

ANIMAL PROXEMICS: A STUDY OF THE USE OF SPACE  
IN MACACA SILENUS AT THE ASSINIBOINE PARK ZOO

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by

Susan G. Hornshaw

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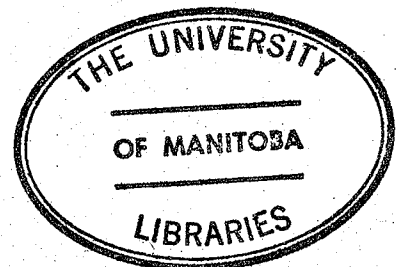
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of the degree of

MASTER OF ARTS

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## Chapter I

### INTRODUCTION

Almost all behavioral primatological studies to date have attempted to make statements regarding the social organization of nonhuman primate societies. The underlying assumption is that nonhuman primate groups and societies are organized and that the task of the primatologist is to identify the principles of this organization.

Until very recently investigators have tried to use unitary factors to explain intra-group cohesion and social organization among nonhuman primates.

There are three such uni-factorial theories:

1. Sexual bond theory
2. Dominance theory
3. Environmental determinism

Sexual bond theory was first proposed by Zuckerman in 1932. Very simply, sexual bond theory states that sexual attraction explains why nonhuman primate groups persist through time. The underlying assumption in this theory is that nonhuman primates are sexually receptive all year round. This assumption was supported by data derived from captive groups. Data available up to 1965 were summarized by Lancaster and

Lee (1965) who concluded that constant sexual attraction could not be the sole basis for the persistent grouping of primates. Their conclusion was supported by more recent data demonstrating that year round sexual receptivity does not occur (Rowell, 1967; Sade, 1964).

Not only does year round sexual receptivity not occur, but, it appears that the predominant daily activity in primate groups is not copulation but feeding and peaceful grooming (e.g. Jay, 1965) and that Gartlan (1966) has demonstrated that the enduring social unit in a nonhuman primate group is not the consort-pair relationship but the mother-infant relationship. It cannot be stated, however, that the consort-pair relationship does not play a major function in nonhuman primate social organization. The critical point is that primatologists cannot use sexual bonding to explain completely social cohesion and organization.

The theory of social dominance, unlike the sexual bond theory, cannot be attributed to any single worker. However, several of the most important influences on the development of this theory have been the work of W. McDougall (1908), T. Schelderup-Ebbe (1931), A. H. Maslow (1963), and Gartlan (1972).

A concept of a simple linear hierarchy pervades both past and contemporary literature. This theory is so prevalent in the thinking of primatologists that its term-

inology is used time and again when the studies are not investigating "dominance", per se. Investigators, in their descriptions of a group, use terms like the "alpha-male" and "alpha-female", "beta-male" and "beta-female" - all of which, taken together, imply a single, simple linear hierarchy.

Social dominance theory makes several implicit assumptions, including (1) that a continuum of rank-order criteria exists throughout groups, and (2) that dominance is a cluster of inter-related behaviour patterns. The former has been demonstrated not to occur, and in the later case behaviour patterns often used as indices of social dominance often show no inter-correlation. There is in addition, the problem of why intense selection for the associated morphological and behavioural phenomena does not occur if sexual behaviour is dependent on dominance characteristics. Evidence indicates that, on the contrary, learning plays a significant part in the assumption of social roles, and that genetic influences are minimal.

Gartlan, 1972: 116

It became clear that a simple linear hierarchy was inadequate to deal with the observed social complexity in nonhuman primate groups. DeVore (1965) made an ad hoc revision of the dominance theory wherein he postulated a "central hierarchy". This modification of the theory stipulates that there is a central group of males and that this central group of males outranks individuals in the group, even though a young male outside the central group might be able to defeat any member of it separately. Not only did the field data not support the theory of social dominance, but the term "central hierarchy" is an oxymoron.

What DeVore is really describing, in the light of more recent evidence, is a clique (see Sade, for a discussion of cliques) and not a hierarchical organization. DeVore excludes all mention of the roles of females in the group even in this revised form of the dominance theory. The theory still reflects an overriding concern with the role of "male". This comment is particularly relevant in view of more recent research that documents the existence of a group of monkeys containing no "dominant" males (see Neville, 1968).

