

Play Behaviour in Lowland Gorillas: Age Differences, Sex Differences, and Possible Functions*

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ABSTRACT. A study on lowland gorilla (*Gorilla gorilla gorilla*) play behaviour was conducted on four exhibits at three different zoological parks so that 19 gorillas were observed. Juvenile gorillas played the most, but play continued at fairly high frequencies through adolescence. Most social play occurred between dyads. Triadic groups usually chased each other. No sex differences in type of play were observed, but gender differences in partner preferences were observed. Males played with both other males and females, while females seldom played together. These data support the social skills hypothesis (BALDWIN & BALDWIN, 1974) of play.

Key Words: Gorilla; Play; Primates; Social skills hypothesis.

INTRODUCTION

Play is a predominant activity of the young of higher primates, especially those that live in complex social organizations (SMITH, 1982), however the function of play in animals remains an enigma (BURGHARDT, 1984). Deprivation studies, commonly used to elucidate the functions of other behaviour, are not as useful in the study of play because, when young animals are deprived of the opportunities to play and of play partners, the resulting environment also deprives them of other social opportunities such as grooming and physical contact (CHALMERS, 1984). BALDWIN and BALDWIN (1973) and BERGER (1980), however, carried out field projects where both playing and non-playing populations of animals were observed in squirrel monkeys and bighorned sheep, respectively. Both studies concluded that animals that did not play developed the skills necessary to survive and reproduce, but that animals that had played displayed larger behavioural repertoires for social situations than those that had not. CHALMERS and LOCKE-HAYDEN (1984) report similar findings in common marmosets. They found that marmosets that engaged in more play activities used a wider variety of behaviours (i.e., more vocalizations, gestures, and avoidance behaviours) in a food test with their mothers than less playful marmosets. These findings support the social skills hypothesis (BALDWIN & BALDWIN, 1974). This hypothesis holds that, although play is not needed for animals to develop adult social skills per se, by enlarging the behavioural repertoire of the individual, it is useful in the refinement of social skills, or in developing what FAGAN (1984) calls behavioural flexibility.

The social skills hypothesis predicts that animals should preferentially play with partners similar to those with whom they form social relationships as adults. For example, if at adult-

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hood an individual interacts equally with both males and females, then it should display little preference for male or female play partners; however, if at adulthood the individual interacts primarily with males or with females, then it should prefer male or female play partners, respectively. One way to test this prediction is to examine play partner preferences in species which have different social organizations. Hanuman langurs (HRDY, 1977) and hamadryas baboons (KUMMER, 1968) both form groups of females that are led by one male. Langur females form stable matrilineal groups for which male langurs compete. In contrast, hamadryas females are unrelated and recruited to the group by a hamadryas male. In both social organizations males interact with other males and females. However, while female langurs interact amongst themselves, female hamadryas baboons seldom interact as adults. Langurs play in large mixed sex groups which occasionally break up into smaller units (DOLHINOW & BISHOP, 1970). In contrast, although young male hamadryas baboons frequently play together, young females seldom play together (KUMMER, 1968).

Another primate species with an unusual social organization is the gorilla. Feral studies report that mountain gorillas form troops which consist of a silverbacked male, one or two blackbacked males which act as "watch-dogs," and three to five females with their offspring (HARCOURT, 1979a; FOSSEY, 1983). The females are usually unrelated because female gorillas emigrate from their natal troops (HARCOURT et al., 1976). The social relationships between male gorillas within a troop are primarily cooperative (HARCOURT, 1979b) and between troops agonistic (FOSSEY, 1983). Females interact closely with and maintain proximity to the silverbacked male of their troop, but seldom interact among themselves (HARCOURT, 1979a).

