

THE USE OF SPACE BY LOWLAND GORILLAS (*GORILLA G. GORILLA*) IN AN OUTDOOR ENCLOSURE¹

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ABSTRACT. Four adult gorillas housed together at the Cincinnati Zoo limited their space use to particular enclosure sections. Contrary to results from a study of juvenile gorillas, there was no consistent relationship between dominance rank and the degree to which an animal limited its space use.

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INTRODUCTION

Within groups of juvenile gorillas, body size is positively correlated with status in the dominance hierarchy (Schaller 1963, Freeman and Alcock 1973). A Cincinnati Zoo study of one group of 4 juvenile gorillas and a second group of 3 juvenile gorillas determined that smaller animals displayed less habitual use of certain cage sections than did larger animals (Hedeem 1982). The dominant larger gorillas apparently occupied the sections that they preferred, leaving the smaller subordinates to distribute themselves throughout the remainder of the cage. Likewise, in studies of human groups, dominant members most frequently used the preferable areas in a prison (Austin and Bates 1974), in a rehabilitation center cottage (Sundstrom and Altman 1974), and in summer camp cabins (Blood and Livant 1957, Savin-Williams 1977).

The male is always the dominant animal within an adult gorilla group consisting of a silver-backed male and several females (Schaller 1963, Harcourt 1979a). Although the females also display dominance interactions, they lack a stable hierarchy among themselves (Harcourt 1979b). The present study of confined adult gorillas was designed to determine if the dominant male would limit his space use more than would the subordinate females.

METHODS AND MATERIALS

King Tut, a male lowland gorilla (*Gorilla g. gorilla*), arrived at the Cincinnati Zoo in 1952. Penelope, a female, was given to the zoo in 1954. Hatari, a male, and Mahari, a female, were donated in 1965. All 4 animals were estimated to be 3 years old at time of arrival.

Samantha was born to King Tut and Penelope on 31 January 1970 (Lotshaw 1971). Samantha was hand-raised in the zoo nursery. She was later housed with 3 other juveniles in a 4 × 3-m indoor cage, an enclosure identical to those that housed the zoo's adult gorillas.

On 6 May 1978, the silver-backed Hatari and females Mahari, Penelope and Samantha were moved to a recently-completed outdoor enclosure. They remained together there through 1980. During this period, approximate weights were 160 kg for Hatari, 125 kg for Mahari, 75 kg for Penelope, and 70 kg for Samantha. The enclosure measured 42 × 10 m. By using vegetation and rocks as visual cues, the enclosure was divided into 12 sites, each approximately 35 m².

The 4 gorillas were observed from 20 September through 14 November 1978 (period 1), from 14 September through 14 October 1979 (period 2), and from 18 September through 19 October 1980 (period 3). Data were collected during 1129 minutes of period 1, 824 minutes of period 2, and 923 minutes of period 3. A time sampling technique was employed, wherein records were made of the gorillas' locations as the second hand passed the minute mark. All observations were made between 13.00 and 17.00 EST.

The "spread of participation index," a numerical measure of spatial behavior (Dickens 1955, Sundstrom and Altman 1974), was calculated for each subject for each of the observation periods 1-3. The index is calculated by the formula:

$$S = \frac{M(n_b - n_a) + (F_a - F_b)}{2(N - M)}$$

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where N = total number of observations of the subject; M = mean frequency of observations in

all of the enclosure sites = N /number of sites; n_b = number of sites with frequencies less than M ; n_a = number of sites with frequencies greater than M ; F_a = total number of observations in sites with frequencies greater than M ; F_b = total number of observations in sites with frequencies less than M .

The spread of participation index ranges from zero to an upper limit of one. Low scores indicate equal usage of many sites. The higher the score, the greater the tendency of a subject to use just a few sites. An index of 1.0 indicates a subject's use of a single site.

RESULTS

Spread of participation index values are listed in table 1. The values, all between 0.2 and 0.7, indicate there was an uneven distribution of locational data for each of the gorillas.

DISCUSSION

Fischer and Nadler (1977, 1978) pointed out that spacing in a wild gorilla group is facilitated by dominance behavior. A subordinate member avoids the space around a dominant animal. Dominance relationships might also be related to spacing in a captive group of gorillas. As in a free-ranging troop, the dominant gorilla in a confined group would occupy a space that it prefers, leaving the subordinates to distribute themselves throughout the remainder of the enclosure. Although the dominant animal could roam the entire enclosure, there would be a positive correlation between dominance rank and frequent use of certain areas.

In 2 groups of juvenile gorillas at the Cincinnati Zoo, dominant animals had higher spread of participation index values than did subordinate cagemates (Hedeem 1982). The index values disclosed a positive relationship between dominance rank and the degree to which an animal limited its space use. Likewise, in the present study of adults, the index values of Hatari, Mahari and Penelope showed a positive relationship between dominance and the frequency of use of certain enclosure sites (table 1). But this correlation dissolved when Samantha's index values were considered in relation to the lower values of

TABLE 1
Spread of participation index values.

Period:	1	2	3
Hatari	0.595	0.642	0.677
Mahari	0.445	0.544	0.495
Penelope	0.303	0.211	0.426
Samantha	0.596	0.673	0.685

the 3 older gorillas. Although she was the smallest gorilla, Samantha displayed the most limited use of space.

Perhaps Samantha's limited space usage was due to her lack of experience with either adult gorillas or an outdoor setting. Prior to her introduction to the new enclosure, Samantha had never been housed with the adults, although they had been housed with each other. Zoo-born Samantha had spent her youth in cages no larger than 12 m², while wild-born Hatari, Mahari and Penelope had spent at least their infant years in African forests. Whether in reaction to the sky, the vegetation, or the three older adults, Samantha was possibly frightened and confused by her new environment. In a confined human group, a subject who is faced with such a situation often achieves some security by limiting his movements to a small portion of the entire enclosure (Altman 1975). Samantha's intense use of particular areas may have been her attempt to reduce complexity and gain control by mastering at least part of the outdoor enclosure.

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