The behaviour patterns often used as indices of social dominance are:

1. Dramatic forms of aggression
  2. Differential access to some desired object such as food or females
- (Bernstein, 1972)

One can derive an axiom from the first index of dominance: the individual who is the largest, the strongest and aggresses the most is defined as the most dominant animal.

Recent data on M. sylvanus (Burton, 1972) would indicate the converse; that is, the animal who has to expend the least amount of energy to effect a behaviour change in the individuals in the group is the most "respected" animal in the group.

There are numerous accounts in the literature of females copulating with subordinate, peripheral, and even extra-troop males. Those individuals who have been designated "dominant" do not necessarily exhibit differential access to females.

The recent data, cited above, in no way imply that the concept of dominance does not exist as an organizing principle of nonhuman primate social organization, but rather that the indices that have been employed heretofore are perhaps not accurate measures of dominance as it is expressed in a nonhuman primate group.

One of the main functions of a hierarchy has generally been considered the reduction of aggression (c.f. (Scott, 1962). However, it seems to be a general rule in primates that hierarchies are both more pronounced and more rigid under captive conditions, and that correlated with this are levels of aggression much higher than normally found in the wild populations.

Gartlan, 1972: 105

Given that hierarchies are more rigid in captive populations and given that aggression is more prevalent in captive populations, then one of four things might be happening.

1. That the function of a hierarchy is not to reduce aggression; that is, that hierarchical organization and aggression do not form a causative relationship.

2. That the function of a hierarchical organization becomes inoperative under captive conditions.
3. That the function of a hierarchical organization becomes transformed under captive conditions.
4. That the form of the expression of aggression becomes transformed under captive conditions. What might have been a subtle facial gesture in the wild becomes an exaggerated or dramatic form of aggression under captive conditions.

It would seem most probable that the form of aggression becomes transformed under captive conditions. The critical difference between the captive and free ranging conditions is that, in the free ranging condition, animals have the alternative of spacing themselves over a wider area. This alternative is denied in the captive condition. An individual who is being aggressed against and has nowhere to escape is left open to overt attack.

The use of environmental determinism is perhaps weak in its explanatory abilities.

Jay (in press, pers comm.) in a comprehensive study of the distribution, ecology and behaviour of wild Macaca mullata noted differences in the size of groups, sex ratios, and behaviour according to the nature of the habitat in which they were found. Thus she was able to distinguish between forest, roadside and city rhesus which showed

differences in social structure and behaviour, particularly an increasing gradient of aggression from forest to city. Southwick, Beg and Siddiqi (1965) also noted fewer individuals in rural habitats and forest areas compared with urban areas.

Gartlan, 1972: 107

The results of studies like Jay's indicate that social structure in many widespread primate species is largely habitat-rather than species-specific. The implications of these findings are considerable for theories of primate social structure.

In the context of biofeedback systems, Wynne-Edwards (1962) defines society as an organization capable of providing conventional competition. While this is undoubtedly one characteristic, to consider a society only in terms of a population regulatory system - as is the tendency when using the concept of social dominance in field studies-represents a gross oversimplification, especially in the persistent grouping of primates. A basic characteristic of society is that there is adaptive differentiation of function among group members (Gartlan 1972: 108). That is, social roles are adaptive to particular environmental pressures.

The idea of analyzing role behaviour is not new to other social sciences such as psychology and social psychology, but is relatively new to primatology. The main drawback of the sex-bond, social dominance and environmental determinism theories is found in their unifactorial approaches. Structure-function analysis is a systems

approach and is more powerful in its explanatory ability.

The analysis of primate social structure in terms of social role differentiation permits the identification of environmental pressures important in moulding the society. Among pressures known to be important ... are population density, the type and availability of good resources and predation pressures. Analysis of this type follows logically from the proposition that social structure is determined multi-factorially and is appropriate to particular ecological conditions. Comparative studies, experimental alteration of the habitat and developmental studies will also indicate which social roles and patterns are species-specific and which are adaptive to particular environmental conditions. The identification of social roles thus permits comparison within and between species both objectively and quantitatively. From such studies, predictions about social structure in particular habitat conditions become possible.

