

Re-inventing the hook: Orangutans spontaneously bend straight wires into hooks to fish for food

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Wild male orangutan. Credit: Graham L. Banes

The bending of a hook into wire to fish for the handle of a basket is surprisingly challenging for young children under eight years of age. Now, cognitive biologists and comparative psychologists led by Isabelle Laumer and Alice Auersperg observed hook tool-making for the first

time in a non-human primate species—the orangutan. To the researchers' surprise, the apes spontaneously manufactured hook tools out of straight wire within the very first trial and in a second task unbent curved wire to make a straight tool.

Human children are already proficient [tool](#) users and tool makers from an early age. Nevertheless, when confronted with a task requiring them to innovate a hooked tool out of a straight piece of wire in order to retrieve a basket from the bottom of a vertical tube, the job proved challenging for children: Three- to five-year-old children rarely succeed, and even at the age of seven, fewer than half were able to solve the task. Only at the age of eight, the majority of children were able to innovate a [hook](#) tool. Interestingly, children of all tested age classes succeeded when given demonstrations on how to bend a hook and use it. Thus, although [young children](#) apparently understand what kind of tool is required and are skilled enough to make a functional tool, there seems to be a cognitive obstacle in innovating one.

The team, consisting of cognitive biologists and comparative psychologists from the University of Vienna, the University of St. Andrews and the University of Veterinary Medicine in Vienna, report for the first time a primate species in the hook-bending task. "We confronted the orangutans with a vertical tube containing a reward basket with a handle and a straight piece of wire. In a second task with a horizontal tube containing a reward at its centre and a piece of wire that was bent at 90 degrees," explains Isabelle Laumer, who conducted the study at the Zoo Leipzig in Germany. "Retrieving the reward from the vertical tube thus required the orangutans to bend a hook into the wire to fish the basket out of the tube. The horizontal tube in turn required the apes to unbend the bent piece of wire in order to make it long enough to push the food out of the tube."

Several orangutans mastered the hook bending task and the unbending

task. Two orangutans even solved both tasks within the first minutes of the very first trial. "The orangutans mostly bent the hooks directly with their teeth and mouths, while keeping the rest of the tool straight. Thereafter, they immediately inserted it in the correct orientation, hooked the handle and pulled the basket up," she says.



Male orangutan using a stick tool. Credit: Alice Auersperg

Orangutans share 97 percent of their DNA with humans and are among the most intelligent primates. They have human-like long-term memory, routinely use a variety of sophisticated tools in the wild, and construct elaborate sleeping nests each night from foliage and branches. Today, orangutans can only be found in the rainforests of Sumatra and Borneo. Like all four great ape species, orangutans are listed as critically endangered (IUCN, Red List). "Habitat loss due to extensive [palm-oil](#)

production, illegal wildlife trade and poaching are the major threats. Palm oil is the most widely used vegetable oil in the world. As long as there is a demand for palm oil and consumers keep buying products that contain palm oil, the palm industry thrives. According to a 2007 survey by the United Nations Environment Program (UNEP) orangutans will be extinct in the wild within two decades if current deforestation trends continue," says Isabelle Laumer.

"The hook-bending task has become a benchmark paradigm to test tool innovation abilities in comparative psychology," says Alice Auersperg from the University of Veterinary Medicine in Vienna. "Considering the speed of their hook innovation, it seems that they actively invented a solution to this problem rather than applying routinized behaviours."

Josep Call of the University of St. Andrews says, "Finding this capacity in one of our closest relatives is astonishing. In human evolution, hook tools appear relatively late. Fish hooks and harpoon-like, curved objects date back only approximately 16,000 to 60,000 years. Although New Caledonian crows use hooks with regularity, there are a few observations of wild apes, such as chimpanzees and orangutans, that use previously detached branches to catch and retrieve out-of-reach branches for locomotion in the canopy. Such branch-hauling tools might represent one of the earliest and simplest raking tools used and made by great apes and our ancestors," says Josep Call of the University of St. Andrews.

So why do younger children struggle with this task? "Follow-up studies showed that children's difficulty with independently finding the solution cannot be explained by fixedness on unmodified tools, impulsivity nor by not being able to change the strategy. The hook-bending task represents a complex problem for which several unrewarded steps must be performed while keeping the final goal in mind," explains Isabelle Laumer. "Interestingly, complex problem solving has been associated to certain areas of the medial prefrontal cortex, which mature later in the

child development. This explanation, in addition to children's strong reliance on social learning, might explain their success at a later age."

More information: I. B. Laumer et al, Spontaneous innovation of hook-bending and unbending in orangutans (*Pongo abelii*), *Scientific Reports* (2018). [DOI: 10.1038/s41598-018-34607-0](https://doi.org/10.1038/s41598-018-34607-0)

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