

Some Preliminary Evidence of the Social Facilitation of Mounting Behavior in a Juvenile Bull Asian Elephant (*Elephas maximus*)

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This study recorded sexual behavior within a captive herd of 8 Asian elephants for approximately 230 hr on 50 days over a period of 10 months. The study observed a single adult and a single juvenile bull mounting cows more than 160 times. When the juvenile bull was between 4 years, 2 months and 4 years, 8 months old, he exhibited mounting behavior only on days when adult mounting occurred. Adult mounting always occurred first. Beyond the age of 4 years, 8 months, the juvenile bull exhibited spontaneous mounting behavior in the absence of adult mounting. This suggests that mounting behavior may develop because of social facilitation. Determining the significance of the presence of sexually active adults in the normal development of sexual behavior in juveniles will require further studies. Encouraging the establishment of larger captive herds containing adults and calves of both sexes—if their presence is important—would improve the welfare of elephants in zoos and increase their potential conservation value.

The development of normal sexual behavior in zoo elephants is both a welfare issue and a conservation issue. The establishment of a self-sustaining captive population of Asian elephants (*Elephas maximus*) is essential if zoos are to play a significant role in the long-term conservation of this species. However, current evidence suggests that Asian elephants in zoos will be extinct within about 50 years due to low fecundity and calf survival (Rees, 2003a; Taylor & Poole,

1998; Wiese, 2000). Increased importation into Western zoos is considered undesirable both from a welfare and a conservation perspective (Rees, 2003a; Sukumar, 2003). It is, therefore, important to improve breeding success in zoos.

There often is very little contact between male and female zoo elephants prior to breeding attempts, and there is anecdotal evidence that some captive bulls show little interest in females and may not know how to mate. Few zoos keep breeding adults alongside young animals, so there has been little opportunity to study the effect of adult sexual behavior on that of juveniles. Useful bibliographies of studies of elephant reproductive behavior may be found in Spinage (1994) and Bagemihl (1999).

Play, particularly playful fighting, often leads to sexual behavior in mammals (Ewer, 1968). Play fighting is common in elephants, and mounting as an element of their sex play has been widely reported in the African species (*Loxodonta africana*; Douglas-Hamilton & Douglas-Hamilton, 1975; Lee, 1987; Moss, 1988). Lee (1986) recognized mounting as an element of play, but she did not discuss its frequency or significance. Douglas-Hamilton and Douglas-Hamilton observed that sex play in African elephants continues in small but mature bulls until they are old enough to be accepted by cows.

Early social isolation from conspecifics can result in deficits in adult courtship and copulatory behavior in mammalian species. Such deficits have been recorded in rhesus macaques (*Macaca mulatta*; Harlow, 1962, 1965), chimpanzees (*Pan troglodytes*; Riesen, 1971; Rogers & Davenport, 1969), gorillas (*Gorilla gorilla*; Beck & Power, 1988), Norway rats (*Rattus norvegicus*), guinea pigs (*Cavia porcellus*), and domestic dogs (Beach, 1968; Gerall, Ward, & Gerall, 1967; Gruendel & Arnold, 1969; Valenstein, Riss, & Young, 1955).

The sexual behavior of male mammals is particularly sensitive to variations in early social experience (Estep & Dewsbury, 1996). In some species, males show an enhancement of sexual performance if they watch other males mount females prior to their own mating. This social facilitation has been observed in domestic cattle and domestic goats (Mader & Price, 1984; Price, Smith, & Katz, 1984).

The lack of social experience may be an important factor causing low libido in some male elephants; however, there have been no studies of the effect of socialization on the normal development of male sexual behavior. This study tests the hypothesis that social facilitation played a part in the development of sexual behavior in a juvenile Asian elephant when he was kept in the same enclosure as a sexually active adult bull.

METHOD

The subject of this study was a herd of Asian elephants held at the North of England Zoological Society's National Elephant Centre (Chester Zoo) in Cheshire,

England. At the beginning of the study, the herd consisted of one adult bull (17 years old), five adult cows (aged 17, 30, 30, 32, and 43 years), a juvenile bull (4 years, 2 months old), and a cow calf (12.5 months old). The adult bull was sexually experienced and had sired six calves prior to the beginning of this study. During the day, the herd was confined within an outdoor enclosure surrounded by a dry moat.

