Comparing Two Manipulable Objects as Enrichment for Captive Chimpanzees

J D Pruetz[1] and M A Bloomsmith[2]

[1] The University of Illinois at Urbana-Champaign, Department of Anthropology

[2] The University of Texas, M D Anderson Cancer Center Science Park, Department of Veterinary Resources, Route 2, Box 151-BI, Bastrop, Texas 78602

ABSTRACT

This study compared the effectiveness of kraft wrapping paper and rubber to as enrichment for 22 chimpanzees group-housed in conventional indoor/outdoor runs. Objects were tested separately during 67 hours of data collection using a group scan sampling technique. Paper was used a mean 27 per cent of the available time, while the Kong Toys were used a mean 10 per cent of the available time. The degree of object manipulation and object contact was higher with the paper, but the level of social play and solitary play with the object was not differential~y affected by the two objects. The objects had differing effects on the subjects' levels of grooming, but affiliation, agonism, inactivity and sexual behaviour did not vary according to the object being used. A gender-by-age interaction was found, with immature males exhibiting the highest levels of solitary play with objects. Object use steadily declined over the first hour of exposure, showing evidence of habituation. Object use when the Kong Toy was present declined over the course of the study, but use of the paper remained consistent. Texture, destructibility, portability, complexity and adaptability may be important in determining the object-s value as effective enrichment. The destructible wrapping paper was a more worthwhile enrichment object than the indestructible Kong Toy' for the captive chimpanzees in this study.

Keywords: animal welfare, hehavioural management, environmental enrichment, great apes, psychological well-being

SUMMARY OF BENEFITS TO ANIMAL WELFARE

Considering potential effects on social behaviour and individual needs according to age and sex differences is important when designing enrichment programmes for captive primates. Manipulable objects are a widely practised form of enrichment at facilities housing non-human primates. Assessing an object's value in promoting the psychological well-being of captive primates, as well as evaluating aspects important to colony management such as safety and housing maintenance, is necessary to develop cost-effective enrichment techniques that promote the welfare of the animals.

INTRODUCTION

Facilities housing chimpanzees have incorporated various means of environmental enrichment for the psychological well-being of these animals (Bayne et al 1990, Bloomsmith et al 1988, Bloomsmith et al 1990a, Bloomsmith et al 1990b, Bloomstrand et al 1986, Brent & Eichberg 1991, Brent et al 1989, Brent et al 1991, Fouts et al 1989, Lambeth & Bloomsmith in press, Maki & Bloomsmith 1989, Maki et al 1989, Paquette & Prescott 1988). Increasing environmental complexity by supplying manipulable objects may be a very practical way of improving captive primate environments. Researchers have experimented with a number of manipulable objects such as balls (Bloomsmith et al 1990a), telephone directories (Bryant et al 1988), forage materials (Tripp 1985), burlap bags (Bayneet al 1990), and rubber toys (Brent et al 1989, Paquette

& Prescott 1988). Although manipulable objects may be beneficial additions to the environments of captive primates, certain items may prove to be more effective and worthwhile than others. Destructibility, complexity, physical alterability, texture, portability, manipulability, colour and size of the objects may influence their utility.

The development of sound enrichment programmes for captive apes depends on quantitative analyses of enrichment devices. To that end, we quantitatively compared the use of wrapping paper with that of a Kong Toy. Our hypothesis was that wrapping paper would prove to be a more effective form of enrichment for chimpanzees than the indestructible rubber toy because the paper provided subjects with more manipulative opportunities (Schefferly 1988). We also anticipated that younger animals would utilize the objects more than would the older animals based on findings in other enrichment studies (Bloomsmith et al 1990a, Brent et al 1989).

METHODS

Subjects

The subjects were 22 chimpanzees (Pan troglodytes) living in seven social groups at the Science Park chimpanzee breeding facility of the University of Texas M D Anderson Cancer Center. Eight adult males, six adult females, five immature males, and three immature females were studied. Groups comprised two to five individuals, and the social structure of the groups varied. Subjects over 10 years of age were classified as adults, and subjects under 10 years of age were classified as immatures. Subjects were housed in conventional indoor/outdoor runs each measuring 2.4m x 6. 1 m x 2.4m and including a concrete floor, resting boards, barred ceilings, and cinder block or chain-link fencing separating the runs. Groups occupied various numbers of these runs according to group size.

