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# OBJECT MANIPULATION IN A CAPTIVE GROUP OF CAPUCHIN MONKEYS (*CEBUS NIGRITUS*)

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## Introduction

Capuchin monkeys (*Cebus* spp.) exploit embedded resources by using foraging strategies that involve several levels of object manipulation, from the simple tearing apart strips of wood to get access to invertebrates to the use of stones as tools (hammer and anvil) to break and open nuts (Ottoni & Mannu 2001; Fragaszy *et al.* 2004; Moura & Lee 2004; Waga *et al.* 2006). Tool use or the use of a detached object as an extension or functional part of the body to modify the position of another object (Beck 1980; Panger 2007) has been reported in wild, semi-captive and captive capuchins (Visalberghi 1990; Fragaszy *et al.* 2004).

Cognitively more complex than tool use, tool making involves a modification of the physical structure of the tool to improve its efficiency, a behavior that requires an understanding of cause-and-effect (Beck 1980). Among primates, tool making has only been reported for great apes (chimpanzees, orangutans and gorillas; Boesch & Boesch 1990; Fontaine *et al.* 1995; van Schaik *et al.* 2003), including humans. Recently, however, Bortolini & Bicca-Marques (2007) observed opportunistically a putative spontaneous event of tool making by a captive adult female *Cebus nigritus* in the Sapucaia do Sul Zoological Park, state of Rio Grande do Sul, Brazil. These authors state that if capuchins can make tools, the cognitive difference between them and the great apes, lineages separated for at least 30 million years, is smaller than previously thought (Bortolini & Bicca-Marques 2007). Because Bortolini & Bicca-Marques (2007) were not able to record the context prior to this event and what happened after it, therefore compromising the interpretation of its meaning, in this research we investigate object manipulation behaviors by the same study group aiming at recording additional cases of capuchin tool making.

## Methods

A group of five capuchin monkeys (adult females Chief and Matilda, adult male Black and juvenile males Sem-topete and Trainer) living in an enclosure (7.0 × 7.7 × 2.9 m) enriched with sand, twigs, ropes and a wood-made wheel in the Sapucaia do Sul Zoological Park, state of Rio Grande do Sul, Brazil, was observed between April and September 2008. Matilda is the individual whose tool-related behavior was reported by Bortolini & Bicca-Marques (2007). Data collection by the behavior sampling method with continuous recording (Martin & Bateson 1993) was conducted from 08:00–08:30 to 13:00–13:30 once a week. Object manipulation was classified into banging (the act of pounding an object against a surface or another object), washing (partial or total immersion of an object in water), scrubbing (the act of rubbing an object against a surface), handling (the act of just touching or holding an object) and biting (the act of biting an object). Events of food banging, washing and scrubbing were included in the analysis, whereas those of handling and biting were not included.

The study was divided into two 50-h stages. In the first stage there was no supplementation of objects to the monkeys besides those normally found in the enclosure, whereas 15 pieces of branch (30 to 40 cm in length) and five stones (6 to 7 cm in diameter) were supplemented before each observation session and removed at the end of the day in the second stage. The frequency of each type of object manipulation during each stage was compared among individuals by the chi-square test and the total individual frequency of object manipulation events was compared between stages by the Student t test considering a level of significance of 0.05 using the software BioEstat 5.0 (Ayres *et al.* 2007).

## Results

Sixty two events of object manipulation (48% banging, 26% washing, 19% handling and 6% scrubbing) were recorded during the first stage, resulting in a rate of 1.2 events per hour. Most of these events involved food items (n = 44). Supplementation with branches and stones in the second stage produced a significant increase in the frequency of object manipulation (428 events: 68% handling, 25% biting and 8% banging; t = 2.138, df = 4, p = 0.042) or a rate of 8.6 events per hour, and a substantial decrease in the number of events involving food items (n = 4). Object manipulation differed among individuals in both stages (1st: $\chi^2 = 13.559$, df = 4, p = 0.008; 2nd: $\chi^2 = 210.570$, df = 4,

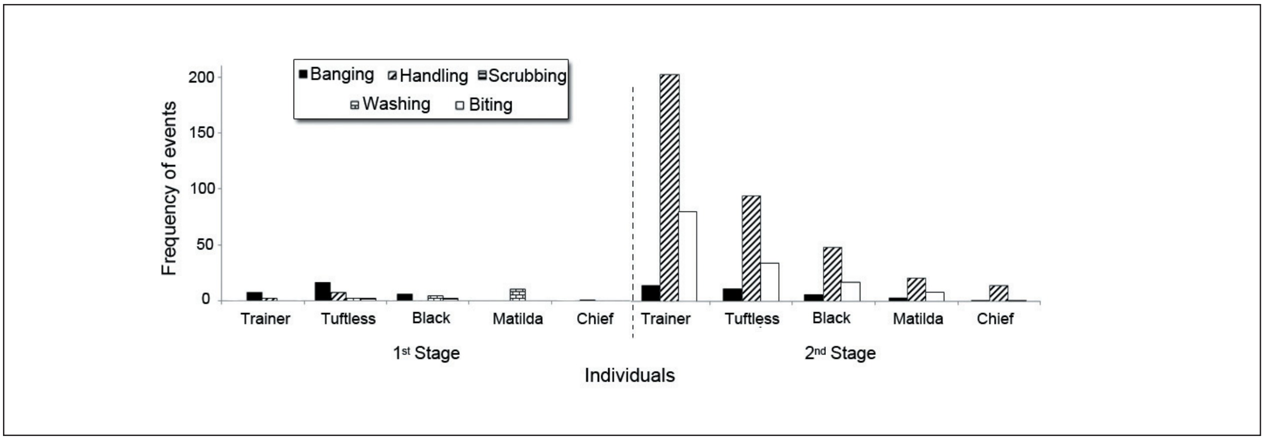

**Figure 1.** Distribution of events of object manipulation among group members during the first and second stages.

$p < 0.001$; Fig. 1). Whereas adult females showed the lowest frequencies of object manipulation (43 and 18 events), juvenile males Trainer (305 events) and Sem-topete (166 events) were the most manipulative group members. No case of tool use or tool making was observed during the 100 h of observation.