The herd was observed for 232 hr over a period of approximately 10 months from mid-January to early November 1999. The study was subdivided into two main study periods: Study Period 1 (January–July 1999), during which no spontaneous juvenile sexual behavior was observed; and Study Period 2 (July 1999–November 1999), which included observations of spontaneous juvenile sexual behavior. Recordings were made continuously throughout the day on a total of 45 days (Study Periods 1 and 2) when all elephants were present together in the paddock. Further observations were made on 5 additional days (between February and May 1999, within Study Period 1) when the adult bull was separated from the herd for management reasons (the control days).

All recordings were made by direct observation by the author, continuously throughout the day (for up to 6 hr). The design of the enclosure was such that all elephants could be seen at all times during the observation period. On the majority of days, observations began when the elephants were released into their enclosure at about 10 a.m. and ended when they were returned to the elephant house at about 6 p.m. Some observation periods were reduced because of operational changes in the elephants' routine and extreme weather conditions.

All incidents of mounting and attempted mounting by bulls were recorded, noting the time of the event (to the nearest minute) and the elephants involved. Attempted mounting was defined as a bull standing directly behind the cow and placing at least one forefoot on her back. The reproductive status of the females was not monitored routinely, but two were pregnant throughout the study; two others were believed not to exhibit estrus.

There was no possibility of adult matings at night because the sexes were housed separately. During the initial months of the study, however, the juvenile bull was housed with the cows and the young calf. No recordings were made while the elephants were confined in the elephant house during the day or the night.

RESULTS

Over a period of 50 days, the two bull elephants were seen mounting cows on 164 occasions (Table 1). During the first part of the study (Period 1), the juvenile bull mounted the cow calf only on days when the adult bull mounted an adult cow (Figure 1). The adult bull was the first to mount on 10 of these days, and the juvenile mounted first on a single day (Figure 2). On 2 days, adult

TABLE 1
Total Number of Mountings Observed During the Study

<i>Recipient of Sexual Mounting Behavior</i>				
<i>Bull</i>	<i>Adult Cow</i>	<i>Cow Calf</i>	<i>Juvenile Bull</i>	<i>Total</i>
Adult	60	0	12	72
Juvenile	2	102	NA	104
Total	62	102	12	176

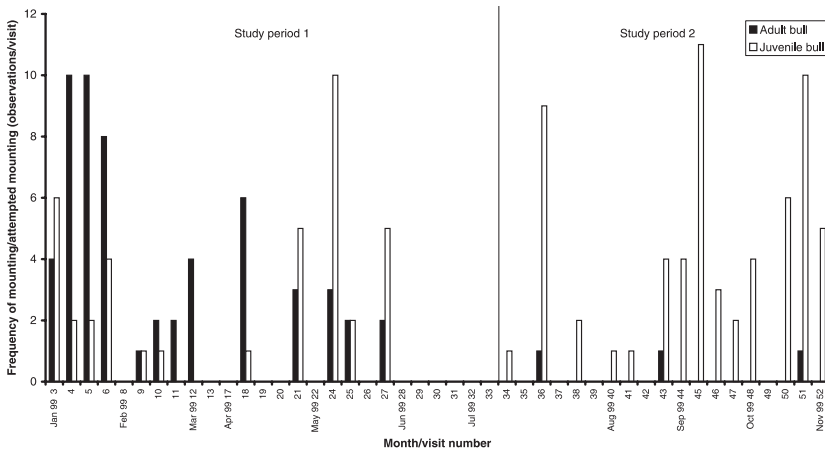


FIGURE 1 Frequency of mounting by adult and juvenile bulls.

mounting was observed in the absence of juvenile mounting. During this period, there was an extremely high association between days on which adult mounting behavior was observed and the days on which mounting behavior was observed in juveniles, $\chi^2(1, N = 26) = 15.758, p < .0005$, one-tailed test with Yates’s correction (Table 2).

