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Spontaneous Object Sharing in Captive Chimpanzees (*Pan troglodytes*)

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Episodes of object transfer were observed among 3 adult and 2 juvenile unrelated females chimpanzees, kept in adjacent cages with bars between them. Only the adult females had small objects available in their cage only juveniles were observed to request them. Although the possessors could easily prevent transfers, 15 episodes of active sharing were recorded, including spontaneous unsolicited donations, sharing preceded by requests, as well as transfers under obnoxious solicitation.

Food sharing has been reported in several primate species, such as callitrichids (*Callithrix flaviceps*, Ferrari, 1987; *Saguinus oedipus*, Feistner & Chamove, 1986; *Leontopithecus rosalia*, Ruiz-Miranda et al., 1999; *L. chrysopygus*, Feistner & Price, 2000; *L. chrysomelas*, Rapaport, 2001), capuchins (*Cebus capuchinus*, Perry & Rose, 1994; *C. apella*, de Waal, 2000), gibbons (*Hylobates lar*, Nettelbeck, 1998) and hominoids (*Pongo pygmaeus*, *Pan paniscus*, *P. troglodytes*, Edwards & Snowdon, 1980; Feistner & McGrew, 1989; Kano, 1980; Ueno & Matsuzawa, 2004). Despite the accumulating literature, among nonhuman primates, sharing has been considered passive, rare and mainly restricted to mother-offspring, rather than unrelated individuals (Feistner & McGrew, 1989; Ueno & Matsuzawa, 2004).

In chimpanzees, the ability to share items was first demonstrated by Nissen & Crawford (1936). Separated by bars, transfers were mostly restricted to voluntary actions, as the items were defensible. It was found that the subjects tended to share more readily less valuable items, and that positive response to solicitation was also due to avoidance of "noxious stimulus". Since then sharing has been documented, both in the field (Goodall, 1986; McGrew, 1975; Silk, 1978; Teleki, 1973) and in captivity (Silk, 1979; de Waal, 1989), mainly among kin-related troop members. Recently, Ueno and Matsuzawa (2004) examined in details food sharing between mother and infant chimpanzees under the controlled experimental setting and found that "active sharing" was limited to non-edible parts of food.

Although bartering with humans has been reported (Lefebvre, 1982; Hyatt & Hopkins, 1998; Tomonaga & Hayashi, 2003), spontaneous object sharing among unrelated individuals within a species seems rare. After Nissen & Crawford (1936), Savage-Rumbaugh et al. (1978) were next to observe spontaneous sharing among captive chimpanzees. Paquette (1992) described object exchange between unrelated individuals, however the sharing was not 'hand to hand', but rather indirect. There is, therefore, still little documented voluntary sharing of objects in cap-

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tive chimpanzees. This article reports 15 episodes of active object sharing, opportunistically observed during sessions of a tool-use experiment upon unrelated captive chimpanzees (Celli et al., 2001, 2003). Possible explanations for the differences with sharing in the wild are discussed.

Method

Subjects and Housing Conditions

Several pairs of chimpanzees were kept in the Kumamoto Primates Park (currently the Chimpanzee Sanctuary Uto), living in adjacent, concrete cages, measuring 4.5 x 2.0 x 2.2 meters, separated from each other by steel bars. Three pairs of adult females served as subjects in a tool use task (see Celli et al., 2001, 2003), called “honey-fishing”, originally invented by Hirata and Morimura (2000; see also Celli, Hirata, & Tomonaga, 2004; Hirata & Celli, 2003). Experimental rooms were interspersed with rooms of non-subject pairs of juvenile female chimpanzees and their mothers; so, the subjects could interact with their pair, as well as the neighboring non-subjects, although only through the bars. The experiment was conducted to study learning processes of tool use behavior and the enrichment effect of tool use on pair-housed chimpanzees. The object transfers involved 3 of the experimental subjects and 2 juvenile females, caged in between the cages of the subjects (Figure 1).

