

ALLOGROOMING AND AFFILIATION
A STUDY OF GROOMING BEHAVIOUR IN TWO
CAPTIVE GROUPS OF LION-TAILED MACAQUES
(MACACA SILENUS) AT THE ASSINIBOINE
PARK ZOO IN WINNIPEG MANITOBA

BY
SHIRLEY LEE

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Submitted to the Faculty of Graduate Studies
in Partial Fulfillment of the Requirements
for the Degree of

MASTER OF ARTS

Department of Anthropology
University of Manitoba
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Abstract

Allogrooming behaviour was observed, for a period of eight months, in two groups of captive lion-tailed macaques (Macaca silenus) at the Assiniboine Park Zoo in Winnipeg. Results indicate that age, sex and genealogy are significant factors in grooming relationships. Grooming appears to be group-specific due to the presence of different types of behaviour in the two groups; mouth grooming was observed in Group One, while hair pulling and eating was a variant in Group Two. Communication is an important aspect in the relationship, specifically in the form of lipsmacks, stretches and "hugging" behaviour. The groomer exerts more influence than the groomee in the interaction, although it is the specific relationship between the two individuals which determines the grooming sequence. This suggests that analyses which focus on the total frequency and duration per individual must take this factor into account.

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Chapter I

Introduction

A researcher once observed a male macaque (M. mulatta) pulling out and biting off the eyebrows of a female macaque (M. irus). He suggested that one animal was actually modifying the appearance of the other. This strange occurrence provoked the following statement:

This is the first recorded instance,
to my knowledge, of one animal's appearing
to contribute to the adornment of another.
Tinklepaugh, 1931: 431

Adornment is a culturally derived human value; in the account cited above, which provides an example of early inquiry into grooming, elements of macaque behaviour have been analyzed and interpreted within a culturally constructed human framework.

Few explanations have been this fanciful. Grooming is considered to be an affiliative behaviour -- it is thought to function in a social capacity expressing bonds between individuals. The utilitarian function of grooming has also been stressed as it is the removal of ectoparasites and dirt which is readily apparent. While it is solely the grooming behaviour of the participants which can be observed directly, more significance has been assigned to the underlying component of grooming (bonds between and among individuals) as the behaviour appears to be based on complex, social interactions among group members (Hinde, 1983). Whether it is possible to see beyond the observable

surface structure is a major question. General patterns which become associated with underlying social behaviours may be the result of interpretations of the observer. These interpretations are influenced primarily by the researcher's cultural and social background.

More recent work has focused on the notion that grooming is a complex, multi-functional behaviour which may be associated with aspects as diverse as friendship (Lindburg, 1973; Seyfarth, 1977; Smuts, 1985; Troisi et al., 1989); an expression of intimacy (Oki and Maeda, 1973); kinship (Sade, 1965; Oki and Maeda, 1973; Lindburg, 1973; Seyfarth, 1977; Defler, 1978; Silk, 1982, 1987; Hinde, 1983; Seyfarth and Cheney, 1984; de Waal and Luttrell, 1986; Goosen, 1987; Mehlman and Chapais, 1988); removal of ectoparasites (Hutchins and Barash, 1976; Barton, 1985); tension reduction (Defler, 1978; McKenna, 1978; Boccia, 1987; Goosen, 1987; Schino et al., 1988a; Mehlman and Chapais, 1988; Troisi et al., 1989); dominance relationships (Seyfarth, 1976, 1977, 1980, 1983; Fairbanks, 1980; Hinde, 1983; Silk, 1982; Boccia et al., 1982; Boccia, 1983; de Waal and Luttrell, 1986; Goosen, 1987; Walters and Seyfarth, 1987; Mehlman and Chapais, 1988); and tactile communication (Boccia, 1983).

Grooming in nonhuman primate groups is commonly approached from a consideration of the amount of grooming individuals "give" and "receive". A common objective has been to determine which of the participants is playing the

more important role. In general, a higher status has been assigned to the individual who receives the most grooming.

Are "receivers" the most favoured individuals? According to E. O. Wilson (1975), it is the recipient in a grooming relationship who derives the greater benefit. The groomer also benefits, although not to the same extent as the groomee. This is associated with dominance systems as grooming is thought to be a conciliation device whereby the subordinate acknowledges its submissive position by grooming its superiors.

Rhesus monkeys are so punctilious in this matter that the rank of the animal can be ascertained simply by observing which group members it grooms and by whom it is groomed.

Wilson, 1975: 132

To ascribe punctiliousness as an attribute of a macaque is notably anthropomorphic and it is doubtful if relationships between individuals can be so easily understood or quite so predictable. Rather, it is conceivable that the benefit associated with the "giver" is equally as important as the one connected to the groomee; one not considered to be beneficial in a conciliatory sense. Consequently, the groomer would occupy a position of comparable influence in relation to the groomee.

A primate grooming model dealing with adult females and in line with the notion that the "receiver" occupies the more important position within the dyad has been proposed by Robert Seyfarth (1977). Equal influence is not an implication of his model. He suggests that both animals

benefit from grooming interactions: the "receiver", due to the removal of ectoparasites and the groomer, who may need the support of the groomee at a later time, for example, in an aggressive coalition (Seyfarth, 1977: 696).

Seyfarth reinforces this suggestion with the idea that high-ranking females receive more total grooming than lower-ranking individuals since they can provide more support to the animal acting as the groomer. An individual's rank is designated by indices based on aggressive interactions. The assumed imbalance between the groomer and the groomee is thus connected to dominance concepts in Seyfarth's model. Whether an imbalance actually exists is not the problem with the above proposal. My concern is with the reason given for this unbalanced relationship -- the link with dominance.

It is not my intent to prove that dominance is not a factor in grooming relationships, but rather to analyze the data without imposing a framework which presupposes hierarchy and dominance concepts as important or necessary factors in grooming partnerships. This framework can be problematic as the underlying assumptions of dominance form the basis of the research design; dominance hierarchies are formulated prior to additional behavioural research. A number of researchers have critiqued the concept of dominance (Gartlan, 1972; Rowell, 1974; Bernstein, 1981; Smith, 1982; Fedigan, 1982; Haraway, 1982). This has not been related to grooming specifically; the critiques have

focused on the dominance concept in a more theoretical context.

Kinship is also used to explain grooming behaviour in macaque species, especially the high incidence of grooming between females. Grooming is thought to be an altruistic act (Kurland, 1977; Silk, 1987), as the cost to the groomer is greater than that to the groomee. Cost is measured in terms of energy expenditure (Silk, 1982). Kin selection theory (Hamilton, 1964), another principle of sociobiology, provides a more satisfactory explanation for altruistic behaviour than does individual selection which does not favour individuals who reduce their own fitness for another's benefit. "When an actor behaves altruistically toward its kin, fitness benefits to kin also benefit the actor ..." (Silk, 1987: 324). In regard to the actor, this is an indirect benefit.

This study will focus on the grooming behaviour of two groups of lion-tailed macaques (Macaca silenus) housed at the Assiniboine Park Zoo in Winnipeg. My objective has been to collect and analyze data on the grooming relationships within the two groups. There are a considerable number of studies dealing with grooming in other macaque species, but not Macaca silenus specifically.

My research originated from a pilot study conducted with one of the lion-tailed macaque populations at the zoo. The results suggested that adult females were involved more intensely in grooming activity, not with the adult male,

but with each other. The two most frequent grooming partners were also half-siblings. In addition, I observed that communication sequences occurred throughout the grooming session, consisting of both facial expressions and body postures. A specific type of grooming was observed: a mouth grooming technique, associated with the grooming of one individual female, was noted frequently.

Although I tested hypotheses employing the variables of sex, age and kinship based on my preliminary research, my study was not conducted utilizing a theoretical paradigm based on the assumptions underlying either dominance or kinship concepts. For this study, I did not construct a dominance hierarchy prior to the collection of data on grooming behaviour. Dominance concepts, in particular, tend to overshadow the behaviours which are being studied and ultimately imply a behavioural difference based on the sex of the individual.

Partner selection in grooming sequences could be related to the social milieu existing within the group. Immediate social interactions among individuals may influence the way in which future associations occur. Relationships expressed in grooming interactions could be the result of a complex interchange based on group dynamics and could be associated with friendly or intimate behaviour between or among group members. The groomer may be exercising her/his choice rather than responding to the concerns of the groomee.

There are two groups of Macaca silenus housed at the Assiniboine Park Zoo, on view to the public. A comparison of the two groups has been done in order to ascertain if their grooming behaviour is similar or if there are any major differences. This provides an opportunity to understand the significance of group-specific social activities, i.e. the incidence of mouth grooming behaviour.

In addition to the analysis of grooming behaviour, my thesis deals with the way in which data are used to support conceptual frameworks. Sex, age and kinship variables are often employed in grooming studies. These variables are used in order to test hypotheses whereby evolutionary processes (individual and kin selection, reciprocal altruism) are thought to have shaped social behaviour. The way in which the research questions are preconceptualized has a direct bearing on whether or not the hypotheses are supported. For example, if kin selection and dominance systems are considered axiomatic, the analysis will reflect this aspect. Unequal situations within the grooming dyad may be perceived due to an insistence on the use of rank designations and due to an acceptance of the idea of altruistic behaviour.

There is another problematic area within the field of primatology which should be addressed in this thesis, albeit in a more cursory manner than the research centering on grooming behaviour. I am referring to the construction of narratives concerning primate life which are generated

from the researchers' own experience and desires, as well as historical influences within science.

Scientific practice may be considered a kind of story-telling practice -- a rule-governed, constrained, historically changing craft of narrating the history of nature. Scientific practice and scientific theories produce and are embedded in particular kinds of stories. Any scientific statement about the world depends intimately upon language, upon metaphor.

Haraway, 1989: 4

We may assert that the study of nonhuman primate behaviour is based on objectivity: that this is an essential goal of primatology. While it may be a desirable goal, it will be clear in the section to follow that this is indeed a difficult task to accomplish, if not an impossible one.

Chapter II

Review of the Literature

Grooming behaviour in nonhuman primate groups has been studied over the years in a variety of species. As my study involves Macaca silenus, I will examine primarily the material pertaining to different species of the genus Macaca. By far the most data has been collected on rhesus monkeys, M. mulatta. In addition, the literature deals with the long-tailed macaque, M. fascicularis; the bonnet macaque, M. radiata; the pig-tailed macaque, M. nemestrina; the stump-tailed macaque, M. arctoides; the Japanese macaque, M. fuscata; the celebes macaque, M. niger; the Barbary macaque, M. sylvanus; and a number of other monkey groups such as baboons, Papio; vervets, Cercopithecus aethiops; langurs, Presbytis entellus; and patas monkeys, Erythrocebus patas.

Many of the perspectives employed in the study of grooming behaviour and in more general primate studies emerge from researchers working in the 1930s and 1940s. It is important to understand this foundation as many of the same perspectives are in use in primate studies today.

Historical Perspective

The sub-human Old World primate may be said to prostitute its sex in a social life that is built upon the principle of dominance.
Zuckerman, 1932: 314

If we take a critical look at the above statement

there are a number of key terms which illustrate the author's viewpoint -- sub-human, prostitute and the principle of dominance. Zuckerman was quick to point out the connection between prostitute and female in his study of baboons, as he noted that females exchanged favours for sex with the male; for example, he referred to the use of food and grooming as items which were exchanged for this purpose. The "chief wife" would groom her "overlord" and he would then concentrate his sexual activities on this female (Zuckerman, 1932: 226).

Sub-human in reference to nonhuman primates was a common terminology of the time; infra-human was used as well (e.g. Maslow, 1940). This is indicative of the way in which nonhuman primates were delineated in regard to humans -- humans existed at the top of the evolutionary ladder. All other species were inferior to humans on this scale and it follows that monkeys, without doubt, could not achieve an equal standing in comparison to Homo sapiens.

Not only was Zuckerman studying the social behaviour of nonhuman primates from an anthropomorphic bias, as indicated above, but he was also interested in the study of behaviour in physiological terms.

Social behaviour -- the inter-relation of individuals within a group -- is determined primarily by the mechanisms of reproductive physiology.

Zuckerman, 1932: 29

Dominance played an essential role in Zuckerman's work, but most research of the time tended to accept this

"principle" (as it was referred to by Zuckerman). This "principle" or concept was directly connected to animal behaviour studies which had identified the existence of a pecking order in domestic fowl and this was thought to be a factor in the formation of dominance hierarchies in birds and mammals (Schjelderup-Ebbe, 1935).

A number of experimental studies on primates were undertaken at this time purporting to demonstrate the existence of a dominance system. One study, in particular, stressed the notion that the dominant animal (the most aggressive) would play the masculine role in a relationship, while the subordinate would play the female role (Maslow, 1940). The research was conducted on three pairs of animals (rhesus macaques, cebus monkeys and chimpanzees). Maslow's aim was to correlate dominance with social behaviour and group organization in nonhuman primate species. He felt the study might be partially applicable to the study of human behaviour.

It was noted in a separate study (consisting of four cebus monkeys, three rhesus macaques and two mangabeys) that dominance was an important factor in their relationships, but it did not seem to be a factor in grooming behaviour (Warden and Galt, 1943). This was determined through a dominance hierarchy constructed from data based on food priority tests where one individual was put in contact with another, regardless of species affiliation. Both of the articles referred to above, highly

experimental in nature, attempt to show that the existence of dominance is an intrinsic component of all primate species.

It was also established in the latter article that grooming activity was disturbed when the frontal lobes of the animals were removed (rather a drastic method to use in behaviour studies). The researchers mentioned that dominance relationships were not affected by the removal of the lobes. The intent of this research was to isolate the source of the behaviour; grooming was associated with a particular section of the brain, while the center that controlled dominance could not be identified. The implication of this research was that the dominance concept existed as an exogenous construct, not subject to control of any kind.

Dominance concepts were also favoured by researchers who undertook field studies on nonhuman primates. It was considered to be an important mechanism in groups of macaques and males were noted to possess superior dominance status in these groups (Carpenter, 1964). Carpenter's work in the late 1930s involved a colony of rhesus monkeys on the island of Cayo Santiago. In studies on the same group, Carpenter suggested that grooming was used as the way one animal gained the tolerance or social acceptance of another, although he did not associate grooming specifically with dominance.

Primatological studies also focused on the need to

research the activity of nonhuman primates in order to understand and predict human behaviour. Primate behaviour was considered to be part of an overall primate pattern from which human behaviour had evolved or changed. It was thought that grooming was a precursor of hairdressing, nursing, medical and surgical treatment (Yerkes, 1933) and that it served as a way to modify the appearance of another (Tinklepaugh, 1931).

Grooming behaviour was also studied from another perspective and one study focused on what the animals were eating while they were grooming (Ewing, 1935). Ewing came to the conclusion that the monkeys he was watching (macaques) were eating hairs, not for the salty excretions, but simply to eat the hair.

Ewing's study dealt with behaviour which occurred when one individual searched the skin of another with both hands in order to find something to put in its mouth. He noted that a different type of grooming was also present.

It does not include hair-plucking, a form of grooming wherein a monkey dislodges hairs by means of jerking them out by their roots. To do this, the tips of the hairs are held firmly between the thumb and fingers of one hand, then by means of a sudden jerk a hair or hairs are dislodged.

Ewing, 1935: 304

Hair-plucking (Ewing's terminology) has been mentioned rarely, if at all, in the primate literature; however, it was a behaviour which was prevalent in one of the groups of Macaca silenus which I studied. Ewing's description is concise and to the point. His study differed from other

research of the time in that he did not impose principles of biology or concepts such as dominance in order to provide an explanation of the behaviour. He relied primarily on description, although anthropomorphism is not absent from his work.

I have dealt in depth with early primatological studies as they provide the groundwork, the base upon which more recent studies are built. By no means am I suggesting that recent work in primatology suffers from the same bias' as much of this early research; however, a number of studies assess grooming behaviour in terms of dominance hierarchies and sex differences within primate groups. The connection this work has to previous studies should not be overlooked.

A Transitional Period

In the 1960s and early 1970s, it was not unusual to find articles which stated that grooming was centered around the dominant male and it was generally accepted that the more dominant males received the most grooming (e.g. Washburn and Devore, 1963; Sparks, 1967; Terry, 1970; Weber, 1973). Nonetheless, a number of studies were dealing with the observation that the adult females seemed to be most involved in this activity and that the majority of their grooming occurred with other adult females (Thompson, 1969; Koyama, 1973; Lindburg, 1973; Oki and Maeda, 1973).

The focus in primate studies began to shift to adult females. This was foreshadowed as early as 1963 in a study on M. fuscata which dealt with the dominance-subordinate relationships of the females (Imanishi, 1963). In general, researchers acknowledged that the exclusive focus on male primates in previous studies could be the result of male bias. It became important to try to establish dominance hierarchies among females, although females and males were not ordinarily categorized together.

Ranking based on dominance-subordinate interactions was used frequently in grooming studies of the mid-1960s to the mid-1970s. The most common interactions used to measure dominance and establish a ranking system were food priority tests (Koyama, 1973; Oki and Maeda, 1973; Lindburg, 1973); occupation of space and aggressive encounters (Oki and Maeda, 1973; Lindburg, 1973; Sade, 1972 aggressive encounters only); and approach-avoidance interactions (Rowell, 1968). In one article (Mori, 1975), the author omitted to describe the measure used to construct the hierarchy.

Although the measures used to formulate a dominance hierarchy varied to a great extent in the studies mentioned, the results were much the same. Grooming was thought to be directed from a low-ranking individual to one of higher rank. In only two of the studies mentioned was the result different -- Lindburg found little correlation between rank and grooming frequency and Koyama did not

attempt to correlate grooming and dominance.

A change was taking place in the concept of dominance, but at the same time, there was a certain amount of confusion regarding its link with female and male behaviour, especially in grooming studies. In a study on langurs, grooming itself was used to ascribe dominance and subordination as females groomed the males more frequently. The grooming actions were assessed to be of a complementary nature which related to dominance:

Passivity during grooming is therefore an indicator of an animal's dominance in this situation; and the active role, conversely, is an indicator of subordination.

Weber, 1973:483

This not only involved dominance concepts, but it was linked to cultural assumptions underlying sex differences as well. The connections were clear: the female represented the subordinate individual, while the male was an embodiment of dominance. In a later study on langurs, Weber's results were disputed.

Females spend much more time grooming each other than they spend grooming adult males, and the female-female bonds thus established and maintained may be more closely tied to the other social roles females perform, such as infant caretaking, soliciting sexual behaviour, and policing activities rather than reflecting a general social position they occupy with respect to the males.

McKenna, 1978: 508

It is clear not all grooming studies correlated high rank with the amount of grooming received by the individual. In a study on rhesus monkeys it was suggested

that other factors might be more important, for example, friendship (Lindburg, 1973). In the same study, grooming was observed to be directed down the hierarchy, not up, and " . . . this tendency does not fit with the frequent suggestion that subordinates groom higher ranking animals in order to gain their acceptance" (Lindburg, 1973: 139). Kinship was also considered to be a factor in the distribution of grooming (Sade, 1965; Oki and Maeda, 1973; Lindburg, 1973).

For the most part, researchers ceased to push the idea that the male received the most grooming, although a number of studies simply changed their focus and dealt only with adult females. In general, researchers still supported the notion that the highest-ranking individual received the most grooming.

This type of research reached a peak in 1977 with the publication of a model for social grooming (Seyfarth, 1977). The model dealt only with adult female monkeys and was formulated on two basic assumptions -- the idea that grooming was associated with the female's position in a linear dominance hierarchy and the notion that most grooming was kin-based. He proposed the idea that high-ranking individuals received more grooming than others.

Seyfarth also suggested that high-ranking individuals were not subject to the same competitive constraints as were low-ranking females in their grooming interactions.

Low-ranking females would have to compete with other individuals for access to more dominant partners while high-ranking females could choose whomever they so desired. Grooming was also thought to be distributed among individuals of a similar rank as this would lead to less competition between individuals.

Recent Approaches to Grooming

The study of grooming behaviour in association with rank designations has a long history. Seyfarth's grooming model was based on data from a number of different studies of macaques and baboons. The grooming data were used to generate a mathematical model of social interaction among female macaques. A major component of the model was the causal relationship between the groomer's activity and the groomee's support in aggressive encounters which could occur at a later time. There has been some disagreement with the causal relationship proposed by Seyfarth. This has not been found in certain studies which have focused on this aspect (Seyfarth 1980; Fairbanks, 1980; de Waal and Luttrell, 1986).

A number of studies are in general agreement with a connection between higher-rank and grooming distribution. Grooming is thought to be directed up the hierarchy (Seyfarth, 1977, 1980, 1983; Fairbanks, 1980; Hinde, 1983; Boccia et al. 1982; Boccia, 1983; de Waal and Luttrell, 1986; Goosen, 1987; Walters and Seyfarth, 1987; Mehlman and

Chapais, 1988), although more grooming may correlate with the highest-ranking individual only (Silk, 1982). Consequently, the majority of grooming studies have attempted to construct a dominance hierarchy before they collect information on grooming.

Various measures have been used to construct the hierarchies and assess individual rank. Data has been collected on the use of threats and aggression (Fairbanks, 1980); the winners and losers of displacements, chases, attacks or threats (Silk, 1982; Mehlman and Chapais, 1988); approach-retreat interactions (Seyfarth, 1980); and "submissive" teeth-baring (de Waal and Luttrell, 1986). All of these measures are dependent on the association of certain behaviours based on the preconstructed categories of dominant and submissive behavioural components. In a few cases, information dealing with the construction of the hierarchy is not considered to be important and in some articles (Boccia et al., 1982; Boccia, 1983), the method has been omitted entirely.

It is evident that hierarchies are constructed using different measures and the way in which the interactions are described has a crucial bearing on the interpretation. For example, what type of behaviour is associated with threats and what constitutes a winner or a loser? These descriptions are rarely included in behavioural studies.

In a study on rhesus monkeys which omitted the measure used to designate rank (Boccia et al. 1982), it was

suggested that the groomee controls the behaviour of the groomer by the positions assumed by the groomee during the interactions. This was related to the fact that the groomee was higher-ranking than the groomer. It was also suggested that the groomee gives the groomer signals as to how the groom will proceed and the areas the groomee wishes to be groomed. It becomes a difficult task, if not an impossible one, to assess results such as these as the results are based on an incomplete disclosure of methods used in the study of a particular behaviour.

Another reason for the grooming behaviour of adult females was mentioned in the grooming model proposed by Seyfarth. It was suggested that grooming would be beneficial for the groomer as well as the groomee if the relationship involved kin members. This has been the focus of a number of studies in which grooming with kin has been found to be more frequent than grooming with nonkin (Defler, 1978; Silk, 1982, 1987; Seyfarth, 1977, 1983; Hinde, 1983; Seyfarth and Cheney, 1984; de Waal and Luttrell, 1986; Goosen, 1987; Mehlman and Chapais, 1988). The groomer would be a beneficiary in this interaction as the behaviour would allow kin to survive, thus insuring the survival of the groomer's genes -- this refers to kin-based altruism (Hamilton, 1964), a fundamental principle of sociobiology.

A number of other reasons have been cited to explain grooming behaviour in general. It is considered to be an

important form of tactile communication (Boccia, 1983); it is thought to relate to friendship between males and females, (Smuts, 1985) or friendship between females (Lindburg, 1973; Seyfarth, 1977; Troisi et al. 1989); it is thought to serve as an expression of intimacy (Oki and Maeda, 1973); it is considered to relate to the more functional purpose of hygiene (Hutchins and Barash, 1976; Barton, 1985); it is thought that the groomer is subject to reduced aggression (Silk, 1982); and it is considered to function as a tension-reduction mechanism (Defler, 1978; McKenna, 1978; Boccia, 1987; Goosen, 1987; Schino et al. 1988a; Mehlman and Chapais, 1988; Troisi et al. 1989).

Tension-reduction was associated with grooming in one study where a relaxed social groom was scored differently from a tension-reducing groom. Any groom which was preceded by an embrace, a social present, aggressive behaviour, a social or sexual mount, or a sexual solicitation involving tense vocalizations and/or facial expressions was considered to be a tension-reducing groom (McKenna, 1978: 504). In another study, tenseness was defined by the presence of certain displacement behaviours -- yawning, autogrooming, body shake and scratching (Schino et al. 1988a: 44).

It is not clear whether these behaviours can always be identified with tense situations and problems arise if these are further correlated with dominant and submissive behaviours. This approach utilizes assumptions similar to

the ones used in studies which suggest a link between grooming and rank association. Ranking studies commonly refer to tense situations found in relationships between dominants and subordinants. It was noted in one of the studies that the use of dominance-subordinance characterization as a behavioural index was often unreliable (McKenna, 1978: 508) so there is a lack of consensus on this subject.

Another approach to female relationships which uses grooming as a measure is based on a concept termed the "similarity principle". It was suggested that rhesus monkey females form close bonds with other females that they most resemble (de Waal and Luttrell, 1986).

The similarity may concern genetical and social background (matrilineal kinship), age (same age class), hierarchical position (closeness in rank) and/or social class (membership of the same class).

de Waal and Luttrell, 1986: 231

This model has much in common with Seyfarth's grooming model as rank and kinship are extremely important. The inclusion of class is questionable -- not all would agree that monkeys are concerned with social class and the more pressing issue is the way in which a researcher could observe this or measure it. Age is an interesting component of the model.

Age has been a commonly used variable in grooming studies as most grooming is thought to occur between the adults, especially adult females (Lindburg, 1973; Drickamer, 1976; Seyfarth, 1977, 1980; Defler, 1978; Silk,

1982; de Waal and Luttrell, 1986; Mehlman and Chapais, 1988; Schino et al. 1988b). It has been suggested that juvenile females direct more grooming to adult females in comparison to adult female grooming directed to the juveniles (Schino et al. 1988b). Another approach has been to postulate that a link exists between sex and age, for example, to suggest that the oldest "matriarchs" receive more grooming than others (de Waal and Luttrell, 1986).