There was a change in the juvenile bull’s behavior after the beginning of July 1999 (Figure 1). In the 6 months prior to this change, juvenile mounting was observed only once in the absence of adult mounting, but this occurred on one of the 5 days on which the adult bull was isolated from the herd (one of the control days). From the beginning of July to the beginning of November 1999 (Study Period 2), sexual behavior of juveniles almost always was spontaneous and only rarely was associated with adult sexual behavior, $\chi^2(1, N = 19) = 0.171, p > .25$, one-tailed test with Yates’s correction, and the frequency of juvenile mounting more than doubled (Table 3). The frequency of juvenile mounting increased from 0.32 per hr of

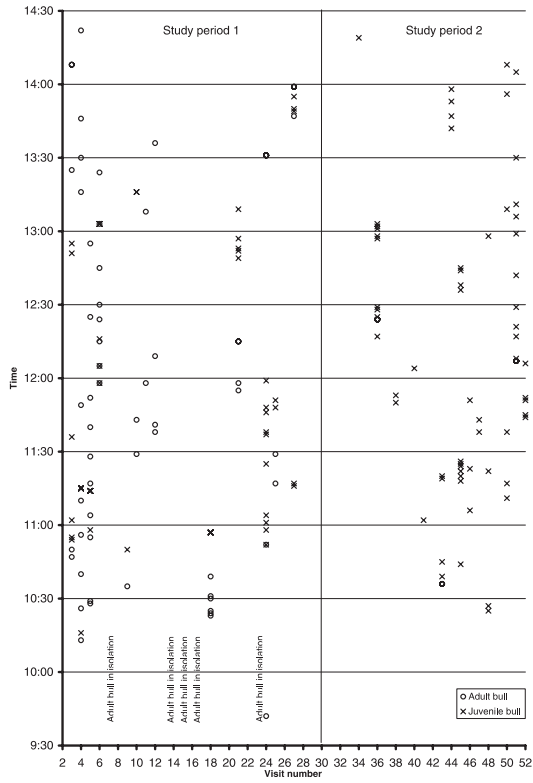


FIGURE 2 Temporal distribution of mounting behavior.

TABLE 2
Number of Days on Which Adult and Juvenile Sexual Behavior
Was Observed During Study Period 1

		<i>Adult Bull</i>		
		<i>Mounting</i>	<i>No Mounting</i>	<i>Totals</i>
Juvenile bull	Mounting	11	0	11
	No mounting	2	13	15
	Totals	13	13	26

TABLE 3
 Number of Days on Which Adult and Juvenile Sexual Behavior
 Was Observed During Study Period 2

		<i>Adult Bull</i>		
		<i>Mounting</i>	<i>No Mounting</i>	<i>Totals</i>
Juvenile bull	Mounting	3	11	14
	No mounting	0	5	5
	Totals	3	16	19

observation in Period 1 to 0.70 per hr in Period 2, whereas the frequency of mounting by the adult bull fell from 0.46 to 0.03, respectively. During the 5 control days, when the adult bull was isolated from the herd in the adjacent bullpen, the juvenile bull mounted the cow calf only once during 19 hr of observation.

In Period 2, mounting was observed on 14 of the 19 study days. The adult bull mounted a cow on just 2 of these days, and juvenile mounting followed this. The juvenile bull was the first of the two to mount on just 1 day. On a further 11 days, he was the only bull to mount.

There were 20 occasions when an adult mounting was followed by a juvenile mounting (Study Periods 1 and 2 combined). The mean interval between the adult mountings and the next juvenile mounting was 10.5 min ($\sigma = 21.34$, $n = 20$) ranging from less than 1 min, simultaneous ($n = 5$) to 93 minutes.

DISCUSSION

Between the ages of 4 years, 2 months and 4 years, 8 months, the juvenile bull exhibited mounting behavior only on days that the adult bull was sexually active; on all but one occasion, adult mounting occurred first. The mean interval between consecutive adult and juvenile mountings was 10.5 min, but some were almost simultaneous. After the age of 4 years, 8 months, the juvenile bull exhibited spontaneous sexual behavior.

These data appear to support the hypothesis that mounting behavior in the juvenile bull was facilitated by the occurrence of mounting behavior in the adult bull during Period 1. However, an alternative hypothesis is that the juvenile bull mounted the juvenile cow only when the adult bull was occupied mounting an adult cow and that later in the year (Period 2) the juvenile was free to mount as the adult cows were not receptive. In the wild, large adult bulls normally prevent younger bulls from mating, but Sukumar (1994) reported opportunistic mating by juveniles. Poole (1989) showed that older, dominant African bulls monopolize females only during the middle phase of estrus when they are most likely to con-

ceive. In early and late estrus, a female may be mated by less socially dominant males. The data from Period 1 do not support this alternative hypothesis because on some days—following an initial mounting by the adult bull—the juvenile bull mounted the juvenile cow on several occasions later in the day when the adult bull was not engaged in sexual behavior (Figure 2).