Gartlan, 1972: 113

It becomes clear, then, that there is a multi-factorial determination of social structure. It is perhaps impractical and unrealistic to analyze primate social structure in terms of variation in strength of a single unitary structuring mechanism. Structural-functional analysis considers sex-bonding, social dominance and the environment as well as the identification of roles to explain nonhuman primate social organization and cohesion.

#### METHODS OF ANALYSIS

Research heretofore can be divided into two areas:

1. Those studies that use description as their mode of analysis.
2. Those studies that use quantification as their mode of analysis.



There are advantages and disadvantages to both forms of analysis. The difference between the two is a qualitative-quantitative distinction. Description permits nominal and ordinal statements, quantification permits interval and ratio statements, the latter being the more precise. However, precision loses sight of qualitative distinctions. Individual values and characteristics are obscured by the averaging process. Those features which are not statistically significant may, nonetheless, be behaviourally or biologically significant.

The use of numerics and observational data in conjunction with each other can be very effective. Not only is the use of quantification the testing area for what has been observed but it is also able to yield data which are not apparent to the eye of the observer. At all times the investigator must keep in mind that statistical analysis is only a tool - a means to an end and not an end in itself.

This study utilizes both behavioural observational data and quantitative analysis.

#### CONTRIBUTIONS OF THIS THESIS

This study provides a testing area for a methodological approach that heretofore has not been applied to the study of nonhuman primates. It is an exercise to determine if proxemics as a methodology generates data that are comparable to the data that traditional approaches to primatology have generated. The study utilizes a numerical analysis of

behavioural input. This generates uncontestable data in the sense that the observational data serve as a check on the quantitative analysis and that the quantitative analysis provides verification and confirmation of the observational data.

The species selected as the subject of the study is little known in the literature. Only one study exists on M. silenus (Sugiyama, 1968) however, as it was not concerned with spatial behaviour, it yields no comparative data relevant to the thesis problem.

#### STATEMENT OF THE PROBLEM

The hypotheses around which this study is centered can be divided into two categories:

1. Those hypotheses that pertain to data arising from the observational process.  
(Type A hypotheses)
2. Those hypotheses that pertain to the numerical analysis of the spatial behaviour of a group of M. silenus.  
(Type B hypotheses)

#### Type A Hypotheses

##### Hypothesis I

That there are preferred areas, that is, that certain individuals prefer to occupy certain areas in the enclosure and that some individuals demonstrate exclusive use of some areas.

### Hypothesis 2

Because M. silenus is arboreal, there should be evidence of a preference for elevated loci. In connection with this there are two trees in the enclosure that are equidistant from the front extremity of the enclosure. It is hypothesized that both these trees should demonstrate equal usage. It is also hypothesized that there should be extensive use of the ledge not only because it is elevated but because it is associated with shelter during inclement conditions.

### Hypothesis 3

Because of the way in which the enclosure is constructed, the sun is most intense in one area of the enclosure (specified in Chapter 3). It is hypothesized then that there would be high group use in this area if for no other reason than monkeys have been shown to express an affinity for the sun (Burton, 1972).

### Hypothesis 4

Because this group of M. silenus is a captive group, it is hypothesized that there should be a high incidence of aggression and

that, connected with this, Goliath, the only mature adult male, would mediate any quarrels that might arise.

#### Type B Hypothesis

Certain kinds of relationships are characterized by low inter-individual distances.

#### Hypothesis 5

It is expected that there should be low inter-individual distances in the following relationships: Consort-pair, mother-infant, play-partner and associational partner.

In general, then, there are two major questions to which this research is addressed:

1. Is there such a phenomenon as personal space in this group of M. silenus?
2. How is this personal space maintained?

The numerical data consist of the mean distances (in centimeters) between every individual for the duration of the study. An analysis of these distances with their standard deviations and the corresponding observational data should yield responses to the questions and hypotheses stated above.