## Discussion

Object supplementation stimulated a significant increase in manipulation events, especially by juveniles, but was not sufficient to elicit additional events of tool making. Therefore, this 100-h study failed to corroborate the observation of Bortolini & Bicca-Marques (2007) and to reject the hypothesis that capuchins despite their high cognitive abilities are not capable of making tools (Fragaszy & Visalberghi 1989; Fragaszy *et al.* 2004; Ottoni *et al.* 2005).

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# Field Observation of Predation of a Slate-Colored Hawk, *Leucopternis schistacea*, on a Juvenile Saddle-Back Tamarin, *Saguinus fuscicollis*

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Due to their small body size, callithrichines are probably subject to high predation pressure; in fact, it may be an important factor shaping their cooperative social systems (Caine, 1993). However, predation events are difficult to observe, and published reports are still scarce (Hart, 2007; Ferrari, 2009). While a number of predators of tamarins have been identified (see Table 1), other potential predators may still remain unknown. Here we add an additional raptor species, the slate-colored hawk, *Leucopternis schistacea*, to the known predators of callithrichines.

The observation reported here was made at the Estación Biológica Quebrada Blanco (EBQB), north-eastern Peru (see Heymann (1995) for details of the study site). A moderately habituated mixed-species troop of 11 saddle-back tamarins, *Saguinus fuscicollis* (5 adult males, 5 adult females and 1 juvenile) and 7 moustached tamarins, *Saguinus mystax* (3 males, 4 females and 1 carried infant), was followed by the second author between 7 and 14 April 2008 to collect fecal samples from the saddle-back tamarins.

On 11 April 2008, at 1000 h, both tamarin species were feeding in a *Protium* spp. tree at about 30 m height. Suddenly, a slate-colored hawk, *Leucopternis schistacea*, flew in and caught a juvenile saddle-back tamarin that was standing without feeding on an exposed branch, lower than the rest of the group. With the prey in its talons, the hawk flew to a nearby tree where it perched at about 30 m height and started to feed on the tamarin. Both saddle-back and moustached tamarins left the *Protium* tree and surrounded the tree where the hawk perched; they vocalized intensely while climbing up and down the tree trunks between 10–20 m. After about one hour, the hawk left with the remains of its prey. The saddle-back tamarins moved c. 200 m and rested for about 2 hours in a tree at about 30 m height. The moustached tamarins travelled into a different direction before being lost by the observers. The saddle-back tamarins entered a sleeping tree at 1650 h. On the following day, 12 April, the saddle-backs left their sleeping tree at 0530 h, moved only about 20 m and then rested until 0900 h. Afterwards, they travelled for the rest of the day, were very difficult to follow, behaved nervously, giving more alarm calls as usual, and increasing their vigilance and went down to about 8 m upon hearing any of the usual noises of the forest. They did not long call until about 1400 h. At that time, they started long calling which ceased when the moustached tamarin arrived and the two tamarin species re-established their association. The group entered a sleeping tree at 1640 h.

On 13 April, the saddle-back tamarins left their sleeping tree at 0620 h. They emitted very few vocalizations and travelled very high in the trees, about 50 m apart from the moustached tamarins, feeding in the same trees but not simultaneously. They entered their sleeping tree at 1640 h. On the next day that the group was followed (16 April) and subsequently (26–29 April) the tamarins seemed to behave normally.

This is the first documented attack of a slate-coloured hawk on callithrichines or any other New World primate (Ferrari, 2009). These medium-sized hawks (bill-tip to tail-tip: 41–43 cm; (Hilty and Brown 1986)) are dietary generalists, usually feeding upon large arthropods and small vertebrates (Robinson, 1994). Thus, tamarins, at least juveniles, fall into the range of potential prey. Peres (1993) considered this species as a potential predator for tamarins and observed alarm calling by moustached tamarins in response to the related *Leucopternis kuhli* and *Leucopternis albicollis*, but did not actually observe any attacks. Our observation confirms Peres' (1993) hypothesis and expands the list of known raptorial predators of tamarins. After the attack, the tamarins followed the raptor and vocalized, as was

**Table 1.** Predation and predation attempts on tamarins

| **Predator** | | **References** |
|---|---|---|
| **Raptors** | Bicolored hawk, *Accipiter bicolor* | (Terborgh, 1983) |
| | Ornate hawk-eagle, *Spizaetus ornatus* | (Terborgh, 1983; Robinson, 1994) |
| | Barred forest-falcon, *Micrastur ruficollis* | (Izawa, 1978) |
| | Red-throated caracara, *Daptrius americanus* | (Ramirez, 1989) |
| | Crested eagle, *Morphnus guianensis* | (Oversluijs Vasquez and Heymann, 2001) |
| | Harpy eagle, *Harpia harpyja* | (Ney Shahuano Tello, pers. comm.) |
| **Reptiles** | Anaconda, *Eunectes murinus* | (Heymann, 1987) |
| | *Boa constrictor* | (Shahuano Tello *et al.*, 2002) |
| **Mammals** | Tayra, *Eira barbara* | (Moynihan, 1970; Goldizen, 1987b; Snowdon and Soini, 1988) |
| | Ocelot, *Felis pardalis* | (Moynihan, 1970; Goldizen, 1987b; Snowdon and Soini, 1988) |