Data collection

The enrichment objects compared were Kong Toys [Primate Products, 1755 East Bayshore Road, Suite 28A, Redwood City, CA 94063; KLASS, 4964 Almaden Exp, Suite 233, San Jose, CA 95118] and kraft wrapping paper [Mine Inc, 950 Albrecht Drive, Lake Bluff, IL 60044]. One conical-shaped, durable, rubber Kong Toy (approximately 16cm x 8cm) or one sheet of brown, kraft wrapping paper (approximately 90cm x 60cm) per animal was given to each group at the start of testing. The Kong Toys each cost about $5.50 and each sheet of paper cost about 1.5 cents. Each object was supplied to the subjects one or two days per week during the 16-week study period from February 1990 to June 1990. Kong Toys and paper were given on different days. All subjects had exposure to both enrichment objects before the testing period began, as the objects had been included in the facility's environmental enrichment programmes. During the study period, access to each of these objects was restricted to only the testing sessions. The wrapping paper was disposed of during the final daily cleaning, and the Kong Toys were removed during the final daily cleaning on test days (although on a few occasions they were removed later because the animals carried the toys with them, and they could not be retrieved by caretakers). The objects were thus not available to the animals for more than a few hours per day when provided.

The daily enrichment programme employed at the facility was continued throughout the duration of the study. Therefore, the subjects often had other enrichment objects available during testing such as mirrors, nylon ropes, Boomer Balls [Boomer Balls, 24171 Route 120, Grayslake, IL 60030], plastic tubs, suspended tyres, frozen juice cups, fresh produce, and food puzzles. Other enrichment was given to the subjects during about one-third of the testing sessions (28% of the time toys were tested and 33% of the time paper was tested). The presence of these other enrichment opportunities may have affected the use of the study objects, but we felt such a research design was necessary to maximize the study's validity.

A mean of 9.6 hours of data per group was collected. Data collection consisted of 12-minute group scan tests using an intersample interval of 15 seconds. A total of 67 hours of data was collected with several groups tested on each testing day. The order of observations was random but balanced over time elapsed following the distribution of either the Kong Toys or the wrapping paper. 'Me objects were distributed to all subjects at the same time. Behaviours recorded included use of the enrichment objects designated by: social play with object, solitary play with object, manipulation of object, and contact with object; and other behavioural categories: affiliative, agonistic, sexual, abnormal, groom, inactive and other behaviour. Simultaneous occurrence of multiple behaviours on the ethogram. were all recorded. In addition to the group scans, all occurrences of aggression over the objects were recorded in a comments section.

Data analysis

Data scans were summarized for each behaviour by subject and a mean score for each behaviour was generated for each subject in the two experimental conditions. A multivariate analysis of variance (MANOVA) was used to test for effects of object type on the object use behaviours. A further MANOVA tested the relationship of object type to several behavioural categories: affiliative, agonistic, sexual, abnormal, groom and inactive. Effects of subject's age and sex on behaviours involving object use were also tested using a MANOVA. Pearson correlations were used to measure habituation to the objects.

RESULTS

Data were analysed to quantify differences between the subjects' responses to the two enrichment objects in their levels of each of the four object-directed behaviours. A MANOVA revealed that the paper was used significantly more (27% of the available time) than the toys (10% of the available time). Manipulating the object and contacting the object were significantly higher with paper, but social play and solitary play with the object were similar with both objects. A second MANOVA showed that the enrichment objects had differing effects on subjects' levels of grooming, with the toy condition showing more grooming, but affiliation, agonism, abnormal behaviour, inactivity, and abnormal behaviour, inactivity, and sexual behaviour did not vary when either object was available, see Table 1.

Table 1 Mean percentages of recorded behaviours for each enrichment object

Behaviour	Wrapping paper	Kong Toy™	MANOVA result[1]		
			F	*df*	*p*
Object-directed behaviours	27.4	10.0	25.9	4,39	<.001
Social play with object	1.1	0.5			
Manipulate object	11.0	2.2	51.4	1,42	<.001
Contact object	10.2	2.4	55.4	1,42	<.001
Solitary play with object	5.2	4.9			
Behaviours not directed to objects	23.2	32.4	3.3	6,37	.01
Inactivity	14.1	19.4			
Grooming	3.6	6.6	6.2	1,42	.02
Sexual	0.1	0.1			
Affiliative	2.1	2.6			
Agonism	1.2	1.3			
Abnormal	2.1	2.4			

[1] Numeric results are included only in cases where the effect of the two objects was statistically significant.

Subjects' object use was compared according to age and sex. A MANOVA showed a significant sex-by-age interaction in object-directed behaviour (F=4.0; df=4,37; p=0.009) accounted for by immature males exhibiting the highest levels of solitary play with the objects, see Table 2.

Table 2 Mean percentages of each object-directed behaviour for each age and sex category

Behaviour	Immature males	Immature females	Adult males	Adult females
Social play with object	2.0	1.2	0.2	0.5
Solitary play with object[1]	18.1	6.0	0.3	0.2
Manipulate object	6.8	8.7	7.0	4.7
Contact object	8.0	9.1	5.1	5.0

[1] Differences in the occurrence of this behaviour were statistically significant (F=13.0; df=1,40; p=.001).