Clearly, sex differences in grooming cannot be separated totally from age differences and sex is another variable commonly used in these studies. Adult males are generally thought to give less grooming than females and to receive less grooming (Lindburg, 1973; Oki and Maeda, 1973; Drickamer, 1976; Defler, 1978), although it has been found that adult males receive more grooming than they give to others (McKenna, 1978). It has also been suggested that males in one-male groups receive the most grooming from the adult females (Schino et al. 1988b). This suggestion will be discussed presently.

Another area of interest in grooming studies is the way in which the behaviour is observed and analyzed. A number of researchers have commented on the difference between the meaning of frequency and duration measures (Altmann, 1974; Dunbar, 1978; Martin and Bateson, 1986; Schino et al., 1988). They relate the difference to a distinction between two types of behaviour patterns --

events and states. Frequencies can be used to define an event which is a behaviour pattern of a relatively short time span, while durations can be used to analyze states which are behaviour patterns of a more prolonged nature.

In connection to grooming, it is possible that frequencies and durations measure and reflect different qualities in a relationship. For example, the most frequent groomers may not be the most persistent (Dunbar, 1978). It is important to determine whether persistence implies a different quality of relationship. Frequency has been thought to refer to competition between groomers, while duration has been used to indicate a groomee's "attractiveness" (Schino et al. 1988b). According to Dunbar, neither frequency nor duration can be considered better than the other as it depends on the research question (Dunbar, 1978). For example, certain individuals may groom more frequently, while others have a longer duration. The most important question becomes: what quality is more important to the researcher?

Problems connected to research design are particularly evident in a study which attempted to test " . . . the generally accepted notion that in one-male groups, females direct most of their grooming to the male" (Schino et al. 1988b: 217). The statement of grooming in one-male groups came from three previous studies and none of these studies specifically focused on the grooming behaviour of the genus Macaca (Hrdy, 1977: langurs; Kummer, 1968: baboons). The

one study which dealt with M. fascicularis was experimental in form and concerned the introduction of a novel male into a captive group (Jones et al. 1982).

The researchers' main interest was to test this hypothesis, as well as two others on grooming involving sex and age, in connection with measures used to analyze the behaviour -- frequency, total duration and mean duration. Three species of macaques (M. fascicularis, M. fuscata and M. nemestrina) were observed in order to complete the study. They suggested that both frequency and total duration could provide the same quantitative description of grooming. The correlations were confirmed in tests of two of the hypotheses (concerning sex and age differences), but there was a problem with the one concerning grooming in one-male groups.

Using the M. fascicularis data base, Schino et al. (1988b) found that total and mean duration scores confirmed the hypothesis that males received more grooming in one-male groups, while frequency of the grooming bouts did not. While they noted that this result did not conform to their previous statement that frequency and total duration gave the same quantitative description, they felt that the hypothesis had been adequately tested and demonstrated. Duration, more than frequency, was thought to express the grooming relationship in which the male received more grooming.

This referred to the male's "attractiveness" as a

partner. A distinction was made between the quality of the frequency measure in relation to the duration measure. It was thought that frequency referred to competition between groomers over certain partners, while duration expressed the groomee's "attractiveness".

I have drawn attention in depth to this study as it is an example of a problematic research question. If the correlation between measures is overemphasized, then it allows the research question to be manipulated. There may well be a difference between frequency and duration measures, but it is not sound methodology to state a difference after postulating that they provide the same quantitative description. The difference must be studied with a critical analysis of the relationships in the group or groups under investigation, not simply based on correlations.

The emphasis on correlations is also noted in a study which compares grooming and interindividual proximity behaviour (Troisi et al. 1989). The researchers found a correlation between the two behaviours in a study on M. fascicularis and M. nemestrina. One of the suggestions to arise from the study was that grooming and proximity could be viewed as different affiliative behaviours " . . . which express the same mutual preference, i.e. an aspect of attraction or friendship" (Troisi et al. 1989: 204). There is a lack of agreement on this correlation as it has also been suggested that grooming and proximity do not

generate the same kind of data and may, in fact, "... mediate different social processes" (Hornshaw, 1991: 23).

The study comparing allogrooming and interindividual proximity raises an interesting point. Troisi et al. (1989) discuss a methodological problem in studies which use individual totals instead of dyadic scores in the statistical analysis. They emphasize the idea that information on dyadic relationships should not be overlooked and they employ this methodology in their data analysis (Troisi et al., 1989: 198).

A number of studies have been done on behaviour patterns which may or may not relate to grooming. Hair pulling and eating has been discussed as a behavioural disorder (Reinhardt et al. 1986), while oral grooming has been compared in patas and rhesus monkey groups (Starkey et al. 1989). More oral grooming is said to occur in patas monkeys, with very little in rhesus macaques, but the reason for the difference in grooming behaviour has not been identified. Both studies are extremely relevant as both hair pulling and oral grooming have been observed and analyzed in my research on the M. silenus groups.

In addition, facial expressions have been studied in a variety of primates and certain types of communicatory gestures have been connected to grooming behaviour. Lipsmacking has been observed as an initiation process in grooming interactions (Van Hooff, 1967; Sparks, 1967; Redican, 1975; Skinner and Lockard, 1979; Johnson, 1985)

and has been associated with both the dominant and the subordinate individual (Van Hooff, 1967). It has also been interpreted as an appeasing or submissive display (Redican, 1975).

A teeth chattering face (Van Hoof, 1967) or a grin-lipsmack (Redican, 1975) has also been observed before grooming sessions. This has been related to communication from subordinates (Van Hooff, 1967), but the facial expression has also been noted in conjunction with both dominants and subordinates (Redican, 1975).

It is important to note that facial expressions which accompany grooming have been interpreted to relate to aspects of dominance and subordination. This type of classification may be too rigid in regard to communication and there may well be other ways of interpreting these expressions. For example, individuals may be "greeting" one another or may be involved in "friendly" behaviour which is not associated with the position the individual occupies in relation to rank.

The study of facial communication has more recently been conducted in terms of local traditions or group-specific meanings (Zeller, 1987; Nishida, 1987) indicating much greater variability than was previously thought. This is particularly relevant to my research as facial communication in connection with grooming behaviour varied considerably between the two groups.

Grooming behaviour has not been dealt with extensively

in lion-tailed macaques, although the functional aspect of grooming in terms of the removal of ectoparasites and dirt has been observed in a M. silenus group (Hutchins and Barash, 1976). Allogrooming was found to be directed towards the inaccessible parts of an individual's body (the head, the neck and the back area) and was also noted in a group of celebes monkeys and in a group of lemurs.

Grooming behaviour has also been mentioned in two ethograms dealing with captive groups of lion-tailed macaques. One study referred to the observation that subordinates groomed dominants (Johnson, 1985) and the other mentioned that allogrooming did not occur frequently and reciprocal and mutual grooming were observed rarely (Skinner and Lockard, 1979).

Proximity behaviour has been studied in captive lion-tails (Hornshaw, 1975, 1985). Results of this analysis included information that mother-offspring proximity distances varied considerably and that genealogical relations were important in the maintenance of proximal associations.

The sexual behaviour of females and males in captivity has been the subject of research, specifically concerning ovulation time (Lindburg et al. 1985). The study on sexual behaviour was conducted experimentally; this refers to the removal of the animals from their social groups one week prior to the test. The results of the study included the presence of a type of stretch which was associated with

the female before mating occurred -- the stretch was termed "the playboy solicitation posture" (Lindburg et al. 1985: 135). This has a definite relationship to my study as stretching was observed to occur in conjunction with grooming behaviour, but not in connection to mating situations.

Given the above approaches to grooming and M. silenus studies in general, there is another issue I would like to explore further in this review. It deals with the way in which we construct acceptable stories or narratives about the life and behaviour of nonhuman primates. Sociobiology, part of the evolutionary biology paradigm, has had a great deal of influence in this construction.

The Construction of Primate Narratives

The way in which we construct stories about the life of primates, which are generally referred to as behavioural studies, incorporates bias in a number of areas -- the text reflects the gender and the cultural context of the observer and it reflects the past history of the discipline (Haraway, 1989).

According to the majority of grooming studies, individuals work out their relationships based on the concepts of dominance and subordination. The concern of the groomer is to placate or appease the groomee as the groomee holds a more important position (i.e. is more dominant) than the groomer. In sociobiology, grooming is thought to

be a ritualized behaviour, the main intent being to avert aggression from a dominant animal. Therefore an individual grooms another in a gesture of conciliation (Wilson, 1975). Although it has the appearance of altruistic behaviour, the groomer is indeed receiving a benefit as less aggression will be directed towards this individual in a later encounter. Studies are not in agreement with the idea that grooming averts aggression. In fact, by placing the individuals in such close proximity, grooming may actually increase the amount of aggression (Fairbanks, 1980; Silk, 1982).

No longer is grooming primarily associated with a hygienic function, not that this function has ceased to exist, but it has taken on another meaning. Grooming has become inextricably linked with aggression through the concept of the dominance hierarchy.

Hierarchies are formed in the course of the initial encounters between animals by means of repeated threats and fighting. But after the issue has been settled, each individual gives way to its superiors with a minimum of hostile exchange. Troops of baboons, for example, often go for hours without displaying enough hostile exchanges to reveal their hierarchy. Then in a moment of tension -- a quarrel over an item of food is sufficient -- the ranking is suddenly revealed appearing in graphic detail rather like an image on photographic paper dipped in developer fluid.

Wilson, 1975: 280

The revelation of rank is indeed a powerful image. At stake is the notion that aggressive tendencies provide evidence for the existence of dominance as this concept

cannot be observed directly. "A moment of tension" furnishes sufficient data to postulate the existence of a dominance hierarchy in the above scenario. If aggressive conflicts are not the measure one uses to interpret social relationships, the image becomes much less powerful.

Dominance concepts and the assessment of rank which flow from dominant-subordinate interactions has been the focus of considerable controversy within the last twenty years. One of the major problems with the concept is whether it is primarily an anthropomorphic approach -- humans may be bound by hierarchical concerns and males, in particular, may relate to this concept, but we cannot be sure that other species do or do not (Rowell, 1974; Bernstein, 1981; Fedigan, 1982).

It has been suggested that monkeys possess the type of cognition necessary in order to rank and classify each other (Seyfarth, 1981, 1983; Cheney et al. 1986). The reason given for this suggestion is highly anthropomorphic -- it is based on the idea that humans construct systems of classification in order to make sense of the world.

From a participant's point of view, social structure is essentially a matter of classification. An individual distinguishes others according, for example, to kinship, marriage, status or residence and he lumps or splits others into different categories that may overlap to varying degrees.

Seyfarth, 1983: 189

While it may be true that some humans are overly concerned with classification, the statement is a broad

generalization and it is not clear how this can be applied to nonhuman primates.

It is also doubtful whether a measure can be devised to ascertain how an animal might indicate knowledge of their ranking position in relation to other individuals. Seyfarth's measure is the grooming interaction, although there is a fundamental circularity in this approach.

... in one group of free-ranging baboons, I found that adult females, whom I had ranked by observing dyadic approach-retreat interactions, made a similar ranking of themselves when responding to each other's grooming solicitations (Seyfarth, 1976). The data were as follows: all females solicited grooming for each other by presenting their flank. Individuals who received such grooming solicitations could respond either by grooming or by ignoring the solicitor. . . . females who received solicitations were given a relatively free opportunity to distinguish among others, and potentially to reveal a rank hierarchy of their own preferences. Results showed that individuals ranked each other in a manner consistent with the dominance ranks I had drawn up on the basis of approach-retreat interactions.

Seyfarth, 1981: 447

The interchangeability of grooming and approach-retreat interactions suggests that the initial construction of rank hierarchies has a profound influence on the interpretations of the grooming relationships. Rank hierarchies may exist because researchers have the ability to count certain types of interactions between individuals and then transform this information into a hierarchy of individual ranks (Bernstein, 1981). To assume that similar rankings are made by the animals themselves when the initial ranking was constructed by the observer may indeed

be problematic. This assumption is an underlying component in a number of primate behavioural studies. If the assumption is found to be unwarranted, this will alter the conclusions drawn in these studies. They must be subject to a complete reevaluation.

It is also unclear how dominance concepts apply to evolutionary theory. If priority to the means of survival and reproductive success is the measure, once again mediated by aggression (Wilson, 1975), then we must assume that the winners of the conflicts have inherited certain qualities. It is not clear how animals can inherit these qualities in regard to relationships, especially in terms of selective pressures. The evolution of social behaviour (in essence, the relationships between and among individuals) has not been demonstrated in biological studies; it is not clear that it can be demonstrated.

Evolutionary selective pressures cannot select for relationships such as heavier than, taller than, smarter than, or more dominant than. Evolutionary selective pressures cannot operate on the relative contents of social contexts favouring one individual over another. Genes lie in the individual, not in the spaces between individuals.

Bernstein, 1981: 422

Whether an individual wins or loses in a conflict situation (winners and losers are perceptions on the part of the observer) may not indicate if an animal is dominant over one individual or all others. Perhaps the perceived subordinate has a significant amount of control over the situation and the concept of a subordination hierarchy has

been proposed (Rowell, 1974). This suggests that interactions can be viewed utilizing substantially different parameters and the change of perspective alters the direction of acceptable behavioural statements. This is an important point as relationships are subject to a radically different interpretation. Nevertheless, the concept remains problematic as it is bound by the underlying assumptions that have produced the link between ranking and dominance -- the implied existence of a hierarchy within the group.

Another concern with the dominance concept is the permanency of the rank order. In one grooming study, status relationships within a group of rhesus monkeys were discussed:

This study also shows that the patterns of interaction that structure a population of monkeys into a society are continually reorganizing, the statuses of individuals continually changing, as individuals mature and as the composition of the group changes through addition and loss of individuals.

Sade, 1965: 16

This is an interesting statement, but it was not one that most researchers of that time took seriously. The dynamic component of primate life is not generally taken into account in the construction of hierarchies which tend to be regarded as stable units.

Dominance hierarchies are not the only systems imposed by the observer. Consider the notion of kinship.

Imagine a network of individuals linked by kinship within a population. These blood relatives cooperate or bestow altruistic

favours on one another in a way that increases the average genetic fitness of the members of the network as a whole, even when this behaviour reduces the individual fitnesses of certain members of the group.

Wilson, 1975: 117

Kin selection theory has been used to promote the idea that it is kin-based altruism which is operating on the grooming unit. To sociobiologists, altruism is difficult to deal with as natural selection favours individuals who selfishly compete in terms of their own survival (Wilson, 1975). If it can be shown that grooming with kin is higher than with unrelated individuals the apparent altruism can be explained. It is important to note that the appearance of altruism in grooming relationships has been explained previously in terms of the reduction of aggression linked to the formation of a dominance hierarchy.

There is a major problem in the use of kin selection theory in primate studies. It is difficult to ascertain, especially in grooming studies, how much grooming has been recorded solely in terms of the immediate mother-offspring unit. A female who gives birth to an infant is in immediate proximity to that infant. For the first six months of the offspring's life, the infant must remain in close contact with the mother in order to obtain sustenance. This may be a biological necessity, but to postulate kin selection based on the intense maternal care of the young infant is problematic.

The use of the term "kinship" is questionable in that it has extreme anthropomorphic connotations. Humans place a

considerable value on kin relationships, but can the same be said of nonhuman primates. Female primates do spend a large amount of time caring for their offspring. Whether this can be shown to relate to genetic differences between females and males in terms of social behaviour has not yet been demonstrated.

Even in studies that provide substantial geneologies, it is difficult to isolate the effects of kinship from other variables. Relationships may be attributable to other factors, for example, to age or friendship. To combat this problem, kinship has been studied in connection with dominance hierarchies and it has been suggested that kin are more likely to support other kin in agonistic encounters than are nonkin (Silk, 1982; Cheney et al. 1986). The assumption which links kinship to alliance formation rests on the interpretation of aggressive situations and is very much subject to prior assumptions of the observer.

In addition to research on kinship, considerable emphasis has been placed on female primates in recent behavioural studies. This is due to a number of factors. There are more women working in the discipline and the focus also reflects the growth of feminist theory in the sciences.

While it may not be surprising that primatologists (both female and male) place considerable emphasis on female primates, this has led to a methodological problem.

The behaviour of female primates is very often interpreted in terms of the "presumed" attributes of male primates -- it is suggested that females can be as dominant, as aggressive and as competitive as males. It is important to realize that by interpreting the behaviour of females in this way the researcher is molding the female into a restrictive framework, one that is ultimately within the sociobiological paradigm (Bleier, 1986).

This further separates females from males as females are considered to have their own dominance hierarchies and are considered to be more "powerful" in certain areas such as those connected to maternal behaviour. This tends to reflect the biology of the female. I am not denying that females are "powerful" primates, but I am suggesting that their influence is seen to be a part of the overall system which sociobiology has created. Differences between female and male are stressed in sociobiology due to separate reproductive strategies (Trivers, 1972). Females and males invest different amounts of time in respect to the care and survival of the young. According to Trivers, the female investment is higher than the male's as the female must not only carry the fetus prior to birth, but she must also protect and nourish the infant for a long period after its birth. The male must spend more time and energy disseminating his genetic material. This results in lower investment by the male in terms of care of the young. For sociobiologists this implies a behavioural difference based

on the sex of the individual.

A considerable amount of confusion has arisen in primate studies connected to the meaning of the terms "sex" and "gender". "Gender is a concept developed to contest the naturalization of sexual difference in multiple arenas of struggle" (Haraway, 1989: 290). Gender is certainly a crucial consideration in terms of the observer, but not necessarily for the animals which are under investigation. The boundary becomes blurred between female primatologist and female nonhuman primate (Haraway, 1989: 292). Blaffer Hrdy made this quite clear as she was commenting on a statement made in one of her books:

For generations, langur females have possessed the means to control their own destinies: caught in an evolutionary trap they have never been able to use them (p. 309). I might as well have said we.
Blaffer Hrdy 1986: 138

This has come to mean that all female primates, human and nonhuman, are considered to be the same. While it is important to understand that gender has implications in the way we look at the overall problem, it is also crucial to realize that this is due to cultural and learned factors relating to the observer and not due to a biologically inherent trait (Code, 1981).

It is interesting to note that in 1970 the statement was made that females had "little or no power" in primate groups (Terry, 1970: 132), while recently reference has been made to females who "empower" themselves by the use of certain mating strategies (Small, 1990), in this case,

synchronization of sexual cycles in female Barbary macaques. We have gone from one extreme to the other and have substituted one conceptual problem for another. "Empowerment" is a term which suggests that people, organizations and communities can gain control or mastery over their own affairs (Rappaport, 1987: 122) and it is used generally in connection with community psychology. There is no reason to assume that female nonhuman primates are in a similar situation to human females within organizations or communities. In addition, the anthropomorphic parallel implies that female nonhuman primates are in an unfair and unequal situation. We cannot make an assumption of this magnitude.

The article which refers to the "empowerment" of females deals with behaviour which is referred to as "promiscuous" in that females mate with multiple males in rapid succession. It is thought to occur "... because males are unable or unwilling to stop them" (Small, 1990: 267). "Promiscuity" becomes a term that is applied to nonhuman primate females because a similar behaviour exhibited by a human female is referred to in this manner. Societal value judgements should not be transferred to another species as the value judgement itself may derive from moralistic concerns and may indeed be questionable.

It appears that Small's main concern is to provide an explanation of this "promiscuous" behaviour which will fit within the bounds of evolutionary theory -- it must be

selective or it will not occur. This explains the interpretation of female behaviour in terms of the male -- the male cannot stop them. The rationale is based on male-centered theory.

Female Barbary macaques are "promiscuous" because males are unable, or unwilling, to stop females from moving on to new partners. Females are undefendable resources to males, because females cycle synchronously.

Small, 1990: 280

The idea that female behaviour must be interpreted in terms of the male is an essential part of sociobiological theory. It has been stated that feminist theory and sociobiology are very similar in their analytic framework in that male domination "... becomes something one does rather than a relationship which depends for both its existence and character on other relationships" (Smith, 1982: 227). This may explain why female primates are analyzed, not only in relation to the male, but in terms of "presumed" male attributes.

One thing is abundantly clear -- it is not a function of primatologists of either gender to attribute the concept of "empowerment" to the nonhuman female primate, assuming this to be possible. This is our construction, not theirs.

Variation in primate species has become a major problem in primatological studies as the main focus of research has been to identify universal patterns of behaviour and thus reduce the amount of difference. In this way the search for evolutionary patterns as typified by the behaviour of humans can be justified. This is illustrated

in articles on grooming behaviour which attempt to explain the behaviour in terms of generalizations covering a large number of primate species (Sparks, 1967; Terry, 1970; Seyfarth, 1977, 1983; Hinde, 1983; Goosen, 1987).

The individual is often underemphasized in primate studies, especially if that individual is displaying behaviour thought to be idiosyncratic. This idea functions at the group level as well.

A pervasive problem in the study of small groups of captive animals is that individual or group peculiarities may bias results.

Barton, 1985: 520

This is not a problem according to researchers who feel that adaptation is a social process and that local traditions, rather than representing peculiarities, express the dynamic process of group interactions (Fedigan, 1976; Hornshaw, 1991).

How we view primate groups depends to a great extent on our background and the situation under which we study. If the objective is to study all animal species in the same way, then the dynamics of a system become less important in contrast to static qualities. Sociobiology's goal is to use the same parameters and theory to analyze both termite colonies and troops of rhesus monkeys (Wilson, 1975: 4). If primatology continues to be dominated by sociobiological principles it is clear that similarities will remain the prime focus not differences or variations in behaviour.

Chapter III

Statement of the Research Problem

The initial objective of my analysis is to determine whether there is a relationship between grooming behaviour and the independent variables of sex, age and kinship. In addition, I will analyze the nature of the relationships involved in order to assess my observations in comparison to previous studies.

Research Questions

1. Is there a relationship between sex and grooming? If sex is a factor in grooming relationships, do males receive more grooming than females? Do the adult females groom more frequently? If this is the case, to whom is their grooming directed?
2. Is there a relationship between age and grooming? If age is a factor in grooming relationships, do adults groom more often than juveniles? Do juveniles direct more grooming towards the adults in contrast to the amount of grooming given to them by the adults?
3. Is there a relationship between genealogy and grooming behaviour? Is more grooming directed to offspring by their mothers? If adults are related, do they groom more frequently than non-related adults?

In addition to the above research questions, there are a number of areas of further interest which can be

investigated. This analysis centres on the description of grooming in the following:

1. Duration of grooming bouts
2. Areas groomed
3. Communication between individuals in the form of initiation sequences, midgroom sequences and groom terminations
4. Specific types of grooming which occur in the two groups, particularly the mouth groom and hair pulling
5. Analysis of specific grooming relationships to ascertain if certain individuals have favoured partners or unique behaviours in particular liaisons

Methods

My study was undertaken at the Assiniboine Park Zoo in Winnipeg, Manitoba and was conducted from May 14th, 1990 through January 30th, 1991 -- a period of eight months. The zoo is home to a large number of lion-tailed macaques (Macaca silenus) and two groups are on view to the public. Their group size varies and it is this aspect which offers an opportunity to compare the grooming behaviour of the two groups and to examine the way in which the behaviour differs.

The data have been collected solely on allogrooming as I am interested in the affiliative relationships between individuals. Allogrooming is described as grooming between or among individuals.

The Subjects in the Study

The group which was housed in the Tropical House consisted of eight individuals at the beginning of the study, while seven individuals remained at the end of the project. At this time, the group was composed of two adult females, one adult male, three juveniles and one infant (Table 1). The group will be referred to as Group One from this point on.

An infant male was born on October 24, 1990, close to the termination of the study. In addition, Mindy, an adult female, and Emily, a female infant, were included in the group at the beginning of the research, but were removed shortly after on May 18, 1990, due to Mindy's health problems. Mindy and Emily are not included in the majority of the data analysis as information on their grooming interactions was not collected after May 18th, 1990.

