Bird Brains

Are Crows as Intelligent as Some Scientists Claim?

BY PATRIK LINDENFORS

MANY SCIENTIFICALLY INTERESTED PEOPLE HAVE SEEN them: films of different species of corvids that put objects in test tubes in order to raise the water surface to get at a floating piece of food. It looks as if the birds assemble an overview of the situation, contemplate how to best solve the problem, and then implement their solution. The experiments have been argued to constitute evidence that these birds can solve problems on about the same level as primates; they have even been compared to 5-7 year old children. But now new analyses from Stockholm University indicate that these assertions must be reconsidered.

The experiments are termed "Aesop's fable" experiments, from the ancient Greek storyteller Aesop's fable of a thirsty crow that finds a pitcher of water. By putting pebbles in the pitcher, the crow manages to raise the water level enough to drink. The moral of the story is that inventiveness and persistence will be rewarded.

Inventive and persistent also describes the scientists who thought of using a similar setup to test corvid cognitive abilities. The experiments have been carried out on rooks, Eurasian jays, and New Caledonian crows. The problem is that if you put a corvid in front of this type of problem in an experimental arena with a test tube filled with water, the birds will normally not think of dropping in pebbles—even if there is a tasty morsel floating on top, just out of reach.

In fact, if the birds weren't given any clues, they would probably die of thirst or starvation before figuring out a solution. The behavior of raising the water level using pebbles is simply not part of the natural behavior of corvids. To test if birds can solve this kind of problem the experimenters must first teach them that there is a solution in sight. You have to *train* them.

But with training, you can teach all kinds of animals pretty much anything. A recent example is that researchers have trained bumblebees to pull a string to get a reward. First the bumblebees were taught to find food in artificial flowers. After having mastered that, the flowers were pushed further and further in under a sheet of Plexiglas. Eventually, some (but not all) bumblebees learned to pull out the flower through the pulling of a string.

In a similar manner, crows are trained to put pebbles in test tubes with water. First, a natural behavior is rewarded. New Caledonian crows, for example, like to use a stick to explore holes. Then only pebbles are provided and with proper rewarding they learn to put these in the tubes. The training in this way ascribes a *value of its own* to the act of putting stones in tubes. After that, the reward is delayed so that the birds have to drop into the tube, for example, four stones.

When the birds enter the experimental arena they therefore already know what to do: put pebbles in the test tube. Because of this previous training, the birds usually get some other task that is the actual experiment. They can, for example, be tested on whether they can differentiate between the effects of large pebbles as compared to small, solid as compared to open structures, what happens if the tubes are filled with sand instead of water, whether the tubes are wide or narrow, and so on. Can the birds differentiate between these experimental conditions?

The consensus conclusion has long been that the birds understand these differences. One type of result, for example, can be that after 20 trials, the birds use the correct solution in more than 70 percent of the cases. The birds have understood the problem and solved it.

But there are two problems with this conclusion. First, if the birds really understand the difference, why don't they make the correct choice all of the time, in 100 percent of the cases? Second, why does it take 20 trials for them to get to the high frequency of correct answers? If, as the experimenters claim, the birds *contemplate* the situation and *think* up the correct solution they should be correct from the first trial.

It is here that the new analyses come in, because the researchers in Stockholm—Stefano Ghirlanda and Johan Lind—in their 2017 paper show that if you only look at what the birds do during the first trial, the results are often completely random ("'Aesop's fable' experiments demonstrate trial-and-error learning in birds, but no causal understanding." *Animal Behaviour* 123: 239-247). The new analyses instead

show that the birds learn through trial-and-error during the experiment itself.

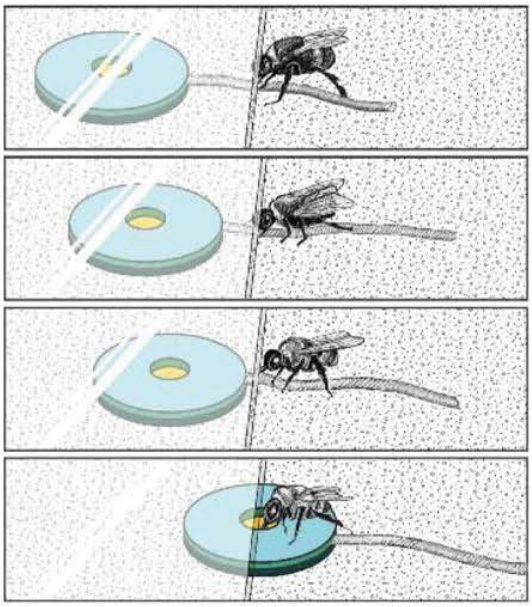
What all these "Aesop's fable" experiments show is thus nothing more than that you can train birds to carry out incredibly complex behavioral sequences and that they don't stop learning just because you have put them in an experimental situation (how would they know that?). Corresponding experiments on children that are six or older show that they can master the situation immediately and then solve the experiments 100 percent correct all the time, so the comparison of crows with 5- to 7-year old children is highly exaggerated.

The same explanation—that trained animals assign a value of its own to a rewarded behavior or object—is also the most probable explanation behind recent claims that ravens can plan for the future. In that experiment, ravens were trained to use stones to push pellets out of a puzzle box. The day after, without the puzzle box present, the birds were offered a choice between a stone and other objects that could not be used to get the pellet. The trained ravens chose the stone almost 80 percent of the time. A similar experiment carried out with tokens that could be exchanged for rewards, gave similar results. However, as the training regimens had ascribed a value of its own to the stones and the tokens, the result is completely unsurprising. Of course animals preferentially choose objects that have previously been associated with rewards.

Does this mean that corvids are not as intelligent as apes and monkeys? Well, what we know is that corvids are generalists, and like all other generalists they have a rich behavioral repertoire. Additionally, like all other animals, they can learn. Since they are generalists they try many things and consequently encounter many behaviors that become rewarded—more so than do specialists. So if by "intelligence" we mean "try many things and find many solutions," then yes, they are "intelligent"—maybe even as intelligent as apes by that definition.

However, when it comes to the basic question—can crows contemplate causality and think up solutions to problems—the answer seems to be "no." While a human being who gets time to consider a problem will solve it faster than a person who does not get thinking time, there is still no comparable observation for other animals. Either they do not have this ability to envision solutions or the proper experiment has not yet been constructed to test for it. But at least we now know that Aesop's fable experiments do not provide us with any clue. S

In Aesop's fable, a thirsty crow fills a pitcher with pebbles to raise the water level high enough to drink.



A bee pulls on a string to bring an artificial flower out from under a sheet of plexiglas so she can reach the nectar reservoir in the center.

A crow in an experimental setting drops stones into a tube partially filled with water until the water level is high enough for a floating treat to be reached.