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Johnson Social behavior of Primates: study of tool uses among Capuchin

(*Sapajus libidinosus*) in Brazil Humans (*Homo sapiens*) have developed tool use throughout history and we are masters of tool-using among all animal kingdom. Throughout years, people have found more and more evidence of primates using tools for different purposes. And purposes of tool use also vary across different species and even different communities of the same species.

Tools such as stick, rock, and leaves have different functions in primate communities. Variation of tool might help us to understand primate cognition and society and how it relates to our human culture. In this article, it gives four different examples of tool use among Capuchin (*Sapajus libidinosus*) living in Brazil. First, what is the definition of tool use? Animal behavior researchers usually adhere to Beck's classical definition of tool use as "the external employment of an unattached object to alter more efficiently the form, position, or condition of another object, another organism, or the user itself, when the user holds and directly manipulates the tool during or prior to use and is responsible for the proper and effective orientation of the tool" (Beck, 1980, cited by its updated edition: Shumaker, Walkrup & Beck, 2011, 5).

Tool use refers to the use of an inanimate object such as stick or rock instead of a spider web (Ottoni, 2015). And the purpose of tool use is to bring animal reward or improve the efficiency of their old method to solve problems. Also, tool use does not have to be a complex cognitive behavior or even much learning. Many animals living in various habitats have been found simple tool

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using to help them to solve problems such as sponging use among Bottlenose dolphin (*Tursiops aduncus*) in Shark Bay, Australia, rock use among sea otter (*Enhydra lutris*), and stick use among woodpecker finch (*Cactospiza pallida*). Even though tool using might not require much of complex cognition some non-human primates suggest a critical role of tool use in individual innovation and socially biased learning (Ottoni, 2015).

What makes primates different from other animals considering tool use? Are there any advantages physically and mentally help primates to develop tool-use ability? There are two major differences between primates and other animal species. First, physically, Primates show “ progressive development of truncal uprightnes” (Johnson, COG 143). Many arboreal primates developed upper-limb mobility to adapt their needs of climbing, jumping and swinging. This development enables primates to free their hands and leads to bipedalism. Humans are the only complete bipedalism species. Five fingers enhance primate’s ability of grasping and mobility.

Fingernails replace claws and protect “ sensitive, acute tactile pads (fingertips) underside” (Johnson, COG 143). Primates hands link perceptual and motor maps in their brains. Hands have the ability to distinguish details and coordinate locomotion.

Neurons in brain coordinate nerves in hands for perception & response – e. g. Some cortical cells do not fire if an object moved across the hand, and do fire if monkey actively grasps an object (Johnson, COG 143). All those developments of hands coordinate with other organs such as eyes.

Compared with animals with dexterous hands (i. e. rats, which have

opposable thumbs and cannot see their hands), primates could see their hands and it helps primates to use tools to manipulate environment (Johnson, COG 143).

Development of primate hands enables them to better grasp and perceive objects. The second difference is the size of the brain. Primates have larger brains than a lot of mammals. Larger brain with more neurons supports more complex activities. When primates see their hands or others' hand performing tasks, mirror cell system between Parietal and Premotor areas is activated and the system helps primates to understand their and others' action. Mirror cell system might play an important role in learning by watching others to manipulate tools. Development of visual system in forebrain helps primates to have a good hand-eye coordination and it increases primates' chance to observe and to learn how to use tools. Dorsal pathway help primates to localize and handle object.

Ventral pathway help primates to identify objects. Different areas of the brain interact with each other to support primates to perform much harder activities than other mammals do. Development of hands and brain gives Primates advantages over other mammals to adopt tool use.

There are a lot of studies on tool use on old-world monkeys but not a lot of data of tool use on new-world monkeys. There are several possible reasons. Most of new-world monkeys are arboreal and many of them live in forest and jungle in Mexico, Central & South America.

These make difficult for researchers observing and collecting data.

Compared with old-world monkeys, new-world monkeys have relatively
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smaller brain size. Among new-world monkeys, Capuchins have largest brain size among all new world monkeys and the size is close to old-world monkeys' size. They live in different group sizes from 3 -50 and in “ a multi-male, multi-female society” ((Ottoni, 2015) They have been known for using tools in a long time but have not been studied until the 1980s with Westergaard, Fragaszy, and Visalberghi (see Fragaszy et al., 2004b). Rest of paper will talk four different tool use examples among Capuchins.

Capuchins have the ability to innovate Researchers reported first probe tool use by a wild adult female bearded capuchin (*Sapajus libidinosus*), at Serra da Capivara National Park (SCNP), Brazil. The female capuchin, Aca'cia, used multiple stick tools and one grass stem to poke her nostrils which caused her to sneeze and also use stick tool to pick her teeth or gum. During observation, Aca'cia carefully inserted a thin plant into the nostril, triggering her to sneeze, and inspected the plant after. Aca'cia also put a think plant against her teeth and gum and then started to move it side-to-side (Falo'tico & Haslam, 2015). After nostrils poking and teeth or gum picking, the female capuchin, Aca'cia, inspected the tool and lick it after. Aca'cia is the first wild female capuchin in SCNP found using probe tool. Probe tool use has only been observed among wild ale capuchin in SCNP.