The group occupying a space in the Monkey House consisted of 12 individuals at the beginning of the study. This group will be referred to as Group Two. The composition of the group included four adult females, one adult male, four male juveniles and three infants, two of which were male and one female (Table 2). By the end of the study, there were 14 members as two new infants were born -- Nini gave birth to a female on November 9, 1990 and Nameless gave birth to a female on December 23, 1990. This will be reflected in the data as the amounts of grooming to both infants will be smaller in relation to other

TABLE 1GROUP ONETROPICAL HOUSE

<u>NAME</u>	<u>SEX</u>	<u>AGE*</u>	<u>DATE OF BIRTH</u>
<u>THUMPER</u>	F	24 YRS	MAY 1966
<u>DEBBIE</u>	F	11 YRS	APR 1979
<u>MINDY**</u>	F	11.5 YRS	NOV 1978
<u>PUNKY</u>	M	15.25 YRS	FEB 1975
<u>JULIUS</u>	M	2 YRS	MAY 1988
<u>BOZ</u>	F	1.66 YRS	SEPT 1988
<u>FUZZ</u>	F	1.16 YRS	MAR 1989
<u>EMILY</u>	F	2 MONTHS	MAR 1990
<u>OTTO***</u>	M	BORN OCTOBER 24 1990	

JULIUS -- OFFSPRING OF THUMPER AND PUNKY
 BOZ EMILY -- OFFSPRING OF MINDY AND PUNKY
 FUZZ OTTO -- OFFSPRING OF DEBBIE AND PUNKY

* AGE AT THE TIME THE STUDY COMMENCED

** MINDY AND EMILY WERE REMOVED FROM THE GROUP ON
 MAY 18 1990

*** OTTO WAS BORN DURING THE STUDY PERIOD

TABLE 2GROUP TWOMONKEY HOUSE

<u>NAME</u>	<u>SEX</u>	<u>AGE*</u>	<u>DATE OF BIRTH</u>
<u>NINI</u>	F	8.5 YRS	NOV 1981
<u>OPHELIA</u>	F	9.25 YRS	AUG 1981
<u>SAMANTHA</u>	F	10 YRS	MAY 1980
<u>NAMELESS</u>	F	9.16 YRS	JULY 1981
<u>WOLFGANG</u>	M	10 YRS	JUNE 1980
<u>KELSEY**</u>	M	2.33 YRS	JAN 1988
<u>SAMMY**</u>	M	2.25 YRS	FEB 1988
<u>JEREMY**</u>	M	2.16 YRS	MAR 1988
<u>NOEL**</u>	M	1.58 YRS	OCT 1988
<u>SLOAN</u>	M	6 MONTHS	NOV 1989
<u>NIEVE</u>	F	6 MONTHS	NOV 1989
<u>CENTURY</u>	M	5 MONTHS	DEC 1989
<u>NORANDER***</u>	F		BORN NOV 11 1990
<u>HOLLY***</u>	F		BORN DEC 12 1990

KELSEY CENTURY	-- OFFSPRING OF OPHELIA AND WOLFGANG
SAMMY SLOAN	-- OFFSPRING OF SAMANTHA AND WOLFGANG
JEREMY HOLLY	-- OFFSPRING OF NAMELESS AND WOLFGANG
NOEL NIEVE NORANDER	-- OFFSPRING OF NINI AND WOLFGANG

* AGE AT THE TIME THE STUDY COMMENCED

** REFERRED TO AS JUVENILES IN THE DATA

*** NORANDER AND HOLLY WERE BORN DURING THE STUDY PERIOD

offspring.

Group members were classified in terms of adults, juveniles and infants:

adult: all the adults were eight years or older and all the adults were sexually mature

juvenile: within this category, I placed all individuals over one year of age, so it included animals from this age up to three years of age -- there were no subadults (three to five years of age) in either of the two groups (the lack of subadults is important to consider when applying the results of this study to other projects)

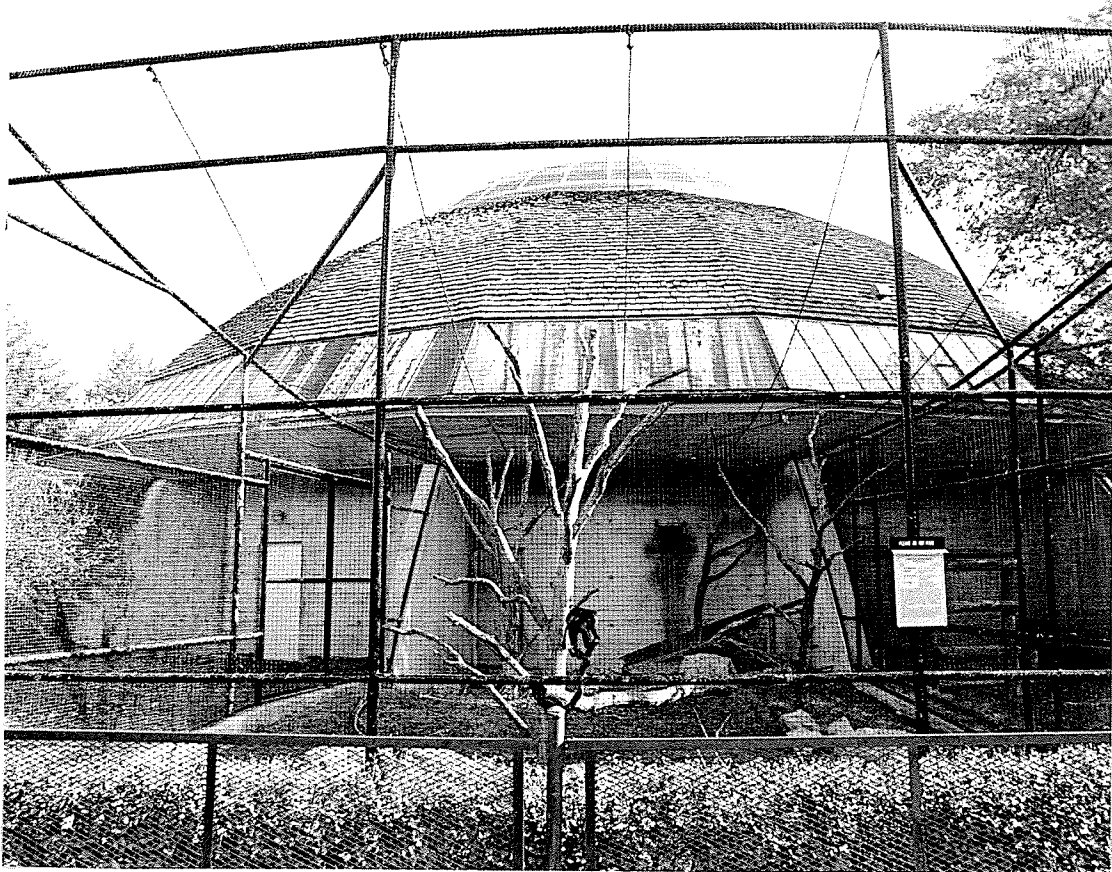
infant: all individuals younger than one year of age.

The reason I chose the division between juvenile and infant at one year relates mainly to the activities of the animals at this age. Prior to this, the infants are primarily in the vicinity of their mothers. After one year, more time is spent playing with other age-mates and older juveniles (personal observation). It is somewhat of an arbitrary procedure to categorize group members in this way and any categorization is a creation of the observer. This is the main reason I employed this system of classification as I felt this division to be the least problematic. The majority of grooming occurs between the adults. To create more categories in respect to individuals of one, two and three years was not a construction necessary to this particular grooming study.

The majority of the individuals in both groups were easily identifiable, except in the case of the juveniles in Group Two. The juveniles, all male, were similar in size and appearance as their ages ranged from 1.6 to 2.3 years. It was evident that accurate identification would be impossible in the time available for my observations. All four juveniles were given the same designation and the impact of this will be discussed in the results section.

The macaques had access to both indoor and outdoor enclosures during the study. Most of the data were collected when the animals occupied the outdoor spaces. In Group One, 77.3 percent of the bouts were observed outside, while 22.7 percent were collected in the indoor enclosure. In Group Two, 76.4 percent were collected in the outdoor enclosure with 23.6 bouts observed inside.

Group One had access to an outdoor cage, measuring 9 metres by 13.7 metres by 5 metres high. It was covered in wire mesh on three sides including the roof, with the wall of the Tropical House enclosure providing the fourth side. The ground was covered in grass and portions of tree trunks and logs were scattered in certain areas along with large rocks. The indoor cage was considerably smaller and measured 3 metres by 4 metres by 3.3 metres high. The walls were made of painted concrete, although a glass partition separated the animals from the public. Three shelves for the animals' use were attached to the walls and a pole was situated in the middle of the cage with a flat

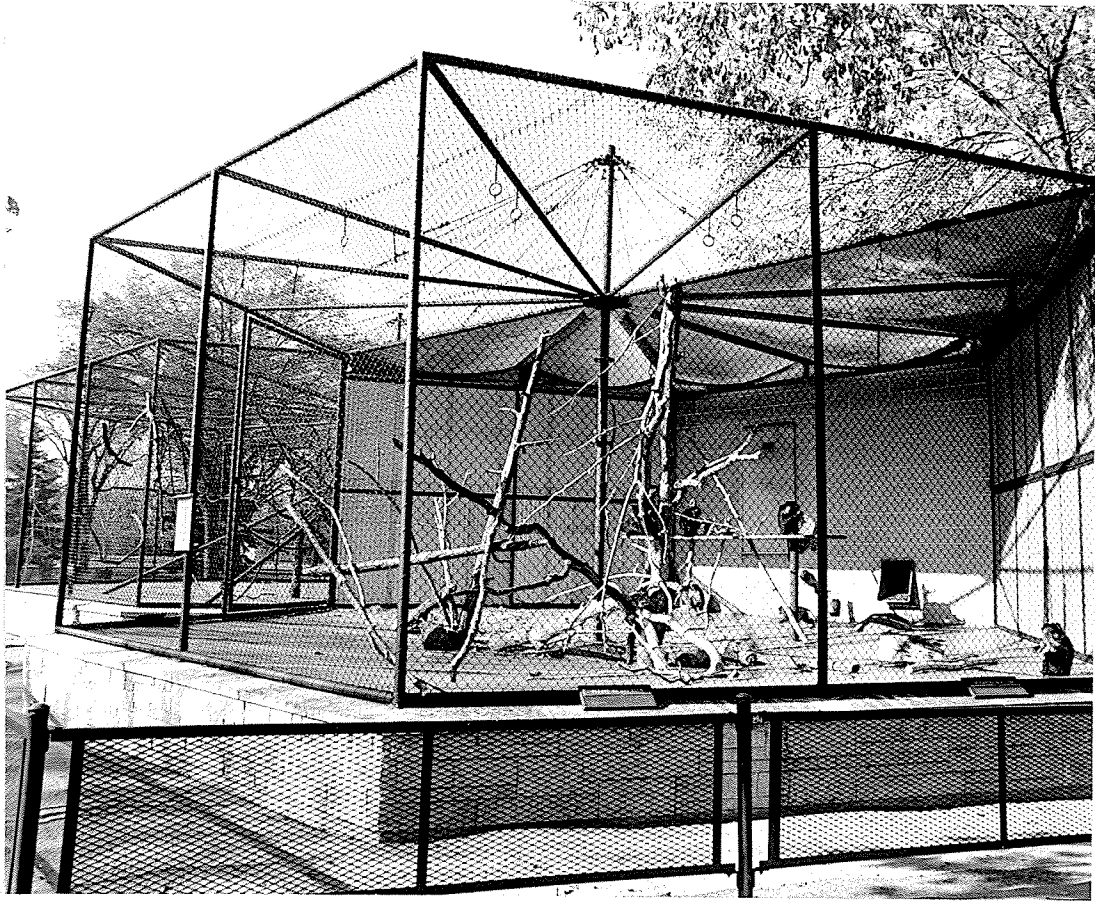


ENCLOSURE GROUP ONE

platform on the top. In both situations, the individuals could be seen and identified easily, but there was a space between the indoor and outdoor areas where they were able to disappear from sight. This did not happen frequently and so did not pose a significant problem.

Group Two had a similar system of enclosures. The cage itself was slightly elevated and the floor of the cage was made of concrete. It was hexagonal in shape and each wall measured 5.2 metres long. The height was 3.6 metres. Inside the cage, there was a long elevated shelf at the rear and two tree trunks toward the front of the cage. The walls were made of wire mesh on three sides including a portion of the roof while the walls of the Monkey House enclosure formed the remaining three sides.

The inside space was somewhat different from the Tropical House as there were three compartments, separate yet connected, for the animals to inhabit. Each compartment measured 1.5 metres by 1.5 metres by 2.4 metres high. Glass formed one wall while the remaining walls were made of concrete and metal. The ceiling had an open design with a series of iron bars forming the top of the cage. The inside and outside enclosures were connected by a long tunnel, but most individuals did not spend much time in the tunnel; in general, they spent their time either inside or outside.



ENCLOSURE GROUP TWO

Method of Data Collection

Data were collected on grooming bouts which occurred between individuals. A grooming bout was defined as any occurrence where one individual picked through the hair of another. Both hands were generally used in grooming, but one-handed grooming also occurred. Grooming by mouth and hair pulling had been observed previously so information on these activities was recorded under the category delineated as a grooming bout.

If a grooming bout had a duration of less than 30 seconds, it was recorded as a brief groom. If the bout lasted 30 seconds or longer, the duration was noted; if the groom was interrupted for more than 30 seconds, this terminated the bout. Information was collected on the areas groomed in order to ascertain if certain areas were groomed more frequently than others. The areas were recorded using the following categories: head, back, chest, limbs, genitals and tail.

Behaviour which occurred prior to the grooming session was noted in order to assess whether the preceeding sequences were associated primarily with the groomer or the groomee. The behaviours included lipsmacking, stretching or an approach to or by another individual. Lipsmacking was defined as a rapid up and down movement of the lips -- the mouth was closed and the teeth were not visible. Stretching referred to a behaviour where the head was tilted back, the chest stretched out and one or both arms were raised in the

air.

In certain cases, the participants were sitting together and one would lean over and start to groom. Any actions other than lipsmacking and stretching were noted and categorized in relation to the groomer and the groomee; for example, a "hugging" sequence, posture change and play. The "hug" was a term used to indicate a ventral-ventral embrace between two individuals. Although I refer to it as a "hug", I realize that the behaviour may be different from the type of hug engaged in by human individuals.

Communication occurred in the middle of a groom as well and notes were taken specifically on sequences of lipsmacking, hugging and stretching. Other behaviours that occurred were also recorded; self-grooming and moving to another area of the cage provide examples of the type of behaviour which was noted.

Groom terminations were observed and information was collected on whether one individual left or another approached, if another groom occurred, if a reciprocal event occurred or if the termination happened due to another interruption.

The data were recorded on a check sheet (Appendix 1). The sessions were timed with a large watch which could be read quickly, although it was necessary to glance downward to record the time. Observations were collected in the morning between 10:00 a.m. and 12:30 p.m. and in the late afternoon between 4:30 p.m. and 6:30 p.m. Both observation

periods took place after the animals had been fed. Sessions ranged from one to two hours in length depending on weather conditions and zoo activity. Data were collected on both groups in the same day by alternating morning and afternoon sessions. The majority of grooming bouts occurred in the morning sessions as opposed to the afternoon sessions. In Group One, 62.2 percent of the bouts occurred in the morning in contrast to 74.2 percent for Group Two.

The technique used to record the grooming behaviour of the two groups is referred to as all occurrence sampling (Altmann, 1974). This reflects the research problem in that a more complete record of the grooming behaviour of all the group members could be compiled. In this way, both frequency and duration could be calculated and both measures are important aspects of grooming behaviour.

All occurrences has also been referred to as a continuous recording technique.

In practice, continuous recording is typically used for recording the frequencies of discrete events and for recording the durations of behavioural states, particularly when it is important to preserve information about the sequence of behaviour patterns.

Martin and Bateson, 1986:53,54

For my purposes, it was important to record as much as possible in relation to grooming, as the study contains both descriptive and inferential statistical analysis. Not only was it crucial to note all categories on my check sheet, it was essential to record those behaviours not outlined specifically on the sheet. While I had completed a

preliminary study of grooming, it was not clear that I had observed all the activity connected to the grooming behaviour of the two groups.

All occurrences sampling provided the most useful method for the collection of grooming data. While grooming occurred frequently, it did not occur at rates so high that I was unable to record all the sequences. At the same time, certain observation sessions had a much higher frequency of grooming interactions and it is not possible to provide an absolute guarantee that all grooming bouts were recorded.

The zoo is a public domain and there were instances when observation conditions were not optimum. For example, if a large number of visitors approached the animal enclosures in a noisy or interfering manner, this would distract the animals and grooming bouts would be discontinued. In these circumstances I could either stop my observations or, if the distraction was not too severe I could keep recording, but it was important to note the reason for the disruption.

For the most part, visitors did not distract the animals except in certain cases where they tried to touch or feed certain individuals. In those cases, I would cease recording to comment on their behaviour (visitors). When this occurred, I would indicate a break in the observation time.

Method of Data Analysis

The data were coded and entered into an SPSS-X

computer program to analyze the results. The chi square test was chosen for the analysis of the independent variables, sex, age and kinship. This was warranted as all the variables were measured at the nominal level (age data were grouped under the categories adult and juvenile). Since the number of choices available to group members were limited, the chi square tests were adjusted accordingly (Ferguson, 1966: 212).

The bouts were separated into three groups: those of brief duration (less than 30 seconds); grooms of 30 seconds or longer; and those of 10 minutes or longer (Table 3). The majority of the analysis has been done on the total number of grooms, although the breakdown into smaller units has been used for specific behaviors, for example, mouth grooming, hair pulling and midgroom sequences. It is important not to overlook the grooming bouts which consist of extreme values (i.e. those of 10 minutes or longer) as these bouts contain information which tends to be excluded from the analysis of the total number of grooming bouts.

In total, 731 grooming bouts were recorded over a period of 8 months for Group One and 1940 bouts were observed in Group Two. Group One spent a total of 19.7 hours engaged in grooming behaviour, while 54.7 hours was the total for Group Two. The two groups were observed for 244.9 hours -- 126.7 hours for Group One and 118.32 hours for Group Two.

TABLE 3BREAKDOWN OF GROOMING BOUTS

	<u>GROUP ONE</u>	<u>GROUP TWO</u>
<u>BRIEF</u>	300	657
<u>30 SEC. OR LONGER</u>	413	1222
<u>INCOMPLETE</u>	18	61
<u>TOTAL NUMBER OF BOUTS</u>	731	1940
<u>MORNING BOUTS</u>	455	1440
<u>AFTERNOON BOUTS</u>	276	500
<u>10 MIN. OR LONGER</u>	17	31
<u>LONGEST GROOMING BOUT</u>	27.5 MIN.	22.25 MIN.
<u>TOTAL DURATION</u>	19.7 HRS	54.7 HRS
<u>TOTAL OBSERVATION TIME</u>	126.7 HRS	118.32 HRS

BOTH GROUPS

<u>TOTAL NUMBER OF GROOMS</u>	2671
<u>TOTAL OBSERVATION TIME</u>	245.02 HRS

Chapter IV

Results

Sex Differences in Grooming

The relationship between the biological sex of the participants and their grooming behaviour was analyzed in both Group One and Group Two. There was a significant difference in the selection pattern of the males and females in both groups (Table 4; chi square, $p < .001$).

Group One:

In comparison to the expected frequency, a higher number of observations were noted in relation to the selection pattern of the females and the males: males groomed females more frequently than expected, while females groomed other females more often. This test deals with the grooming frequencies in relation to the total number of females and males (excluding one infant) -- analysis is based on a comparison of four females and two males. Specific partnerships and durations between individual group members will be discussed in the following chapter.

In terms of descriptive statistics (Figs.1,2; Table 4A), the females had a grooming frequency of 86.7 percent of the total bouts compared to the frequency of the number of male grooming bouts at 13.1 percent; males received more grooms than they gave to others, while the females acted as the groomers more often than they acted as the groomees. The females were involved in more grooming sessions with

TABLE 4CHI SQUARE OBSERVED AND EXPECTED FREQUENCIES
SEXGROUP ONE

	<u>Fo</u>	<u>Fe</u>
<u>MALE TO MALE</u>	12	18.8
<u>MALE TO FEMALE</u>	82	75.2
<u>FEMALE TO MALE</u>	186	232.8
<u>FEMALE TO FEMALE</u>	396	349.2
<u>TOTAL</u>	676	

CHI SQUARE - 18.75 df - 2 $p < .001$ GROUP TWO

	<u>Fo</u>	<u>Fe</u>
<u>MALE TO MALE</u>	9	108.5
<u>MALE TO FEMALE</u>	208	108.5
<u>FEMALE TO MALE</u>	550	785.0
<u>FEMALE TO FEMALE</u>	706	471.0
<u>TOTAL</u>	1473	

CHI SQUARE - 370.1 df - 2 $p < .001$

TABLE 4A

GROOMING DISTRIBUTION OF FEMALES AND MALESGROUP ONE

<u>GROOMER</u>	<u># OF GROOMS</u>	<u># TO FEMALES</u>	<u># TO MALES</u>
<u>FEMALES</u>	634	406 (64%)	226 (35.6%)
<u>MALES</u>	96	83 (86.5%)	13 (13.5%)
<u>INCOMPLETE</u>	1		
<u>TOTAL</u>	<u>731</u>	<u>% AS GROOMERS</u>	<u>% AS GROOMEES</u>
		FEMALES 86.7	FEMALES 66.9
		MALES 13.1	MALES 32.7

<u>GROOMEES</u>	<u>HOURS</u>	<u>PERCENT OF TOTAL</u>
<u>FEMALES</u>	10.8	54.8
<u>MALES</u>	8.7	44.2
<u>INCOMPLETE</u>	0.2	1.0
<u>TOTAL HOURS</u>	<u>19.7</u>	

GROUP TWO

<u>GROOMER</u>	<u># OF GROOMS</u>	<u># TO FEMALES</u>	<u># TO MALES</u>
<u>FEMALES</u>	1709	962 (56.3%)	725 (42.4%)
<u>MALES</u>	225	215 (95.6%)	10 (4.4%)
<u>INCOMPLETE</u>	6		
<u>TOTAL</u>	<u>1940</u>	<u>% AS GROOMERS</u>	<u>% AS GROOMEES</u>
		FEMALES 88.1	FEMALES 60.9
		MALES 11.6	MALES 37.9

<u>GROOMEES</u>	<u>HOURS</u>	<u>PERCENT OF TOTAL</u>
<u>FEMALES</u>	32.0	58.5
<u>MALES</u>	22.4	41.0
<u>INCOMPLETE</u>	0.3	0.5
<u>TOTAL HOURS</u>	<u>54.7</u>	

Grooming By Sex Frequencies

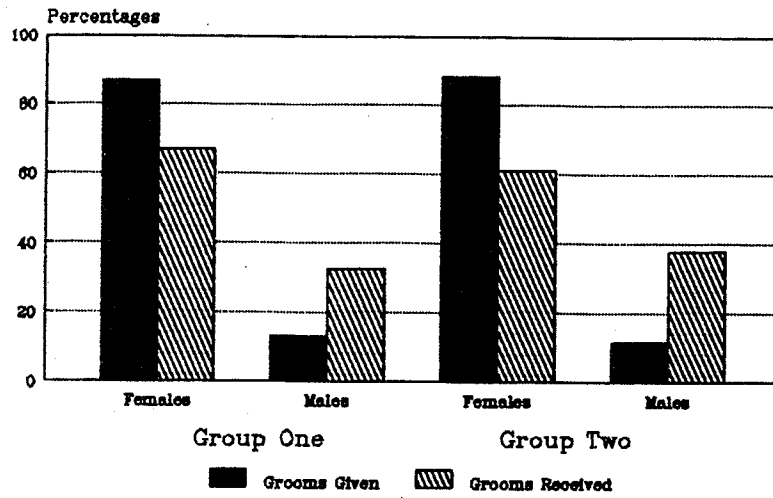


Fig. 1

Grooming By Sex Frequencies of Selection Patterns

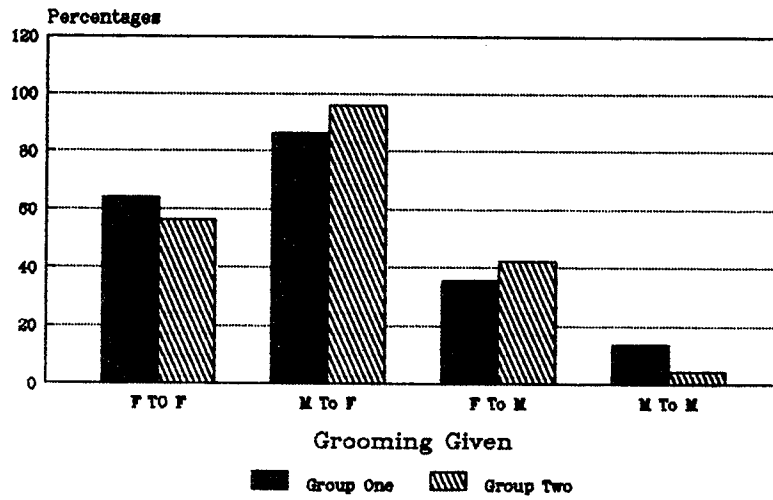


Fig. 2

other females than they were with the males: females selected female partners in 64 percent of the grooming bouts, while they groomed males in 35.6 percent of the bouts; males selected female partners 86.5 percent and groomed other males 13.5 percent.

Group Two:

In terms of the chi square test, the results of this group were similar to Group One. Males groomed females with a frequency higher than expected and this was the case for females grooming other females, as well. As indicated for Group One, this analysis deals with the grooming frequencies in relation to the total number of males and females (excluding five infants) -- the data is based on a comparison of five males and four females. Specific partnerships and durations between individual group members will be discussed later.

In terms of descriptive statistics (Figs.1,2; Table 4A), females groomed for 88.1 percent of the total bouts, while the males groomed for 11.6 percent; females received 60.9 percent of the grooms, while the males received 37.9 percent. The total number of grooms attributed to females consisted of 1709 sessions; they groomed each other for 56.3 percent and groomed the males for 42.4 percent. The males had a total of 225 grooms of which 95.6 percent were directed to the females and 4.4 percent to other males.

Age Differences in Grooming

Data on age were collected in terms of the following categories: adult, juvenile and infant. For the purposes of the chi square test, the data were grouped under the headings of adult and juvenile. All the infants were removed from the data base for this analysis as they did not groom others. There was a significant difference in the grooming patterns in relation to these two categories in both groups (Table 5; chi square, $p < .001$).

Group One:

In comparison to the expected frequencies, a higher number of observations was noted in the grooming pattern between the two categories: adults groomed adults more frequently than expected and juveniles groomed adults more often than other juveniles.

When the descriptive statistics are considered (Fig.3, Table 5A), 52.5 percent of adult grooming bouts were directed to other adults, while the adults groomed the juveniles for 42.1 percent of the total number of adult bouts. Juveniles groomed the adults for a total of 87.8 percent of their bouts with only 3.1 percent directed to other juveniles. The infants did not groom at all and the juveniles and infant received more grooming than they gave to others; the opposite was true for the adults.

