Insight From Capuchin Monkey Studies: Ingredients of, Recipes for, and Flaws in Capuchins' success
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Many years ago, while passing in front of a group of capuchin monkeys (*Cebus apella*) at the Rome Zoo, I was lucky to see an adult male pounding an unshelled peanut with a boiled potato. Why was he behaving like this? Peanuts can be opened easily and, moreover, boiled potatoes are soft. Could it have been that he was so fond of pounding with tools that he kept doing so even in circumstances in which the function would be sheer fun rather than ... trying to achieve an impossible goal?

The fact that capuchins were doing something smart in a silly way, or something silly in a smart way, struck my interest. I was fascinated and overwhelmed by them, as many other scientists have been before me (Erasmus Darwin and Konrand Lorenz, to cite only two very famous ones). Capuchins are the right species for an enthusiastic, rational and skeptical person like me. The delicate balance between chance and necessity, doing and understanding, ingredients and outcome has, indeed, fuelled all of my future research. What I have done since then is demonstrate, on the one hand, how successful capuchins are in solving problems and, on the other, how relatively little they understand of what they do. My research has focused on sorting out the ingredients of, the recipe for and the flaws in their success. Here, I will focus on capuchins' success in using tools and solving a task cooperatively and will discuss how their behavioral traits (e.g., interest towards objects, combinatorial activities, associative learning and "chance" in the case of tool use; manipulative tendencies, high inter-individual tolerance, associative learning and "chance" in the case of cooperation) foster their success and how their cognitive capacities constrain what they are able to understand regarding the necessary conditions for success.

Tool use

The use of tools may enable or increase the exploitation of resources, such as foods that are difficult to obtain through direct action with hands or teeth. Our contemporary fascination with tool using in nonhuman species reflects a profound appreciation of the importance of tool use to our own species. There is no doubt that the use of tools has empowered humans to diversify their way of life and to exploit resources not available to other primates. Apart from the issue of intelligence, tool using is of interest to biologists because it is a means by which an individual can extend what it can do or where it can live. In the wild, the use of tools is widespread in chimpanzees, but observed less often in other apes. However, great apes and several species of monkeys use tools readily in captivity (Tomasello and Call 1997). Among monkeys, capuchins stand out as masters of tool use. Though in natural settings they rarely use tools, in captivity capuchins, like the apes, readily and spontaneously use tools in a large variety of circumstances (Visalberghi 1990; Anderson 1996).

Biologists and psychologists have speculated widely as to how nonhuman animals arrive at the efficient and sometimes elegant and skillful use of objects as tools. One common notion is that one individual learns to use a tool by observing another, as often happens in humans. In nonhuman primates, however, recent research has shown that imitation as we typically think of it (watching and then reproducing novel actions) plays a null (monkeys) or a limited (great apes) role in learning a new tool using behavior (Visalberghi and Fragaszy 1990).

The normal way of acquiring a new tool using skill by nonhuman primates involves both social influences and individual discovery (Fragaszy and Visalberghi 1989). For example, we presented capuchin monkeys with a food (apple sauce) source inside a container. The food could be obtained only through openings too small for the monkeys' hands, but large enough to allow the insertion of sticks or straws, which were both available to them. The monkeys showed immediate interest in the food and tried to get at it in every possible way. For the capuchin