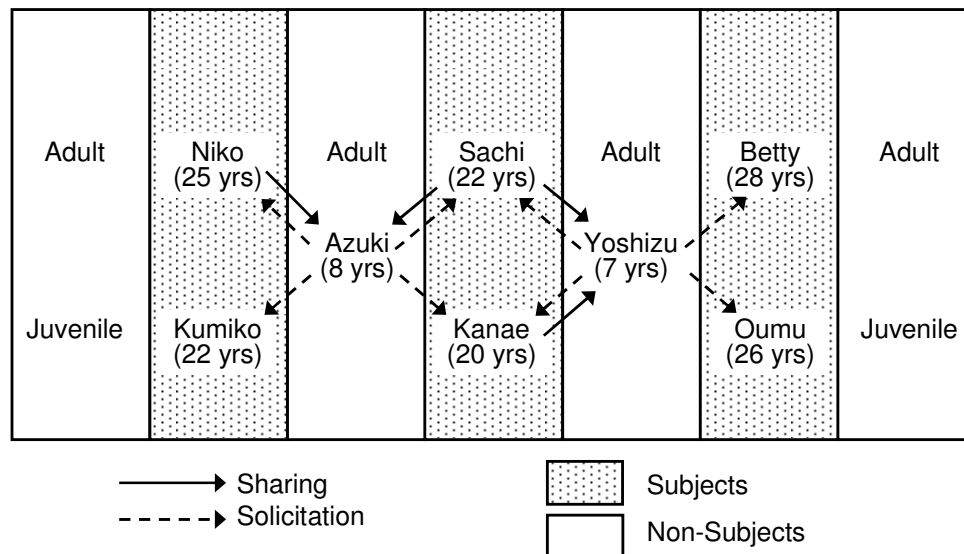


Figure 1. Location of the subjects of the tool use experiment and neighbor non-subject pairs, some of whom were involved in episodes of object sharing observed (although there were other identical cages housing more pairs, only the subjects and closest neighbors were represented here).

Observations

The subjects were observed for a total of 120 hours (Celli et al., 2001). However, object transfers were possible only after the introduction of transferable objects, available during the later conditions of the experiment, for a total of 108 hours. In those conditions 2 sets of 20 artificial materials were presented to the subjects to be used as tools during the mentioned task. The materials - spoons, brushes, wires, chopsticks, etc - were novel to all chimpanzees.

The objects were given to each pair of subjects at the beginning of the 1-hour experimental session, conducted each day. Transfers were possible all day, from the start of the sessions until the chimpanzees were moved to their night cages and objects taken away. We will focus only on the transfers occurred when observation was being conducted (the 108 hours mentioned above).

Studies on chimpanzees have either avoided defining sharing (McGrew, 1975) or included actions initiated by non-possessors ('stealing' or 'passive sharing'; Silk, 1978; de Waal, 1989;

Paquette, 1992). Here it refers to the *active* transfer of items from a possessor to a recipient, via throwing or offering, preceded or not by solicitation. This set of criteria distinguishes sharing from unresisted theft and other passive means of transfer. *Solicitation* is defined as requesting behaviors from a potential recipient to a possessor, such as ‘beg’ (stretched arm or hand), ‘tease’ (spitting water), or ‘threat’ to spit water.

The first author collected sharing episodes from direct observations during experimental sessions and videos, and the second author coded 14 of the 15 episodes to check inter-observer reliability. Twelve of 14 episodes were coded identically (85.7%). Due to poor quality video-recordings, 2 episodes were coded differently with regard to the presence/absence of solicitations. Limitations of the data collection made impossible to determine precisely the frequency of unsuccessful solicitation, once ‘beg’ and ‘threat’ were less conspicuous behaviors than ‘tease’ and often performed out of the range recorded.

Results

Three of 6 subjects of the tool-use experiment shared objects available in their cages with 2 neighbor, non-subject, juvenile chimpanzees. The transfers described here were all voluntary, either spontaneously initiated by the possessors, or following solicitations from the juveniles (e.g. Fig. 2). The 15 episodes of object transfers observed are described in Table 1, but although they were all considered as sharing, differences in type of solicitation, and response of the possessor were noticed.

Table 1

Date, parties, circumstances and behavioural responses involved in each of the episodes of object sharing observed.

Case	Date ¹	Time ²	Parties		Solicitation			Sharing		Object
			possessor	recipient	beg	tease	threat	offer	throw	
1	9/3	09:14'28"	Kanae	Yoshizu	-	-	-	X	-	piece of plastic
2	9/4	10:32'05"	Sachi	Azuki	X	-	-	X	-	metal brush
3	9/7	09:19'05"	Sachi	Yoshizu	X	-	-	X	-	chopstick*
4	9/3	11:31'26"	Niko	Azuki	-	X	-	X	-	plastic pin
5	9/3	11:46'15"	Niko	Azuki	-	-	-	X	-	metal brush
6	9/4	11:35'03"	Niko	Azuki	-	X	-	-	X	metal bolt
7	9/6	09:15'09"	Niko	Azuki	-	X	-	-	X	plastic brush
8	9/7	10:32'24"	Niko	Azuki	-	-	X	-	X	plastic spoon
9	9/7	10:33'06"	Niko	Azuki	-	X	X	-	X	metal brush
10	9/7	10:33'26"	Niko	Azuki	-	-	X	-	X	chopstick*
11	9/7	10:34'12"	Niko	Azuki	-	X	-	-	X	plastic pin
12	9/7	10:35'14"	Niko	Azuki	-	X	-	-	X	plastic brush
13	9/7	10:35'18"	Niko	Azuki	-	X	-	-	X	metal bolt
14	9/7	10:37'15"	Niko	Azuki	-	-	X	-	X	plastic brush
15	9/7	10:37'50"	Niko	Azuki	-	X	-	-	X	metal brush