For the distribution of age and sex combined, see Table 6. Of particular interest are the grooms between adult females and juvenile females. The adult females

TABLE 5

CHI SQUARE OBSERVED AND EXPECTED FREQUENCIES
AGE

GROUP ONE

	<u>F_o</u>	<u>F_e</u>
<u>ADULT TO ADULT</u>	332	235.2
<u>ADULT TO JUVENILE</u>	266	352.8
<u>JUVENILE TO ADULT</u>	85	53.0
<u>JUVENILE TO JUVENILE</u>	3	35.0
<u>TOTAL</u>	676	

CHI SQUARE -- 102.02 df -- 2 $p < .001$

GROUP TWO

	<u>F_o</u>	<u>F_e</u>
<u>ADULT TO ADULT</u>	1020	707.0
<u>ADULT TO JUVENILE</u>	394	707.0
<u>JUVENILE TO ADULT</u>	56	36.9
<u>JUVENILE TO JUVENILE</u>	3	22.1
<u>TOTAL</u>	1473	

CHI SQUARE -- 303.58 df -- 2 $p < .001$

TABLE 5A

GROOMING DISTRIBUTION -- AGEGROUP ONE

<u>GROOMER</u>	<u># OF</u> <u>GROOMS</u>	<u># TO</u> <u>ADULTS</u>	<u># TO</u> <u>JUV</u>	<u># TO</u> <u>INF</u>
<u>ADULT</u>	632	332 (52.5%)	266 (42.1%)	32 (5.1%)
<u>JUVENILES</u>	98	86 (87.8%)	3 (3.1%)	9 (9.2%)
<u>INFANT</u>	0	0	0	0
<u>INCOMPLETE</u>	1			
<u>TOTAL</u>	<u>731</u>	<u>ADULT</u> <u>86.5%</u>		
		<u>JUVENILE</u> <u>13.4%</u>		

GROUP TWO

<u>GROOMER</u>	<u># OF</u> <u>GROOMS</u>	<u># TO</u> <u>ADULTS</u>	<u># TO</u> <u>JUV</u>	<u># TO</u> <u>INF</u>
<u>ADULT</u>	1864	1020 (54.7%)	394 (21.1%)	428 (23%)
<u>JUVENILE</u>	61	56 (91.8%)	3 (4.9%)	2 (3.3%)
<u>INFANT</u>	9	5 (55.6%)	1 (11.1%)	3 (33.3%)
<u>INCOMPLETE</u>	6			
<u>TOTAL</u>	<u>1940</u>	<u>ADULT</u> <u>96.1%</u>		
		<u>JUVENILE</u> <u>3.1%</u>		
		<u>INFANT</u> <u>0.5%</u>		

Grooming By Age Frequencies

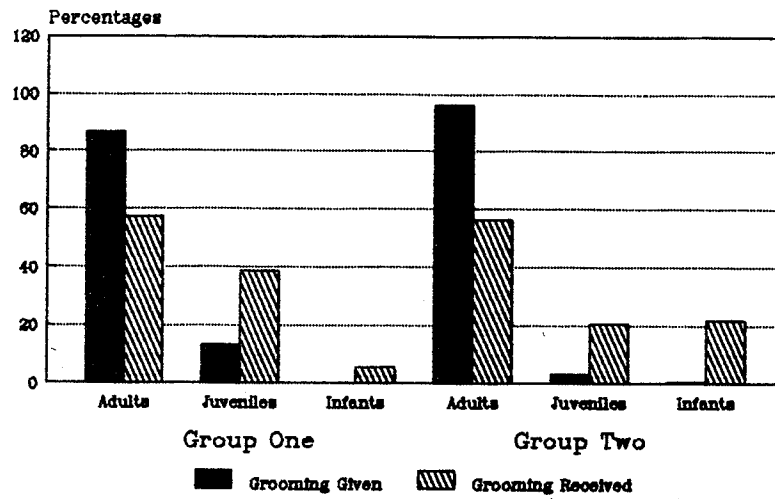


Fig. 3

TABLE 6

GROOMING DISTRIBUTION
SEX AND AGE COMBINED

GROUP ONE

<u>GROOMER</u>	<u># OF</u> <u>GROOMS</u>	<u>PERCENT</u>	<u>ADULTF</u>	<u>PERCENT TO</u>				<u>INFM</u>
				<u>ADULTM</u>	<u>JUVF</u>	<u>JUVM</u>		
<u>ADULTF</u>	566	77.4	34.5	12.7	29.5	17.5		5.5
<u>ADULTM</u>	66	9.0	98.5	0.0	0.0	0.0		1.5
<u>JUVF</u>	68	9.3	63.2	19.1	1.5	2.9		13.2
<u>JUVM</u>	30	4.1	60.0	40.0	0.0	0.0		0.0
<u>INFM</u>	0	0.0	0.0	0.0	0.0	0.0		0.0
<u>INCOMPLETE</u>	1	0.2						
<u>TOTAL</u>	<u>731</u>							

GROUP TWO

<u>GROOMER</u>	<u># OF</u> <u>GROOMS</u>	<u>PERCENT</u>	<u>ADULTF</u>	<u>PERCENT TO</u>				<u>INFM</u>
				<u>ADULTM</u>	<u>JUVM</u>	<u>INFF</u>		
<u>ADULTF</u>	1702	87.7	41.5	9.5	22.8	14.7		10.2
<u>ADULTM</u>	162	8.4	93.8	0.0	3.7	1.9		0.6
<u>JUVM</u>	61	3.1	91.8	0.0	4.9	3.3		0.0
<u>INFF</u>	7	0.4	42.9	0.0	14.3	28.6		14.3
<u>INFM</u>	2	0.1	100.0	0.0	0.0	0.0		0.0
<u>INCOMPLETE</u>	6	0.3						
<u>TOTAL</u>	<u>1940</u>							

groomed juvenile females for 29.5 percent of the grooming bouts of the adult females. This is in contrast to 63.2 percent of juvenile female grooming towards the adult females. The number of juvenile male grooms should be noted, both to the adult females (60 percent) and to the adult male (40 percent).

Group Two:

This group was similar to Group One in the selection pattern of the adults and the juveniles. In comparison to the expected frequencies, there was a higher number of observations in terms of adults choosing other adults and the juveniles groomed the adults more frequently than expected.

In terms of descriptive statistics (Fig.3, Table 5A), the adults had the most grooming bouts, 96.1 percent, with 55 percent of their grooming directed to other adults, while 21.1 percent was directed to the juveniles. The juveniles groomed the adults in 91.8 percent of their total bouts and groomed each other in only 4.9 percent of their total bouts. Juveniles and infants received more grooms than they gave, but the infants did, in fact, groom others -- only nine grooms, but of these grooms, five were directed towards the adults. Of the remaining four grooms, one was given to a juvenile, while three were directed to other infants.

For the distribution of age and sex combined, see Table 6. In terms of the juvenile males, 91.8 percent of

their grooms were directed to the adult females -- the juvenile males did not groom the adult male at all. The adult females directed 22.8 percent of their grooms to the juvenile males, while other adult females received 41.5 percent of the grooms. The adult male received only 9.5 percent of grooms from the adult females. There were no juvenile females in this group.

Kinship Relationships in Grooming

The distribution of kin and nonkin grooming in the two groups was analyzed in terms of descriptive statistics (Table 7), while a chi square test was conducted only on the adult female kin and nonkin categories in Group Two. There was a significant difference in the selection patterns of kin and nonkin in this group (Table 7; chi square, $p < .001$). The test was not done on Group One as there were no kin relationships between the adult females in this group.

Group One:

Within Group One, it was possible to determine all kinship connections in the grooming bouts and all the juveniles could be identified. The group had a slightly higher total of nonkin grooming bouts than those related to kin members (50.7 percent to 49.3 percent, Table 7A). The juveniles and infant had the most kin grooming, while the adults were groomed more by nonkin -- 76 percent of kin grooming went to the juveniles and infant, while 89 percent

TABLE 7

CHI SQUARE OBSERVED AND EXPECTED FREQUENCIES
KINSHIP AMONG ADULT FEMALES

GROUP TWO

	<u>Fo</u>	<u>Fe</u>
<u>KIN GROOMING</u>	298	232.3
<u>NONKIN GROOMING</u>	399	464.7
<u>TOTAL</u>	697	

CHI SQUARE -- 27.84 df -- 1 p < .001

GROOMING DISTRIBUTION -- KINSHIP

GROUP ONE

<u>GROOMER</u>	<u># OF GROOMS</u>	<u>PERCENT</u>	<u>ADULTS</u>	<u>OFFSPRING</u>
<u>KIN</u>	359	49.3	24%	76%
<u>NONKIN</u>	369	50.7	90%	10%
<u>TOTAL</u>	<u>728</u>			

GROUP TWO
EXCLUDING JUVENILES

<u>GROOMER</u> <u>OFFSPRING</u>	<u># OF GROOMS</u>	<u>PERCENT</u>	<u>ADULTS</u>	
<u>KIN</u>	695	49.2	44.6%	55.4%
<u>NONKIN</u>	718	50.8	99.3%	0.7%
<u>TOTAL</u>	<u>1413</u>			

Grooming By Kinship Frequencies

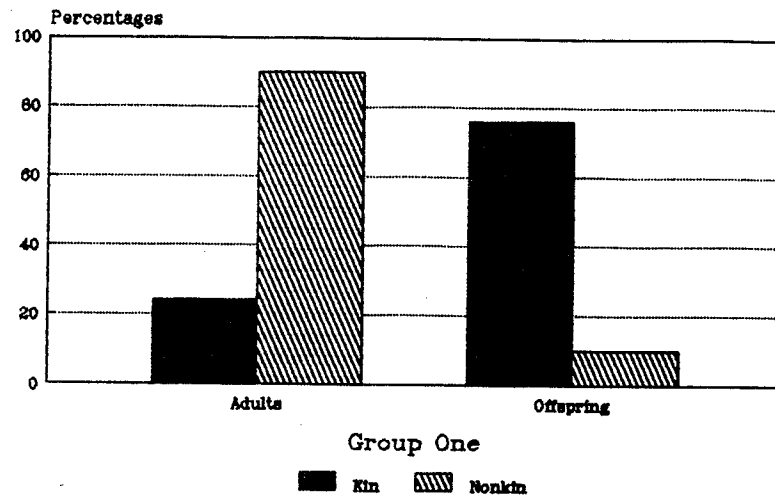


Fig. 4

Grooming By Kinship Frequencies

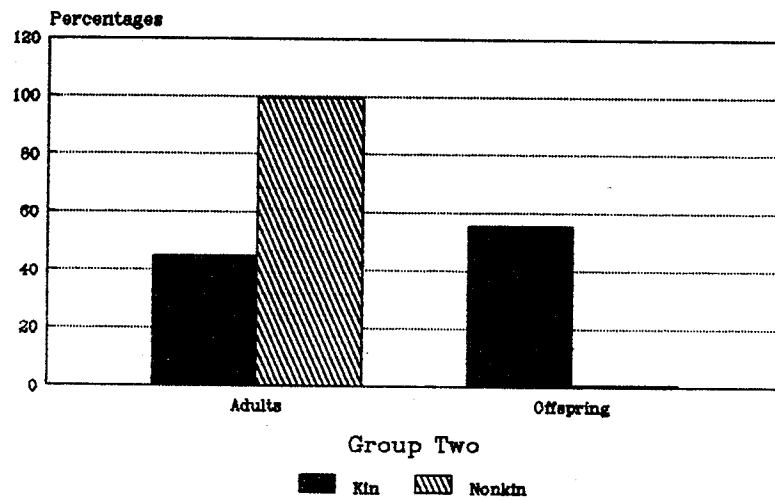


Fig. 4a

of nonkin grooming went to the adults. As indicated previously, the only kin relationships that exist in this group are between the adults and their offspring.

Group Two:

In this group, there were four juveniles who were very close in age to each other and it was not possible to distinguish accurately between them in all grooming bouts. This posed a problem in the determination of kin connections in this group. Due to this complication, the juveniles were removed from the data base in order to establish the number of kin and nonkin grooming bouts.

When the juveniles were removed from the data base, kin grooming had a frequency of 49.2 percent, while nonkin grooming accounted for 50.8 percent. Kin grooming was distributed to the offspring in 55.4 percent of the grooms, while the adults received 99.3 percent of nonkin grooming.

In terms of the adult females, kin grooming accounted for a total of 298 grooms, while nonkin grooming consisted of 399 grooming sessions (697 total grooming bouts). There was a higher than expected number of grooms between kin members (Table 7; chi square, $p < .001$). There are two full siblings and two half-siblings in this group. Since the test deals with the total number of kin grooms, a significant difference between full sibling and half-sibling grooming was not determined. It will be necessary in the following chapter to analyze specific partnerships in terms of both frequency and duration.

Grooming Frequencies and Durations

Group One:

In terms of frequency, the adult females had a higher number of grooming bouts, both as groomers and as groomees. Debbie gave 54.8 percent of the grooming bouts, while Thumper (the oldest female) received the most grooming bouts with a percentage of 23.3 (Fig.5, Appendix 2).

There was substantial variation in the proportion of grooms given, to the number of grooms received. The males received more than they directed to others in all cases. Among the adult females, Thumper received slightly more than she gave, while with Debbie it was the reverse: 54.7 percent as groomer; 19.2 percent as groomee (for frequencies of grooms categorized according to length, see Fig. 6, 7 and 8; Appendix 2). In brief grooming sessions, both Thumper and Boz, a juvenile female, received more grooming bouts than they gave to others. In grooms 10 min. or longer, Thumper gave the highest number of grooms, while Boz was not involved in any grooms of this length.

Overall, the females were groomed for a total of 10.8 hours (out of a total of 19.7 hours) or 54.8 percent, while the males were groomed for 8.7 hours or a total of 44.2 percent. Although Punky, the adult male, was groomed for 5.9 hours (the highest duration), the majority of his grooming was given by Thumper who provided 76.3 percent of his total amount (Appendix 4). In contrast, Debbie groomed Punky for a total of 16.9 percent.

Group One Grooming Frequencies

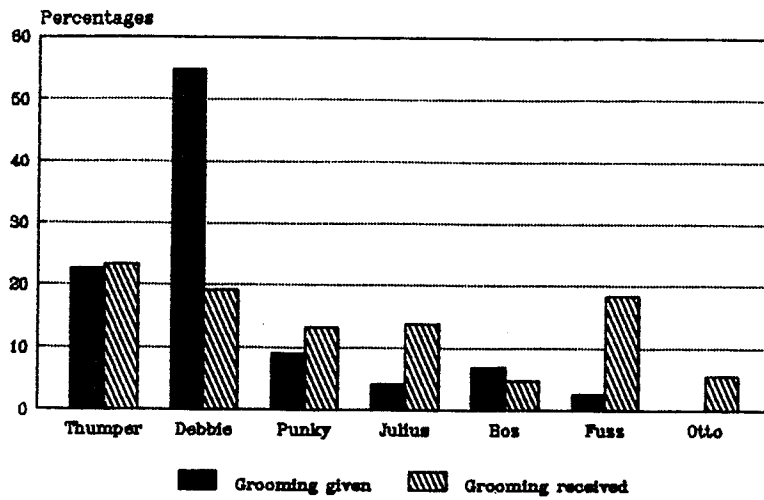


Fig. 5: total number of grooms

Grooming Frequencies

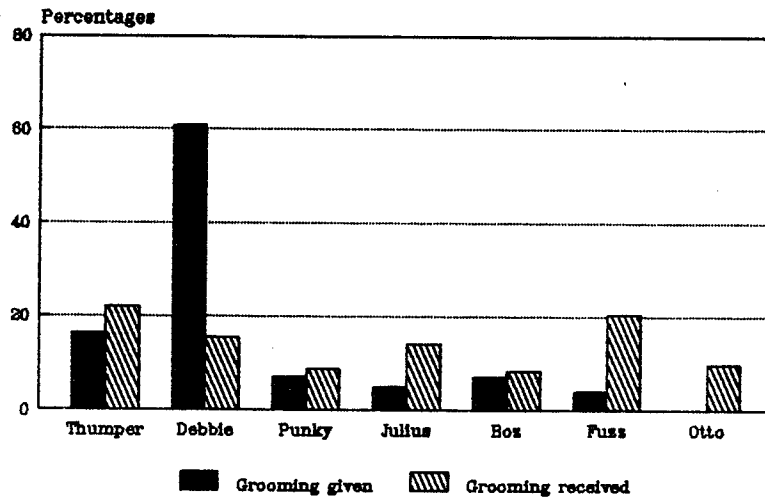


Fig. 6: brief grooms

Group One Grooming Frequencies

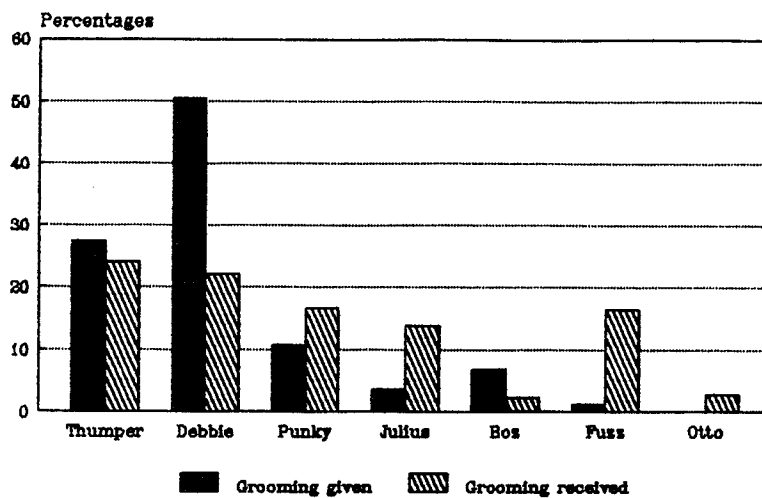


Fig. 7: 30 sec. or longer

Grooming Frequencies

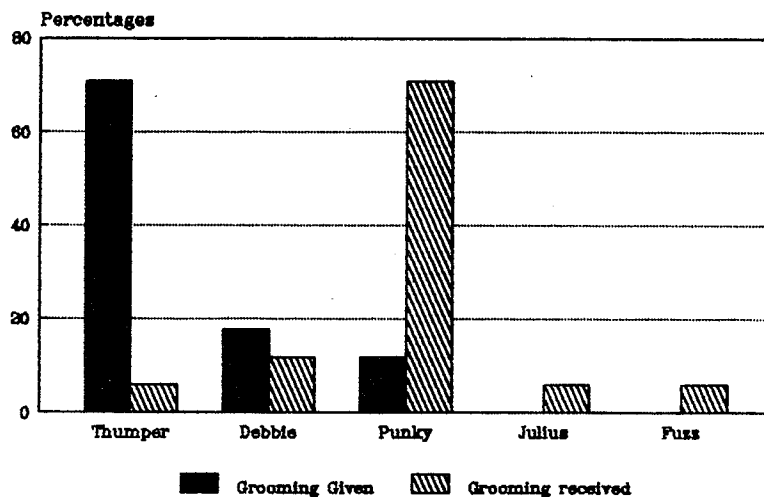


Fig. 8: grooms 10 min. or longer

Thumper groomed for 8.3 hours which was the longest duration per groomer, although Debbie spent a total of 8 hours in grooming bouts which was close to the amount Thumper accumulated. The longest groom was between Thumper (groomer) and Punky (groomee) and lasted for 27.5 minutes.

Group Two:

Nini, an adult female, had the highest frequency of grooming bouts at 32.9 percent and she also received the most grooms with 13 percent of the total bouts. The juveniles and infants had a higher frequency in total, but their grooms were distributed among 4 and 5 individuals respectively (Fig. 9, Appendix 3).

In this group, all the adult females gave more grooming than they received, in relation to the total number of bouts. The grooming frequencies of the adult male present an interesting case in that he had the same number of grooms in both categories (grooms given and grooms received) with a frequency of 8.4 percent.

Among the frequencies of grooming bouts of different lengths (Figs. 10, 11, 12, Appendix 3), both Wolfgang and Nameless show unusual results. These results may be important in determining the variability within female and male behaviour patterns. Wolfgang gave more brief grooms than he received (10.4 percent to 5.0 percent), while, in grooms of 10 minutes or longer, Nameless received more bouts than she gave to others (12.9 percent to 9.7 percent). Wolfgang's behaviour raises an interesting

Group Two Grooming Frequencies

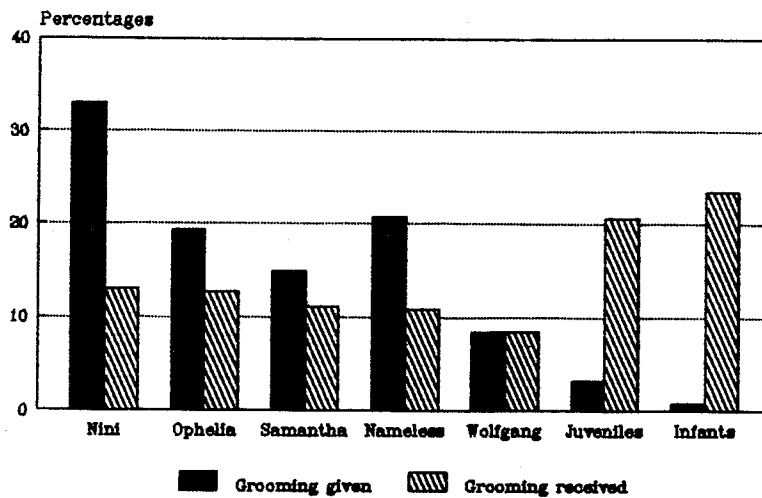


Fig. 9: total number of grooms

Grooming Frequencies

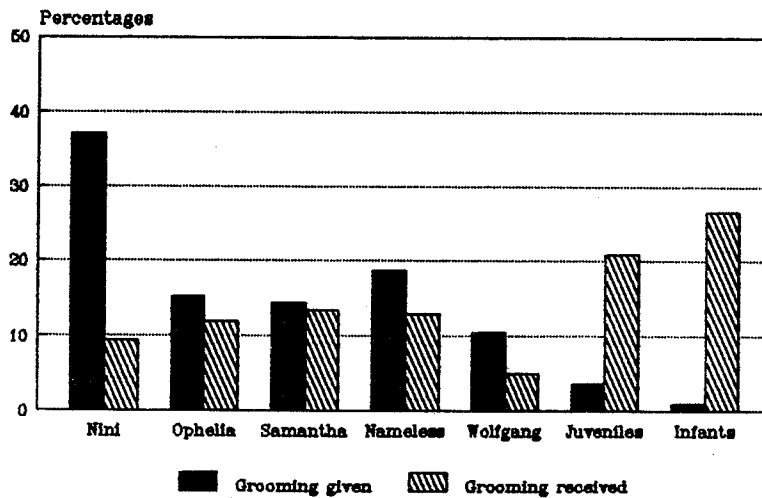


Fig. 10: brief grooms

Group Two Grooming Frequencies

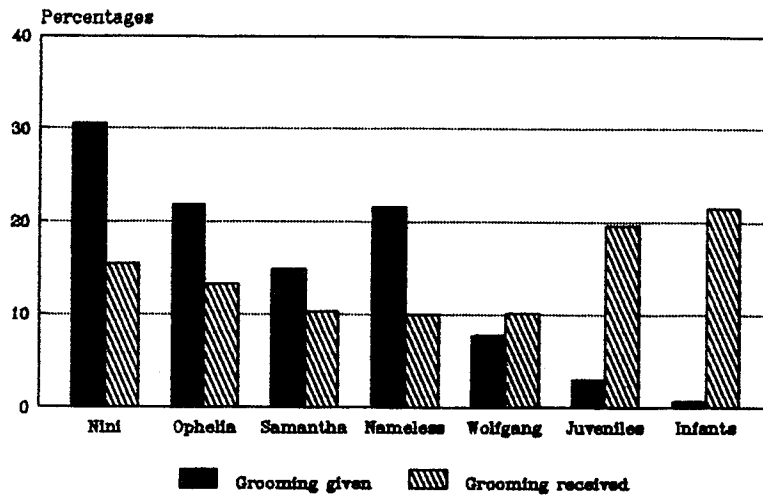


Fig. 11: 30 sec. or longer

Grooming Frequencies

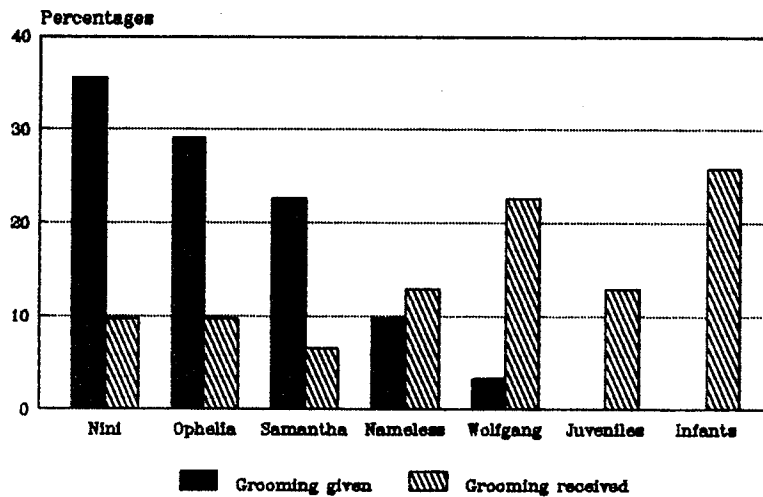


Fig. 12: 10 min. or longer

question in connection to the meaning of brief grooming sessions as opposed to grooms of longer duration. There may be a qualitative difference between long and short grooming sessions. This will be examined further in the discussion section.