There are five principles that are hypothesized as governing the spacing of the individuals in this M. silenus group:

1. Age
2. Status
3. Role
4. Sex - (a) gender  
(b) sexuality or reproductive status
5. Tradition

The fifth principle accounts for qualities that are ineffable, that is, things that become apparent observationally but that cannot be demonstrated numerically, but are real nonetheless. Tradition includes such factors as group and individual history, "charisma" and "personality".

## Chapter II

REVIEW OF THE LITERATUREINTRODUCTION

Social co-ordination and adaptation cannot exist without communication. The modalities of communication are kinesic, tactile, olfactory, and auditory-vocal. Although not a modality, proxemics is a result of modalities - a social phenomenon, a nonverbal communication.

Research on the modalities of communication in non-human primates has been extensive (See Altmann, 1972; Marler, 1965; and Sebeok, 1971). There has been no research published to date on proxemic behaviour of nonhuman primates.

All literature on the genus *Macaca* is relevant insofar as the group presently under study belongs to it. Of particular significance are the studies on the species of macaque which fall within the geopolitical area of India, that is:

*M. mulatta*

*M. radiata*

*M. silenus*

The literature on *M. mulatta* is particularly voluminous because this species has been used by a variety of disciplines for many kinds of research, both in the laboratory and in the field. Research to date encompasses physiology, pathology, sensory behaviour and social behaviour.

Ideally, field and laboratory research should be mutually complementary (Jay, 1969). Each should draw on the other for evidence and hypotheses and thus provide the essential comparisons and corrections that will result in the most comprehensive understanding of the social organization and individual social behaviours of nonhuman primates (R. E. Miller, 1971).

#### GENERAL BEHAVIOURAL CHARACTERISTICS OF MACACA

Groups of macaques ... have ranged in size from a single pair and young of M. nemestrinus to more than 150 individuals of a troop of common macaques in the Waterfall Gardens of Penang, Malaya. A typical undisturbed group of Macaca assamensis in Thailand consisted of two adult males, six adult females, two of which were carrying infants, and two juveniles. Another group had four adult males, ten adult females, four of which carried infants, and eight juveniles. The semi-domesticated rhesus monkey groups on Santiago Island, Puerto Rico, ranged in size from about 13 to 150 animals. On April 19, 1940, Group I, which I believe to be a rather typical grouping for this species, contained a total of seventy-three animals. These groupings are believed to characterize the range of groupings of M. mulatta of India.

C. R. Carpenter, 1963

The number of females predominate over the number of males in every observed group of macaques and for all species except Macaca nemestrina which is little known. There is only one laboratory study on M. nemestrina (Jensen, Bobbitt and Gordon, 1969) and there is little opportunity to extract more information on this species

because it has been virtually exterminated (Bernstein, 1966).

Within organized groups, the males dominate all other individuals, but exclusive dominance like that described by Zuckerman for the baboon is not found, unless M. nemestrina proves to be an exception. M. nemestrina may very well be an exception but the paucity of data on this species does not allow one to make a conclusive statement of any kind.

Extra group males in the large genus of *Macaca* live both temporarily isolated, and also more frequently, in unisexual male groupings (Carpenter, 1963).

#### DOMINANCE

Dominance is one of the unifactorial theories proposed to explain nonhuman primate social organization. Much theorizing has been devoted to the concept of dominance. Investigators assume an underlying organization by dominance and even though they are not expressly dealing with dominance, they discuss it at length.

Kaufman (in Neville, 1969) stated that a rhesus troop's dominant male is characterized by his assurance, expressed in posture (such as the position of his tail, often erect when walking) and behaviour. The other males react cautiously to him and he is usually surrounded by a relatively large "social space". The dominant male is



more likely than other males to terminate fights, which he does by chasing or threatening some animal in the vicinity of the fight (Kaufman in Neville, 1969). The dominant male is also more successful in mating.