Levels of object-directed behaviour were examined over the course of the study period to measure habituation to the objects. A Pearson correlation revealed that object-directed behaviour for the Kong Toy (r=0.23), but not for that of the wrapping paper (r=0.02), declined over the duration of the study, see Figure la. An additional Pearson correlation examined object-directed behaviour over the first 1.2 hours of exposure during each testing session and revealed a significant decline in object-directed behaviour for both the toy (r=0.22) and the paper (r=0.21), see Figure 1b.

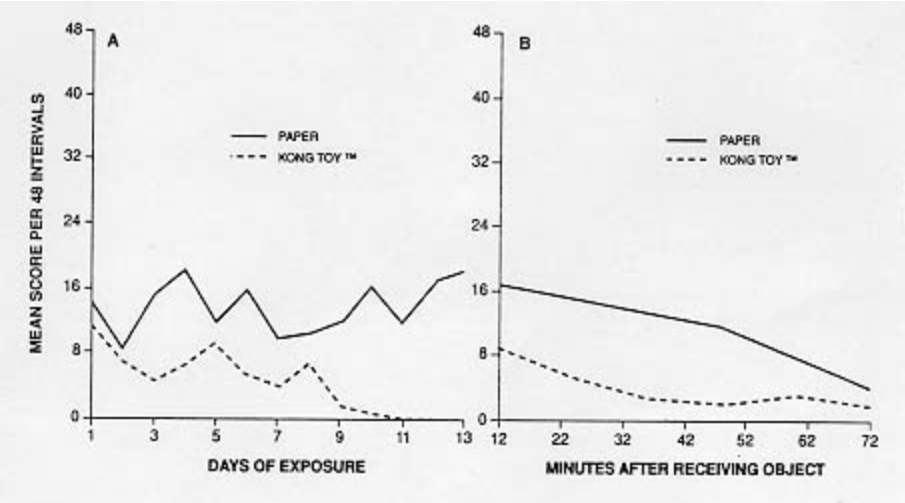
The rate of agonism involving the enrichment objects was low with only six incidents occurring, each in a group of immature subjects containing two juvenile males and two adolescent females. In each instance the older females were the aggressors towards one or both of the younger males. 'Mere were no incidents of wounding involving the enrichment objects. There were also eight incidents involving dominance of one animal over another regarding possession of an enrichment object, although no overt aggression occurred in those cases. Five of these were with the same group of two juvenile males and two adolescent females, with one of the older females being the dominant animal in all instances. Two occurrences were in a group containing two immature males and one immature female of similar ages, with one of the males dominating the female in one incident, and with this male being dominated by the other male in the group on the other occasion. An adult female in a group consisting of three adult females and their three immature offspring dominated an unrelated immature female regarding possession of an enrichment object one time.

In two incidents, an enrichment object seemed to cause distress to a subject. In one case, an adult male was unable to pull a toy down into his cage through the ceiling bars and then began stereotyped pacing around the cage. In the other case, an adult female who had been exposed to the toys but had not been previously seen to interact with the toys began slapping her head and face while standing over and staring at a toy. This behaviour was only observed for a short time and did not recur after the subject finally touched, picked up, and manipulated the toy.

A variety of uses of the enrichment objects could be classified as species-specific behaviour. Many subjects tore the wrapping paper into small pieces, which they then wadded up and chewed/sucked in their mouths, often mixing with water. This resembles Goodall's (1986) reports of leaf sponge use and 'wadging' of certain foods by wild chimpanzees. Paper was also used to make nests and to sit or lie on while eating. Several males used both the wrapping paper and the

Kong Toys in their bluff displays. Both adult and immature males were also observed to sexually mount and thrust against the toys. A female at the peak of her sexual cycle was observed to manipulate her genital swelling with the paper. Toys were sometimes filled with both food and water. Various manipulations of the enrichment objects were observed during play, such as simply wrestling over and with the objects, chasing one another with objects, and many forms of solitary play with the objects. Toys were chewed during play, but remained intact. Paper was often draped over or around the body, rubbed on the floor, walls or cage bars or thrown and waved around during play. Toys were sometimes held in subjects' hands outside of the cage through the barred ceilings of the cages or dropped under outside doors into gutters where they then could not be retrieved by the animals. Most subjects seemed to be doing this to watch the toys bounce away. Paper was infrequently placed outside of cages by subjects. A more practical enrichment item in cases such as this might be one that was of sufficient size and shape so that it could not be thrown outside of the animals' cages. However, there would then be the drawback of decreased ability of caretakers to deliver objects to the animals.