The females were groomed for a total duration of 32 hours (out of a total of 54.7 hours) or 58.5 percent. The males were groomed for 22.4 hours or 41.0 percent. Nini, an adult female, accumulated the highest number of hours in both the groomer and groomee category with the exception of the juvenile classification (four individuals contributed to their total). Nini spent a total of 16 hours as groomer and she was groomed for a total of 8 hours. In terms of both frequency and duration, Nini had the highest amount as groomer and as groomee.

Wolfgang was groomed for a total of 7.3 hours, and in his case, Samantha provided 43.8 percent of his total grooming (Appendix 6). The longest groom occurred between Ophelia (groomer) and Wolfgang (groomee) and lasted for 22.25 minutes.

Areas Groomed

Percentages for the areas groomed in both groups are given in Table 8 and the groups differ to the greatest extent in the amount of grooming to the limbs and genital area. Adults in Group One groomed the genital area of

partners more frequently than the limb area, while in Group Two, it was the reverse, except in Wolfgang's case. This may relate to sexual activity connected to the adult male in Group Two. Frequently he would attempt to mate with a female and, if mating did not occur, he would groom the genital area of the female.

In Group One, the highest number of grooms were focused on the back. The exception was Boz who groomed the head area more frequently. In Group Two, the results were not as clear. The area of the back was more frequently groomed, although there were a number of individuals who gave more grooming to the head area, specifically, Ophelia, Nameless and Nieve.

Approaches and Initiation Sequences

A number of actions involving communication between the groomer and the groomee were recorded prior to the grooming session. One very interesting result was that the majority of initiation sequences occurred in grooms which had a duration of 30 sec. or longer, not in grooms of brief duration (Tables 10 and 12).

Group One:

Lipsmacks were observed with all individuals, both as groomer and as groomee, although Thumper and Debbie had the highest frequencies, respectively. The use of the stretch was another matter. As groomers, Debbie and Boz used this exclusively, while as groomees Debbie and Punky were the

TABLE 8

AREAS GROOMED
PERCENTAGE OF TOTAL # OF GROOMS

	<u>GROUP ONE</u>	<u>GROUP TWO</u>
<u>HEAD</u>	44.2	45.8
<u>BACK</u>	68.1	60.2
<u>CHEST</u>	10.1	9.2
<u>LIMBS</u>	14.6	24.2
<u>GENITALS</u>	22.2	15.5
<u>TAIL</u>	17.4	19.1

AREAS GROOMED
PERCENTAGE OF GROOMS PER INDIVIDUAL

	<u>GROUP ONE</u>					
<u>GROOMER</u>	<u>HEAD</u>	<u>BACK</u>	<u>CHEST</u>	<u>LIMBS</u>	<u>GENITALS</u>	<u>TAIL</u>
<u>THUMPER</u>	54.8	73.5	22.9	21.7	38.0	27.1
<u>DEBBIE</u>	38.5	68.8	6.0	13.8	17.5	18.0
<u>PUNKY</u>	51.5	68.2	10.6	12.1	33.3	7.6
<u>JULIUS</u>	13.3	70.0	13.3	16.7	16.7	6.7
<u>BOZ</u>	70.0	44.0	2.0	4.0	2.0	4.0
<u>FUZZ</u>	27.7	72.2	0.0	5.6	5.6	5.6

	<u>GROUP TWO</u>					
<u>GROOMER</u>	<u>HEAD</u>	<u>BACK</u>	<u>CHEST</u>	<u>LIMBS</u>	<u>GENITALS</u>	<u>TAIL</u>
<u>NINI</u>	42.0	59.4	7.1	30.9	18.3	18.8
<u>OPHELIA</u>	57.3	53.6	14.1	25.6	20.0	19.2
<u>SAMANTHA</u>	52.7	67.4	17.7	26.4	22.2	15.6
<u>NAMELESS</u>	55.1	51.4	5.7	22.9	6.7	24.7
<u>WOLFGANG</u>	11.1	79.6	1.9	2.5	8.6	17.9
<u>JUVENILES</u>	18.0	80.3	3.3	4.9	4.9	8.2
<u>SLOAN</u>	0.0	100.0	0.0	0.0	0.0	0.0
<u>NIEVE</u>	57.1	42.9	0.0	0.0	0.0	14.3

only individuals involved.

There was no indication that the stretch was associated with sexual activity, as Debbie used the posture prior to grooming Thumper, not only in grooms with the adult male. Reference has been made to a type of stretch associated with sexual activity and performed by the female which has been termed the "playboy solicitation posture" (Lindburg et al., 1985: 134). The stretch was not observed with any incidence of mating behaviour in this group. A connection, or lack of one, between the two types of stretching behaviour will be analyzed further in the discussion section.

The category "other by groomer" consisted of "hugs", mating, play, "grinning", touching another individual and "inspecting" the genital area. Thumper was involved in the most sequences, with play between Thumper and Julius the most frequent activity. This is somewhat surprising, although Julius is Thumper's last offspring. Play sequences between adult females and juveniles are not emphasized in the primate literature, presumably due to the notion that adults do not engage in juvenile (play) behaviour.

"Other by groomee" consisted of a number of behaviours: laying down in front of the groomer; protruded lips expression with head stretch; mating; "hugs"; play; rear present; approach with head lowered; and "grinning". Punky had the highest frequency with a postural initiation, that of laying down in front of the groomer.

In 74 percent of the total grooms, the approach by an individual was noted (Table 9). Debbie had the highest frequency as groomer with 12.8 percent of the approaches made and Fuzz had the highest as groomee with 7.6 percent (Table 11). This may relate to the distinction between adult and juvenile grooming patterns. Participants engaged in grooming 24.6 percent while sitting together before the groom commenced.

Groomers approached in 39.2 percent of the bouts, while groomees had a frequency of 27.4 percent of approaches. The adults approached more times as groomers, while the juveniles and infant approached more often as groomees. There was one exception, however. Boz followed the pattern of the adults and it is interesting to compare Boz and Fuzz, both young females, in the number of approaches made. Boz approached as groomer, 30 times, and approached only 12 times as groomee. Fuzz exhibited the reverse with 11 approaches as groomer to 41 as groomee.

Group Two:

Lipsmacks and stretches by groomer were used only by the adult females, but the stretch by groomee included Wolfgang as well (Tables 12 and 13). Lipsmacks by groomee were observed with the adult females and the juveniles, as well as with Nieve, an infant female. In this group, stretches occurred between females who were grooming each other in addition to being used by Wolfgang, so there is no evidence to link this type of stretch to sexual activity.

TABLE 9

INITIATION SEQUENCES
PERCENTAGE OF TOTAL # OF GROOMS

	<u>GROUP ONE</u>	<u>GROUP TWO</u>
<u>STRETCH BY GROOMER</u>	1.8	1.1
<u>STRETCH BY GROOMEE</u>	1.9	1.2
<u>LIPSMACK BY GROOMER</u>	5.3	4.7
<u>LIPSMACK BY GROOMEE</u>	4.7	3.4
<u>OTHER BY GROOMER</u>	7.0	4.4
<u>OTHER BY GROOMEE</u>	9.2	4.2
 <u>APPROACHES RECORDED</u>	 74.0	 57.5
<u>APPROACH BY GROOMER</u>	58.8	71.9
<u>APPROACH BY GROOMEE</u>	41.2	28.1
 <u>SITTING TOGETHER</u>	 24.6	 19.8

INITIATION SEQUENCES
PERCENTAGE OF GROOMS 30 SEC. OR LONGER

	<u>GROUP ONE</u>	<u>GROUP TWO</u>
<u>STRETCH BY GROOMER</u>	2.7	1.6
<u>STRETCH BY GROOMEE</u>	3.1	1.2
<u>LIPSMACK BY GROOMER</u>	9.0	6.5
<u>LIPSMACK BY GROOMEE</u>	8.0	4.7
<u>OTHER BY GROOMER</u>	9.0	5.2
<u>OTHER BY GROOMEE</u>	12.8	4.8

TABLE 10

INITIATION SEQUENCESGROUP ONE

	<u>TOTAL GROOMS</u>	<u>GROOMS 30 SEC. OR LONGER</u>	<u>% OF TOTAL</u>
<u>STRETCH BY GROOMER</u>	13	11	84.6
<u>STRETCH BY GROOMEE</u>	14	13	92.9
<u>LIPSMACK BY GROOMER</u>	39	37	94.9
<u>LIPSMACK BY GROOMEE</u>	34	33	97.1
<u>OTHER BY GROOMER</u>	51	37	72.5
<u>OTHER BY GROOMEE</u>	67	53	79.1

GROOMING DYADS - HIGHEST FREQUENCY
GROOMS 30 SEC. OR LONGER

	<u>GROOMER</u>	<u>GROOMEE</u>	<u># OF GROOMS</u>
<u>STRETCH BY GROOMER</u>	DEBBIE	THUMPER	9
<u>STRETCH BY GROOMEE</u>	PUNKY	DEBBIE	7
<u>LIPSMACK BY GROOMER</u>	THUMPER	DEBBIE	11
<u>LIPSMACK BY GROOMEE</u>	THUMPER	DEBBIE	11
<u>OTHER BY GROOMER</u>	BOZ	DEBBIE	7
<u>OTHER BY GROOMEE</u>	THUMPER	PUNKY	14

HIGHEST INDIVIDUAL FREQUENCY

	<u>NAME</u>	<u>AMOUNT</u>
<u>STRETCH BY GROOMER</u>	DEBBIE	10
<u>STRETCH BY GROOMEE</u>	DEBBIE	10
<u>LIPSMACK BY GROOMER</u>	THUMPER	20
<u>LIPSMACK BY GROOMEE</u>	DEBBIE	15
<u>OTHER BY GROOMER</u>	THUMPER	15
<u>OTHER BY GROOMEE</u>	PUNKY	21

MIDGROOM SEQUENCES

	<u>TOTAL #</u>	<u>HIGHEST FREQUENCY</u>	<u># OF GROOMS</u>
<u>STRETCH</u>	27	<u>GROOMER</u> THUMPER <u>GROOMEE</u> DEBBIE	10
		THUMPER PUNKY	10
<u>LIPSMACK</u>	18	THUMPER DEBBIE	6
		DEBBIE THUMPER	6
<u>HUG</u>	4	THUMPER PUNKY	3
<u>OTHER</u>	25	THUMPER PUNKY	9

TABLE 11

APPROACHES AND INITIATION SEQUENCES
PERCENTAGE OF GROOMS PER INDIVIDUAL

GROUP ONE

<u>GROOMER</u>	<u>APPROACHER</u>	<u>TOGETHER</u>	<u>STRETCH</u>	<u>LIPSMACK</u>	<u>OTHER</u>
<u>THUMPER</u>	27.1	15.7	0.0	12.7	12.0
<u>DEBBIE</u>	17.3	30.5	3.0	2.0	2.5
<u>PUNKY</u>	56.1	16.7	0.0	1.5	12.0
<u>JULIUS</u>	66.7	13.3	0.0	3.3	10.0
<u>BOZ</u>	60.0	26.0	2.0	12.0	18.0
<u>FUZZ</u>	61.1	16.7	0.0	11.1	5.0

<u>GROOMEE</u>	<u>APPROACHER</u>	<u>TOGETHER</u>	<u>STRETCH</u>	<u>LIPSMACK</u>	<u>OTHER</u>
<u>THUMPER</u>	17.1	30.6	0.0	2.9	9.4
<u>DEBBIE</u>	16.4	17.9	7.1	11.4	9.3
<u>PUNKY</u>	18.6	11.3	4.1	10.3	25.8
<u>JULIUS</u>	22.8	19.8	0.0	1.0	7.9
<u>BOZ</u>	35.3	32.4	0.0	0.0	0.0
<u>FUZZ</u>	30.6	18.7	0.0	0.7	1.5
<u>OTTO</u>	4.9	80.5	0.0	2.4	4.9

PERCENTAGE OF APPROACHES NOTED

	<u>GROOMER</u>	<u>GROOMEE</u>
<u>THUMPER</u>	8.3	5.4
<u>DEBBIE</u>	12.8	4.3
<u>PUNKY</u>	6.8	3.3
<u>JULIUS</u>	3.7	4.3
<u>BOZ</u>	5.5	2.2
<u>FUZZ</u>	2.0	7.6
<u>OTTO</u>	0.0	0.4

Ophelia had the highest frequency of stretches by a groomee; she had a distinctive style, usually raising one arm in the air above her head with her body curving backwards. Nameless also had an initiation pattern -- she would lipsmack, stretch her head back, and reach out with one arm to touch the individual who was to be groomed. Occasionally, she would "grin" as well.

In the category "other by groomer", Nameless had the highest individual frequency due to her sequence of lipsmacking, stretching and touching. In addition, Nameless engaged in "hugs" with other individuals. The remainder of the category for all individuals included mating behaviour; "unsuccessful" mating attempts; mounts; "inspecting" the genital area; and "grinning".

"Other by the groomee" was most frequently associated with Nini who engaged in the highest number of "hugs" with others. As well, individuals were noted laying down in front of groomer; mating; mounting; "grinning"; exhibiting the front crouch and the rear present.

In 57.5 percent of the total grooms, the approach by an individual was noted (Table 9). Nini had the highest frequency as groomer with 14 percent of the approaches, while the juveniles and Nieve had the highest as groomee with 3.5 percent (Table 13). Sitting together before the groom commenced occurred for 19.8 percent of the grooming bouts observed.

Groomers approached more frequently than groomees with

TABLE 12INITIATION SEQUENCESGROUP TWO

	<u>TOTAL GROOMS</u>	<u>GROOMS 30 SEC. OR LONGER</u>	<u>% OF TOTAL</u>
<u>STRETCH BY GROOMER</u>	21	19	90.5
<u>STRETCH BY GROOME</u>	24	15	62.5
<u>LIPSMACK BY GROOMER</u>	92	79	85.9
<u>LIPSMACK BY GROOME</u>	66	57	86.4
<u>OTHER BY GROOMER</u>	85	63	74.1
<u>OTHER BY GROOME</u>	82	59	72.0

GROOMING DYADS - HIGHEST FREQUENCYGROOMS 30 SEC. OR LONGER

	<u>GROOMER</u>	<u>GROOME</u>	<u># OF GROOMS</u>
<u>STRETCH BY GROOMER</u>	NAMELESS	NINI	9
<u>STRETCH BY GROOME</u>	OPHELIA	NINI	3
	NINI	OPHELIA	3
	WOLFGANG	OPHELIA	3
<u>LIPSMACK BY GROOMER</u>	NAMELESS	NINI	26
<u>LIPSMACK BY GROOME</u>	NAMELESS	NINI	10
<u>OTHER BY GROOMER</u>	NAMELESS	NINI	15
<u>OTHER BY GROOME</u>	SAMANTHA	WOLFGANG	8

HIGHEST INDIVIDUAL FREQUENCY

	<u>NAME</u>	<u>AMOUNT</u>
<u>STRETCH BY GROOMER</u>	NAMELESS	14
<u>STRETCH BY GROOME</u>	OPHELIA	8
<u>LIPSMACK BY GROOMER</u>	NAMELESS	34
<u>LIPSMACK BY GROOME</u>	NINI	21
<u>OTHER BY GROOMER</u>	NAMELESS	24
<u>OTHER BY GROOME</u>	NINI	13

TABLE 12 CONT.MIDGROOM SEQUENCES

	<u>TOTAL #</u>	<u>HIGHEST GROOMER</u>	<u>FREQUENCY GROOMEE</u>	<u># OF GROOMS</u>
<u>STRETCH</u>	22	NAMELESS	OPHELIA	4
		OPHELIA	WOLFGANG	4
<u>LIPSMACK</u>	42	OPHELIA	NINI	5
<u>HUG</u>	4	SAMANTHA	OPHELIA	1
		NAMELESS	OPHELIA	1
		OPHELIA	SAMANTHA	1
		NAMELESS	CENTURY	1
<u>OTHER</u>	38	OPHELIA	NINI	5
		NINI	NIEVE	5

TABLE 13

APPROACHES AND INITIATION SEQUENCES
PERCENTAGE OF GROOMS PER INDIVIDUAL

GROUP TWO

<u>GROOMER</u>	<u>APPROACHES</u>	<u>TOGETHER</u>	<u>STRETCH</u>	<u>LIPSMACK</u>	<u>OTHER</u>
<u>NINI</u>	24.6	17.9	0.3	3.3	1.6
<u>OPHELIA</u>	26.1	21.3	0.8	5.6	3.2
<u>SAMANTHA</u>	19.8	25.0	0.3	4.9	6.9
<u>NAMELESS</u>	25.4	22.4	4.0	9.0	6.2
<u>WOLFGANG</u>	47.5	11.7	0.0	0.0	10.5
<u>JUVENILES</u>	50.8	9.8	0.0	0.0	1.6
<u>SLOAN</u>	0.0	50.0	0.0	0.0	0.0
<u>NIEVE</u>	42.9	14.3	0.0	0.0	0.0

<u>GROOMEE</u>	<u>APPROACHES</u>	<u>TOGETHER</u>	<u>STRETCH</u>	<u>LIPSMACK</u>	<u>OTHER</u>
<u>NINI</u>	11.1	24.5	2.0	10.3	5.5
<u>OPHELIA</u>	7.7	15.8	6.1	5.3	4.0
<u>SAMANTHA</u>	9.3	16.3	0.5	7.9	6.5
<u>NAMELESS</u>	12.0	15.3	0.5	2.4	7.2
<u>WOLFGANG</u>	11.1	17.9	1.2	0.0	10.5
<u>JUVENILES</u>	9.8	14.8	0.0	0.5	1.8
<u>SLOAN</u>	10.0	31.1	0.0	0.0	0.0
<u>NIEVE</u>	18.9	16.0	0.0	1.0	1.5
<u>CENTURY</u>	7.1	24.7	0.0	0.0	1.2
<u>NORANDER</u>	0.0	85.7	0.0	0.0	0.0
<u>HOLLY</u>	0.0	90.0	0.0	0.0	0.0

PERCENTAGE OF APPROACHES NOTED

	<u>GROOMER</u>	<u>GROOMEE</u>
<u>NINI</u>	14.1	2.5
<u>OPHELIA</u>	8.8	1.7
<u>SAMANTHA</u>	5.1	1.8
<u>NAMELESS</u>	9.1	2.2
<u>WOLFGANG</u>	6.9	1.6
<u>JUVENILES</u>	2.8	3.5
<u>SLOAN</u>	0.0	0.8
<u>NIEVE</u>	0.3	3.5
<u>CENTURY</u>	0.0	0.5
<u>NORANDER</u>	0.0	0.0
<u>HOLLY</u>	0.0	0.0

47.1 percent to 18.4 percent. In all cases, adults approached more as the groomers, while juveniles and infants approached more as the groomees; for example, Nini approached 157 times as groomer and only 28 times as groomee. In the reverse situation, Nieve approached three times as groomer and 39 times as groomee.

Midgroom Sequences

Data was collected specifically on stretching, lipsmacking and "hugging" which occurred once a groom had commenced. All midgroom activities were noted and placed in a category called 'midgroom other', so that a more comprehensive record could be made concerning sequences which occurred within a groom. Stretches and lipsmacks occurred more frequently in Group One than in Group Two.

	<u>GROUP ONE</u>	<u>GROUP TWO</u>
<u>STRETCH</u>	6.5	1.6
<u>LIPSMACK</u>	4.4	3.0
<u>HUG</u>	1.0	0.3
<u>OTHER</u>	6.1	3.0

Group One had a frequency of 6.5 percent for stretches compared to Group Two with 1.6 percent. In the case of lipsmacks, Group One had a frequency of 4.4 percent and Group Two had a frequency of 3.0 percent. There were only four hugs per group with all four occurring between Thumper and Punky in Group One, while in Group Two, all the females except for Nini were involved.

"Midgroom other" sequences consisted of a change in position, such as a front-crouch, laying down, lowering the

head; the groomer or groomee moving away with the other following; approach of a third individual to groom, to mate or to sit beside the pair; approach of a juvenile, generally disruptive (i.e. jumping on an adult's back or head), who was usually chased away; and brief self grooming.

Data on midgroom sequences suggest that certain behaviours communicate particular information to either the groomer or the groomee. These sequences may be useful in understanding relationships which appear to differ in a qualitative sense and may, in fact, be long term connections. For example, in both groups, two of the four "hugs" were given in grooms of 10 minutes or longer.

Groom Terminations

The termination of grooming bouts was recorded in the following areas: the individual who left, if another individual approached, if another groom occurred and if a reciprocal event took place immediately following the initial groom. A list was compiled of other events or actions which did not fit into the above categories.

Group One:

In 50.5 percent of all cases, the individual who left was noted (Table 14). Groomers left more frequently than the groomees -- 58.8 percent to 40.6 percent. The adults tended to leave more frequently if they were the groomers, while for the juveniles and infants, it was the reverse.

TABLE 14

GROOM TERMINATIONS
INDIVIDUAL WHO LEFT

	<u>GROUP ONE</u>	<u>GROUP TWO</u>
<u>TOTAL NUMBER</u>	369	822
<u>PERCENTAGE</u>	50.5	42.4

<u>GROUP ONE</u>		
	<u># LEFT AS GROOMER</u>	<u># LEFT AS GROOME</u>
<u>THUMPER</u>	51	29
<u>DEBBIE</u>	100	23
<u>PUNKY</u>	22	6
<u>JULIUS</u>	17	37
<u>BOZ</u>	21	10
<u>FUZZ</u>	6	41
<u>OTTO</u>	0	4
<u>TOTAL PERCENT AS GROOMERS</u>	<u>58.8</u>	
<u>TOTAL PERCENT AS GROOMEES</u>	<u>40.6</u>	

<u>GROUP TWO</u>		
	<u># LEFT AS GROOMER</u>	<u># LEFT AS GROOME</u>
<u>NINI</u>	91	44
<u>OPHELIA</u>	113	64
<u>SAMANTHA</u>	68	52
<u>NAMELESS</u>	91	39
<u>WOLFGANG</u>	46	32
<u>JUVENILES</u>	17	66
<u>SLOAN</u>	1	9
<u>NIEVE</u>	2	57
<u>CENTURY</u>	0	12
<u>NORANDER</u>	0	0
<u>HOLLY</u>	0	0
<u>TOTAL PERCENT AS GROOMERS</u>	<u>52.2</u>	
<u>TOTAL PERCENT AS GROOMEES</u>	<u>45.6</u>	

TABLE 15
GROOM TERMINATIONS
INDIVIDUAL WHO APPROACHED

	<u>GROUP ONE</u>	<u>GROUP TWO</u>
<u>TOTAL NUMBER</u>	48	147
<u>PERCENTAGE</u>	6.6	7.6

GROUP ONE
FREQUENCIES

	<u>APPROACHES</u>	<u>CROSSTAB</u> <u>WHO LEFT WITH APPROACHES</u>
<u>THUMPER</u>	7	4
<u>DEBBIE</u>	0	6
<u>PUNKY</u>	11	1
<u>JULIUS</u>	13	4
<u>BOZ</u>	2	4
<u>FUZZ</u>	10	3
<u>OTTO</u>	3	0
<u>NONID</u>	2	0
<u>TOTAL</u>	<u>48</u>	<u>22</u>

GROUP TWO
FREQUENCIES

	<u>APPROACHES</u>	<u>CROSSTAB</u> <u>WHO LEFT WITH APPROACHES</u>
<u>NINI</u>	33	9
<u>OPHELIA</u>	10	23
<u>SAMANTHA</u>	23	8
<u>NAMELESS</u>	8	31
<u>WOLFGANG</u>	48	1
<u>JUVENILES</u>	12	3
<u>SLOAN</u>	3	0
<u>NIEVE</u>	3	0
<u>CENTURY</u>	4	0
<u>NORANDER</u>	1	0
<u>HOLLY</u>	0	0
<u>NONID</u>	2	0
<u>TOTAL</u>	<u>147</u>	<u>75</u>

TABLE 15 CONT.GROOM TERMINATIONS

FREQUENCIES
PERCENTAGE OF TOTAL # OF GROOMS

	<u>GROUP ONE</u>	<u>GROUP TWO</u>
<u>ANOTHER GROOM OCCURRED</u>	5.2	9.6
<u>RECIPROCAL GROOM</u>	5.1	6.1
<u>OTHER TERMINATION</u>	8.9	11.4

GROUP ONE
PERCENTAGE OF GROOMS NOTED

	<u>ANOTHER GROOM</u>	<u>RECIPROCAL</u>
<u>THUMPER</u>	18.4	18.9
<u>DEBBIE</u>	47.4	64.9
<u>PUNKY</u>	7.9	2.7
<u>JULIUS</u>	5.3	2.7
<u>BOZ</u>	21.1	2.7
<u>FUZZ</u>	0.0	8.1
<u>TOTAL</u>	<u>38</u>	<u>37</u>

GROUP TWO
PERCENTAGE OF GROOMS NOTED

	<u>ANOTHER GROOM</u>	<u>RECIPROCAL</u>
<u>NINI</u>	35.3	15.1
<u>OPHELIA</u>	28.3	33.6
<u>SAMANTHA</u>	8.6	20.2
<u>NAMELESS</u>	25.1	20.2
<u>WOLFGANG</u>	1.6	4.2
<u>JUVENILES</u>	1.1	5.0
<u>SLOAN</u>	0.0	0.0
<u>NIEVE</u>	0.0	0.0
<u>TOTAL</u>	<u>187</u>	<u>119</u>

There was one exception to the clear-cut division between adults and juveniles and infants. Boz left more frequently when acting as groomer than as groomee (21 as groomer to 10 as groomee). This is in contrast to Fuzz who left six times as groomer and 41 times as groomee.

The data for an individual approaching as a groom terminated consisted of 48 cases and was found in 6.6 percent of the grooms (Table 15). Julius had the highest frequency with 27 percent of the total approaches made. There did not appear to be a pattern where one individual left as another approached. This was noted in only 22 cases out of the total data base.

