Play Initiating Behaviors and Responses in Red Colobus Monkeys

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Red colobus monkeys are playful primates, making them an important species in which to study animal play. The author examines play behaviors and responses in the species for its play initiation events, age differences in initiating frequency and initiating behavior, and the types of social play that result from specific initiating behaviors. Out of the eighteen attempts to initiate play observed by the author, four resulted in play fighting, six in social-locomotor play, four in aggressive rebuffs, and four in passive withdrawals. Old infants proved both the primary initiators and targets of play initiation attempts. Fourteen attempts involved contact with the target animal, suggesting that contact is a species-specific strategy used to initiate play. The author found no relationship however, between specific initiating behaviors and the type of social play that ensued. The author discusses the limitations of the study and directions for future research. **Key words:** Kibale; play fighting; play initiation; *Procolobus rufomitratus*; red colobus monkeys; rough-and-tumble play; social-locomotor play

Monkeys, like humans, have an extended period of immaturity, during which they spend a good deal of time in play. Play dominates the activity of infant primates and remains one of the top three or four activities of juvenile and adolescent primates (Fagen 1981; Roopnarine and Johnson 1994). Highly social creatures, primates find initiating social play and learning to respond properly to play solicitations to be important skills they must master as early as possible. Depending upon the taxonomy, experts consider the number of extant primate species to range between 190 and 300—200 species can serve us as a reasonable approximation (World Wildlife Fund 2012). But because most primates, regardless of species, live in highly stratified environments such as rainforests whose intractable conditions make viewing their complex behavior difficult, detailed studies of play in the wild are rare and involve only a few species. Researchers have conducted, however, numerous studies of captive primates at play.

In this article, I look at occurrences of play initiation in a group of red colobus monkeys *(Procolobus rufomitratus)* in Kibale National Park in Uganda.

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Although difficult study conditions led to a limited data set, these preliminary results add a new dimension to our knowledge of red colobus monkeys at play. It is an intriguing species to use to study play initiation because red colobus infants and juveniles devote approximately 27 percent of their activity to play (Worch 2002, 2010), which far exceeds the times reported for other primate—not to mention nonprimate—species. For example, vervets spend 13 percent of their time at play (Govindarajulu et al. 1993); cheetahs, 8 percent (Caro 1995); and meerkats, 3 percent (Sharpe 2002). Despite the propensity of red colobuses for play, however, we know little about how they initiate it.

Among the primate species that have been studied extensively in the wild, the amount of time they play—and, to a lesser extent, the types of play in which they engage—vary remarkably. Still, they share a number of characteristics.The amount of time on average individual red colobuses spend in play tends—as it does with humans—to decline with age (Fagen 1993). This reduction in play may result from physiological changes that lead to increased aggressiveness (Caine 1986; Lewis and Barton 2006) and to reduced responsiveness to play solicitations (Levy 1979; Lewis and Barton 2006). Social influences that encourage work-a-day, adult-like behavior may also have a role in reducing play time. For nonhuman primates in particular, weaning requires youngsters to fend for their own nutritional needs and actually helps define the onset of the juvenile period (Subcommittee on Conservation of Natural Populations 1981). Thus, much of the time once available for play during infancy must be devoted to finding food during juvenility.

Researchers have observed sex differences in the play of wild primates. In most species, juvenile males tend to play more frequently and for longer durations than females (Hayaki 1985; Poirier et al. 1978; Pusey 1983; Symons 1978). Also, males usually engage in more play fighting than females (Japanese macaques [Hayaki 1983]; chimpanzees [Hayaki 1985]; vervets [Govindarajulu et al. 1993]; savannah baboons [Owens 1975; Raleigh et al. 1979]; rhesus macaques [Symons 1978]; long-tailed macaques [Van Noordwijk et al. 1993]; and gorillas [Watts and Pusey 1993]). Some explain the sex differences in play fighting using a motor-training hypothesis, which posits that play develops muscles and neurons associated with specific adult behaviors (Byers and Walker 1995). Because, as a rule, physical fitness and the ability to fight influence the reproductive success of adult males more than of females, immature males should engage in more play fighting than females (Chalmers 1984; Fagen 1981; Govindarajulu et al. 1993; Groos 1898; Smith 1978; Symons 1978). Lewis and Barton (2006) propose a