Few studies have concentrated on the play behaviour of gorillas, and the feral and captive studies that exist report different frequencies of play among gorillas. SCHALLER (1963) reported that mountain gorillas seldom played in the wild (.11 instances/hr) and ceased playing at 6 years of age. In contrast, CARPENTER (1937) reported high frequencies of play between two captive 8-year-old male mountain gorillas. The differences in play frequencies between feral and captive animals can be accounted for, in part, by FOSSEY'S (1983) observations that gorillas usually cease playing in the presence of a human observer. Even when they do play in the presence of an observer, their play behaviour is qualitatively different (stilted gaits with moves directed at the observer) than when they are unaware of the observer's presence (relaxed gaits with moves directed at other gorillas). In addition to CARPENTER'S (1937) study of sub-adult males, play behaviour has been studied in captive infant (HOFF et al., 1981), juvenile (FREEMAN & ALCOCK, 1973), and adult female (FISCHER & NADLER, 1978) lowland gorillas. Each of these studies, however, has focussed on a single age group in a single gorilla group, and thus all have small ns (≤ 3).

The present study of gorilla play behaviour was designed (1) to study as many gorilla groups as possible, (2) to document the occurrence of play from late infancy through adulthood, and (3) to examine social play including size of play groups, choice of play partners, and sex differences in types of play, in order to better understand the possible functions of social play in gorillas.

METHODS

SUBJECTS

Nineteen lowland gorillas (*Gorilla gorilla gorilla*) were observed at three zoological parks—

Table 1. Compositions of the gorilla groups.

Zoological park		Los Angeles Zoological Park				San Diego Wild Animal Park	
Audubon Park and Zoological Garden		North exhibit		South exhibit			
		Pre-switch:					
	Age		Age		Age	Age	
Bb-M ¹⁾	7	Juv-F	5.5	Adol-F	8	Juv-M	4
Bb-M	7	Juv-M	6	Adol-F	11	Juv-F	5
Adol-F	9 ²⁾	Juv-M	6.5	Ad-F	20 ³⁾	Adol-F	7
Adol-F	13 ³⁾	Ad-F	21 ³⁾	Sb-M	26 ³⁾	Ad-F	21 ³⁾
		Sb-M	21 ³⁾			Ad-F	26 ³⁾
						Sb-M	26 ³⁾
		Post-switch:					
		Juv-F	5.5	Adol-F	8		
		Ad-F	21 ³⁾	Adol-F	11		
		Ad-F	20 ³⁾	Juv-M	6		
		Sb-M	21 ³⁾	Juv-M	6.5		
				Sb-M	26 ³⁾		

1) Juv-M: a juvenile male; Bb-M: a blackbacked male; Sb-M: a silver-backed male; Juv-F: a juvenile female; Adol-F: an adolescent female; Ad-F: an adult female. 2) Female was pregnant at the time of the study. 3) Gorilla was wild-captured so age is approximate.

the Audubon Park and Zoological Gardens, New Orleans (Audubon group), the Los Angeles Zoological Park (L.A. groups), and the San Diego Wild Animal Park (SWAP group). Because the L.A. zoo contained two exhibits, L.A. north and L.A. south, a total of four exhibits were observed. The gorillas ranged from 4 to approximately 26 years of age, and from four to six gorillas were housed in each exhibit (see Table 1 for group compositions). Both L.A. groups and the SWAP group contained silverbacked males; however the silverbacked male in the L.A. north exhibit was not considered a regular group member because he was only intermittently released into the enclosure. Both males in the Audubon group were blackbacked, but at least one male was sexually mature since a female was pregnant at the time of the study. For ease of communication, the gorillas have been divided into three age groups: juveniles < 7 years ($N = 5$), adolescent 7–15 years ($N = 7$), and adults > 15 years ($N = 7$). None of the juvenile or adolescent gorillas had been sired by the silverbacked males in their exhibits.

EXHIBITS

All four enclosures were constructed of man-made boulders and contained water pools, trees, open spaces of grass, boulders, and several areas where the gorillas could retreat from public view. Moats separated all the enclosures from the public. The Audubon exhibit measured approximately 667 m² (for a full description of the Audubon exhibit see BROWN & WAGSTER, 1986). The Audubon and L.A. exhibits were about the same size, and the SWAP exhibit was approximately twice as large as the others. Trees were accessible to and climbed by the gorillas in the Audubon and L.A. enclosures but were strung with electrical wire and therefore inaccessible to the SWAP group.