Another groom to a different individual occurred in 5.2 percent of the grooms, with a reciprocal event occurring in only 5.1 percent of the bouts (Table 15). Debbie had the highest number of reciprocal events in her grooming sessions with 64.9 percent of the occurrences. Debbie also gave the most grooms to another with 47.4 percent out of a total of 38 bouts. "Other terminations" accounted for 8.9 percent of the total grooms and consisted primarily of interruptions to the groom, most often by two juveniles who were engaged in play behaviour.

Group Two:

In 42.2 percent of the total grooms, the individual who left was noted (Table 14). Groomers left more frequently than the groomees -- 52.2 percent to 45.6 percent (this data was not tested in terms of significant

differences). When acting as the groomer, the adults left more often, while the juveniles and infants left more frequently as groomees. This was a similar pattern to that of Group One.

There were 147 cases noted where another individual approached the grooming pair and the groom terminated (Table 15). This number comprised 7.6 percent of the total grooms. Wolfgang had the highest frequency of approaches with 32.7 percent of the total approaches. When the approaching individual was cross-tabulated with the individual who left the groom first, 75 occurrences were recorded, with Nameless as the individual with the highest frequency of leaving the dyad due to the approach of another -- 41.3 percent.

Another groom occurred in 9.6 percent of the grooms (Table 15) and Nini terminated her grooms more frequently in this manner. She had a percentage of 35.3 in relation to these grooms. Reciprocal events (directly relating to a previous groom) had a frequency of 6.1 percent and it was in grooms with Ophelia that the number was the highest -- 33.6 percent. "Other terminations" occurred in 11.4 percent of the total grooms and consisted primarily of individuals who started to self groom or a situation where both individuals left at the same time.

Specific Types of Grooming

Specific types of grooming were recorded and the

following tables break down the distribution per group in relation to the total number of grooms and grooms 30 seconds or longer (numbers in percentages).

Total Number of Grooms

	<u>GROUP ONE</u>	<u>GROUP TWO</u>
<u>TWO HANDED GROOM</u>	72.9	93.5
<u>ONE HANDED GROOM</u>	16.3	4.7
<u>MOUTH GROOM</u>	18.2	1.7
<u>PULLING HAIR</u>	0.1	4.4

Grooms 30 Seconds or Longer

	<u>GROUP ONE</u>	<u>GROUP TWO</u>
<u>TWO HANDED GROOM</u>	79.7	97.5
<u>ONE HANDED GROOM</u>	17.2	4.1
<u>MOUTH GROOM</u>	15.7	1.6
<u>PULLING HAIR</u>	0.2	2.5

Mouth Grooming

This type of grooming behaviour was most frequent in Group One, although it was noted with one individual in Group Two (Tables 16 and 17). Debbie, in Group One, used this technique in 31.7 percent of her grooming bouts. She had the highest frequency of mouth grooming with 95.5 percent of all mouth grooms. Thumper was her most frequent partner with 59.8 percent. Mouth grooming made up 18.2 percent of the total number of grooms in this group.

Fuzz, an offspring of Debbie's, was observed attempting a similar behaviour five times, although she lacked the fluidity involved in Debbie's grooming technique. In all probability, this is an example of an offspring learning a grooming skill from its mother.

TABLE 16MOUTH GROOMGROUP ONE

	<u># GIVEN</u>	<u>FREQ. %</u>	<u>% OF INDIV. GROOMS</u>
<u>DEBBIE</u>	127	95.5	31.7
<u>THUMPER</u>	1	.8	.6
<u>FUZZ</u>	5	3.7	27.7
<u>TOTAL #</u>	<u>133</u>		
<u>TOTAL BOUTS</u>	<u>731</u>	<u>% OF TOTAL BOUTS</u>	<u>18.2</u>

MOUTH GROOM DYADS

<u>GROOMER</u>	<u>GROOMEE</u>	<u># OF GROOMS</u>
DEBBIE	THUMPER	76
	MINDY	2
	PUNKY	10
	JULIUS	14
	BOZ	9
	FUZZ	15
	OTTO	1
THUMPER	PUNKY	1
FUZZ	THUMPER	1
	DEBBIE	4

This type of grooming was also observed in grooms of longer duration, not only in brief grooming episodes. Of the 133 mouth grooms, 65 were observed in grooms 30 seconds or longer, constituting 15.7 percent of the longer grooms. Mouth grooming has not been dealt with previously as a type of groom in macaque species and the significance of this will be analyzed in the discussion section.

The mouth groom was also observed in Group Two, specifically associated with Nameless. Mouth grooming made up only 1.7 percent of these grooms. It is interesting to note that Debbie and Nameless are full siblings.

Hair Pulling

Hair pulling and eating was observed with two individuals in Group Two (Table 17). There was only one occurrence in Group One. Nini had the higher frequency with 69.4 percent of all hair pulling, while Wolfgang had a frequency of 30.6 percent. Wolfgang used this technique more in his grooming bouts -- 16 percent of his bouts involved grooms that pulled out hair.

The two individuals exhibited different methods of hair pulling behaviour. Nini used both hands to grab a clump of hair which she appeared to eat, while Wolfgang used a one handed method to pull out a number of individual hairs. Usually after five or six pulls, it appeared as if he ate the hair and this was similar to the action of Nini.

Both individuals used this behaviour in grooms 30

TABLE 17PULLING HAIRGROUP TWO

	<u># GIVEN</u>	<u>FREQ. %</u>	<u>% OF INDIV. GROOMS</u>
<u>NINI</u>	59	69.4	9.2
<u>WOLFGANG</u>	26	30.6	16.0
<u>TOTAL #</u>	<u>85</u>		
<u>TOTAL BOUTS</u>	<u>1940</u>	<u>% OF TOTAL BOUTS</u>	<u>4.4</u>

PULLING HAIR DYADS

<u>GROOMER</u>	<u>GROOMEE</u>	<u># OF GROOMS</u>
NINI	OPHELIA	22
	SAMANTHA	11
	NAMELESS	3
	JUVENILES	12
	NIEVE	7
	NON ID	4
WOLFGANG	NINI	4 OPHELIA
	15	
	SAMANTHA	6
	NAMELESS	1

MOUTH GROOMGROUP TWO

	<u># GIVEN</u>	<u>FREQ. %</u>	<u>% OF INDIV. GROOMS</u>
<u>NAMELESS</u>	31	93.9	7.7
<u>OPHELIA</u>	1	3.0	0.3
<u>WOLFGANG</u>	1	3.0	0.6
<u>TOTAL #</u>	<u>33</u>		
<u>TOTAL BOUTS</u>	<u>1940</u>	<u>% OF TOTAL BOUTS</u>	<u>1.7</u>

seconds or longer with 35.3 percent of all hair pulling in the longer grooms. Wolfgang had a higher frequency with 53.3 percent, in comparison to Nini with 46.7 percent. Individuals would move frequently while Nini was grooming in this manner and many of the incidents were only attempted once as the groomee ran off. Wolfgang had a less intense pulling motion and groomees did not leave as frequently.

I have referred to this behaviour as a groom for descriptive purposes. Whether it is in fact a behavioural disorder will be discussed in the next section.

One Handed Grooming

One handed grooming, as opposed to the use of two hands, occurred in both groups, although it had a higher frequency in Group One. Of the total bouts, 16.3 percent occurred in Group One, compared to 4.7 percent in Group Two.

<u>GROUP ONE</u>			
	<u># GIVEN</u>	<u>FREQ %</u>	<u>% OF INDIV TOTAL</u>
<u>PUNKY</u>	66	55.5	100.0
<u>DEBBIE</u>	18	15.1	4.5
<u>JULIUS</u>	12	10.1	40.0
<u>BOZ</u>	12	10.1	24.0
<u>THUMPER</u>	9	7.6	5.4
<u>FUZZ</u>	2	1.7	11.1
<u>TOTAL #</u>	<u>119</u>	<u>% OF</u>	
<u>TOTAL BOUTS</u>	<u>731</u>	<u>TOTAL BOUTS</u>	<u>16.3</u>

GROUP TWO

	<u># GIVEN</u>	<u>FREQ %</u>	<u>% OF INDIV TOTAL</u>
<u>WOLFGANG</u>	76	82.6	46.9
<u>JUVENILES</u>	11	12.0	18.0
<u>SAMANTHA</u>	3	3.3	1.0
<u>NINI</u>	2	2.2	0.3

<u>TOTAL #</u>	<u>92</u>	<u>% OF</u>	
<u>TOTAL BOUTS</u>	<u>1940</u>	<u>TOTAL BOUTS</u>	<u>4.7</u>

All of Punky's grooms involved this technique in combination with two-handed grooming, while Wolfgang, in Group Two, had a frequency of 46.9 percent of one-handed grooming. As well, all group members used the technique in Group One, except Thumper and Otto, while in Group Two, only Wolfgang, Samantha, Nini and the juveniles used it. It was associated more frequently with males than with females.

Relationships Within Grooming Dyads

This section deals with grooming partners who are most often associated with the groomers. I refer to the groomee as the "preferred partner". This relates to the individual who has the highest frequency and duration in relation to the groomer.

Group One (Tables 18 and 19):

Thumper

Preferred Partner: In terms of duration, Punky was groomed by Thumper for 4.5 hours. Julius, in terms of frequency, was Thumper's preferred partner with 65 bouts. In the case of adults, Thumper's most frequent partner was Debbie with 55 bouts.

TABLE 18GROUP ONEGROOMING DYADS

DURATION OF GROOMING IN MINUTES
TOTAL NUMBER OF GROOMS

G R O O M E E R	G R O O M E E						
	<u>Thumper</u>	<u>Debbie</u>	<u>Punky</u>	<u>Julius</u>	<u>Boz</u>	<u>Fuzz</u>	<u>Otto</u>
	<u>Thumper</u>	90.8	272.2	121.9	2.0	br	--
	<u>Debbie</u>	178.7	58.2	26.7	13.2	176	14.7
	<u>Punky</u>	19.2	111.0	--	--	--	br
	<u>Julius</u>	11.7	br	11.5	--	--	--
	<u>Boz</u>	6.8	23.9	12.0	0.5	--	1.8
	<u>Fuzz</u>	br	4.5	5.0	br	br	br
	<u>Otto</u>	--	--	--	--	--	--

FREQUENCY OF GROOMING

G R O O M E E R	G R O O M E E						
	<u>Thumper</u>	<u>Debbie</u>	<u>Punky</u>	<u>Julius</u>	<u>Boz</u>	<u>Fuzz</u>	<u>Otto</u>
	<u>Thumper</u>	55	37	65	2	2	0
	<u>Debbie</u>	125	33	32	32	126	31
	<u>Punky</u>	15	49	0	0	0	1
	<u>Julius</u>	16	1	12	0	0	0
	<u>Boz</u>	7	22	1		1	8
	<u>Fuzz</u>	2	10	3	0		1
	<u>Otto</u>	0	0	0	0	0	

-- FOR TOTALS AND MEANS PER INDIVIDUAL SEE APPENDIX 4

TABLE 19GROUP ONEGROOMING DYADSDURATION OF GROOMING IN MINUTES
BOUTS 10 MIN. OR LONGER

		<u>G R O O M E E</u>				
		<u>Thumper</u>	<u>Debbie</u>	<u>Punky</u>	<u>Julius</u>	<u>Fuzz</u>
G R O O M E R	<u>Thumper</u>		--	177.5	15.5	--
	<u>Debbie</u>	12		10.5	--	10
	<u>Punky</u>	--	22.5		--	--

FREQUENCY OF GROOMING

		<u>G R O O M E E</u>				
		<u>Thumper</u>	<u>Debbie</u>	<u>Punky</u>	<u>Julius</u>	<u>Fuzz</u>
G R O O M E R	<u>Thumper</u>		0	11	1	0
	<u>Debbie</u>	1		1	0	1
	<u>Punky</u>	0	2		0	0

-- FOR TOTALS AND MEANS PER INDIVIDUAL SEE APPENDIX 5

An interesting feature of grooms between Thumper and Punky was the length. Thumper groomed Punky for a duration of 3 hours in grooms which had a length of 10 minutes or longer (Table 19). This comprised 66.6 percent of the total amount of grooming that Punky received from Thumper. In addition, the mean length of Punky's grooms from Thumper was 7.3 minutes; this is much higher than the mean for the group (1.6 minutes) and could signify a different type of relationship between the two individuals.

Debbie

Preferred Partner: In terms of duration, Thumper was groomed for 3 hours by Debbie, although Fuzz accumulated a similar amount (2.9 hours). This was the case, as well, in terms of frequency. Debbie's most frequent partner was Fuzz with 126 grooms, while Thumper followed closely with 125 grooms.

At the end of the study period, Debbie had a total of two offspring in the group. She had a frequency of 51.3 percent in relation to kin grooming, with 48.5 percent for nonkin grooming.

Punky

Preferred Partner: Punky's most frequent partner was Debbie and she was also his partner for the longest duration, a total of 1.8 hours. Punky was groomed by Debbie for a total of 1 hour; in this partnership, the male was the groomer for a longer period than he spent as the groomee.

Julius

Preferred Partner: In terms of frequency, Thumper had the highest number of bouts with 16 sessions in total. As for duration, Thumper and Punky were very close, with Thumper having a total of 11.7 minutes, compared to Punky with 11.5 minutes.

Boz

Preferred Partner: Debbie was the most frequent partner with Boz, as well as the partner of the longest duration. Debbie had a total of 23.9 minutes in duration, with 22 grooming bouts recorded.

Boz was only groomed by Debbie and Thumper, with the highest number of bouts from Debbie. Only 26.4 percent of Boz' grooms were of 30 seconds or longer -- the majority were brief episodes.

Fuzz

Preferred Partner: Debbie had a total of 10 grooming bouts from Fuzz, but Punky received the highest duration. He had three bouts with Fuzz, totalling 5 minutes in length. Debbie had 10 bouts, but the length was only 4.5 minutes.

Both Fuzz and Boz were young females, close in age. While Fuzz was groomed for a total of 2.9 hours, Boz accumulated only 18 minutes. At the beginning of the study period, Mindy, Boz' mother, was removed from the group for health reasons. Fuzz is Debbie's offspring and this may account for the difference in grooming duration.

Otto

Otto was born in October, so for most of the study period, he was a small infant. He was not involved in grooming any individuals, but did receive grooming from Debbie, Punky, Boz and Fuzz, with a total of 31 bouts from Debbie; one bout from Punky; eight bouts from Boz; and one bout from Fuzz.

Group Two (Tables 20 and 21):Nini

Preferred Partner: Nieve, an offspring of Nini's, was the individual with the highest frequency and duration. She had a total of 177 grooms lasting for a period of 6 hours. In terms of the adults, Ophelia had both the highest frequency and the longest duration, although Samantha was groomed almost as much as Ophelia. Grooming frequencies consisted of 83 bouts with Ophelia and 82 sessions with Samantha. Ophelia was groomed for 2.4 hours. Wolfgang had the lowest frequency in the adult category and the second lowest duration in relation to grooms from Nini.

Samantha is Nini's full sibling and the data suggest adult kin are not favoured over nonkin in this grooming relationship.

Ophelia

Preferred Partner: Nini was Ophelia's most frequent partner with 78 grooming bouts. She also had the highest duration with a total of 3.2 hours. Nameless, her half-sibling, had

TABLE 20

GROUP TWO

GROOMING DYADS

DURATION OF GROOMING IN MINUTES
TOTAL NUMBER OF GROOMS

	G R O O M E E								
	<u>N</u>	<u>Q</u>	<u>S</u>	<u>Na</u>	<u>W</u>	<u>J</u>	<u>Sl</u>	<u>Ni</u>	<u>Ce</u>
<u>N</u>		146.2	109.1	39.5	47.5	216.5	4.8	357.2	1
<u>Q</u>	192.8		73.2	147.3	134.2	115.8	br	0.7	112.2
<u>S</u>	93.5	26.7		10	190.5	71.3	163.3	0.6	1
<u>Na</u>	145.9	165.1	77.9		65.8	185.7	0.5	11.3	11.5
<u>W</u>	22.8	41	62.1	91.1		14.5	--	br	0.5
<u>J</u>	19.5	6.8	7	18.2	--	6.8	--	1.8	--
<u>Sl</u>	--	1	br	--	--	--		--	--
<u>Ni</u>	2	--	br	br	--	2	--		0.8

FREQUENCY OF GROOMING

	G R O O M E E								
	<u>N</u>	<u>Q</u>	<u>S</u>	<u>Na</u>	<u>W</u>	<u>J</u>	<u>Sl</u>	<u>Ni</u>	<u>Ce</u>
<u>N</u>		83	82	45	30	145	6	177	4
<u>Q</u>	78		36	68	57	60	2	3	59
<u>S</u>	57	22		21	42	47	75	2	4
<u>Na</u>	71	91	43		27	113	3	9	14
<u>W</u>	25	35	42	50		6	0	1	1
<u>J</u>	17	9	7	20	0	3	0	2	0
<u>Sl</u>	0	1	1	0	0	0		0	0
<u>Ni</u>	1	0	1	1	0	1	0		1

--- FOR TOTALS AND MEANS PER INDIVIDUAL SEE APPENDIX 6

TABLE 21

GROUP TWO

GROOMING DYADS

DURATION OF GROOMING IN MINUTES
BOUNDS 10 MIN. OR LONGER

G R O O M E R	G R O O M E E							
	<u>N</u>	<u>Q</u>	<u>S</u>	<u>Na</u>	<u>W</u>	<u>J</u>	<u>Ni</u>	<u>Ce</u>
	<u>N</u>	10	10	0	0	28	88	0
	<u>Q</u>	11	12	37.7	33.3	12.5	0	10
	<u>S</u>	10	12	0	63.5	10	0	0
	<u>Na</u>	11.3	13	0	11.5	0	0	0
	<u>W</u>	0	0	0	12.5	0	0	0

FREQUENCY OF GROOMING

G R O O M E R	G R O O M E E							
	<u>N</u>	<u>Q</u>	<u>S</u>	<u>Na</u>	<u>W</u>	<u>J</u>	<u>Ni</u>	<u>Ce</u>
	<u>N</u>	1	1	0	0	2	7	0
	<u>Q</u>	1	1	3	2	1	0	1
	<u>S</u>	1	1	0	4	1	0	0
	<u>Na</u>	1	1	0	1	0	0	0
	<u>W</u>	0	0	0	1	0	0	0

-- FOR TOTALS AND MEANS PER INDIVIDUAL SEE APPENDIX 7

68 grooming bouts with a duration of 2.5 hours. In the case of the adults, Samantha had the lowest frequency and duration.

Century, an offspring of Ophelia's, had 59 bouts and, although he received the most grooming from his mother, he was not her preferred partner. Ophelia did not groom her infant preferentially; in addition, she did not groom her half-sibling with the highest frequency or duration. In relation to Ophelia's interactions, nonkin grooming was more frequent than kin grooming.

Samantha

Preferred Partner: Samantha was the only groomer whose preferred partner was the male rather than another female. Wolfgang received a total duration of 3.2 hours from Samantha. Sloan, her offspring, had 2.7 hours. In terms of frequency, Sloan had the most grooms with 75 bouts. Wolfgang had fewer bouts, 42, but was groomed for a longer period. Nameless had the lowest frequency and duration, in terms of the adults.

Nini did not receive more grooming from Samantha, even though they were full siblings. In terms, of long grooms, Samantha gave four to Wolfgang, totalling 1.1 hours.

Nameless

Preferred Partner: Ophelia had the highest frequency with 91 bouts and she had the longest duration, 2.7 hours. The juveniles, as a group, received more grooming. The large amount of juvenile grooming from Nameless is interesting as

Nameless' last offspring was a juvenile. It is possible that Nameless was grooming her last offspring preferentially -- the juveniles could not be identified so it is impossible to ascertain this with certainty. In terms of the adults, Wolfgang received the least grooming in terms of frequency and duration.

In this case, Ophelia was the preferred partner of Nameless and this followed kin lines as Ophelia is her half-sibling.

Wolfgang

Preferred Partner: Nameless had the highest frequency and the longest duration with 50 grooming bouts that lasted 1.5 hours. Nini had the least amount with 25 bouts lasting 22.8 minutes.

In grooms of 10 minutes or longer, Nameless was the only partner of Wolfgang's with one groom which lasted for 12.5 minutes.

Juveniles

Preferred Partner: Nameless had the highest frequency with 20 bouts, while Nini had the longest duration of 19.5 minutes. Nameless was very close to Nini with a duration of 18.2 minutes.

Sloan

He had two grooming episodes, each with Ophelia and Samantha. Samantha was his mother, but her groom was of brief duration. Ophelia had a groom of 1 minute in length. Sloan did not groom his mother for a longer period than he

groomed Ophelia even though he spent more time in proximity to his mother.

Nieve

She had seven grooming bouts all with different individuals and the longest occurred with her mother, Nini and a juvenile. Both these bouts had a length of two minutes.

Comparison of the Two Groups

In a comparison of the mean bout length in relation to both groups (Table 22), a significant difference was not found in conjunction with the total number of grooms, grooms of 30 seconds or longer duration and those of 10 minutes or longer duration (t-test results). As the grooming behaviour in both groups varied considerably in relation to group patterns and individual preferences, this is an unusual result. It is important to understand that the mean bout length is only one aspect of the grooming relationship and, in this case, it appears to have a limited application. The mean may be similar in the two groups, but that does not indicate that all relationships are similar.

The proportion of grooming in relation to observation time was substantially different for each group. Group One spent 15.5 percent of their time grooming, while Group Two engaged in this activity for 46.2 percent of the total observation time. There were 14 individuals in Group Two

TABLE 22MEANS AND STANDARD DEVIATIONSTOTAL GROOMING BOUTS

	<u>GROUP ONE</u>	<u>GROUP TWO</u>
<u>NUMBER OF BOUTS</u>	713	1879
<u>MEAN</u>	1.6599	1.7460
<u>STD DEV</u>	2.8159	2.4085
<u>MISSING</u>	18	61
<u>NUMBER OF GROOMERS</u>	6	12

GROOMS 30 SEC. OR LONGER

<u>NUMBER OF BOUTS</u>	413	1222
<u>MEAN</u>	2.8656	2.6847
<u>STD DEV</u>	3.1999	2.5297
<u>NUMBER OF GROOMERS</u>	6	12

GROOMS 10 MIN. OR LONGER

<u>NUMBER OF BOUTS</u>	17	31
<u>MEAN</u>	14.5882	12.7823
<u>STD DEV</u>	4.6063	3.2215
<u>NUMBER OF GROOMERS</u>	3	5

in contrast to seven individuals in Group One. This suggests that the increased number of members in the group has the effect of altering the time spent grooming, in addition to the number of juveniles and infants in the group. For example, in Group One, there was a total of four juveniles and infants, while in Group Two, the total consisted of nine individuals. The amount of grooming between females and their offspring comprise a large part of the total amount of grooming per group -- 37.3 percent of the total for Group Two and 24.9 percent for Group One.

Summary of Results

A number of differences and similarities between the two groups are apparent in this analysis.

1. Selection pattern between males and females were significantly different in both groups -- females selected females and males selected females more frequently than expected. Females groomed more often and for a longer duration than the males in both groups, although the amounts varied substantially among the individuals within the group. This was also found in a comparison of the two groups. For example, the adult males in both groups did not groom in a similar manner nor did they receive the same type of grooming. In addition, grooming behaviour of the females varied considerably and it was especially noticable in Group One. While one of the adult females followed the general pattern of grooming (giving more and receiving less), the other adult female maintained the opposite pattern.
2. Selection patterns between adults and juveniles varied in both groups. In Group One, adults selected adults and juveniles selected adults more frequently. In Group Two, juveniles chose adult partners more frequently, but the adults selected adult partners more often. Adults groomed more frequently than juveniles and infants, but a few individuals exhibited differences in connection to age-related patterns. For example, Thumper, the oldest

female in Group One, exhibited a wide range in the number of grooms given and received, especially when brief sessions were compared to longer ones. Boz, a juvenile female, did not groom in the same manner as the other juvenile female of similar age in Group One. Boz gave more grooming than she received when the total number of grooms were considered.

3. Genealogy was considered to be an important factor in both groups. The juveniles and infants received more kin grooming than the adults and the kin grooming of the juveniles and infants was associated predominantly with maternal grooming. When grooming was analyzed between adult half-siblings and full siblings in Group Two, there was a significant difference in the selection pattern between kin and nonkin categories. Durations between kin-related dyads did not correspond to frequency data in all cases. For example, while the frequency of grooming between Nini and Samantha was high, the duration of the grooming was lower in comparison to non-related individuals.

4. The groomer's behaviour was as important as that of the groomees' and this was evident in the number of approaches and terminations initiated by the groomers. In addition, communication occurred between both the groomer and the groomee and it was not clear that one

individual used this to solicit grooming more than the other individual in the partnership. This suggests it is the specific context which determines the activity between individuals. Partners in certain interactions engaged in sequences which were particular to their unit; for example, Nameless and Nini in Group Two exhibited a specific pattern of behaviour prior to the commencement of the groom (a grin-lipsmack in conjunction with a head stretch, eyelid flash and touch).

5. There was a different pattern in relation to brief grooming sessions and those of 10 minutes or longer duration in both groups. As this could not be tested in the t-test statistic (brief grooms do not have duration), the examination involves a comparison between individuals within the groups. One way in which the difference was illustrated was in the number of communication sequences which occurred in the long grooms (i.e. "hugs") and in other patterns which emerged in these two categories. This suggests that a special type of bond may exist in the female/male dyads: Thumper and Punky in Group One and Samantha and Wolfgang in Group Two. Samantha is the oldest female in Group Two, while Thumper is the oldest female in Group One.

