



Thinking about thinking: how do birds make choices?



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Abstract

What do you do when you're asked a tricky question in class? Do you take a guess or wait for an easier question? The capacity to answer this question is called metacognition. It describes the ability to assess what you know and make good decisions from that information. Lots of mammals show metacognition. We wanted to know if birds do, too.

We tested Eurasian jays with a food puzzle. We hid their favorite food under one of two cups. Then we moved the cups around once (easy) or three to four times (hard).

The jays could take a guess at where the food was. Or they could opt out and choose their second favorite food under a third cup. Some of our jays were very successful in assessing their choices. They only chose the hard task when they knew where the food was. This means that these individuals showed metacognition! In the wild, this is important as it can help them find and store food for the winter.

Introduction

When was the last time you solved a difficult problem? Afterwards, did you look back on the steps you took?

The ability to reflect on your own thinking is called **metacognition**. Metacognition can help humans be more efficient, detect errors, and make decisions. Scientists have found evidence that other mammals can keep track of what they know and how sure they are. This can help individuals make better decisions in tricky situations. In the wild, this might help them survive and go on to have offspring. This gives them a strong **evolutionary** advantage.

Different behaviors could suggest metacognition. For example, animals may be able to opt out of a task when it is too hard. To do this, they have to be able to assess how hard the task might be. Scientists have seen rats, monkeys, and dolphins all opt out of tasks, including puzzle-like problems. But so far, most of this research has focused on mammals. We know much less about other groups of animals. We thought birds might be a good group to explore.



The Eurasian jay is a woodland bird that can be found across a huge region from Europe to northern Africa to Asia. There are therefore many subspecies that each have their own distinctive appearance.

There have been lots of studies on how birds like crows and jays think. For example, crows show certainty when they are doing a task. But they often can't remember that certainty for future tasks. In contrast, jays do well at remembering where rewards are hidden. They can also

seek out more information about a task when they think they don't have enough!

We wanted to explore metacognition in jays. Can jays recognize how confident they are in a memory task? Can they opt out when the task is too hard?

Methods

To answer our questions, we tested the ability of 7 Eurasian jays to assess metacognition. All our jays took part in the experiment voluntarily. We tested each jay separately. We also tested them multiple times.

First, we figured out what each jay's favorite and second favorite foods were. Then we trained the jays to learn that their favorite food was always hidden under a red cup. Their second favorite food was always hidden under a blue cup. This way they associated red cups with a better reward: their favorite food! They associated a blue cup with a less valuable reward.

We presented each jay with two red cups and one blue cup. We placed their second favorite food under the blue

cup. Then we placed their favorite food under one of the red cups. The jays watched this process. We shuffled the red cups either once (easy) or three to four times (hard). Afterwards, we let the birds lift up one of the three cups. The jays could guess which red cup hid their favorite food. Or they could opt out and choose the blue cup containing their second favorite food (Fig. 1). If they guessed incorrectly, they lost and received no food.

We then counted how many times each jay guessed or opted out. If they guessed, we counted how often they guessed correctly. We used statistics to figure out if this was more or less often than chance.

Figure 1: The experimental set-up showing the location of food, how the cups were shuffled, and what choices the jay could make.

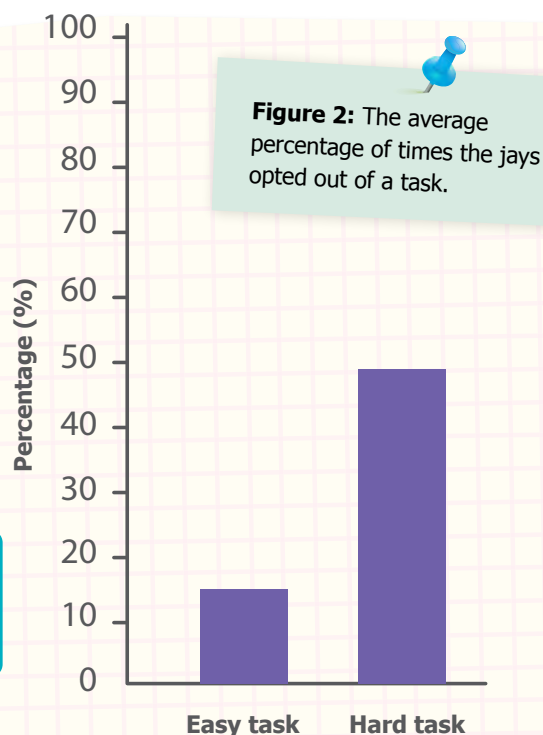


Results

We saw that the jays opted out of the hard task 49% of the time. In contrast, we saw they opted out of the easy task only 15% of the time (Fig. 2).

We found that jays were pretty successful when they guessed during the easy task. Jays found their favorite foods 87% of the time. But we noticed that during a hard task, some individuals were much more successful than others. For example, we found that three of the jays, named Dolci, Jaylo, and Poe, found their favorite food at least 80% of the time. But the jay named Stuka could only find her favorite food 34% of the time during a hard task.

What was the average percentage of times the jays opted out of the hard task? Why do you think the birds might have opted out of the hard task more often?



Discussion

We saw that the jays had more success with the easier task than the hard one. Three of the birds opted out of the hard task more often than would happen by chance. This suggests they knew which task had a greater risk of making a mistake. They chose to get their second favorite food instead of risking no food at all. These three same birds were also most successful when they did choose the hard task. They were confident they knew where the food was most of the time. This is a sign of metacognition!

Metacognition can help jays survive in the wild. They can make better decisions about where and when to store food.

It can also help them assess the environment to figure out when to retrieve food.

But not all our birds did very well at assessing how much information they knew. And we're not sure why. We don't think it is because they don't possess metacognitive abilities. The jays could have different personalities or motivations. Just like you and your friends! They might also differ in their self-control. A bolder individual may be more likely to choose the hard task, despite risking losing it all. Looking at previous behavioral studies might help us find out more.

Conclusion

Eurasian jays show metacognition by thinking about what they know. They might remember hiding spots for their food. Or they might decide to move it to stop it being stolen.

You use metacognition too! During a spelling test, you might think, "I know this word!" and write it fast. If unsure, you might picture the letters in your mind or check your notes.

Or, when preparing to go to school, you might ask yourself, "Have I remembered my homework?" Metacognition can help jays survive in the wild, and it helps you succeed in your daily life.

Glossary of Key Terms

Eurasian jay - an intelligent woodland bird from the same family as crows and magpies (corvids) found across Europe and Asia.

Evolutionary - how organisms gradually develop and change over very long periods of time, often improving their survival chances in Nature with beneficial traits.

Metacognition - the idea that an animal is aware of, and can reflect on, their own thought processes.

Check your understanding

- 1 Before this study, what did we already show that jays could do, suggesting metacognition?
- 2 Briefly describe each of the 3 main steps involved in our study (shown in Figure 1).
- 3 How do jays benefit in the wild from their ability to make choices based on their own certainty?
- 4 Metacognition is especially helpful when performing hard tasks. Imagine that you need to navigate to the other side of the city where you live. But you are new to the area! What strategies could you use? Why might they be good or bad?

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