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A NEW CALEDONIAN CROW. CREDIT: ALEX TAYLOR & COLLEAGUES.

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Intelligent Crows Flunk Causality Test (But Babies Pass)

BY ED YONG

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You drop a block onto a box, and a toy pops out. If a baby was watching you, she could deduce that your action caused the happy arrival of the toy, because she understands cause and effect. She'd also realise that she could trigger the same event by placing a block on the box herself, because she can *use* her knowledge to actively shape her world.

These two abilities—understanding causality, and using that understanding—seem so simple and mundane to us that it feels weird to lay them out, and weirder still to separate them. But they *are* separate. That much becomes clear when you study an animal that can do one of these things and not the other.

The New Caledonian crow is one such animal. These birds are renowned for their intelligence, problem-solving acumen, and skill with tools. In their attempts to extract grubs from dead wood, they can choose the right tool for different jobs, combine tools together, and improvise from unusual materials. Their skills are impressive enough that many biologists have described them as "feathered primates".

If these crows are so good at using tools, it stands to reason that they'd understand cause and effect very well. Auguste von Bayern from the University of Oxford showed as much in 2009 : she found that crows that got food after pushing a platform with their beaks would then drop stones on the platform if it was placed out of reach. But these birds had experience–they had all previously pushed the platform themselves and been rewarded for their trouble. What happens without that experience?

That's what Alex Taylor from the Universities of Cambridge and Auckland wanted to find out. He tested some crows with a similar task. The birds saw a Perspex box with several holes in it and a rotating cylinder inside. The first time round, a plastic block sat on a ledge above the cylinder, with a piece of meat attached to it. When the crows pecked at the meat, the block would fall and land on the cylinder, which would rotate and drop a second lump of meat onto the ground next to the crow.

The next time round, the plastic block was sitting on the ground *outside* the Perspex box. If the crows understood what they had previously seen, they would pick up the block, and drop it into one of the holes overlooking the cylinder. The block would land, the cylinder would roll, and a tasty hunk of meat would drop within reach.

Taylor tested five crows. All of them failed.

Over 100 trials, none of them dropped the box onto the ledge. "We thought they'd be good at this," he says. "It's interesting that they really, really struggle."

It's also interesting that human babies don't struggle. Taylor's team, including child psychologist Alison Gopnik, tested 22 two-year-olds with basically the same task, except with a marble instead of meat. Their initial attempts to reach a marble caused a block to fall off a ledge, rotate a cylinder, and dispense a second marble. The next time round, 16 of them dropped the block directly onto the ledge, within a few trials. They managed it, when the crows uniformly didn't.

"We've got to test more crows and try different types of apparatus and behaviour," says Taylor. "It's hard to interpret a failure but given that we have the children passing with flying colours at age 2, for this particular paradigm, it's pretty clear that the crows really can't do it."

The crows weren't lacking in motivation; they were always quick to approach the plastic block and continued to do so over the course of the experiment. There's nothing about the task itself that stops them, either. Taylor's team found that they could train three other crows to drop the plastic block into the right hole, by walking them through the process and rewarding them at every step. They just won't do it spontaneously; only the babies did that. We see, then do. They need to do before they can do.

This discovery highlights one of the important parts of Taylor's study: he only worked with wild crows. His team captured the birds in New Caledonia, housed them in an aviary for a few months while they took part in experiments, and then released them. This means that, unlike many similar studies on animal intelligence, these birds had no experience with experiments and no training in the task they were tested on. "You've got these minds that evolved to function in the wild, so it's important to look at the wild cognition if you can do so," says Taylor.

The crows' failure means that the ability to "create causal interventions"—that is, to do things that result in a desired effect—can be separated from the ability to understand causality in the first place. We have both; crows (at least as per this study) only have the latter. "We have the complete package, so it's really hard for us to know what's particularly special and what isn't," says Taylor. "Studies like this provide a more nuanced view of what's going on."

Indeed, Taylor speculates that our ability to learn about causality through observation alone could have been one of the driving forces behind our success as a species. "It seems so obvious to a human but that's almost the point," he says. He's now talking to colleagues who work with primates to see if our closest relatives can pass the same test.

Causal interventions: a key difference between the...

Reference: Taylor, Cheke, Waismeyer, Meltzoff, Miller, Gopnik, Clayton & Gray. 2014. Of babies and birds: complex tool behaviours are not sufficient for the evolution of the ability to create a novel causal intervention. Proc Roy Soc B. http://dx.doi.org/10.1098/rspb.2014.0837

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