisingsimilarities between apes and corvids indicate that convergent evolution of intelligence may be worth looking into in taxa that have been previously dismissed in terms of intelligence. Furthermore, more research should be done on the brains of corvid birds in order to determine the physical source of their complex behavior. These results could be applicable to other species. All in all, the evolution of intelligence is a fascinating subject that is far more complex than we understand.

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