In Period 2, the juvenile bull showed spontaneous mounting behavior. This may have been because he had now sufficiently improved the behavior through practice, or it may have simply been due to maturation. In any event, the presence of the adult bull did not inhibit the juvenile bull's sexual behavior. Furthermore, although adult cows (especially the mother) were sometimes observed chasing the juvenile bull away from the cow calf when he was "courting" or mounting her, the adult bull was never observed attempting to deter the juvenile bull from sexual activity during the study. The alternative interpretation, that adult females were unreceptive in Period 2, leaving the juvenile bull free to mount without being inhibited by the adult bull, could not be tested because no data on the reproductive status of the cows were available. However, two cows were pregnant from the beginning of the study and two others were believed not to exhibit estrus, so the availability of estrus females throughout the study could never have been high.

Improvement in the performance of a behavior pattern may be associated with the development of the nervous system due to maturation (Bolhuis & Hogan, 1999; Cruze, 1935; Hess, 1956; Spalding, 1873). This could be established only by studying control animals who have not been reared in the presence of sexually active adults. The development of sexual behavior in most vertebrates is linked with the growth of the gonads, and the main hormone that induces sexual behavior in males is testosterone (Slater, 1978). An Asian bull has successfully mated at the age of 9 years (Spinage, 1994), and the adult bull in this study fathered a calf at the age of 10 (Rees, 2003c). However, it seems unlikely that the juvenile bull in this study had reached puberty at the age of 4 years, 8 months.

It is possible that the adult and juvenile bulls initially exhibited mounting behavior on the same days because they both were responding to chemical signals from the adult cow(s). In almost all cases where juvenile and adult sexual behavior were observed on the same day, however, the latter preceded the former, indicating a response to adult behavior rather than to chemicals present in the urine and feces of adult cows (Rasmussen & Schulte, 1998).

Especially with bulls, early association with other young animals may enhance the future breeding potential of juvenile elephants. There is evidence from other mammalian studies that the role of experience in mating is greater in males than in females (Beach, 1944, 1947; Carr, Loeb, & Wylie, 1965) and particularly important in higher mammals (Beach, 1967). Opportunities for such experience to occur from soon after birth have been reported for some species (Hanby, 1972; Harlow & Harlow, 1965; Zuckerman, 1932). It may be significant that very young bull calves show an interest in adult urine and feces if they are exposed to them (Rees,

2003b), considering the important role chemical communication undoubtedly plays in elephant reproduction (Rasmussen & Schulte, 1998).

This article presents preliminary evidence of the possible social facilitation of sexual behavior in a single juvenile bull Asian elephant. There is evidence that the juvenile bull was stimulated to mount the juvenile cow after observing adult mating up to the age of approximately 4 years, 8 months. In the absence of a control, however, it is not possible to determine whether the occurrence of spontaneous mounting behavior thereafter was the result of facilitation, maturation, or the absence of inhibition.

Throughout the world, most of the zoos currently holding Asian elephants have very small groups, with some 50% holding either one or two elephants (Rees, 2003a; Wiese, 2000). Few zoos afford calves the opportunity to learn sexual behavior from adults, simply because most zoos keep small numbers of elephants.

The results of further studies of the development of sexual behavior in zoo elephants may be important in improving their welfare and establishing their conservation potential. Such studies should attempt to answer the following questions:

1. Does the social isolation of juvenile bulls (especially from juvenile cows) reduce their libido?
2. Do juvenile bulls reared in isolation from sexually active adults develop normal sexual behavior by maturation?
3. Does the presence of sexually active adult bulls inhibit sexual activity in juvenile bulls and subdominant bulls?

Unfortunately, only carefully controlled experiments—unacceptable from a welfare point of view—or comparisons of animals reared under different husbandry regimes—where many variables might influence the outcome—could answer such questions.

If socialization proves to be important to the development of normal sexual behavior in elephants, the keeping of small groups in zoos could adversely affect the welfare of the individual animals and jeopardize the long-term prospect of creating a sustainable zoo population that eventually may contribute to elephant conservation.

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