* Material inappropriate, but that could be transformed and used as a tool for the task.

¹ Month/day of 1999.

² Hour:minute'second". All observations occurred in the morning.

Some transfers occurred, from the possessor to the prospective recipient, in a playful or relaxed manner (5 cases, 33.3%). In 2 of these 5 episodes, the possessor initiated the transfer spontaneously, offering the objects without any previous begging or other solicitation by the juveniles. The remaining 10 episodes (66.6%), involved more aggressive behavior from the possessor, as the objects were thrown to the juvenile, rather than given. Those transfers were preceded by more intense solicitation, such as constant, strong water spitting and threats.

Including unsuccessful cases, solicitation was always directed from a juvenile to an adult, and only juveniles (1 individual in 13 cases, 86.7%) were recipients of the transfers. The objects were novel too and not available for non-subjects, so, they naturally elicited solicitations from the juveniles; nevertheless, the mothers paired with them, whom also had no access to the novel objects, were never seen soliciting or receiving objects. Only 2 of the 4 juveniles that had contact with the adult female possessors of the objects engaged in solicitation, but although all 6 possessors were seized by these, only 3 adult females were seen to actively share the objects with the recipients.

All the objects transferred were inappropriate for the task and, therefore, had no value as tools with the exception of 1 material that could be used with relative efficiency once transformed. Objects were either near by, on the floor, or being manipulated by the possessor at the moment of the transfer. We did not observe any kind of specific requesting behavior by the recipients (e.g. finger pointing) or selection of objects by the possessor prior to sharing.

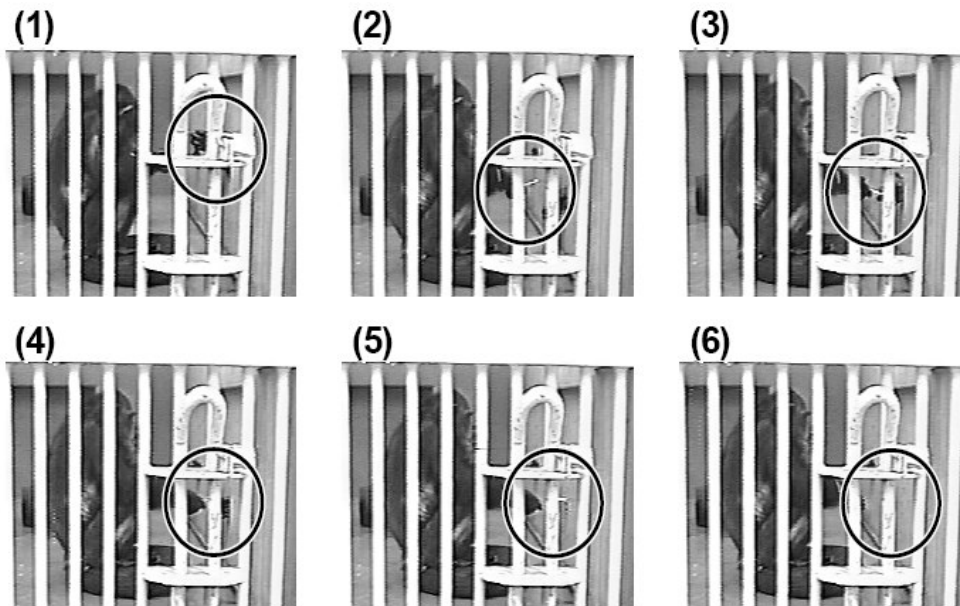


Figure 2. Still pictures from the video-tapes representing the behavioral sequence observed in Case 3: (1) Yoshizu stretches her arm and hand through the bars, begging; while Sachi manipulates a chopstick in front of her. (2) Sachi points the chopstick in Yoshizu's direction. Yoshizu presents her hand, palm up. (3-4) Sachi hands the object to Yoshizu. (5-6) Yoshizu takes the chopstick and moves away.