physiological mechanism for sex differences in primate play suggesting that the actions of perinatal androgens on the amygdala and hypothalamus cause sexual differentiation in their size. However, the propensity for males to engage in play more frequently than females is not universal among primates. I (2010) found no difference in the amount of time red colobus males and females engaged in play fighting even though as adults males are much more aggressive than females. Likewise, Raleigh et al. (1979) found no difference in the amount of time male and female vervets played. Furthermore, in some species, including talapoins, females play more than males (Wolhiem 1977). For comparison, in a long-term study of meerkats, Sharpe (2005) found no correlation between juvenile play fighting and adult fighting success in males. Thus, the delayed motor benefits of play fighting, if any, may vary by species and sex. For example, red colobus males and females may derive different benefits (or no benefits) from play. Furthermore, what various species or sexes acquire through play may not be essential to their development or may serve only to enhance that development.

Choice of play partners also varies among wild primates, from species in which males and females show distinct differences in their partner preferences—savannah baboons (Cheney 1978); chimpanzees (Pusey 1990); and rhesus macaques (Symons 1978)—to species like vervets, in which some populations show clear differences in partner preferences (Govindarajulu et al. 1993); and others show no preferences at all (Lee 1983). The rules governing play-partner selection and initiating strategies may be situational. For example, to gain the most from play fighting and to reduce the possibility of injury, ideal play partners would match in size and strength (Symons 1978). However, if play helps prepare animals to cope with unexpected situations (Pellis et al. 2010), individuals would benefit from playing with partners of both sexes and all ages.

Initiating Play

Learning how to initiate social play and to sustain it are important skills. Initiating strategies among primates may vary by the age of the target animal. Primates may use calm approaches and gentle contacts with younger animals and boisterous approaches and rough contacts with animals of similar age and older (Van Lawick-Goodall 1968). This study focuses on the behaviors red colobus monkeys used to initiate both play fighting and social locomotor play— including play chasing—and on the corresponding responses of the targets of these initiation

attempts. It is important to note that play fighting and play chasing are not less aggressive forms of adult aggression. Rather, they are distinctive behaviors with their own characteristics and sets of rules (Reinhart et al. 2010). They are distinguished from aggression and fighting by the presence of both cooperation and competition. They involve reversals of aggressive roles (e.g., pursuer becomes pursued), lighter blows and bites, stereotyped signals that are absent in fighting, and the placing of lesser importance on defensive maneuvers.

Nonhuman primates deploy a variety of tactics to initiate play (Powers 2000). I describe the behaviors they use to initiate play as provoking, which involves physical contact or the threat of physical contact, and inviting, which does not involve contact or the threat of it. Provoking behaviors include biting, slapping, and grabbing specific targets on the body, as well as leaping at, pouncing on, chasing after, and running toward the play partners. Inviting behaviors include shaking sticks or branches from a distance, swinging at play partners, and gamboling and leaping beside them.

Key Questions

In this study, I sought answers to several questions: (1) Who is more likely to attempt play initiations, and who is the target of initiations? (2) What physical actions do red colobus monkeys use to initiate play? (3) What is the success rate of initiating attempts? (4) Is play more likely to ensue after physical contact by the initiator? (5) What type of play results from specific initiating behaviors?

Methods

Subjects

The focal animals for this study were infants and juveniles from a single group of red colobus monkeys living in Kibale National Park in Uganda. The group consisted of forty-two individuals: nine infants, eight juveniles, eight subadults, eleven adult females, and six adult males. Red colobuses are arboreal and eat primarily leaves. Their digestive tracts and behavior patterns are adapted to processing large amounts. Adult red colobuses spend much of their day resting and grooming in close proximity to each other after gorging on leaves in trees with crowns large enough to accommodate the entire group. This lifestyle provides youngsters with ample opportunities to engage in social play in relative safety (Worch 2002). Infants and juveniles spend more than one-fourth of their

day playing (Worch 2002, 2010), an amount far surpassing the smaller, fruit-eating, red-tailed monkeys (2.13 percent) and blue monkeys (1.83 percent) with whom red colobuses frequently associate at Kibale (Worch 2002). Unlike the other species, however, immature red colobuses were the only ones interested in interspecific play. It is the only species I observed that attempted, always unsuccessfully, to initiate play with species other than its own.