Researchers raised several hypothesizes to explain Aca'cia behavior by comparing it with other primates that have been recorded with probe tool use on nostrils and teeth. However, none of them seem to fully explain her intentions. Though Aca'cia was the first female capuchin innovated probe tool use behavior, however, there were no other capuchins around her that were paying attention. Further study of multiple capuchin groups living in <https://assignbuster.com/chaoran-animal-reward-or-improve-the-efficiency-of/>

SCNP can help us to determine whether Aca´cia behaviors can “ spread via social learning or remains an idiosyncrasy” (Faló´tico & Haslam, 2015). Aca´cia’s example of tool use shows that primates have ability to recognize different functions of a tool.

Aca´cia does not only use probe tool to pick her nostrils but also use probe tool to pick her teeth. Her behavior shows that she could use the same tool for different purposes. Capuchin groups could use different tools to solve the same problem.

Wild capuchins from Serra da Capivara National Park (in Brazil adjust their tool selection when processing cashew (*Anacardium* spp.) nuts. During the ripening process, a caustic liquid is produced inside the shell and the liquid, Cashew Nut Shell Liquid (CNSL), would cause a severe reaction when in contact with the skin or mucosa (Luncz, Faló´tico, Pascual-Garrido, Corat, Mosley, Haslam, 2016). To avoid the potential damage of CNSL to their skins, wild capuchins in Fazenda Boa Vista (FBV) and Serra da Capivara National Park (SCNP) developed different strategies to get nuts with minimum cost. Wild Capuchins in SCNP adapt stone hammer strategy, using stones of different weights and two maturation stages of cashew nuts(Luncz, Faló´tico, Pascual-Garrido, Corat, Mosley, Haslam, 2016). Wild Capuchins in FBV adapt a strategy to rub of the nut on a hard surface. The study of Wild capuchins in SCNP shows that Capuchin selected different stone weights depending on maturation stages of cashew nuts Also, interestingly, capuchins used larger, heavier stones to crack fresh nuts even the nuts are easier to crack. This behavior could be explained by protecting themselves from contacting with CNSL in fresh nuts.

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Though fresh nuts are easier to crack they release more CNSL. When SCNP capuchins selected larger and heavier rocks to crack fresh cashew nuts, they cracked nuts with fewer hits than lighter rocks and more shields to protect them. The findings suggest that capuchin monkeys may use stone tools not only merely to access encased food items, but for protective strategies to shield themselves from caustic liquids during food processing ((Luncz, Falótico, Pascual-Garrido, Corat, Mosley, Haslam, 2016, 8).

Capuchins at each site have developed a group-specific technique. Their technique has been learning within their group among multiple generations. Capuchins adapt different methods to solve the same problem. It shows their adjustments to local circumstances. Capuchins show self-control through using a familiar food item as a tool to reach a resource that is difficult to access otherwise. Among urban capuchin population in Foz do Iguaçu, Brazil, researchers observed capuchins monkeys using a small piece of bread provided by humans to dip into a tree trunk holes (Aguiar, Cardoso, Back, Carneiro, Suzin & Ottoni).

A Juvenile capuchin sucked a small piece of bread repeatedly after dipped the bread into a hole several times. After the capuchin dipped and sucked five times, the juvenile capuchin ate the bread. The urban capuchins use dipping tools as a sponge and it shows their ability to modify an object. When the capuchin was given the small piece of bread, the capuchin was able to control an immediate reaction which was to eat the bread and to postpone this reaction to access water, which is a valuable resource for this capuchin population. Capuchins in both captive and non-captive situation both showed the ability to use food as a tool. Because of abundant resources <https://assignbuster.com/chaoran-animal-reward-or-improve-the-efficiency-of/>

in urban cities, capuchins might have developed this tool use strategy based on the opportunistic habits (Haslam 2013).

Compare with food resource, water is scarcer and harder to find. This could explain that Capuchin populations in urban forest use food as a tool to help them access other resources. Self-control and rational thoughts have also been studied in the lab among other primates. An example is Greedy-Giveaway task. Two chimpanzees are number-trained and have to choose between two piles of M&Ms, with one pile having more M&Ms than the other pile.

When actual M&Ms are presented, chimpanzee always selects a larger pile but get the other smaller pile. When numbers are presented, chimpanzee always can choose a smaller number which indicates a larger pile of M&Ms. Both Greedy-Giveaway task and study above show that primates are more rational in their decisions when they use an object with a different function. Capuchin monkeys in Foz do Iguazu use bread as a tool to access water instead of food resource and chimpanzees in Greedy-Giveaway task use numbers as a way to get more M&Ms instead of symbols. Rationality approves their social behaviors because other animals are dumb. Capuchin's tool selection shows the importance of social influence.