PROCEDURE

Data were collected on the Audubon group from March 22 to June 3, 1983 (20 hr), on the L.A. groups from January 19 to June 7, 1984 (69 hr), and on the SWAP group from April 21

to May 26, 1984 (12 hr). Three of the gorillas in the L.A. groups were switched between the exhibits on March 16, 1984 (Table 1) so the L.A. data were divided into pre-switch (January 19–March 15; 33 hr) and post-switch (March 16–June 7; 36 hr) observations.

Inter-observer reliabilities were obtained by having two observers record the gorillas' activities in the same exhibit for 60 min. The 60 min of observations were then broken down into six 10-min intervals and frequencies of solitary play, social play, and chestpounds were tallied for each observer. Since some of the frequencies were small, total frequencies of the above events were correlated. The inter-observer correlations for seven pairs were .99, .98, .98, .97, .95, .85, and .54.

Except when inter-observer reliabilities were obtained, one observer recorded activities on the Audubon and L.A. groups. Since the SWAP exhibit was twice as large as the other exhibits, two observers, each assigned half the enclosure, obtained data on the SWAP group. Two 1-hr serial records were obtained per exhibit each week of the project except in inclement weather. Frequencies of solitary, object, and social play, and the identities of the gorillas who participated in the play bouts were recorded. Solitary play included types of rotational/locomotor play, object play included play with inanimate objects and other species, and social play included two broad categories, moderate and active play (see Table 2 for play descriptions and definitions). Since chest-pounding has been associated with social play (MAPLE & HOFF, 1982; CARPENTER, 1937), the occurrences of chest-pounds and the behaviour which occurred within 15 s of a chest-pound were also recorded.

RESULTS

DESCRIPTIONS OF PLAY

Solitary and Object Play

When adult gorillas played, they usually played with water (7/11 instances). For example, the silverbacked male in the L.A. south exhibit slapped at and splashed water in a small pool on five occasions. Most of the juvenile and adolescent gorillas also played with or in water. One of the juvenile males at L.A. ran through and jumped at the water coming from sprinklers in the exhibit ($N = 4$), and an adolescent male at Audubon frequently played ($N = 16$) in the water moat. Rotational/locomotor play was the most frequent form of solitary play (average of 2.2 bouts/hr) observed in gorillas less than 20 years. Most of the rotational/locomotor play occurred on the ground rather than in trees or on boulders and consisted of twirls, somersaults, rolls, jumps, and self manipulations; climbing, swinging, and hanging were less frequently observed (average of .05 bouts/hr). Branches were the most frequent objects manipulated in solitary play bouts and were twirled, thrown and inspected during the bouts.

Bird chasing (peacocks, chickens, and sparrows) was also reported in all exhibits (average of .2 bouts/hr). Chest-pounding, similar to that observed in social play bouts, often occurred prior to and during the bird chase. The gorillas never hurt the birds. In fact, once the males in the Audubon enclosure cornered a chicken several times, but, rather than catching it, they moved away and resumed the chase after the chicken left the corner.

Social Play

Chest-pounding was closely associated with social play; 20% of the chest-pounds observed

occurred either prior to or during a play bout. Interestingly, after the juvenile males were transferred out of the L.A. north exhibit, the only remaining juvenile, a female, directed 44% (15/34) of her chest-pounds at the adjacent exhibit where the males had been transferred. At these times ($N = 5$), the female climbed to the highest point in the exhibit (a high rock formation planted with a climbable tree), oriented towards the adjacent exhibit, chest-pounded once or several times, and then descended to a lower level using the same gait observed in play chases (Table 2).

The gorillas never played in groups larger than three. Triadic play groups occurred less frequently (frequency/hr = .2) than dyadic play groups (frequency/hr = 6.2). The majority of triadic play bouts were active (88%) with the gorillas chasing and charging each other in turn. Only two moderate play bouts involving three gorillas were observed. In the moderate bouts, the gorillas switched partners during the bout so that, at any particular time, only two gorillas were wrestling while the third sat and watched nearby.

Table 2. Characteristics and descriptions of play behaviours.