Site

I collected data at Makerere University Biological Field Station, located in the northwest corner of Kibale National Park near the village of Kanyawara. The field station sits approximately 50 kilometers north of the equator at an altitude of 1500 meters (Mahaney et al. 2005). Kibale encompasses a medium-altitude, moist, evergreen forest. The tree canopy averages around 30 meters in height with some trees approaching 55 meters (Butynski 1990). Thus, when monkeys reach the upper canopy, getting a clear, unobstructed view of them can be difficult. Detailed descriptions of the site can be found in Strusaker (1975) and Skorupa (1986).

Data Collection and Analysis

I recorded approximately four hours of red colobus play and nonplay activity on an *ad libitum* schedule using a Sony Hi8 camcorder with twenty-four-times optical zoom, manually adjusted backlighting, and manually adjusted focus. I ran the video through a Sony player with touch-advance slow motion and a digital counter, and I viewed the video on a Sony monitor. With the help of two undergraduate research assistants, I scanned the video for instances of play initiation. When we observed a play-initiation attempt, we noted the age and behavior of the initiator and the age, species, and response of the recipient. We determined the age of the initiating and target individuals primarily by body size. The presence of a mother also helped us confirm whether individuals were infants or juveniles. Although I was frequently able to determine the sex of immature red colobuses in the wild, I found it difficult to get the excellent visibility required for a proper view of the perineal region (Worch 2010). However, it was impossible for us to determine sex based on the video back at our laboratory.

Following Martin and Caro (1985), I defined play as motor patterns resembling those used in serious functional contexts—feeding, fighting, fleeing, traveling, and reproduction—but used in modified forms in activities that appear to have no obvious immediate benefits to the players. The motor acts have some

or all of the following features: exaggeration of movements, repetition of motor acts, and fragmentation or disordering of sequences of motor acts relative to how they would be performed in functional contexts.

Social play in red colobuses at Kibale includes play fighting, which is characterized by body contact (appendages, head, and torso), and behaviors such as wrestling, grappling, slapping, pouncing, grabbing, pulling, and pushing. Although in both play fighting and aggression, one individual tries to gain advantage over another, they are distinctly different behaviors (Reinhart et al. 2010). I defined play fighting by the presence of one or more of the following: cooperation (as players reverse aggressive roles), the use of lighter bites and blows (usually with open hands), and the absence of screams or threatening behaviors (Cheney 1978).

Social play also includes play chasing, games, and parallel locomotor play (in which individuals gambol, hang, swing, leap, bounce, and run with but not at or away from each other). Although there are elements of play chasing that resemble play fighting, I classified it as social locomotor play. Unlike aggressive pursuit and flight, individuals who are play chasing do not run at maximum speed toward a protector or toward a hiding place, and they do not emit panic calls (Aldis 1975). Whereas play chasing is a dyadic activity, I have observed a similar chasing behavior among small groups of monkeys that is best described as follow-the-leader.

Results

Initiators and Targets

I observed a total of eighteen play initiating attempts. This is equivalent to 4.5 initiations per hour. All but one attempt was made by an old infant; in the one exception an old juvenile initiated the play. The majority of the target animals were old infants (fifteen of eighteen), two of which were black-and-white colobus monkeys. One young juvenile and two young infants, including one blue monkey, were also targeted.

Initiating Behaviors and Success Rates

Eight of the eighteen attempts (44.4 percent) did not result in social play (figure 1). Two unsuccessful attempts by an old infant targeted old infant black-and-white colobus monkeys. One resulted in an aggressive rebuff by the

Age of solicitor	Initiating behavior	Target age	Initial response
old juvenile	bite shoulder	old juvenile	aggressive bite
old infant	grapple	old infant	aggressive hit
old infant	grapple	old infant black-and-white monkey	aggressive grapple
old infant	grab leg	old infant black-and-white monkey	withdraw
old infant	reach	old infant	withdraw
old infant	swing	old infant	withdraw
old infant	slap arm/hand	young infant blue monkey	run
old infant	slap arm/hand	old infant	aggressive hit