Wild bearded capuchins in Fazenda Boa Vista, Piau , Brazil adopt a skill to use stones to crack nuts placing in different anvils. Wild bearded capuchins evaluate how easy to use a hammerstone to crack a nut and how suitable a hammerstone is to crack a nut placed on an anvil. (Liu, K. Wright, Fragaszy, B. Wright, Izar, Visaberghi, 2001). Researchers design an experiment to test

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wild bearded capuchins' ability to crack nuts in anvils. The study involves three different anvils with different width and depth pits on them.

The study found that often an individual would use the same anvil immediately after the preceding individual left. An individual would also place a nut on the same pit as previously individual placed. Researchers observed that during the study, members in capuchin group often stay relatively close. Other members would wait in nearby trees for their turn to crack nuts (Liu, K. Wright, Fragaszy, B.

Wright, Izar, Visaberghi, 2001). They could observe other capuchins' choice of the pit. The results have proved that capuchins from the same group usually select the same pit even the pit might not be the most effective. However, in other studies, researchers found that capuchins prefer to follow the most proficient nut-crackers (Ottoni, 2005). The study shows that capuchins' behavior is influenced by others in a group. Social influence plays an important role in capuchin's choice of tool use, whether it would improve their efficiency to solve problems or not. Socially biased learning could help capuchin population to develop a behavioral tradition.

Socially biased learning is to use the success of others to make one's social learning decisions (Baldini, 2013). A study of a semi-free capuchin population in n the Tietê Ecological Park (TEP), Brazil shows how do young, juvenile capuchins learn a stone-tool cracking skill by closely observing, even scrounging, from older capuchins (Ottoni, 2015). Typically, most adults and older juveniles have mastered the skill of tool use. They frequently use stones to crack nuts and the process is efficient. However, capuchins could

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not fully develop stool tool use skill until three-years-old. For those young capuchins, they often closely observe those older ones using the stone tools and sometimes scoured food from older capuchins.

Their behavior is tolerated by those capuchins who have already master stone tool use skill. Researchers speculate that scrounging might motivate young capuchins to adopt stone tool skill and helps them to make social learning decisions. Similar learning behavior has been observed among other primates. Matsuzawa observed similar learning behavior among Bossou chimpanzees.

Bossou chimpanzee infants start to use stones to crack nuts around the age of 3.5 - 5-years-old (Matsuzawa, 2003). Before they start to use tools, infants are exposed to the nut-cracking activities of others especially their mom for a long time. The infants would sit very close to their mom and watch their mom to crack nuts. Sometimes the infants would even steal nuts from their moms and the moms show high tolerance.

Though both Bossou chimpanzees and capuchin in SCNP never teach their kids how to use tools, social tolerance close observation of from older individuals in their groups help young individuals in the groups to learn how to use tools before they start to use tools. This shows primates cognitive ability to learn through observing others. Capuchins in SCNP not only use tools as "percussive tools" (i. e. stone) to crack hard shell food but also use tools as "precursors" (i. e.

digging tool to loosen soil) to access roots. (Ottoni 2015). Capuchins in SCNP uses tool to dig up food. They primarily use their hands to search for roots <https://assignbuster.com/chaoran-animal-reward-or-improve-the-efficiency-of/>

and fossorial arthropods on the ground but also use stone tool to loosen the soil to help them during the process (Falótico, Siqueira, Ottoni, 2017).

Researchers observed that digging with tool use is customary in all groups in SCNP.

Juveniles and adults, and males and females use different size of tools based on their body sizes. Also, they select the different sizes of tool depending on the size of roots and hardness of the soil they are searching for. Using the different sizes of tool aids their process of digging root from underground. It shows that their ability to recognize the difference between tools and how they choose tools according to their needs. Studies above show various tool use in capuchin population in Brazil.

Those studied capuchin populations live in different habitats and with different food resources. Despite those difference, capuchin monkeys still could develop different tool use behavior to fit needs of local circumstance. They innovated different tool use skills, learned from other members of their groups controlled their natural behaviors to help them to accomplish a higher goal.

Their behaviors demonstrate their cognitive ability and how social interaction helps them to learn. However, there are still a lot of their behaviors cannot be fully explained by scientists and further studies are required.

Development of hands and size of the brain give primates advantage to use tools to help them to access food and other resources. Tool use was once a critical definition of “ human nature” (Ottoni, 2005). More findings of tool use behavior in non-human primates (new-world monkeys and old-world

monkeys) forced us to rethink the traditional views of “ human nature”. From all those studies have done above and other studies have been conducted in different species of primates we know that “ technological abilities” is not exclusive to humans.

Many of our close relatives, other non-human primates, have skills of tool use. Future studies of tool use in non-human primates can help us further understand difference and similarity between humans and them.

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