Neville (1969) working with M. mulatta in India, concludes that the factors involved in the assumption and maintenance of the dominant position are very complex. Physical strength and aggressiveness do not guarantee immediate accession to the position. "Aggression is evidently not a constant correlate of high status; ... it should no longer be considered either the most important aspect of a dominant individual's behaviour or the determinant of rank." (Chance and Jolly, 1972: 203-204).

In 1938, C. R. Carpenter took 400 M. mulatta from India to Cayo Santiago. The monkeys presently living on Cayo Santiago are descendants of these 400 monkeys.

Loy (in Sade, 1972) examined the relations among frequency of mating, dominance rank, age, rank of mate and age of mate among rhesus monkeys (M. mulatta) and concluded that dominance relations of the maturing young can be predicted to a greater or lesser degree by knowledge of the dominance relations among their mothers. His conclusions were supported by Kawamura, (1958); Kawai, (1958); Koford, (1963); Koyama, (1967); and Sade, (1966, 1967).

The regularity in rise in rank of younger over older sisters and unrelated adult females from low-ranking

genealogies suggests that two sets of mechanisms must exist. The first set includes those factors which initiate the rise in rank of the young female. The second set includes those factors which limit that rise in rank to the position just below her mother or to the position which her mother would have occupied (in the case of death) (Sade, 1965: 396).

A rhesus female and her offspring can continue to maintain a distinct relation into the offspring's physical maturity and the offspring often develops its strongest relations with monkeys of its own genealogy. The observer identifies relations by the consistent close spacing of individual monkeys, by incidents such as fights, and by the frequency of interactions such as grooming (Sade, 1965: I). This would mean, then, that an individual born to a high-ranking mother would associate or be in contact with other individuals of high rank because these would be the mother's associational partners. The converse would also be the case, that is, that an individual born to a low-ranking mother would be most in contact with other individuals of low rank. The relationship between infant and mother is assumed from the constant close spacing of the individuals. The inter-individual distances were achieved by "eyeballing" the subjects rather than actually calculating the distances. This would have been a perfect opportunity to employ the methodology of proxemics.

GROOMING

To this date, emphasis on the description of the daily activities of nonhuman primates has focused on agonistic encounters because of their dramatic nature. However, monkeys spend most of their day in peaceful grooming sessions.

Sade (1965) states that bouts of grooming may last only a few seconds or may last as long as an hour. In some sequences grooming seems to placate an aggressor, especially when the aggressor is a relative or frequent partner in peaceful inter-actions. After being cuffed or threatened, the victim making a display of submissive gestures, often approaches the aggressor and grooms with exaggerated movements and at a rapid rate. This kind of sequence is very frequently seen during the birth season when parents cuff and threaten older offspring who are trying to poke, tug, groom, or steal the newborn infant (Sade, 1965: 8).

Bouts of grooming may be terminated by either of the participants or by disturbances. The groomer may end the bout by soliciting grooming from the groomed. A pair may alternate for an hour or more. The groomer may simply stop grooming and leave to groom another monkey or to do something else, or to stay and go to sleep. The monkey being groomed may end the bout by getting up and leaving (Sade, 1965).

Simonds (1965) concluded that there is no significant difference between the amount that males and females groom in a Bonnet macaque (M. radiata) group; the female Bonnet macaque is not the major groomer either in number of interactions or in the time spent in grooming. Both sexes groom every age and either sex category in the group.

Grooming is a proximal or contact behaviour and, again, no measures of inter-individual distances were made in either the study by Sade or Simonds.

The general social behaviour of Bonnet macaques falls within the range of that reported for other macaques and baboons. Bonnet macaques live in highly organized groups, which include adult males, adult females, subadults, juveniles, and infants. They have a dominance hierarchy that is well marked in the males and rather less clear among the females. Their social communication is very elaborate, consisting of gestures and vocalizations (Simonds, 1965: 196).

#### Macaca silenus

The only study on Macaca silenus (Sugiyama) is a brief and rather uninformative account of two groups of M. silenus in Kerala State in India. In general appearance the lion-tailed macaque differs from other macaques (see plates 1 - 4). Group size is smaller (from sixteen to twenty-two individuals) and the sex ratio lower than in some other species of macaques. The social organization