Play category	Behaviour	Defining characteristic/description
Solitary:		
Rotational/locomotor	Twirl	Spinning around bipedally
	Somersault	Turning the body one full rotation head over heels
	Roll	Turning the body from side to side while supine can be complete or incomplete rotation
	Run	Loose limbed gait, usually bipedal
	Self	Slapping the face, clapping hands, or rubbing oneself without grooming
Object play	Climb/swing	From a tree, boulder, or ledge
	Manipulate	An external object such as grass, dirt, or a branch
	Throw	An external object while in a relaxed stance
	Swing	An external object while in a relaxed stance
	Water	Water is used in the play sequence
Social:		
Moderate	Open-mouth-wrestling	Limbs entwined while sitting or laying, gorillas roll/twist together placing open mouths on each other
Active	Rough/tumble	Vigorous bipedal wrestling
	Chasing	One gorilla rapidly following another both with relaxed, running gaits

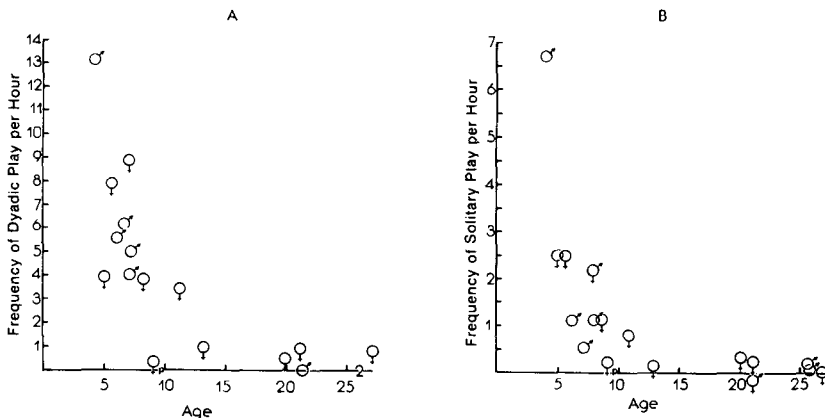


Fig. 1. Frequencies of dyadic (A) and solitary (B) play by age.

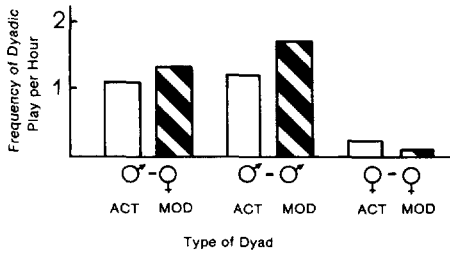


Fig. 2. Sexual preferences in play partners by active (solid bars) and moderate (stripped bars) play.

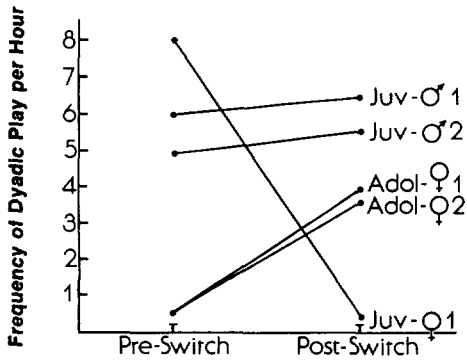


Fig. 3. Frequency of dyadic play before and after gorillas were switched between exhibits at the L.A. Zoo.

Dyadic play bouts consisted of both active and moderate play with moderate bouts occasionally grading into active bouts ($N = 25$, data are from the L.A. and SWAP exhibits) and vice versa ($N = 30$). Male and female gorillas did not differ in the frequency of their dyadic play bouts (Fig. 1A) or in the type of play they engaged in (Fig. 2).

AGE EFFECTS ON PLAY

The frequencies of both solitary and dyadic play decreased as a function of age and were well fit by a right hyperbola (Fig. 1). Gorillas older than 20 years seldom played (11 times) by themselves or with objects. Silverbacked males never participated in dyadic play bouts, and females past the age of 20 only played with juvenile partners. Both the adult females at SWAP played with the 4-year-old male; however, in these bouts, the females took relatively passive roles. They remained sitting on the ground and rolled the male after he approached them. After the adolescent males were removed from the L.A. north exhibit, the frequency of the juvenile female's dyadic play bouts dropped considerably (Fig. 3), but she occasionally played with an adult female. This young female, like the juvenile male at SWAP, initiated and maintained all the play bouts between herself and the adult; in fact, her play solicitations to the older female were usually unsuccessful (Similar findings are reported for squirrel monkeys, BALDWIN & BALDWIN, 1974). In contrast to gorillas older than 20, younger gorillas often played together (Fig. 1A).

