Sex Differences in Object Use by Young Chimpanzees Resemble Those of Children

Sex differences in object use by young chimpanzees resemble those of children

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Sex differences in children's choice of play objects, and how they play with them, are a cross-cultural universal. They include girls tending to play more with dolls, and boys more with weapons. Explanations include socialization by elders and peers, male rejection of opposite-sex behavior, and innate sex differences in activity preferences [1]. Biological factors are controversial but are indicated by girls' toy choices tending to be masculinized following exposure to high fetal androgen levels [2]. Studies of captive primates also suggest a biological influence on toy choice. When offered sex-stereotyped human toys, female monkeys played more with girls' toys such as dolls, whereas males played more with boys' toys such as trucks [1]. Here we report on a long-term study of object use by wild chimpanzees (*Pan troglodytes*). We find that young females tend to carry sticks in a manner suggestive of doll play. By contrast males tend to use sticks as

weapons. This is the first report in a wild non-human species of sex differences in object use resembling those in children's toy play.

During 14 years of observation of the Kanyawara community of chimpanzees in Kibale National Park, Uganda, we found that chimpanzees used sticks in three main ways. First, they carried sticks by holding or cradling them in their hand, mouth, underarm or tucked between the abdomen and thigh (Fig. S1). They kept sticks for periods of one minute to more than four hours during which they rested, walked, climbed, slept and fed as usual. Carried sticks averaged 36 cm in length, 112 g in weight (median of 6 recovered sticks) and served no practical function. Second, chimpanzees used sticks as probes to investigate holes potentially containing water or honey. Third, they used sticks as weapons in aggressive displays towards conspecifics or other species, including waving them, throwing them or hitting with them. Stick-carry, probe and weapon use were mutually exclusive activities.

During all-events recording of chimpanzee parties from 1993 to 2006 we observed 195 independent cases of stick use (stick-carry n = 115 cases, probe n = 49, weapon-use n = 31). Stick-carrying peaked among juveniles (Fig. 1). Neither sex carried sticks as adults, but prior to adulthood females carried sticks at higher rates than males (Fig. 1). On at least 25 occasions chimpanzees (6 females, 2 males) took sticks into day-nests, where they rested and were sometimes seen to play casually with the stick. Probes and weapons were not taken into nests.

In line with previous findings that female chimpanzees tend to be more frequent tool users than males [3], juvenile and adolescent females used probes more often than

same-aged males (medians per 1000 hours; probing: male 0.00, n = 13; female 0.48, n = 10; Mann-Whitney U = 108.5, P = 0.004, 2-tailed). However females also used some objects less than males did. First, older males used sticks as weapons more often than females did (weapon use for adolescents and adults: male 0.09, n = 19; female 0.00, n = 30; U = 597, P = 0.002). Second, adult males used leaves for wiping their bodies more often than adult females did, particularly for cleaning their genitals after copulation (self-clean: male 0.87, n = 14; female 0.00, n = 24; U = 344, P = 0.0002).

Since both stick-carrying and probing rates were higher in young females than males, the two behaviors could in theory be motivationally related to each other. However individual variation in the frequency of stick-carrying was unrelated to the frequency of probing (Spearman R = 0.20, n = 10 juvenile and adolescent females, P = ns). Furthermore there was no overlap in the diameters of carried sticks and probes: carried sticks (range 2-7 cm diameter, n = 6) were at least twice as thick as probes ((0.3 - 1 cm, n = 14 ; Fig. S2). There was thus no evidence of stick-carrying being functionally related to probing.

Lonsdorf et al. [4] found that in Gombe, Tanzania, sex differences among juvenile chimpanzees in the frequency and effectiveness of termite-fishing resulted from females modeling their mother's behavior more effectively than males. By contrast sex differences in stick-carrying in Kanyawara did not result from young females observing their mothers carrying sticks, since mothers never carried sticks. Given that stick-carrying has no practical functions, is practiced mostly by females, includes sticks being taken into nests and ceases shortly before motherhood, we suggest that it is motivationally related to

infant care, similar to doll play in human children. In support of this view, the capacity for young chimpanzees to direct care towards objects is indicated by two detailed reports of treating sticks like dolls. At Kanyawara an 8-year-old male carried and played with a log for four hours and also made a separate nest for it [5]; and while her mother was carrying her sick infant sibling, an 8-year-old female at Bossou (Guinea) carried a log in a doll-like manner, including patting it like "slapping the back of an infant". [6]. The sex differences in Kanyawara also resemble observations in Bossou of a dead hyrax (*Dendrohyrax dorsalis*) being carried by a juvenile female, whereas it was hit and beaten by two juvenile males [7].

Regular stick-carrying has not been reported from other chimpanzee studies [8], even where stick use has been carefully documented for many years [9]. This suggests that stick-carrying at Kanyawara is a juvenile tradition in which youngsters learn socially from pre-adults rather than adults. Juvenile traditions have previously been described only in humans [10].