6. Group-specific behaviour was noted in both groups, for example, mouth grooming in Group One and hair pulling and eating in Group Two. Another feature relating to the group, rather than to the species, was the behaviour of the older individual in Group One as opposed to the behaviour of individuals of similar age in Group Two. In general, while females in Group Two gave more grooming in relation to the amount they received, this was not the case for the oldest female in Group One.

I will discuss these issues in depth in the following chapter.

Chapter VDiscussion

One of the more interesting suggestions to emerge from this study is the idea that the groomer occupies a more dynamic position than that of the groomee. In fact, it appears to be the groomer who determines the course of the interaction, not the groomee. The results of the approach and termination sequences provide evidence for this suggestion. This result is substantially different from the view which asserts that the groomee exerts greater control over the grooming bout than does the groomer (Boccia et al. 1982: 104).

Prior to the grooming session, the groomer was the individual who made the initial approach more frequently, in contrast to the approach made by the groomee. In addition, the groomer terminated the grooming bout more frequently than did the groomee. This does not mean that the action of the groomee does not influence this behaviour to any extent, as it is the interaction between the two grooming partners and other members of the group which ultimately determines the nature of the relationship.

While I state that it is the groomer who determines the course of the interaction, I am not suggesting that the groomer's action is correlated to a position within the group which is dependent on rank. More significance has been assigned traditionally to the activity of the groomee

as it has been postulated that a higher-ranking individual will "receive" more grooming than one of lower-rank (Seyfarth, 1977). As I discussed in Chapter III, it is the "receiver" who is designated as the dominant individual in the dyad.

There is no intrinsic reason to think that the "receiver" occupies a more important position than the "giver" or that the reverse scenario exists. If equal stress is placed on both partners, the grooming interaction can be understood in ways not considered previously, since the position of the groomee has always overshadowed that of the groomer. If we consider the "giver" as the individual who "acts as the groomer" and the "receiver" as the individual who "acts as the groomee", this may help to deflect the emphasis placed on the groomee's role as the more important individual in the dyad. It is critical that we note the difference in emphasis as it should be clear that the manner in which an action is described influences the meaning (i.e. our interpretation) of the activity. Where possible in this section I have inserted the alternate terminology; this is in contrast to the use of the traditional terminology in the Results Section. The alternate wording is rather cumbersome, but the implications of the different terminologies will be evident in the contrast between the two sections.

Indeed, it is not clear that ranking based on the concept of a dominance hierarchy is an aspect which is

important to the groups of Macaca silenus which I studied. At the same time, rank was not an index that I employed in my study. Nevertheless, the reason for my suggestion that rank designations are not important is the manner in which communication is used in the grooming sessions. Communication plays a significant role in all aspects of the grooming sequence. Examples of this include the use of facial expressions such as lipsmacks and grin-lipsmacks; and the use of body postures such as stretching and "hugging".

Lipsmacks were used by both partners in the grooming interaction and although the distribution varied considerably, it was not clear that the groomer or the groomee used this facial expression as an indicator of either a dominant or a submissive position. Often both partners were involved in the exchange of lipsmacks, thus it is difficult to attach a difference in rank position relating to these sequences.

The grin-lipsmack was used primarily by one individual in Group Two who exhibited an interesting sequence. This facial expression involves a typical lipsmack in conjunction with a grin -- the mouth is slightly open, the teeth are visible and the lips are retracted. Nameless grin-lipsmacked, stretched her head back, lowered her eyelids and reached out to touch the individual with whom she was in contact. This type of gesture has been described in the literature as a gesture of submission among

lion-tailed macaques (Johnson, 1985), but he did not specify the manner in which submissive behaviour was categorized. Nameless used this sequence in the position of both the groomer and of the groomee and this indicates that categorizing the expression as submissive may present a problem.

Due to the prevalence of these actions among both groomers and groomees, I could not distinguish a relationship between facial expressions and the elements of dominant and submissive behaviour in my study. In all fairness I should point out that the connection between the two elements was not a parameter that I considered to be important. Since I did not construct a dominance hierarchy it was not possible to assess individuals with either a dominant or a submissive ranking. The implied connection cannot be disregarded completely due to the frequency of its use in behavioural studies. This allows a correlation between facial expressions and dominance positions to be formulated based on the initial ranking designation. The correlation is based on the assumption that the dominance hierarchy is a valid construction. As I have discussed previously in Chapter III, this may or may not be a correct assumption.

The use of this methodology serves to simplify the process and this has been the case in a large number of grooming studies (i.e. the circular approach used by Seyfarth (1976) is a good example as grooming partnerships

can be retranslated in terms of rank designations). It has severe limitations in that one type of relationship predisposes the type of behaviour individuals will exhibit in other behavioural sequences. It is not enough to identify and categorize facial expressions and apply this construction indiscriminately to all facets of primate behaviour. The reasons that certain connections have been made must be examined frequently as primate behaviour is a dynamic process.

I suggest that the use of facial expressions in conjunction with grooming behaviour relates to an exchange of information between individuals as they "greet" one another --in other words, it could be indicative of "friendly" behaviour. "Friendship" is difficult to assess in nonhuman primates, although the notion does not have to be restricted solely to human behaviour (for a discussion of "friendship" in baboons, see Smuts, 1985 -- it is also mentioned by Lindburg, 1973; Seyfarth, 1977; Troisi et al. 1989). The concept of "friendship" between monkeys is as plausible as the concept of dominance relations existing between individuals; in fact, it is a more reasonable suggestion in my view. These concepts are both examples of observer construction and, although there is no reason to assume that "friendship" does not exist, it is another example of an anthropomorphic juxtaposition. Both these concepts are interpretations which the observer incorporates into the text of the behavioural study. The

main difference between the two suggestions is that dominance is based on aggressive behaviour in the group, while "friendship" is an affiliative behaviour. The acceptance of one concept over another depends on the way in which the observer views her/his world and this is translated into the behaviour of the nonhuman primate group under study.

"Hugs" were used by both partners in certain grooms and "hugging" between individuals provides another example of a "friendly" behaviour. "Hugging" behaviour has been noted previously in a group of lion-tailed macaques and has been referred to as a "greeting" behaviour (Johnson, 1985).

Stretches were used by both the groomer and the groomee, although stretching behaviour may have a different connotation to the one indicated by the "hug". The stretch was noted exclusively with grooming sequences; this takes on added significance as stretches have been referred to previously as behaviours which occur in a sexual context. The "playboy solicitation posture" has been associated with the behaviour of the female before mating occurs (Lindburg et al. 1985). The construction which links the posture of a female macaque to the sexual behaviour of a human female as interpreted by a human male is inherently anthropomorphic and notably problematic.

The analogy between stretching activity and male soliciting implies that the behaviour of a female monkey is part of a response pattern attributed to female primates,

no matter what the species affiliation happens to be. This is not a construction of a macaque female -- it is one which has been imposed by the observer. That the analogy can be interpreted in a negative way with implications of female submissiveness in response to the male is evident, although no mention has been made in this regard by the researchers. This is an example of observer bias which has not been acknowledged as such, although in the textualization of primate behaviour this is not considered to be an aspect which generally requires discussion. The fact that the research was designed utilizing an experimental component also poses a problem for analysis.

Females were removed from their social groups and were kept in a separate cage for at least one week prior to the test. This constitutes a change in the social context and the isolation which is imposed on the individual may have an effect on her later behaviour. At the time the observations were made, the male was given access to the cage where the female was situated. It is entirely possible that the stretch associated with the female could have been connected to a groom solicitation and not sexual activity. The fact that sexual behaviour did occur does not preclude the groom solicitation scenario. At the same time, it is possible that the stretch described in the study on sexual behaviour is different from the stretch noted before and during the grooming session.

In the two groups which I observed, both females and

males used stretching behaviour before a groom commenced and in the middle of a grooming sequence. The observation that this behaviour is associated with the male as well as the female removes the activity from one that can be connected to sexual difference, i.e. associated with the female only. In fact, the stretch can be interpreted as part of a solicitation posture preceeding a grooming bout and it appears to be important as a communicatory device associated with the continuation of a groom sequence. In other words, although the stretch is connected to grooming behaviour, it may be multi-functional in meaning.

Of particular interest, are the activities which occurred as midgroom sequences in longer grooms. The use of lipsmacks, "hugs" and stretches appears to relate to "friendly" behaviour exchanged between individuals in the group. A good example of the use of these sequences is illustrated in the following description of a long duration groom.

On July 5th, 1990, a groom occurred in Group One between Thumper, an adult female, and Punky, an adult male. It was a memorable event (at least for the observer) as it was the longest groom observed in both groups during the study period. During the groom, which lasted for 27.5 minutes, lipsmacking was observed between both the groomer (Thumper) and the groomee (Punky); Punky was noted to stretch twice throughout the session; and six minutes before the groom ended, Thumper and Punky lipsmacked and "hugged" each other.

I have provided the above description in order to illustrate a fundamental point. Above all other factors, it is the specific relationship between individuals which is of the utmost importance in assessing the function of

grooming in a primate group. The fact that certain communicatory sequences are noted in these grooms of long duration specifically, leads to the speculation that communication may be used differently in a longer grooming session than in an interaction of a brief nature. In brief grooming sessions, the frequency of lipsmacks and stretches did not exceed 1.8 percent of the bouts in either group. When longer bouts were compared with the brief sessions, the contrast was substantial, especially in Group One. Lipsmacks by the groomer and the groomee occurred in 9 percent and 8 percent of the bouts respectively in grooms of longer duration.

The different communicative aspects associated with grooming suggest that different types of relationships exist between and amongst members in a particular group. There is no reason to assume that all relationships between individuals will be the same within a group -- rather, the reverse may be the case. Interactions of a longer duration may be a factor for certain partnerships, but other individuals may be responding to group dynamics and changeable conditions. Therefore, it is extremely important to note variations in behaviour. The social matrix of the group may be revealed in interactions of a shorter duration not only in those of longer duration. Nevertheless, this revelation remains an interpretation of the observer.

If one were to summarize the behaviour of females and males in both groups, the following suggestion could be

proposed: in general, the females "acted as the groomers" more frequently and for a longer duration than did the males; in general, the males "acted as the groomees" more often than they "acted as the groomers". When selection patterns between group members are analyzed, more differences become apparent. Chi square tests undertaken on both groups separately indicated that male and female selection patterns were significantly different. Females selected females more frequently than expected and the same applied to the selection of females by males. This does not address the specific patterns between adult females and the adult male and more testing is needed in order to state the significance of individual partnerships. Nevertheless, a discussion can be undertaken using both frequency and duration data in relation to individual dyads.

When the total number of grooms were analyzed in Group One, Punky, the adult male, accumulated the highest duration relative to the amount of grooming received while Thumper had the highest frequency. Debbie had the highest frequency when "acting as the groomer" in the total number of bouts, while Thumper groomed for the longest duration. In relation to the amount of grooming received as an absolute total, Punky stands out as the most "favoured" in traditional terms. When Punky's relationships are examined in depth, the figures regarding total duration become extremely variable in regard to all group members, specifically the two adult females.

Punky was the "preferred partner" of only one of the females, in this case, Thumper. While Thumper directed a large part of her grooming to Punky, Debbie did not. Debbie's "preferred partners" were Thumper and Fuzz. Also, Thumper's "preferred partner" in terms of frequency was Julius, her most recent offspring. It is in the analysis of the frequency and duration data for grooms 10 minutes or longer that the relationship between Thumper and Punky overshadows all other interactions between members in the group.

The long groom cited above constituted only one of 11 grooms of 10 minutes or longer that Thumper gave to Punky. It is important to note that 64.7 percent of the long grooms in Group One were between Thumper and Punky (11 bouts out of a total of 17) and composed 71.4 percent of the total amount of grooming in terms of duration (re: long grooms). This amount must be taken into account when the total duration per individual is considered, especially in terms of the total duration for the adult male.

The groomer may determine the amount of grooming the "favoured" individual receives and this changes the dynamic between the two individuals. In the long grooms which Thumper and Punky engaged in, I made the observation that the individual who controlled the interaction was the groomer. This supports my suggestion that the groomer is as active a participant as the groomee in the grooming interaction. At the beginning of the long groom described

previously, Thumper approached Punky and it was Thumper who left thus terminating the groom.

One interpretation of grooms of long duration is that they signify a special type of bond between individuals, particularly between a female and a male, although the bond could also exist between adult females. In the case of the female and the male, the grooms may reflect the fact that Thumper and Punky have been together in this group for 11 years (longer than others in the group) and are the oldest members of the group as well. It may also be an aspect of groups which are multi-female/uni-male as there is no reason to expect that all adult females will have the same relationship with the adult male. It may well depend on the social history of the individuals; for example, the length of time group members have been in association.

Debbie, the other adult female in Group One, exhibited a different pattern in grooms of long duration. She "acted as the groomer" in three grooms with three different individuals -- Thumper, Punky and Fuzz. Debbie "acted as the groomee" in two grooms and both of these were given by Punky. Thumper did not receive grooming from Punky at all in grooms of 10 minutes or longer. Reciprocal grooming (i.e. mutual grooming or a reversal of groomer/groomee roles directly after the initial bout) was not found to be a factor of either long or short grooms in both groups.

There is no reason to assume that reciprocity is a feature of grooming relationships, strictly in terms of

frequency or duration. Our sense of time, for example, may not be the same as an individual of another species. The activity which constitutes the behaviour may be more important than the total frequency or duration. Their behaviour may well be reciprocal, although individuals may utilize different criteria in the determination of reciprocity -- their actions may be of a complementary nature. Researchers must also remember that a reciprocal situation may be solely a human construction, particularly associated with the paradigm of evolutionary behavioural biology. I am referring to the use of an evolutionary model based on the notion of reciprocal altruism (Trivers, 1978).

In contrast to Group One, there was a broad variety of long grooms in Group Two. Nini groomed one of her offspring more frequently and for a longer duration than other individuals -- 22.5 percent of the long grooms were between Nini and Nieve, constituting 22.7 percent of the total amount of grooming (re: long grooms). Nameless was the only adult female who "acted as the groomee" in more grooms than she "acted as the groomer", although the difference was a close one with three grooms given and four grooms received. In addition, the adult male "acted as the groomee" in more grooms than he "acted as the groomer" as did the juveniles and the infants. The behaviour of Nameless in terms of grooms of long duration is an interesting phenomenon as she engages in a behaviour similar to the adult male and the offspring. The

significance of this similarity will be discussed presently.

Wolfgang, the adult male, was associated more frequently with Samantha, and although she gave him a total of four grooms only (he received a total of seven grooms), they lasted for 15.2 percent of the total amount of grooming time (re: long grooms). The grooms between Samantha and Wolfgang may reflect the same type of bond present with Thumper and Punky, although to a much smaller degree or the grooms may reflect the potential for such a relationship. Both Samantha and Thumper are the oldest females in the two groups.

The difference between the two grooming pairs may, in all probability, be connected to the age and history of the individuals within the particular group. Thumper is 25 years old and Punky is 15 years of age. Debbie, the other adult female in Group One, is 11 years old. As there are only two adult females in the group and as their age varies considerably, the older female's relationship with the male stands out significantly.

In Group Two, all the adult females are close in age and this ranges from 8.5 years to 10 years of age. Wolfgang is also 10 years old. This suggests that, in Group Two, the dynamics between all the adults is much more pronounced than it is in Group One where there is a longer social history between the two older members of the group. It would be interesting to study further the interaction

between Samantha and Wolfgang to ascertain whether the relationship indicated between the two persists over time or whether the relationship is subject to change.

When the total number of grooms were analyzed in Group Two, the grooming behaviour of the adult females followed a general pattern. All the females "acted as the groomers" more frequently than they "acted as the groomees", although one female (Nini) had a much higher frequency than the others --she "acted as the groomer" in 32.9 percent of the bouts with the next highest total being 20.7 percent from Nameless. When the number of grooms with Nieve, her offspring, are totalled and removed from the data base, Nini's total drops to 23 percent, a much closer figure to that of Nameless. In terms of "acting as the groomee", Nini also had the highest total, although the frequencies were similar among all the adult females and ranged from 10.8 percent to 13.0 percent.

In terms of duration, Nini accumulated the highest total in both "acting as the groomer" and "acting as the groomee". There was more variation in grooming given -- 9.3 hours to 16 hours. Nini spent six hours grooming Nieve and, when this amount is taken into account and removed, the durations attributed to the females become very similar. Little difference was evident in grooming received -- 5.2 hours to 8 hours.

Why would Nini have the highest totals in all categories relating to the total number of grooms? One

reason was the frequency with which she groomed Nieve. Her behaviour was unusual in contrast to the females in Group One who exhibited varied patterns in terms of giving and receiving grooms. If we examine all the females in Group Two, Nini's behaviour is a more extreme form of a similar pattern which exists for all females. It may be simply that she exhibits more grooming in relation to her offspring.

Wolfgang, the adult male, also exhibited an unusual pattern, especially when his behaviour is contrasted with Punky, in Group One. Wolfgang did not "act as the groomee" more often in terms of frequency or duration in this group. He was the "preferred partner" of one adult female, Samantha, and this was the case only in terms of duration (43.8 percent of his grooming was given by Samantha). When the total number of grooms were considered, Wolfgang "acted as the groomer" for the same frequency as he "acted as the groomee". In terms of brief grooms, Wolfgang gave more than he received. This did not occur in Punky's grooming sessions and, in all cases, Punky "acted as the groomee" more frequently and for a longer duration than he "acted as the groomer". This is an interesting result -- male behaviour varied considerably in the two groups, while the behaviour of the adult male in Group Two was very much similar to the female pattern in that group.

The behaviour of the adult males in the two groups was substantially different. This should not have occurred if the expression of grooming was dependent on male

behavioural characteristics. The difference appears to lie in the composition of the group. Thumper, an older female, is part of the group Punky is associated with, while in Group Two, all the females Wolfgang is associated with are close in age. This may indicate that Wolfgang is in the same position as the females in terms of establishing relationships among group members. It is this activity which appears to be more important to the group dynamic than the behaviour whereby the individual "acts as the groomee".

While it is clear that the males are not as active as the females in grooming sessions, the results do not suggest that the reason for this behaviour is due to a dominance factor (i.e. the male as the more dominant individual). Rather, the data suggests that the male position in the group is peripheral to the central core of females. An interesting comment concerning the role of the adult male in a lion-tailed group was made by a researcher studying one of three groups in a wildlife sanctuary in India:

The adult male's role during mild agonism was passive, as often he could be found away from the core of interactions (consisting of females and immatures) and observing the proceedings from some vantage point.

Kumar and Kurup, 1985: 98

The most interesting aspect of their observation is the idea that the adult male is not as involved in the group as the females appear to be, although it is aggression under

discussion, not affiliative behaviour. While I have reservations concerning the use of the term passive (what may appear passive to the observer may not in actuality be the same thing to the animals), the role of the adult male does appear to be less central to that of the female. This may be reflected in the amount of grooming associated with the male, but it is important to note the variation which is evident when the two adult males are compared.

If the male role is peripheral, Wolfgang and Punky do not exhibit this to the same degree in the two groups. Indeed, male behaviour may not be representative of a peripheral position as much as behaviour which is based on different criteria within the group. The males may be as involved as the more active females -- activity in this case may not be the distinguishing feature of male and female roles. Differences in female and male behaviour should not be primarily associated with sexual difference. Rather, the variation occurs in response to social processes occurring within the group.

Relationships imply a dynamic element as they do not remain the same. A pattern may exist when the individuals have been associated in an interaction which has occurred over a long period. Age and the experience which is connected to this variable is far more important in terms of individual relationships than variation based on sexual difference. Male and female behaviour may differ according to the social milieu existing in each group. As individuals

age, the experience acquired will have a differential effect on their relationships with others. Punky is five years older than Wolfgang -- this could be a factor in relation to the variation in male behaviour.

When age was analyzed in the two groups, the chi square tests indicated that the selection pattern was different for the adults as opposed to the juveniles and infants. The most interesting result of a further analysis connected to age is the manner in which the oldest female, Thumper, is represented. Her pattern is substantially different from Debbie and from the adult females in Group Two. In fact, only in grooms of long duration does Thumper "act as the groomer" more often than she "acts as the groomee". It has been demonstrated previously that this may relate to her relationship with the adult male and suggests that older animals occupy a position of considerable influence within the group. The dyad of Thumper and Punky (the two oldest individuals in Group One) had the highest frequency and duration in grooms of long duration. Debbie, a much younger animal than Thumper, does not exhibit a similar pattern in her grooming bouts; indeed, her grooming is completely opposite to the manner in which Thumper grooms members of the group.

If we consider this data and examine Group Two, we find a different situation. All the adults are of similar age and this includes the adult male. As indicated previously, this may account for the distinction between

Wolfgang's grooming and Punky's sessions. Wolfgang is associating with four females of similar age -- his grooming bouts may reflect his position in regard to the females. He is the "preferred partner" of Samantha, but it is interesting to note that Wolfgang's "preferred partner" is Nameless. This association between Wolfgang and Nameless may be related to the degree of peripherality in relation to their positions within the group. This is a possibility, although as I have discussed previously, the circumstances which indicate peripherality to an observer may be indicative of another aspect of their relationship. It is not clear what this aspect is, at present.

An event occurred during the study period which may shed some insight on the position of Nameless. Nameless was removed from Group Two for eight days due to a gash inflicted by another group member. The day she was returned to the group (see Appendix 8 for more details), Nameless received more grooming than she gave to others, almost three times as much, and Wolfgang groomed her for a longer duration than any other individual. Granted, Nameless had a wound which group members appeared to be investigating; nevertheless, the amount of grooming given by Wolfgang is an interesting aspect of her return. In addition, Samantha "acted as the groomer" in only one brief session with Nameless -- Samantha's total was much lower than any of the adults. It is the lack of grooming from Samantha which is of interest and this may help to illustrate the different

types of relationships which occur between the adult females and with the adult male.

In all grooming sessions, excluding those of 10 minutes or longer, Samantha had the lowest frequency of grooming bouts in relation to the adult females when she "acted as the groomer". This was the case in terms of duration as well. This variation, in connection with the data which indicated that her "preferred partner" was the adult male, suggest that her position may be different in respect to the other adult females in the group. It could also be an element exemplifying individual variation.

It was necessary to analyze grooming behaviour in terms of brief grooming bouts for all individuals, not only those of long duration. The grooms of long duration among all individuals composed 2.3 percent of the total grooms for Group One and 1.6 percent for Group Two. On the other hand, brief grooming sessions made up a larger percentage of the total bouts: 33.9 percent for Group One and 41 percent for Group Two. These two categories provide extreme values in grooming relationships, but the samples are important to analyze separately as they provide information not found in the frequencies and durations relating to the total number of bouts. It is in the brief grooming sessions, not only the longer grooming bouts, that interesting and unusual patterns emerge that help to explain key components of grooming interaction within the group.

Various patterns were evident in grooms categorized as brief (meaning that the length of the bout was less than 30 seconds), and in most cases, the grooms lasted for five or ten seconds. For example, consider the incidence of brief grooming sessions in Group Two. All adult individuals "acted as the groomers" more often than they "acted as the groomees" and this includes the adult male. In fact, Wolfgang "acted as the groomer" twice as often as he "acted as the groomee". This proportion was higher than all other adult females except for Nini who "acted as the groomer" four times as often as she "acted as the groomee".

In Group One, Debbie was the only individual who gave more grooming than she received. She "acted as the groomer" four times as often as she "acted as the groomee" -- this was similar to Nini's grooming in Group Two. Thumper "acted as the groomee" more times than she "acted as the groomer" as did Punky, although Thumper had a higher frequency with 22 percent to 8.7 percent for Punky. The brief grooms emphasize the difference in adult female grooming in Group One, while in Group Two, a similar pattern exists for all the adults. Wolfgang displays unusual behaviour in that his pattern follows that of the adult females.

Clearly, different forces are operating within the two groups and this dynamic relates to the size of the group and the age of the individuals. I am not suggesting that the difference between short and long grooms lies in the

competition over the groomee, although the possibility of this connection can not be overlooked. Rather, the variation may concern the rapidly changing situation of the individuals in Group Two in contrast to the more established positions among certain group members in Group One. It may be more important to form differential relationships among adult individuals in Group Two due to their similarity in age (this remark is highly speculative on my part). The groomers are selecting individuals, presumably for different reasons, although it is difficult if not impossible to assess the qualitative aspect of these relationships.

Debbie follows much the same pattern as the adults in Group Two and she is also in the same age range as these adults. In the case of the juveniles and infants in both groups, these individuals tended to "act as the groomees" more often than they "acted as the groomers". This appears to be an example of age -- females groom their offspring frequently and it appears that the pattern selected by the mother tends to predominate throughout the juvenile years for both female and male offspring.

There was one major exception to this pattern. Boz, a young juvenile in Group One, had a remarkably different selection pattern as opposed to the one displayed by an age-mate, another juvenile female. When the total number of grooms were analyzed, Boz "acted as the groomer" more frequently than she "acted as the groomee". She followed

the general pattern set by the adult females. This was also the case in terms of the approaches and terminations of grooming bouts. Boz adopted the adult pattern in that she approached and terminated bouts while occupying the position of groomer. The pattern of the juveniles and infants was the reverse -- they approached and terminated sessions more frequently when they were "acting as the groomees".

The reason the selection pattern differs in relation to Boz may be connected to the absence of her mother in the group. Mindy, Boz's mother, was removed from the group when Boz was 1.6 years old. The two other juveniles, offspring of Thumper and Debbie, have never been separated from their mothers. The absence of Boz's mother may be a significant factor in that Boz did not have an adult present who would respond to her in the way an adult female would respond to her own offspring. Boz's behaviour is different from that of the juvenile whose mother has always been present in the group. The behaviour that Boz exhibits appears to be similar to the general pattern of the adult females in that "acting as the groomer" is a more frequent activity than "acting as the groomee". This behaviour relates to the idea that it may be more important to select partners rather than to be on the receiving end of another's selection pattern. It would have been interesting to note whether the pattern would have been similar had Boz been a male.