SEXUAL PREFERENCES IN PLAY

The gorillas displayed sexual preferences in their choice of play partners. Male-male dyads

(average of 2.9 bouts/hr) and male-female dyads (average of 2.4 bouts/hr) frequently played, but female-female dyads (average of .3 bouts/hr) seldom played (Fig. 2). Chi-squares were conducted to test whether the theoretical frequencies derived from no play partner preferences differed significantly from the observed frequencies of play partners in each of the four exhibits (Audubon, L.A. north—pre-switch, L.A. south—post-switch, and SWAP) where the gorillas could show a play partner preference. Consistently across the exhibits where female-female dyadic play could have occurred the observed frequencies were less than the expected frequencies [Audubon— χ^2 (2) = 96.42; $p < .01$; L.A. South post-switch— χ^2 (2) = 23.87; $p < .01$; SWAP— χ^2 (1) = 36.54; $p < .01$]. Individual preferences among gorillas showed that the Audubon males played together more often than with the females, but in the L.A. North exhibit (pre-switch), the males played more with the female than with each other [χ^2 (1) = 11.99, $p < .01$].

Sexual preferences in play partners were clearly demonstrated in the L.A. enclosures as a function of the switch. Pre-switch, the two adolescent females in the L.A. south enclosure seldom played together (.5/hr), but post-switch, after the two adolescent males from the L.A. north exhibit were released into the south exhibit, the dyadic play frequencies of both females increased (Fig. 3). The increase in play displayed by the females was entirely a function of their playing with the males because their rate of play together (.6/hr) remained the same as their pre-switch level.

DISCUSSION

Lowland gorillas frequently play in captivity, however whether or not they exhibit play behaviour is a function of many factors; several of which were illustrated in the present study. The age of the gorilla is important. Juvenile gorillas play the most and with the largest variety of partners—other juveniles, adolescents, and adults. Both solitary and social play frequencies decrease as a function of age such that gorillas of 20 years or older play infrequently. Unlike SCHALLER's (1963) study, the results of the current study indicate that gorillas continued to play fairly frequently until they are 13 years old. Similar curvilinear relationships between age and frequency of play behaviour have been reported for other primates (vervets, BRAMBLETT, 1978; squirrel monkeys, BALDWIN, 1969; baboons, OWENS, 1975). Adult female gorillas play with infants (HOFF et al., 1981) and occasionally with juveniles (current study) but do not actively solicit play bouts with juveniles. While the silverbacked males did not exhibit social play, they did play with external objects, especially water. Water play has been observed in another silverbacked male (BROWN et al., 1982).

Gorillas must also have the appropriate play partners to display social play. This can simply mean partners of the appropriate age class as illustrated by the juvenile female's (L.A. north exhibit) decrease in play after the two juvenile males were removed to the adjacent exhibit, leaving her in an enclosure with all adult animals.

Partner choice in gorillas can also mean a partner of the appropriate gender. Female gorillas seldom played together in any of the four enclosures that were observed; this is consistent with other studies of gorilla play. FREEMAN and ALCOCK (1973) found in their study of play in a mixed group of gorillas and orangutans that female gorillas rarely played together, and FISCHER and NADLER (1978), likewise, found that adolescent females seldom played together (.06 instances/hr). In contrast, female gorillas frequently played with males, also reported by FREEMAN and ALCOCK (1973). Males, besides playing with females, also

Table 3. Gender differences in types of play and partner preferences for five species of primates.

