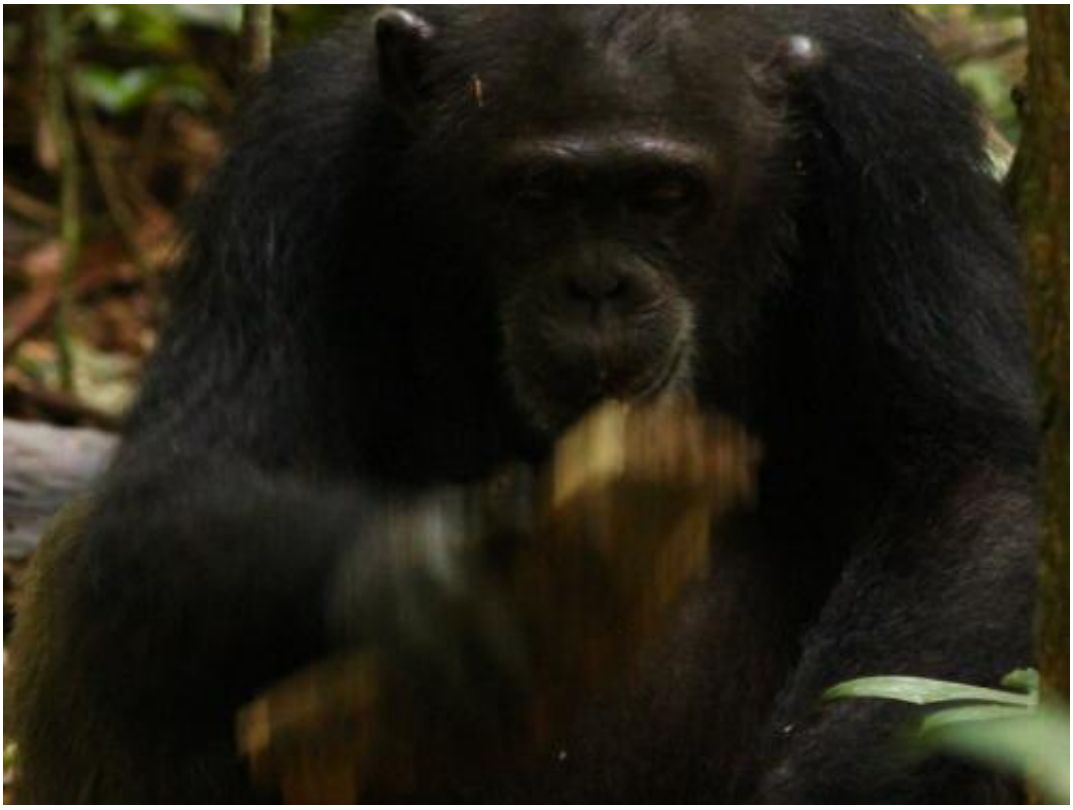
Chimpanzees select nut-cracking tools taking account of up to five different factors

January 5 2015



Female chimpanzee cracking a nut. Credit: MPI f. Evolutionary Anthropology/ Giulia Sirianni

Are chimpanzees sensitive to the effect of an object's properties on nut-cracking efficiency and plan their tool selection accordingly? An international team of researchers of the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, has now investigated

the selection of hammers used for cracking Coula edulis nuts by wild chimpanzees in the Taï National Park, Côte d'Ivoire, taking into account the availability of potential tools at the site and time at which each tool selection episode occurred. The researchers found that wild chimpanzees select the optimal tool for the task at hand by considering several variables and conditions at once, including the weight, the material and the hardness of the hammer, the location of the anvil and whether they needed to transport it over a distance.

Some wild populations of chimpanzees crack nutritious but hard-shelled nuts by placing them on a rock, a hard root or a tree branch (anvil) and then pounding them with a wooden club or a stone (hammer). Though this tool using behaviour has been documented for almost 30 years, so far very little was known about chimpanzees' ability to select the optimal hammer in terms of its physical properties and in relation to different contexts. "The litter of a rainforest is dotted with potential hammers: wooden clubs and stones differing in size, weight and hardness. No two of them are equally good for cracking nuts fast and efficiently, and, for a wild animal, saving time and energy can boost the chances for survival, and reproduction", says Giulia Sirianni of the Max Planck Institute for Evolutionary Anthropology.

During two field seasons of five months each, Sirianni and her colleagues followed one of five adult females every day from dawn to dusk. Whenever the chimpanzee picked up a hammer they marked the selection point via GPS and by using a plastic tape. On the next day, they returned to the selection point in order to describe the nut-cracking site by recording physical properties as well as the distance to the anvil of all potential hammers available on the spot. "This experimental design allowed us to statistically contrast the used hammer against the background of potential choices, so to describe chimpanzees' selection patterns", says Sirianni.

The researchers found that, in order to achieve an optimal solution of the task, chimpanzees select nut-cracking tools taking account of several variables at the same time and that their preference for hammer weight is flexibly adjusted depending on the hardness of the hammer, the expected transport distance and the location of the anvil (a ground root or a branch in the tree). In particular, chimpanzees i) preferred harder stones over more abundant softer wooden clubs and hard woods over soft woods; ii) selected for very heavy stones but, when using wooden hammers, preferred middle sized handy ones. Since stone is denser than wood, heavy stones are still relatively small and manageable; iii) for longer transports, they selected lighter hammers; and iv) selected lighter hammers when transporting and using them up in a tree, where they must sit in an unbalanced position while handling multiple objects at the same time. The last two results represent instances of tool selection conditional upon the coming transports and stability of the nut-cracking site, suggesting that chimpanzees engage in some form of short-term planning when they select a nut-cracking tool.

http://www.mpg.de/8820519/zoom.jpg

This large set of conditional rules suggests a high level of cognitive sophistication in a tool use task, providing a compelling example of how powerful cognitive skills allow the optimization of an ecologically relevant foraging activity. "For a long time people have thought that only humans were able to use tools. Today, we not only know that we share this ability with other species, but also that chimpanzees, one of our closest living relatives, select tools in a very smart way, carefully planning their choices according to the subtleties of the task at hand", says Sirianni. "Our results support the hypothesis that the selective advantage provided by the ability to access encased foods has been one of the drivers for the evolution of complex cognition in our lineage" says Christophe Boesch.

More information: Giulia Sirianni, Roger Mundry, Christophe Boesch, "When to choose which tool: multidimensional and conditional selection of nut-cracking hammers in wild chimpanzees," *Animal Behaviour*, Volume 100, February 2015, Pages 152-165, ISSN 0003-3472, dx.doi.org/10.1016/j.anbehav.2014.11.022