The sex difference in stick-carrying and weapon use described here is similar to those found in human societies. It occurs without any teaching by adults and is consistent with practice for adult roles. Our results suggest that humans have had similar sex differences in pre-adult object use since at least their common ancestry with chimpanzees, well before sex role identification or direct socialization became important.

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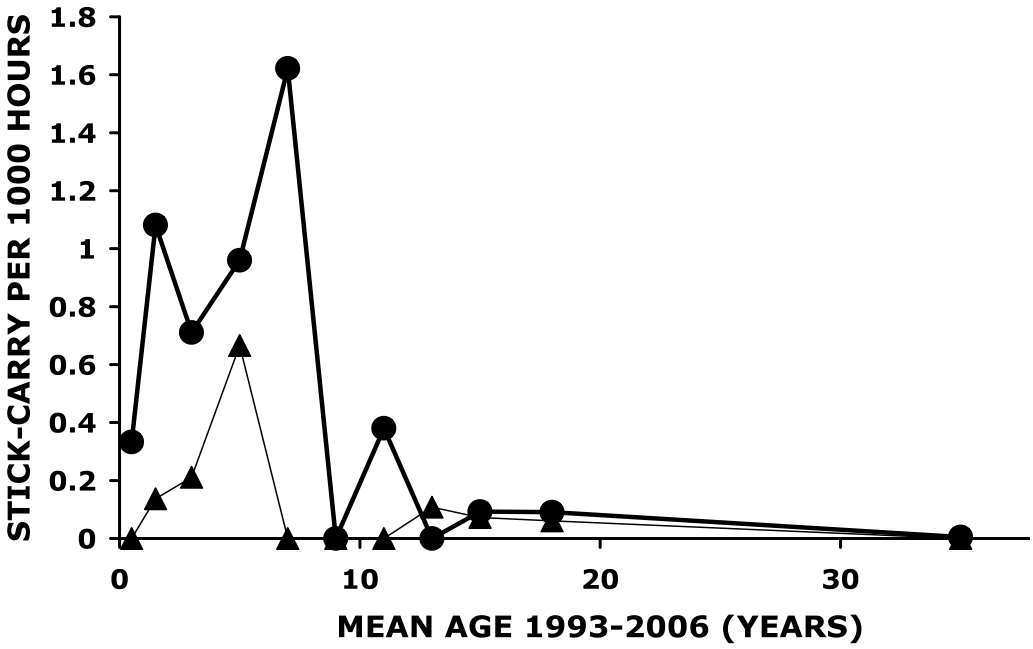
Figure legend

Fig. 1

Age and sex differences in rate of stick-carrying.

Females: circles, thick line. Males: triangles, thin line. Age category definitions are infants (0-4.9 yrs), juveniles (5-7.9 yrs), adolescents (8-14.9 yrs), and adults (>15 yrs, male; after full sexual swelling, females). To control for age and satisfy small samples of individuals per age category, each individual was assigned to one of 11 age-classes. Assignation to age-class was determined by the individual's mean age between their start and end of observations, 1993-2006. Age-classes, together with sample sizes of females and males respectively (total 37 females, 31 males), were: 0-1 yr (1,2), 1-2 yrs (5,4), 2-4 yrs (1,5), 4-6 yrs (3,2), 6-8 yrs (4,1), 8-10 yrs (1,2), 10-12 yrs (1,1), 12-14 yrs (1,1), 14-16 yrs (4,1), 16-20 yrs (2,1) and > 20 yrs (14,11). Mean stick-carrying rates across individuals were higher for females than for males (Wilcoxon signed rank $T = 3$, $n = 10$ age-classes, $P = 0.017$ (2-tailed)). No stick-carrying was observed for individuals in the 8-10 year age-class. Note that although Fig. 1 shows stick-carrying by individuals whose mid-point was in the Adult range, no individual carried a stick after entering the Adult age-category.

Fig. 1


STICK-CARRY PER 1000 HOURS
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
10
20
30
MEAN AGE 1993-2006 (YEARS)

Explanation of Supplementary Information

(1) Supplemental data gives photographic examples of stick-carrying and carried sticks.

(2) Supplemental Experimental Procedures describes the study population and observation procedures.

(3) Supplemental references are supplied in support of the observation methods.

SUPPLEMENTAL DATA

Figure S1

Stick-carrying by 9-year-old female (OK, February 2003). Photo: Sonya Kahlenberg.