Figure 1. Unsuccessful play initiations by red colobus monkeys

target and withdrawal of the initiator; the other ended in a passive withdrawal by the target. A third unsuccessful interspecific attempt by an old infant targeted a young infant blue monkey and resulted in the younger infant's passive withdrawal. One unsuccessful attempt was initiated by an old juvenile who targeted another old juvenile. This attempt also resulted in a brief aggressive rebuff followed by withdrawal of the target animal. The four remaining unsuccessful attempts were initiated by old infants who targeted other old infant red colobus. Two of these attempts resulted in aggressive rebuffs; and two resulted in passive withdrawals.

Ten of the eighteen attempts (55.6 percent) resulted in play activities—four instances of play fighting and six instances of social-locomotor play (figure 2). All successful attempts were initiated by old infants. One target animal was a young juvenile, one was a young infant, and the other eight were old infants.

Contact versus Noncontact Initiation Behaviors

The majority of successful attempts (eight out of ten) and unsuccessful attempts (six out of eight) involved contact with the target animal (figure 1). Based on the research of Reinhart and her colleagues concerning macaques (2010), I hypothesized that attempts in which physical contact occurs between the initiator and the target animal are more likely to lead to play than attempts without contact. With the probability set at .50 for both strategies, one-sample binomial tests were performed. The results show that physical contact with the target animal was associated significantly more with playful outcomes than noncontact initiation strategies ($N = 10$; $p = .044$). Furthermore, although not always successful, red colobuses attempted to initiate play through physical contact with the target animal significantly more often than not ($N = 18$, $p = .031$).

To initiate play, the instigator most frequently slapped an arm or leg. Slapping a leg resulted in play two out of three times. Slapping an arm resulted in play in only one of three attempts. Biting the shoulder succeeded in one of two attempts. Neither grappling nor grabbing a leg resulted in play, whereas pulling fur, grabbing a hand, and poking the chest did lead to play. The three noncontact initiating behaviors were leaping, reaching, and swinging. Only the two leaping attempts resulted in play. I found no correlation between a specific initiating behavior and the targets' responding behavior ($r = .438$, $p = .069$) or between a specific initiating behavior and whether the attempt resulted in play or not ($r = .343$, $p = .163$).

Initiating behavior	Target age	Initial response	Ensuing play
slap arm/hand	old infant	grapple	play-fighting
slap foot/leg	old infant	run	social locomotor
slap foot/leg	old infant	drop to branch	social locomotor
bite shoulder	old infant	grapple	play-fighting
grab hands	young juvenile	grapple	play-fighting
leap toward	old infant	leap	social locomotor
leap toward	young infant	leap	social locomotor
poke chest	old infant	grapple	play-fighting
pull fur	old infant	bounce	social locomotor
pull fur	old infant	drop to branch	social locomotor

Figure 2. Successful play initiations by old infant red colobus monkeys

Discussion

In four hours of recorded video of red colobus play and nonplay activities, we observed eighteen play initiation attempts. Old infants are the most frequent initiators of play, as well as the most likely targets of initiating attempts. The results indicate that red colobuses are significantly more likely to initiate play by making physical contact with a target animal and that play is more likely to occur with physical contact than without. Although the data are preliminary, they suggest that red colobus monkeys exhibit a species-specific strategy to initiate play by making contact with some portion of the target animal's body. However, no one strategy for making contact with the target animal was more successful than any other at initiating play.

Powers (2000) identified nine behaviors that primates use to initiate play fighting: lunge/pounce, bite/slash, push, paw/swat/kick, grab/hold, pull, wrestle/pin, mount, and chase. All of these behaviors involve contact or the threat of contact if the target animal is caught. Red colobuses at Kibale employed six of these behaviors during thirteen attempts to initiate play: bite, push, pull, swat, grab, and wrestle. Three attempts resulted in play fighting, four attempts resulted in locomotor play, and six failed to lead to any social play. Because of its aggressive appearance, play chasing is often combined with play fighting to signify the category of social play (Powers 2000) even though distinct differences between the two forms of play have been known for some time (Aldis 1975). Furthermore, parallel play, social-object play, and games are seldom mentioned in studies about social play in primates.

