

Cockatoos know to bring along multiple tools when they fish for cashews

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A series of photos of Figaro the Goffin's cockatoo flying while carrying a set of two tools towards a box containing a cashew. Credit: Thomas Suchanek

Goffin's cockatoos have been added to the short list of non-human animals that use and transport toolsets. In a study publishing in the journal *Current Biology* on February 10, researchers show that the cockatoos carry multiple tools to their worksite when the job calls for it. This behavior has only been previously reported in chimpanzees, our closest relatives.

Goffin's cockatoos are small white parrots that hail from the Tanimbar Islands archipelago in Indonesia. Captive Goffin's cockatoos use and

manufacture tools, and a [previous study](#) of wild-caught cockatoos reported that they can use up to three different tools to extract seeds from a particular fruit. Up until now, though, it wasn't clear whether the cockatoos considered these tools as a "set"; it's possible that what may look like a toolset is instead nothing more than a chain of single tool uses, with the need for each new tool appearing to the animal as the task evolves.

Now, a team of researchers have used controlled experiments to clarify that the cockatoos do indeed recognize when a job requires more than one tool. "With this experiment we can say that, like chimpanzees, Goffin's cockatoos not only appear to be using toolsets, but they know that they are using toolsets," says first author Antonio Osuna-Mascaró, an evolutionary biologist at the University of Veterinary Medicine Vienna. "Their flexibility of behavior is stunning."

Osuna-Mascaró was inspired by the termite-fishing Goulougo Triangle chimpanzees of northern Congo, the only other known non-human animal to use toolsets. These chimpanzees fish for termites via a two-step process: first, they use a blunt stick to break holes in the termite mound, and then they insert a long, flexible probe to "fish" the termites out of the holes. In this study, Osuna-Mascaró's team tasked the cockatoos with fishing for cashews instead of termites.

To mimic the termite-fishing set-up, the researchers presented the cockatoos with a box containing a cashew behind a transparent paper membrane. To reach the cashew, the cockatoos had to punch through the membrane and then "fish" the cashew out. They were provided with a short, pointy stick for punching holes and a vertically halved plastic straw for fishing.

Seven of the ten cockatoos tested taught themselves to extract cashews successfully by punching through the membrane, and two of the

cockatoos (Figaro and Fini) completed the task within 35 seconds on their first attempt. The cockatoos don't have an equivalent foraging behavior in the wild, so there was no chance that their [tool use](#) was based on innate behaviors, and each cockatoo used a slightly different technique.

Next, the team tested the cockatoos' ability to change their tool use in a flexible manner depending on the situation. To do this, they presented each cockatoo with two different types of box: one with a membrane and one without. The cockatoos were given the same two tools, but they only needed the pointy stick when a membrane was in the way. "The cockatoos had to act according to the problem; sometimes the toolset was needed, and sometimes only one tool was enough," says Osuna-Mascaró.

All of the cockatoos mastered the test in a very short period of time and were able to recognize when a single tool was sufficient. However, the birds engaged in an interesting behavior during this choosing phase. "When making the choice between which tool to use first, they were picking one up, releasing it, then picking up the other one, releasing it, returning to the first one, and so on," says Osuna-Mascaró. The researchers found that when cockatoos did this switching, they performed better on the tests.



A photograph of a cockatoo using the first tool (a sharp stick) to punch through a membrane. Credit: Thomas Suchanek

Next, the team tested the cockatoos' ability to transport the tools as a set on an as-needed basis. They put the cockatoos through a series of increasingly challenging trials to reach the boxes: first they had to climb a short ladder while carrying their tools; then they had to fly horizontally with them; and in the final test, they had to carry the tools while flying vertically. As before, the birds were only sometimes presented with a box with a membrane barrier, so they had to decide whether the problem required one or both tools.

Some cockatoos learned to carry the two tools together—by inserting the short punching stick into the groove of the halved straw—when they

were presented with a box that required both. This meant they only had to make one trip, albeit while carrying a heavier toolset. Most of the cockatoos transported the toolset on an as-needed basis, further indicating that they knew ahead of time when two tools were required, though some made two trips when necessary. One cockatoo, Figaro, decided not to waste time thinking and instead carried both tools in almost every trial.

"We really did not know whether the cockatoos would transport two objects together," says Alice Auersperg, senior author on the study and a cognitive biologist at the University of Veterinary Medicine Vienna. "It was a little bit of a gamble because I have seen birds combining objects playfully, but they very rarely transport more than one object together in their normal behavior."



A photograph of a cockatoo using the second tool (a vertically halved straw) to fish out a cashew. Credit: Thomas Suchanek



Illustration of a cockatoo carrying a toolbox. Credit: Liana Wait

There's a lot more to be learned about [cockatoo](#) tool use, the researchers say. "We feel that, in terms of technical cognition and [tool](#) use, parrots

have been underestimated and understudied," says Auersperg.

"We've learned how dexterous the [cockatoos](#) are when using a toolset, and we have a lot of things to follow-up on," says Osuna-Mascaró. "The switching behavior is very interesting to us, and we are definitely going to use it to explore their [decision making](#) and their metacognition—their ability to recognize their own knowledge."

More information: Antonio J. Osuna-Mascaró, Flexible tool set transport in Goffin's cockatoos, *Current Biology* (2023). [DOI: 10.1016/j.cub.2023.01.023](#). [www.cell.com/current-biology/f...0960-9822\(23\)00057-X](#)

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