In general, the enrichment objects tested in this study proved to be well suited to the housing situation of the subjects. Neither object posed a problem regarding housing maintenance or subjects' safety. Excess noise or damage to painted walls that may be found with other items such as hard plastic balls or metal barrels was not a problem with these particular objects. In addition, the wrapping paper was relatively inexpensive.



DISCUSSION

Our results show that both kraft wrapping paper and rubber Kong Toys. can be effectively provided as enrichment for captive chimpanzees in conventional housing situations. The amount of object-directed behaviour towards both the paper and the Kong Toys exceeded the level of use found in other studies where enrichment was evaluated and deemed to be worthwhile (Bloomsmith et al 1990a, Reinhardt 1989). Relatively high use might have been anticipated because subjects housed in such conventional enclosures have made greater use of other enrichment opportunities than subjects living in large, outdoor corrals (Bloomsmith et al 1990a, Maki & Bloomsmith 1989). These manipulable objects facilitated species-specific behaviour, and such similarities between the behaviour of captive and wild primates can be viewed as evidence for improving the psychological well-being of captive chimpanzees (Bloomsmith 1989, Line 1987, Maki & Bloomsmith 1989, Wilson 1982).

A higher level of use of the paper and the lack of habituation to the paper over the course of the study suggest that wrapping paper was a more useful enrichment item than Kong Toys for the chimpanzees in this study. The lower level of grooming found when the wrapping paper was present suggests that this enrichment object might reduce levels of overgrooming. Although the levels of manipulating and contacting the objects were significantly higher with paper, social play and solitary play with the object was similar between the two objects. This suggests that both objects might be especially suitable for younger animals that exhibit high levels of social and solitary play with objects (Goodall 1986).

Brent et al (1989) found that younger animals and ones that were more active utilized manipulable objects most. In our study, qualities of the wrapping paper, in comparison to the Kong Toys such as its greater destructibility and alterability seemed to contribute to its value as an enrichment item. The paper was utilized in various ways as it became altered, and this type of material may be especially beneficial to animals in housing situations where natural substrates such as grass are not available. Our finding that the destructible object was used more than the indestructible one agrees with Schefferly's (1988) finding that immature chimpanzees exhibited less inactivity with destructible manipulable objects than with indestructible ones. Our finding also agrees with that of Bryant et al (1988), who showed that a destructible object was preferred over an indestructible one by macaques. All subjects in this study were members of social groups, and the enrichment objects tested were often used in social interactions. O'Neill (1988, p 33) concluded that enrichment objects '... are tools for redirecting and in some cases enhancing or stimulating social interactions primarily through play' in rhesus macaques. The use of both of the enrichment objects in displays by male subjects in this study may reflect aggression that might otherwise have been directed at cagemates. Although each animal was provided with one Kong Toy or one sheet of wrapping paper, some agonistic incidents occurred concerning monopolizing the enrichment objects. These incidents did not result in injuries and seemed to be a form of 'bullying' by adolescents toward juveniles. Westergaard and Fragaszy (1985) found that familiar non-edible objects did not elicit social tension among captive capuchin monkeys.

Higher levels of object use by immature males for solitary play with the objects in this study suggests that they may benefit most from the provision of manipulable objects as enrichment. Similar findings have been reported by other investigators (Bloomsmith et al 1990a, Brent at al 1989). However, most of the observed agonism occurred in groups composed solely of immature chimpanzees, so extra caution may be necessary when using these objects for enrichment in such groups.

Mean rates of abnormal behaviours such as coprophagy, faeces spreading, head shaking, rocking, urine consumption, self-slapping and idiosyncratic stereotypies were found to be similar with both enrichment objects, so one object cannot be recommended over the other if a colony manager's goal is to reduce abnormal behaviour. However, three subjects in one group of three adult females and their three offspring were observed to urinate onto the paper and then consume the urine off the paper. Such urophagy was not observed in this group during testing sessions with the Kong Toys.

The decline in object use for both objects over the first 1.2 hours after the introduction of the enrichment objects on test days and the decline in object use for Kong Toys over the length of the study period suggest that continual exposure to manipulable objects may not be the most effective way of offering enrichment for captive chimpanzees. Paquette and Prescott (1988) found that novel objects reduced inactivity and self-grooming and increased manipulation in captive chimpanzees, but that object manipulation did decrease over time. Bryant et al (1988) also found some habituation to novel enrichment with repeated exposure. The current study provided renewing novelty of the enrichment objects by exposing subjects to the objects once or twice weekly for only a few hours. Other available enrichment was sometimes used by the

animals in combination with the enrichment objects, for example paper was manipulated into a feeding enrichment device, and sticks were inserted into the toys. Use of the objects being tested during the presence of other enrichment further validates these objects' effectiveness as part of an enrichment programme.

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