

## Further Resources

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Anindya Sinha

## Tools Tool Use

Only a few centuries ago, most people believed that humans were the only species intelligent enough to use tools. Tool use, so it was believed, was one of the few capacities that separated our species from other animals. Today, however, scientists realize that humans are not alone in their skilled use of objects. In fact, many different animals—from crabs to crows to chimpanzees—use tools in complex, functional ways.

In an influential book, Benjamin Beck (1980) provided a comprehensive and much cited definition of animal tool use. To be a tool user, according to Beck, an organism must carry, modify, or manipulate an external object and then use it to effect a change on another object in the environment. This definition suggests that in order to qualify as tool-using, an animal must utilize an object outside its own body to achieve a particular goal; simply using one's own body part (e.g., a strong beak, prehensile tail, long claw) in a functional way does not count as tool use. Similarly, Beck's definition requires organisms to demonstrate some action on the object (e.g., orienting it correctly, carrying it, modifying it) prior to use. As such, merely using an external object functionally (e.g., pulling a vine to get an attached piece of fruit) does not qualify. To date, scientists have observed many examples of animal behavior that qualify as tool use under Beck's definition (see Beck 1980 for review). Since a comprehensive review of animal tool use is beyond the focus of this entry, we instead focus on a few of the most common examples of tool use in wild nonhuman animals.

Many classic examples of nonhuman tool use are seen in the domain of foraging. A number of species use tools to carry food during foraging: Ants (Genus *Aphaenogaster*) create sponges from leaves and wood and use these sponges to carry fruity liquids back to their colony (Fellers & Fellers 1976). Similarly, a number of researchers have observed wild chimpanzees using leaf sponges to carry water from streams and holes in trees (Goodall 1986).

Other animals use tools to open hard objects that contain food. Sea otters, for example, use stone tools both as levers to pry clams from their fixed underwater location and as anvils placed on their chest to use while hammering the clams (see Griffin 1992). Similarly, Egyptian vultures (*Neophron percnopterus*) find hard stones to throw at vulture eggs they desire to break open (Goodall & van Lawick 1966). In perhaps the most famous example,

wild chimpanzees (*Pan troglodytes*) in the Tai forest crack hard nuts using stone hammers and anvils (see McGrew 1992 for review). Moreover, Boesch & Boesch (1983) observed that chimpanzees carry heavier stones longer distances, suggesting that they know to invest in a particularly effective hammering stone.

Animals also use tools to extract foods from hard-to-reach places. In addition to their skills with stone hammers, wild chimpanzees are famous for their extraction tools; chimpanzees use twigs to extract foods as diverse as termites, ants, insect larvae, honey, and bone marrow from hard to reach places (Goodall 1986). Likewise, woodpecker finches (*Cactospiza pallida*) from the Galapagos islands hold cactus spines in their beaks and use these to pry insects from inside their burrows (Grant 1986). The New Caledonian crow (*Corvus moneduloides*) also forages for insects and larvae that live in the tiny cavities of trees. Hunt (1996, 2000) observed that wild crows extract these foods using at least two different types of extraction tools, each designed for the task at hand. The first, a long thin hook-shaped twig is used to hook insects hiding in narrow holes. The other, a rough horizontal tool made from leaves, is designed for extracting foods from less narrow kinds of holes.

Animals also use objects to protect themselves and their young from predation and other unwanted social situations. A number of primate species break branches and use them during defensive displays against predators or conspecifics (e.g., Beck 1980; Boinski 1988; Goodall 1986). Female sand wasps (*Ammophila campestris*) protect their buried eggs by using stone tools to pack down the soil and sand above their burrows (Beck 1980). Moreover, certain crab species pick up stinging anemones and hold them with their claws to ward off potential predators (see Griffin 1992). Other animals use tools to protect themselves from uncomfortable physical situations; chimpanzees, for example, break off pieces of bark to use as primitive slippers when climbing up prickly trees to get fruit (Alp 1997).

Although many animals use tools, only a few species actually modify objects and make new tools. One such species is the chimpanzee, which modifies a number of different objects (see Tomasello & Call 1997 for review). Chimpanzees will chew leaves to make their sponges more absorbent, bite branches to make effectively-sized probing tools, and alter the height of a stone anvil using smaller pebbles. Chimpanzees can also use tools in combination to solve problems (Sugiyama 1997). Chimpanzees have been observed to use small twigs to push their leaf sponges inside the cavities of trees and to employ two different tools in succession to perforate and then dip into termite mounds. But chimpanzees are not the only species that modifies tools. Recent research suggests that New Caledonian crows also modify leaves and twigs to create better tools. In order to learn what these birds understood about creating effective extraction tools, Weir, Chappell, & Kacelnik (2002) presented captive crows with a problem in which a bucket containing food was lodged in a narrow transparent tube. To retrieve the bucket, birds were allowed to use straight pieces of pliant wire, a material they had no prior experience with. During the study, one female crow found a solution to the extraction problem; she took the wire and bent it to create a curved cane shape that could be used to hook the bucket. These results suggest that crows, like chimpanzees, are able to modify objects flexibly and spontaneously to solve novel foraging tasks.

*See also* Tools—*Tool Manufacture by a Wild Bonnet Macaque*  
 Tools—*Tool Use and Manufacture by Birds*  
 Tools—*Tool Use by Dolphins*  
 Tools—*Tool Use by Elephants*

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Laurie R. Santos

## Tools

### Tool Use and Manufacture by Birds

Of course, we all know that only humans make and use tools, right? Well, OK, some primates might be able to, but certainly no other animals.

This was the traditional view of tool use, but is, in fact, very wrong. Tool manufacture and use is surprisingly widespread among animals (see Griffin 2001 or Hauser 2001 for examples), including several birds. Most common is the use of twigs or pieces of bark to extract insects from crevices, but there are also birds that drop stones onto eggs to break them (or onto intruders to scare them off), birds that attract fish with bait, and even birds that use herbs to control nest parasites such as mites!

Perhaps the most impressive avian tool users, however, are New Caledonian crows (*Corvus moneduloides*). These crows are endemic to the island of New Caledonia in the South Pacific. They make at least four types of tools—straight twigs, hooked sticks, barbed vine leaves, and stepped-cut pandanus probes—and use these to extract invertebrates from crevices. The pandanus probes are made from the long, broad leaves of the pandanus tree (or “screw pine”): The crow cuts into the leaf, then tears it longitudinally, repeating this sequence several times until it has fashioned a tapering, stepped tool, with the optimal combination of stiffness (due to its wide base) and usefulness (the narrow tip). Such complex tool manufacture is almost unknown outside of humans.