Discussion

This report documents 15 episodes of spontaneous, active object sharing among captive non-kin female chimpanzees, involving 3 adult as possessor and 2 juvenile as recipients.

Teleki (1973) reported that, among wild chimpanzees, meat is rarely transferred by donation. According to de Waal (1989), within nonhuman primates, voluntary handing over of food is virtually absent, justifying, perhaps, the absence of 'active sharing' within his definitions of five possible methods of food transfers among large captive colonies of chimpanzees. Reviewing the literature on sharing in primates, Feistner and McGrew (1989) found that the vast majority of food transfers are of a passive nature, with the possessor allowing others to remove food from his hand, mouth or within his reach, also labeled 'tolerated theft' by Blurton Jones (1987). Paquette's observations (1992) follow this line, as the transfers he observed among unrelated captive chimpanzees were all passive sharing.

In the wild or captive social conditions, items can be taken away by force. In these situations, sharing might happen 'under pressure' (Wrangham, 1975), as a mechanism to avoid fights, once the cost of sharing is lower than defending the item. In the cases described here, however, the bars separating the possessor and potential recipient, assured that the items were easily defensible and transfers would only occur as a voluntary act of the owner. In 5 of the 15 incidents of transfers described, the possessor actually offered, handed over the objects to the recipient. Not all of these 5 episodes were preceded by solicitation by the recipients, being spontaneously initiated by the possessor, and none was accompanied by resistance from possessor. Thus, all these transfers were considered as true 'active sharing'.

The other 10 cases could, however, be interpreted in different ways. Assuming that the possessors recognized the solicitations, the observed behaviors that led to object transfers could be considered emotional responses by the adult female, possessor, to the juveniles in the next cage, as 'forced' sharing, since the teasing was, at the very least, a source of irritation.

Teasing, common among young chimpanzees (de Waal & Hoekstra, 1980), may have been a form of play, developed under captive conditions lack in stimulation. However, if we regard a tool as a detached object used to achieve a goal (Matsuzawa, 2000), it could be interpreted that the possessor used the objects as tools to enhance display, as observed in wild chimpanzees (Goodall, 1986) and/or to physically block out the juveniles' requests.

We could not determine whether the primary intention of the adult female in those cases was to satisfy the juvenile's requests, or a self-rewarding behavior that prevented further solicitation. Nevertheless, in case 3, Azuki similarly teased Niko and immediately received the object, implying that the female had an understanding of teasing as an expression of the juvenile's desire. This interpretation, however, does not exclude the possibility of the response having been to also avoid "noxious stimulus", as found by Nissen and Crawford (1936).

Although infants are more successful when begging than juveniles (Silk, 1979), according to Goodall (1986), youngsters generally continue to receive food that is difficult to process. Perhaps it explains why only juveniles, and never their

mothers, were engaged in soliciting, and sometimes given objects, that were otherwise impossible to obtain.

Goodall (1986) described mothers as having a distinct difference in generosity, and Feistner & McGrew (1989) report sharing as being selective, with not all possessors being equally tolerant to all individuals. Whenever occurring within unrelated individuals, such as the meta distribution after hunting, sharing has been described as 'biased' (Teleki, 1973). In captivity, Nissen and Crawford (1936) showed that 'friendship' established during daily life influenced the proportion of requests and responses. Although unrelated females were found least inclined to share food (Silk, 1979), sharing among captive females can indicate a more intimate relationship, as a result of environmental conditions. This can explain why only a few females, one individual in particular, shared items with the juveniles.

All of the objects transferred were inappropriate for the task and not used as tools. This might be related to the transfers, as found by Nissen and Crawford (1936), as sharing did not represent a direct cost to the possessors. However, small manipulative items were previously unavailable inside the cages and were novelties. Objects clearly do not have the same fitness value as food for wild mothers and infants. In captivity, nevertheless, objects are potential environmental enrichment toys (Celli et al., 2003), and, therefore, have greater adaptive function than they would otherwise.

Social interactions might have determined the nature and result of the transfers, but could not be assessed, as the individuals were not observed outside the 1-hour sessions (see Celli et al., 2001). Therefore we do not exclude the possibility of a reciprocal exchange of services between recipients and possessors, such as grooming and other social favors, as discussed by de Waal (1989, 1997), and observed by Savage-Rumbaugh et al. (1978), as a possible explanation for the incidents observed.

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