Species	Social organization	Gender differences in play	Partner choice based on gender
Squirrel monkeys (<i>Saimiri sciureus</i>)	Multi-male troops numbering up to 300 are formed in unaltered habitats; no or overlapping territories between troops (BALDWIN & BALDWIN, 1971).	Females more likely to engage in non-directional wrestling bouts (with no obvious winner) than males (BIBEN, 1986).	M-M, M-F, & F-F dyads are observed frequently, however M-M dyads are the most frequent (BIBEN, 1986). In feral populations, mixed sex groups of 4-7 are common (BALDWIN & BALDWIN, 1974).
Olive baboons (<i>Papio anubis</i>)	Multi-male troops based on stable female matriline with male exchange between troops and territorial overlap between troops (ROWELL, 1969; ALTMANN & ALTMANN, 1970).	Males engage in more active roles and in more rough & tumble, while females engage in passive roles and in more mauling play (OWENS, 1975).	Partner choice is not based on gender (OWENS, 1975).
Rhesus monkeys (<i>Macaca mulatta</i>)	Multi-male troops based on stable female matriline with male exchange between troops and territorial overlap between troops (MISSAKIAN, 1972).	Male play is more aggressive and males are more likely to attempt to gain advantageous positions. Female play is usually passive (SYMONS, 1978).	M-M, M-F, & F-F dyads are common, however M-M dyads are the most frequent (RUPPENTHAL et al., 1974; SYMONS, 1978).
Hanuman langurs (<i>Presbytis entellus</i>)	Single male troops based on several female matriline with an unstable female hierarchy (HRDY, 1977).	Males engage in more active play than females who play more passively (DOLHINOW & BISHOP, 1970).	Mixed sex play groups of up to 16 & smaller groups of 2-3; no gender preference (DOLHINOW & BISHOP, 1970).
Hamadryas baboons (<i>Papio hamadryas</i>)	Single male troops based on male recruitment of unrelated females (KUMMER, 1968).	Males engage in more play fighting and both sexes play wrestle (ABEGGLEN, 1984).	Males play together in large groups. Females occasionally play as infants, but stop almost entirely after they are one (ABEGGLEN, 1984).

frequently played together, however, unlike previous research (HOFF et al., 1981), no sex differences in the types of play males and females engaged in were found.

The findings of the present study—partner preference, no gender differences in types of play, playing with external objects such as water, and interspecific play with birds—support the social skills hypothesis of play (BALDWIN & BALDWIN, 1974). This becomes especially clear when gorillas are compared with other primate species. Table 3 presents information on several well documented primate species with different social organizations. The social skills hypothesis predicts that individuals should prefer to play with partners similar to individuals they will interact with at adulthood to gain flexibility in these interactions. Both hamadryas baboons (KUMMER, 1968) and gorillas (HARCOURT, 1979a) form groups of unrelated females, which seldom interact, centered around a single male who interacts with both males and females. In contrast to hamadryas baboons and gorillas, most primate groups are centered around a group of related females for which males compete. While females in these later species frequently play together, hamadryas and gorilla females seldom play together. However, in all these species males, and males and females play together (Table 3) and also interact with one another at adulthood.

The social skills hypothesis also predicts sex differences in play, especially if males and females have different life histories at adulthood. For example, in most primate species female matrilineal groups form a stable core for which males compete and from which males emigrate. Successful transfer and emigration, whether or not an individual is male or female, should require the same social skills, and therefore gender differences in play might not be expected in a species where both males and females transfer out of their natal troop as in the gorilla (HARCOURT et al., 1976).

Additional support for the social skills hypothesis comes from our findings regarding object and interspecific play. If play functions to enable an individual to explore and develop strategies of dealing with its environment (FAGAN, 1984), then the individual should be attracted to novel individuals in its environment. An individual's external environment consists of individuals from different troops and species. Interestingly, both HRDY (1977) and FOSSEY (1983) report, for langurs and gorillas, respectively, that when two troops meet, juvenile and adolescent animals often play while the adults are displaying and being aggressive. This would give the young primates an opportunity to play with new individuals and perhaps learn new patterns and strategies of play. These occurrences of play deserve more detailed attention.

Individuals also play with other species. Gorillas, in every exhibit observed, were attracted to and played with the birds which flew into their exhibits. Playing with birds has been filmed in bears (BENNETT, 1982) and described between ravens and wolves (MECH, 1966). Interspecific play in the wild has also been reported between spider monkeys and howlers (KLEIN & KLEIN, 1973), chimpanzees and baboons (VAN LAWICK-GOODALL, 1971), squirrel monkeys and tamarins (BALDWIN & BALDWIN, 1974), and humans and gorillas (FOSSEY, 1983). Play with novel individuals as described in this and the other studies could help the individual to explore and refine its interactions with its environment.

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