Therefore, it is not surprising that my review of the literature did not uncover a list of general initiating behaviors primates use that result in social play other than play fighting. However, I observed that leaping toward the target animal, pulling fur, and slapping a leg, all three of which were identified by Powers (2000) as initiators of play fighting, led to social-locomotor play in red colobuses on five occasions. Furthermore, we observed that these behaviors did not result in play fighting. Although the data set is small, these results underscore the complexity of the play initiation-reception process and the unpredictability of the outcome of an initiating attempt. Nonetheless, making contact with the target animal seems to be the underlying strategy for initiating play in red colobus.

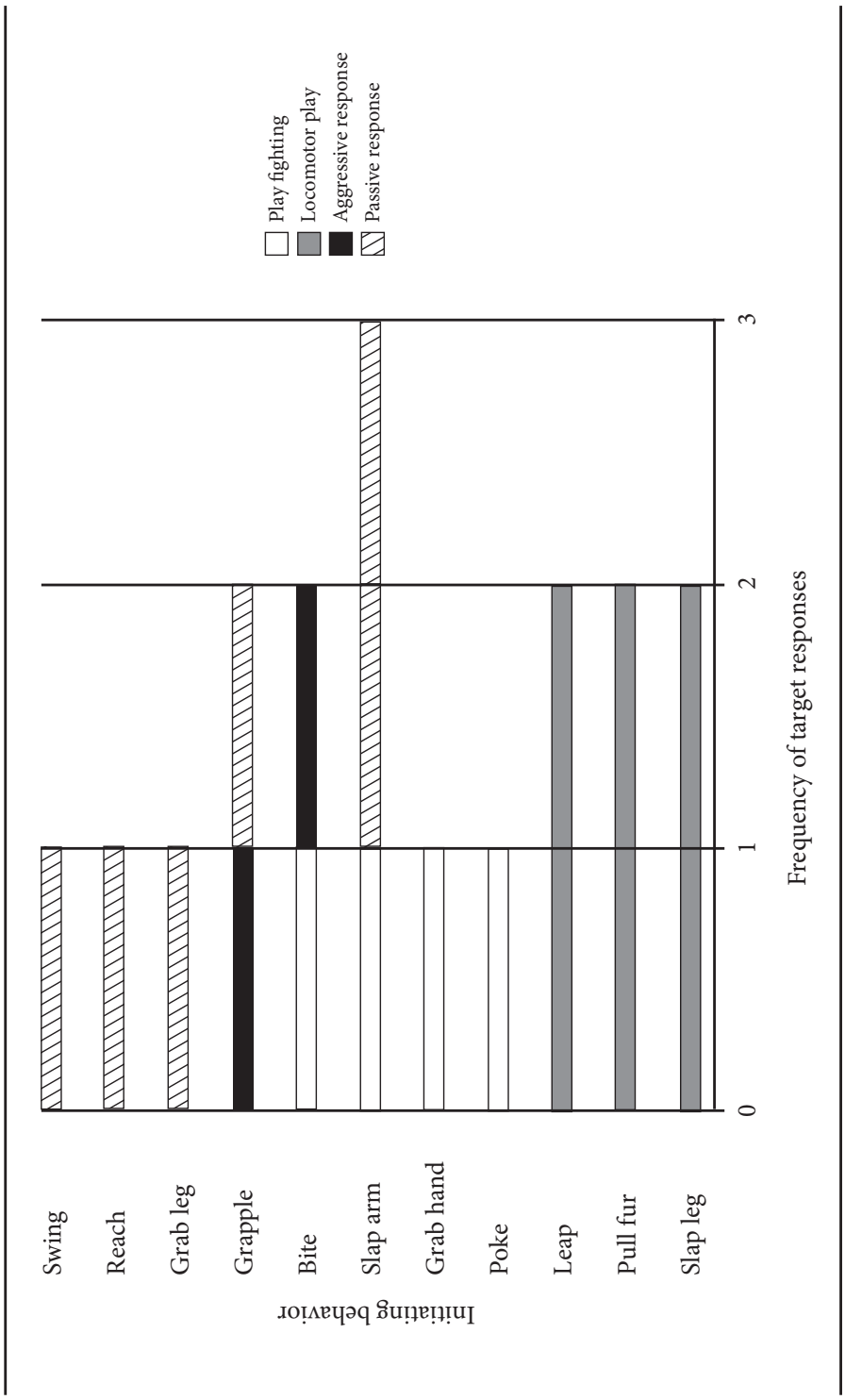

Figure 3. Play initiating behaviors and frequency of response behaviors of target animals