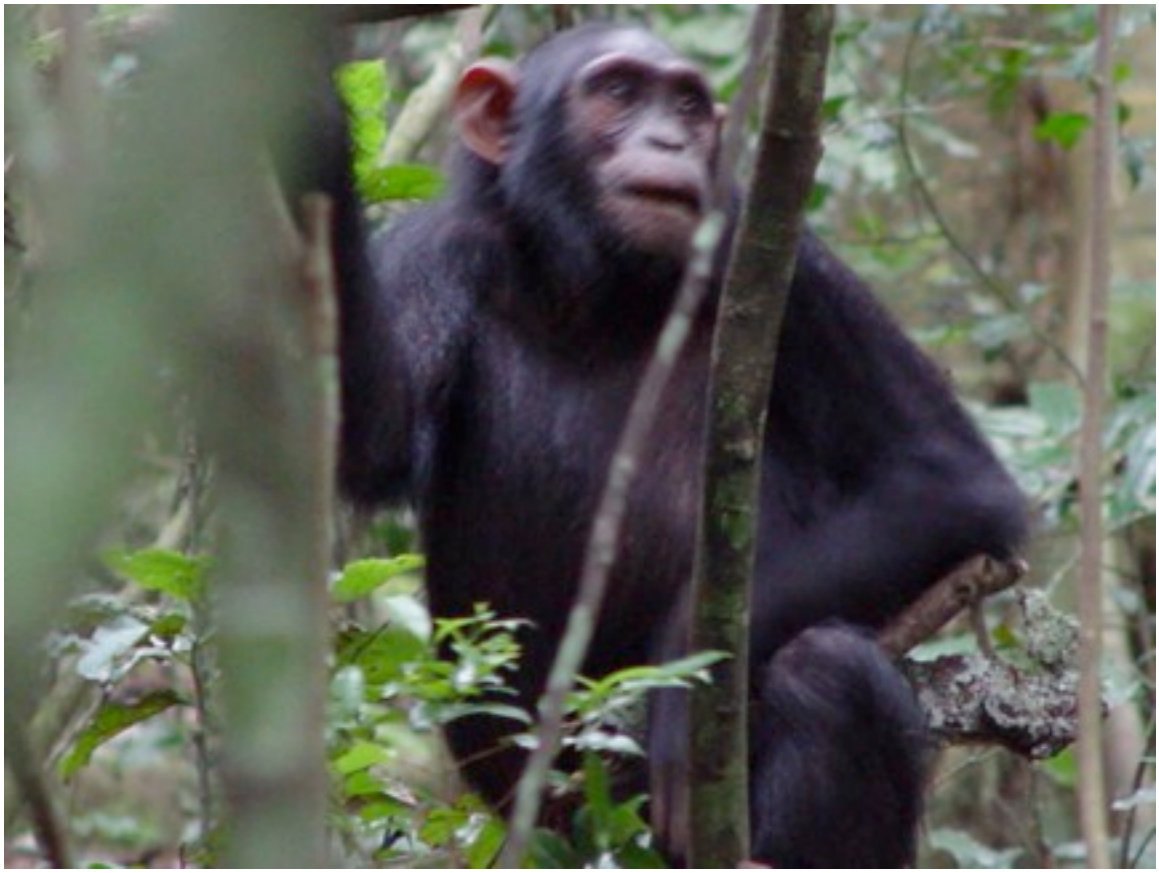


Figure S2

Comparison of sticks chosen by chimpanzees for stick-carrying (4 left) and probes (4 right). Scale is in centimeters. Photo: Sonya Kahlenberg.

SUPPLEMENTAL EXPERIMENTAL PROCEDURES

Research subjects were 68 members of the Kanyawara community in Kibale National Park, Uganda, a chimpanzee (*Pan troglodytes schweinfurthii*) population that has been studied continuously since 1987. The present study incorporates data from January 1993 to December 2006. During this period the community included up to 52 individuals at one time.

Behavior of individuals in temporary sub-groups was recorded by teams of observers, normally comprising 2-3 long-term Ugandan field assistants and 1-2 university-based researchers (graduate students, postdoctoral researchers, or one of the authors). Confidence in the accuracy of long-term behavioral data comes from tests documenting close agreement between focal data collected by researchers and all-occurrence sampling data collected independently by field assistants (Muller et al. 2007, Gilby et al in press), together with routine measures of inter-observer reliability (Kibale Chimpanzee Project, unpublished data). Individuals were observed for between 551 and 16437 hours each (mean female 3116 (n = 37), male 5556 hours (n = 31)). An additional 13 individuals who were peripheral or only briefly present during the study period were observed for less than 500 hours, and were not included in the analysis.

Chimpanzees were found by following their tracks, listening for calls or waiting near fruiting trees. Whenever possible, observers followed chimpanzees from the time that they woke in the morning until they constructed their night nests. Observers identified all individuals present in a focal party at 15-min intervals throughout the day. A party was defined as all chimpanzees within 50 meters of each other. Observers also

detailed the behavior of individual party members during 10 min focal sessions. Focal targets consisted of all age-sex classes, and were randomly selected throughout the day from observable party members. Observers attempted to record all instances of object use, but undoubtedly many were missed due to parties being spread out in thick vegetation. Observed rates of stick-carrying, probing and weapon use are thus under-estimates.

We considered object use events by the same individual (ID) to be independent if they occurred more than 10 min apart. Rates were calculated for each ID by dividing the number of object use events involving an ID by the number of 15-minute scans in which that ID was observed. We approximated hours by dividing 15-minute scans by four. Due to the rarity of object use events, we report rates using hours multiplied by 1000.

SUPPLEMENTAL REFERENCES

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