Limitations

One important limitation to this study involves the number of play initiations we observed. With only eighteen initiation attempts, statistical analysis was limited to a few nonparametric tests. Another limitation is the number of old infants included in the data set. The abundance of attempts by old infants that we observed in the video exceeded our expectations based on the amount of time each age class has been reported to play at Kibale (Worch 2002, 2010). That is, I found through field observations that old infants and young infants engage in nearly equal amounts of play overall (32 percent and 31 percent of all observed behavior, respectively) and social play in particular (49 percent and 48 percent of all observed play, respectively); therefore, I expected to observe some initiation attempts made by young infants on the video.

Furthermore, although my field observations show that young juveniles play significantly less than old infants (24 percent and 32 percent of observed behavior, respectively), they engage in significantly more social play than old infants (59 percent and 49 percent of observed play, respectively); therefore, I expected to observe at least one initiation by a young juvenile in the video. Finally, old juveniles engage in much less play overall compared to the other age groups (10 percent of observed behavior) and only 28 percent of their play is social, yet an attempt by an old juvenile was recorded. Aside from the potential for unconscious bias in how I determined when to videotape, I can offer no satisfactory explanation for the discrepancy between the field-based and recorded frequencies.

Future Directions

Preliminary in nature, the results of this study suggest a number of directions for future research. For example, in a study of three monkey species at Kibale, including red colobus, I found that a species' diet has a significant influence on the amount of time youngsters have available to play (Worch 2002). Red colobus monkeys at Kibale are remarkably playful. These leaf-eating monkeys engaged in up to fourteen times more play than the fruit-eating monkeys with which they closely associate. Is this dietary relationship a universal pattern among primates? Red colobuses live in larger social groups than the other monkeys at Kibale. What is the influence of group size on play among species with similar diets?

Play initiation was not a central focus of my research on play among red colobuses. A study focused exclusively on play initiations, however, would produce a richer data set to address a number of research questions. How, for example, do initiation behaviors change with age? Are specific behaviors used more frequently to initiate play? Are initiating behaviors associated with the physical environment, such as tree crown and substrate size? Do the types of initiating behaviors and target animal responses vary by time of day?

The height of the canopy and dense understory impose significant limitations to play research at Kibale. The identification of individuals and their relative ranking in the social hierarchy was not possible under field conditions at Kibale; therefore, we were not able to identify individuals and their ranks on the video. However, at field sites where individuals are easily identified, one could carry out a detailed naturalistic study of differences in initiating and responding behaviors based on rank, age, and sex. Individual primates could be followed longitudinally to examine changes over time in play initiating behaviors, responsiveness to initiations, and the types of play exhibited by age and sex. In addition, one can ask how play partner relationships manifest themselves in adulthood. Although some work has been done in this area, only a few species have been examined.

An examination of play initiation and response based on social rank in primates would serve as a comparative backdrop to contextualize the role of play fighting in humans. For example, Pellegrini (1995) found in adolescent boys that play-fighting initiations by popular boys tended to show the restrained features of play, rather than those seen in aggression, and these boys tended to respond to initiations in an affiliative manner. Furthermore, these initiations tended to lead to play more often than aggression. However, unpopular boys more often used aggressive initiation behaviors and frequently responded to initiations in an aggressive manner. Thus, play fighting for popular boys serves as a means to develop social competence; for unpopular boys, it may indicate a social-information deficit (Pellegrini 1995) or serve as a means to achieve some measure of dominance otherwise lacking in everyday life (Smith 1989). Comprehensive studies across a wide range of species would help us understand the evolutionary significance of play as humans negotiate the trials of living in social groups.

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