This is another reason for the suggestion that the groomer has the more active role and in this case, it corresponds to the central position females occupy in the group. Keep in mind that this does not have to be associated exclusively with females. Wolfgang exhibits behaviour closer to that expressed by the females and the pattern of Nameless is closer in many respects to that of Wolfgang (particularly in grooms of 10 minutes or longer).

Genealogy is another variable which appears to exert considerable influence within the group. In Group One, there was a higher number of kin grooming bouts between females and their offspring. The same could be applied to Group Two, although in this case, kin connections existed between certain adult females. A chi square test conducted on the adult females indicated that kin grooming was more significant than nonkin grooming within this category. This result is in agreement with conclusions from previous literature as it has been suggested that genealogical connections, both mother-offspring and more extensive kin affiliations (siblings, extended lineages) affect both grooming behaviour (Sade, 1965, 1972; Defler, 1978; Silk, 1982; Seyfarth 1977; Seyfarth and Cheney, 1984; de Waal and Luttrell, 1986; Mehlman and Chapais, 1988) and proximity behaviour (Hornshaw, 1975, 1985). The work on proximity behaviour is interesting as it was undertaken on a lion-tailed group at the Assiniboine Park Zoo in 1973 --the group included Thumper who is currently a member of Group

One. Since kin grooming could not be tested among adult females in Group One, a comparison can not be made between the two affiliative behaviours, proximity and grooming.

Based on frequency data, kin grooming is an important factor in Group Two. When individual dyads are examined, the conclusions are not as clear-cut. This is illustrated in an examination of the grooming sessions between full and half siblings in Group Two. Nini and Samantha are full sisters -- Nini did not groom Samantha more often or for a longer duration than other individuals in the group. Ophelia had a higher frequency than Samantha (although the two differed by only one groom) and Ophelia's grooms were of a longer duration than Samantha's bouts. Samantha groomed Wolfgang for the longest duration, but in terms of frequency, she gave more grooming to Nini. In relation to this dyad, duration figures vary considerably.

Nameless and Ophelia are half-siblings in Group Two as well. Ophelia's "preferred partner" in terms of both frequency and duration was Nini, not Nameless, while Nameless "acted as the groomer" in relation to Ophelia more frequently and for a longer duration. Kin relations were favoured in one direction, but not in the other. Nameless groomed Ophelia preferentially, whereas Ophelia did not exhibit a grooming preference for Nameless. While frequency data has indicated a selection preference for kin grooming in contrast to nonkin grooming, data on duration is not in agreement in all cases. More analysis is needed in order

to state the importance of kin grooming more definitively and to discuss the difference between frequency and duration measures.

In most cases, offspring were groomed more frequently by kin than others (mother-offspring grooming), but there were groom sequences in which the infant was not the most frequent partner; for example, Ophelia did not groom her offspring preferentially. Her grooming was associated more frequently and for a longer duration with Nini, an adult female. Variation in mother-offspring relationships was also found in the previous study on proximity behaviour (Hornshaw, 1975).

The discussion of kinship in grooming studies is closely associated with the notion that behaviour has a genetic base rather than a connection to learning ability associated with the social milieu. It is not clear that grooming in particular female dyads is solely related to the influence of the kinship variable. There may be other factors involved, although it may be difficult to isolate these influences, for example, friendship. In addition, offspring do receive a high amount of grooming from their mothers, but this is extremely variable. Infants, in particular, are carried by their mothers almost exclusively during the first six months of their lives. It is not surprising that in this situation most females groom their infants preferentially.

There are other indications that learning is an

important aspect of the groups in this study. Different types of grooming behaviour were present within the two groups. In Group One, grooming by mouth was a behaviour used by one of the adult females, while in Group Two, hair pulling and eating was undertaken by two of the adults, a female and a male.

Should these activities be included in a discussion of grooming behaviour? There is no doubt that mouth grooming fits into this category. Debbie, the adult female who used the technique, utilized this type of grooming in 31.7 percent of her grooming bouts. Not only was it used in brief sessions, but it was also a feature of longer grooms.

Grooming by mouth in a macaque species (M. mulatta) has been referred to previously as a mouthpick and it has been described as the "... movement of the groomer's head to the groomee's fur, followed by labial removal of debris from the fur" (Starkey et al. 1989: 328). The type of mouth grooming observed in Group One involved a similar activity, but the teeth were used to pull out individual hair, not to remove debris from the skin. At the same time, the head was moved in a rapid downward motion. The mouthpick described in rhesus macaques appears to be related to a grooming movement whereby both hands are used to spread the hair, then the groomer's head is lowered to remove any particles which this sequence uncovers. For my purposes, this activity has been included in the typical grooming sequence as individuals use either their hands or

their mouths to remove particles from the skin. The behaviour which was noted in Group One involves individual hair being removed from the groomee and involves the use of the teeth, not the lips.

During the mouth groom, the groomee did not attempt to stop the groomer by terminating the groom. Only in the case of the juveniles did the mouth groom consistently occur as a brief activity. During these episodes, the juvenile would be passing close by Debbie, the groomer, who would extend her head and neck in order to mouth groom as the juvenile passed by. In most cases, she was successful in this endeavour. The juvenile tended to keep moving, one reason being that play was in progress with another individual and often the juvenile was involved in a chase sequence.

Another interesting feature of the mouth groom is the manner in which Fuzz, Debbie's offspring, imitates her mother's behaviour. Granted this is an interpretation which I have imposed on the behaviour of the juvenile female, but it was clear that she pursued an activity which appeared to be similar to Debbie's. Fuzz' mouth was lowered to the groomee's back and the downward movement of her head as she grabbed the hair with her teeth was much the same as the behaviour Debbie displayed. During the study I noted this behaviour only five times, but I have also observed this behaviour recently.

Debbie, in Group One, and Nameless, in Group Two, are full siblings. Nameless has been observed in a similar

behaviour to the one associated with Debbie. Her activity is not as frequent, but it is interesting to note that a relationship exists between the two individuals. It is possible a similar activity was used by their mother, although I have not been able to ascertain this.

Hair pulling and eating occurs in Group Two and the two individuals involved in this behaviour employ different techniques in the sequence. Nini, an adult female, uses two hands to touch the individual, then she pulls out a clump of hair with one hand. Wolfgang uses the behaviour as part of his grooming sequence in that he grooms other individuals using a one-handed technique.

Hair pulling and eating has been referred to previously as a behavioural disorder in rhesus macaques. It is compared to trichotillomania in humans and the researchers conclude that "... hair pulling and eating is an aggressive behavioural disorder in rhesus monkeys reflecting adjustment problems to a stressful environment" (Reinhardt et al. 1986: 158). There may be problems associated with Nini's behaviour in the group as the individuals she selects tend to move out of her vicinity as she engages in this behaviour. I would not label the behaviour as aggressive as there is no indication that other individuals fear or avoid Nini, other than at the time the behaviour occurs. It is difficult to postulate the reason for her behaviour, although it has been mentioned that a similar behaviour was present in the group in

previous years connected to another individual who is no longer in the group. It is quite possible this behaviour has been learned from another individual, although this is speculation on my part.

On the other hand, Wolfgang employs the technique in his grooms and the individuals to whom he "acts as the groomer" remain in his proximity. His behaviour appears less intense in contrast to Nini's and he uses one hand to pluck individual hairs out of the head or back area. After five or six motions, he puts the hair in his mouth and appears to swallow it. The grooming sequence he employs seems to be a variation based on the one-handed groom technique.

One-handed grooming has been observed in relation to Punky in Group One. All of his grooms involved this motion, although he has been noted to use two hands occasionally in association with the one-handed groom. Other individuals engage in one-handed grooming as well -- two adult females in Group Two along with the male juveniles and one female infant. It is interesting that all males use this to some extent, but it is not associated exclusively with male behaviour as Boz, a juvenile female in Group One has been observed using the technique in a similar manner to Punky and two of the adult females in Group Two employ this technique.

The presence of innovative techniques in regard to grooming behaviour suggest that certain activities are

passed on to others in group situations. This learned behaviour is very important to the concept of group tradition. One might refer to this type of shared behaviour as an element associated with the existence of local tradition in nonhuman primate groups. A focus on the importance of learning in contrast to the genetic determination of behaviour is a crucial component of nonhuman primate life. There is no reason to suggest that learning ability rules out the role genetics plays in the inheritance of morphological characteristics. Social behaviour does not have to be seen to be subject to the same evolutionary forces. The way in which genetic determination is constructed tends to focus on the inherent dualism between the two concepts rather than on their complementary nature.

We superimpose a great many concepts on the animals which we study and the way in which we measure their behaviour is a good example of this imposition. This is accomplished by counting the number of times a particular activity occurs or by considering the total amount of time in which the sequence takes place. Both frequency and duration are important to employ in research and although they are useful in different ways, the two measures are of use to the researcher only. The animals who serve as the objects of this study do not have any stake in these results -- it does not matter to them whether frequency or duration data are used or how a researcher chooses to

record their behaviour.

Nevertheless, researchers have attempted to correlate frequency and duration data and it has been suggested that these methods provide the same quantitative measure in relation to grooming behaviour (Schino et al. 1988b). This correlation would simplify behavioural studies immensely, as it would reduce the amount of variation to be studied within the group. What appears to be advantageous for the observer has profound implications for the animals under study -- a large amount of behaviour would be lumped into one category and differences would be ignored and consequently lost in the analysis. It is in this manner that the analysis has profound effects on the animals under study, although this is dependent on the way in which the results are mobilized. If the information is used in ways destructive to the composition of the group (i.e. removal of particular animals based on the presence of a specific behaviour), then the analysis can have an impact on the animals under study.

Consider the following construction which has been used traditionally to provide a framework to study grooming. Groomers compete for contact with particular groomees -- frequency data relate to this idea and all grooming sessions, both brief grooms and those of longer duration are included in this total. The individuals who are more successful competitors engage in grooms in which duration can be calculated; it follows that grooms of

longer duration relate to the "attractiveness" of the groomee (Schino et al. 1988b). This construction can be justified only if the researcher makes the assumption that the groomee is the most important individual in the grooming dyad and if grooms of longer duration are considered to be of more importance than those categorized as brief.

Many researchers place a qualitative difference on brief grooms in relation to those of longer duration. This may relate to the distinction made by the observer between short term and long term relationships. If so, then this is another example of anthropomorphism in that some humans consider a lengthy event to be of more quality than an activity which occurs briefly. There is no indication that nonhuman primates value this aspect of relationships in the same way as humans. Brief interactions which deal with immediate dynamics between individuals may be as important to group structure as long term associations are. What we observe and record in connection to grooming may have implications in regard to the meaning of this behaviour, but it does not provide motivations or reasons for this behaviour.

A scenario could be constructed whereby the groomer selects partners on the groomer's own terms, not according to the desires or "attractiveness" of the groomee. The groomer is the individual who is actually performing the activity. This is another example of a problematic

construction as it is difficult to ascertain the groomers' own terms. We can only speculate and no matter what quantitative measures are employed in this process, the explanations we arrive at are bounded by our past experience and by our own view of the world.

The term "attractive" may not convey the same meaning to a monkey as it does to a human. Researchers use this term to indicate the "favoured" position the groomee occupies. It is overwhelmingly anthropomorphic. The "attractiveness" of the groomee in human terms relates to the power the individual wields in relation to the service given by another individual. At least, this is the interpretation placed on the interaction by a number of primatologists (e.g. Seyfarth, 1977; Seyfarth and Cheney, 1984). In addition, "attractive" implies that an individual holds a "favoured" position -- in human society we tend to reward these individuals for possessing this quality regardless of what it is they accomplish. Rewards based on the possession of an attribute (appearance) that individuals have little control over emerges as a problematic area in human terms and it is dangerous ground when discussing monkeys. It is impossible for human observers to ascertain the attributes of an "attractive" monkey.

The difference between frequency and duration in the case of the groomer could be associated with a selection process far removed from the one postulating the groomees'

"attractiveness". Perhaps the process depends on the information that both individuals relay to each other. The important point to consider is that frequency and duration data provide only one part of the puzzle. It must be used in conjunction with other information in order to complete the picture (see Troisi et al. 1989).

A good example of this disjunction is the reliance on total duration data whereby an individual who amasses this total is considered to be the most important member of the group or the most "favoured" individual (i.e. the adult male). For example, in Group One, Punky "acted as the groomee" for a longer duration than other individuals yet the majority of his grooming was associated with one individual. If one were to take the duration figure only, Punky would indeed be the "favoured" individual, notwithstanding the fact that his duration is only part of the picture. This may be a reason total duration is "favoured" over the use of frequency as a meaningful measure, especially if the results of other grooming studies provide similar statements to the one referred to above. Duration data is not more accurate than frequency data -- it simply depends on the focus of the study and the result one hopes to achieve.

It is important to bear in mind the reason given for the behavioural study. A behaviour such as grooming may express a relationship between individuals -- it may signify the strength of a relationship or 'bond' which

exists between group members. This may not be the only way to measure the relationship between group members and some individuals may not express closeness in this manner. Grooming as an indication of the relationship of one individual to another is only one measure of social affiliation. It is important to realize that grooming behaviour may not relate to all social aspects among individuals in the group. The results of grooming studies may be considerably different from proximity research and studies which concentrate on communication aspects of primate groups. Researchers may attempt to reduce the complexity of behavioural data by correlating the meaning of different behaviours as well as correlating the measures used to record behaviour patterns. This leads to an emphasis on universal patterns. It may be more useful to attribute a higher degree of complexity to the behaviour of nonhuman primates as it is evident that reductionist techniques have severe problems in behavioural research (the work of Schino et al. 1988b is an example of the emphasis placed on the correlation of measures).

Instead of learning more about the behaviour of the animals under study we have tried to make them conform to our standards. Obviously this limits analysis in much the same way as the methodology used which concentrates on the similarities between individuals at the expense of their differences.

Throughout this section, I have neglected to discuss

an important aspect of grooming behaviour. This concerns the idea that allogrooming is primarily utilitarian in function -- animals are groomed by other individuals for hygienic purposes. It follows that allogrooming involves those areas inaccessible to the individual, as areas accessible to the individual receive attention when the animal engages in autogrooming behaviour.

While the results indicated that the areas of the back and head were the focus of the majority of grooming interactions, it was not clear that this referred to the division made between accessible and inaccessible areas. Accessible areas were also the focus of allogrooming behaviour. While it is evident that the hygienic aspect should not be downplayed, it is also clear that the strictly utilitarian function of grooming should not preclude the social component of the interaction. No matter what the function of grooming is postulated to be it is, above all, a social process.

Chapter VISummary and Conclusions

1. Age, more than sex or genealogy is an important factor in the grooming relationships of the two M. silenus groups. In addition, demographic factors are a crucial element in relation to grooming behaviour.
2. Grooming appears to be group-specific, rather than species-specific. This was evident in the use of mouth grooming, hair pulling and eating and the variation in behaviour noted between females in the two groups and male behaviour in the two groups.
3. Communication is an important aspect of grooming behaviour, specifically the use of lipsmacks, stretches and "hugging" behaviours.
4. The groomer was found to exert more influence than the groomee in the grooming interaction, but this does not indicate that either partner occupies a more important position than the other in the dyad. It is essential to note that the choice of partner associated with the groomer may have important implications in regard to the way in which the grooming dyad is viewed.

5. It is the specific relationship between the two individuals which influences the grooming interaction. Analyses which focus on the total frequency and duration per individual must take this factor into account.

The results of my thesis suggest that the meaning attributed to grooming behaviour within a group depends on the context in which it occurs. Grooming, while it may express a bond between individuals, may also be a component which relates to the dynamic structure of the group. Grooming behaviour is extremely variable in terms of the relationships expressed in particular dyads. It varies considerably among females in relation to their offspring; it differs among the adult females themselves; it has different connotations in the relationships which occur between an adult female and the adult male; it is not the same for all juveniles in relation to the adults; and females and males of the same species in separate groups exhibit different characteristics of grooming behaviour.

The emphasis on context and specific relationships between individuals differs from the "accepted" approach taken in relation to grooming behaviour. Variability is the key component of the study which I have undertaken.

I am well aware that the framework of the study is a creation attributed solely by the observer; it is a construction which I and others have superimposed on the

behaviour of the animals under study. In the process of textualization, we all begin with axioms. I employed a specific focus -- the idea that behaviour in nonhuman primate groups is influenced primarily by the social milieu existing in the group (see Fedigan, 1976; Hornshaw, 1991). To be sure, a bias exists in my study as it does in all behavioural studies. Nevertheless, I feel the approach selected is the least restrictive in regard to behaviour as it allows for the perception of considerable variation among individuals in the group. This study concentrates on difference, but it also incorporates a framework which does not exclude similarities when the data indicate that they are present. Patterns and similarities of behaviour remain possibilities, but they are not the critical focus of study.

As I have indicated throughout this thesis, it is virtually impossible to remove observer bias from behavioural research. It is crucial to provide a discussion of the approach the observer has taken in response to the research problem, both methodologically and epistemologically. Not only do I suspect that learning is a considerable factor in relation to the social matrix, I am also a female researcher. This is an important point to stress as there can be a vast difference in perception relating to the gender of the observer. This has been demonstrated in Chapter III as behavioural studies have tended to concentrate on the male position within the

group. Gender difference is a cultural construction -- the main impact of gender in behavioural studies is that researchers realize it is an observer construct, not necessarily a property of the nonhuman groups which we study.

Variability is a key concept in the two groups which I studied for this thesis. Their grooming patterns, although similar in certain cases, differed considerably in expression. I believe this is an exciting aspect of behavioural studies. Differences which we have accepted as given in primate groups do not necessarily relate to sex differences, but appear to be connected to the age of the individuals in the group and the overall size and composition of the group (for the groups at this time). This is not to say that male and female differences do not exist in any form, but they may not be as predetermined as some researchers have proposed.

There are a number of other issues which are in need of further analysis; for example, in one of the groups, kin connections among adult females were significant -- kinship connections could be studied further in terms of the difference of frequency and duration data. As well, relationships between the adult females and the adult male in one-male groups could be investigated in detail. In order to state more forcefully that group-specific behaviour is a more important aspect than species-specific behaviour, it would be necessary to conduct either time

successive studies on grooming or longitudinal research on the groups involved. In addition, research on the relationship between Samantha and Wolfgang would be interesting to pursue in order to ascertain if their relationship is similar to the one between Thumper and Punky. It would also be useful to follow both mouth grooming and hair pulling activity to ascertain the impact of this behaviour in future.

It is in the area of communication that additional study needs to be conducted. I have dealt with this aspect in a very brief manner, although it was clear that communication was an essential ingredient in grooming relationships. More study should be focused on communication within grooming, while communication, as a topic in itself, has the potential to provide new and insightful information in primate behavioural studies.

As a final comment, I wish to emphasize the point that the conclusions I have arrived at in this thesis, while based on solid observation, present my speculations on life in two lion-tailed macaque groups. It is above all a textualization, one which I hope bears some resemblance to the lives the individuals lead. While I realize this sentiment is generally not included in scientific discourse, this does not deny the validity of the comment.

APPENDIX 1

DATA SHEET - <u>M. silenus</u>		LOCATION: _____						
No: _____		DATE: _____						
TIME: _____								
#	ONSET	INITIATION SEQUENCE INITIATOR	GROOMER	GROONEE	AREA GROOMED	TIME ON AREA	GROOM SEQUENCE TERMINATION	NOTES
					1 2 3 4 5 6		1 2 3 4 5 6	
					1 2 3 4 5 6		1 2 3 4 5 6	
					1 2 3 4 5 6		1 2 3 4 5 6	
					1 2 3 4 5 6		1 2 3 4 5 6	
					1 2 3 4 5 6		1 2 3 4 5 6	
					1 2 3 4 5 6		1 2 3 4 5 6	

FACSIMILE OF DATA SHEET

APPENDIX 2GROUP ONEFREQUENCY AND DURATION -- TOTAL # OF GROOMS

	<u>#GIVEN</u>	<u>FREQ. %</u>	<u>DUR. HRS.</u>	<u>#REC'D</u>	<u>FREQ. %</u>	<u>DUR. HRS.</u>
<u>THUMPER</u>	166	22.7	8.3	170	23.3	3.6
<u>DEBBIE</u>	400	54.8	8.0	140	19.2	3.8
<u>MINDY</u>	0	0.0	0.0	11	1.5	0.2
<u>PUNKY</u>	66	9.0	2.2	97	13.3	5.9
<u>JULIUS</u>	30	4.1	0.4	101	13.8	2.5
<u>BOZ</u>	50	6.8	0.7	34	4.7	0.3
<u>FUZZ</u>	18	2.5	0.2	134	18.4	2.9
<u>OTTO</u>	0	0.0	0.0	41	5.6	0.3
<u>NON ID</u>	0	0.0	0.0	2	0.3	0.2
<u>INCOMPLETE</u>	1	0.1	0.0	1	0.1	0.0

TOTAL # OF GROOMS: 731TOTAL DURATION IN HOURS: 19.7FREQUENCY -- BRIEF GROOMS

	<u># GIVEN</u>	<u>FREQ. %</u>	<u># REC'D</u>	<u>FREQ. %</u>
<u>THUMPER</u>	49	16.3	66	22.0
<u>DEBBIE</u>	182	60.7	46	15.3
<u>PUNKY</u>	21	7.0	26	8.7
<u>JULIUS</u>	15	5.0	42	14.0
<u>BOZ</u>	21	7.0	25	8.3
<u>FUZZ</u>	12	4.0	61	20.3
<u>OTTO</u>	0	0.0	29	9.7

TOTAL # OF GROOMS: 300

APPENDIX 2 CONT.GROUP ONEFREQUENCY -- GROOMS 30 SEC. OR LONGER

	<u># GIVEN</u>	<u>FREQ. %</u>	<u># REC'D</u>	<u>FREQ. %</u>
<u>THUMPER</u>	113	27.4	99	24.0
<u>DEBBIE</u>	208	50.4	91	22.0
<u>MINDY</u>	0	0.0	6	1.5
<u>PUNKY</u>	44	10.7	69	16.7
<u>JULIUS</u>	15	3.6	57	13.8
<u>BOZ</u>	28	6.8	9	2.2
<u>FUZZ</u>	5	1.2	68	16.5
<u>OTTO</u>	0	0.0	12	2.9
<u>NON ID</u>	0	0.0	2	0.5

TOTAL # OF GROOMS: 413

FREQUENCY AND DURATION -- GROOMS 10 MIN. OR LONGER

	<u># GIVEN</u>	<u>FREQ. %</u>	<u>DUR. HRS</u>	<u># REC'D</u>	<u>FREQ. %</u>	<u>DUR. HRS</u>
<u>THUMPER</u>	12	70.6	3.2	1	5.9	0.2
<u>DEBBIE</u>	3	17.6	0.6	2	11.8	0.4
<u>PUNKY</u>	2	11.8	0.4	12	70.6	3.2
<u>JULIUS</u>	0	0.0	0.0	1	5.9	0.2
<u>FUZZ</u>	0	0.0	0.0	1	5.9	0.2

TOTAL # OF GROOMS: 17

TOTAL DURATION IN HOURS: 4.2

APPENDIX 3GROUP TWOFREQUENCY AND DURATION -- TOTAL # OF GROOMS

	<u>#GIVEN</u>	<u>FREQ. %</u>	<u>DUR. HRS.</u>	<u>#REC'D</u>	<u>FREQ. %</u>	<u>DUR. HRS.</u>
<u>NINI</u>	638	32.9	16.0	253	13.0	8.0
<u>OPHELIA</u>	375	19.3	13.0	247	12.7	6.4
<u>SAMANTHA</u>	288	14.8	9.3	215	11.1	5.6
<u>NAMELESS</u>	401	20.7	11.2	209	10.8	5.2
<u>WOLFGANG</u>	162	8.4	3.9	162	8.4	7.3
<u>JUVENILES</u>	61	3.1	1.0	399	20.6	10.2
<u>SLOAN</u>	2	0.1	0.01	90	4.6	2.8
<u>NIEVE</u>	7	0.4	0.1	206	10.6	6.2
<u>CENTURY</u>	0	0.0	0.0	85	4.4	2.1
<u>NORANDER</u>	0	0.0	0.0	42	2.2	0.5
<u>HOLLY</u>	0	0.0	0.0	10	0.5	0.1
<u>NON ID</u>	6	0.3	0.2	22	1.1	0.3

TOTAL # OF GROOMS: 1940

TOTAL DURATION IN HOURS: 54.7

FREQUENCY -- BRIEF GROOMS

	<u># GIVEN</u>	<u>FREQ. %</u>	<u># REC'D</u>	<u>FREQ. %</u>
<u>NINI</u>	243	37.0	62	9.4
<u>OPHELIA</u>	100	15.2	78	11.9
<u>SAMANTHA</u>	94	14.3	88	13.4
<u>NAMELESS</u>	123	18.7	85	12.9
<u>WOLFGANG</u>	68	10.4	33	5.0
<u>JUVENILES</u>	23	3.5	137	20.9
<u>SLOAN</u>	1	0.2	31	4.7
<u>NIEVE</u>	2	0.3	72	11.0
<u>CENTURY</u>	0	0.0	32	4.9
<u>NORANDER</u>	0	0.0	21	3.2
<u>HOLLY</u>	0	0.0	5	0.8
<u>NON ID</u>	3	0.5	13	2.0

TOTAL # OF GROOMS: 657

APPENDIX 3 CONT.GROUP TWOFREQUENCY -- GROOMS 30 SEC. OR LONGER

	<u># GIVEN</u>	<u>FREQ. %</u>	<u># REC'D</u>	<u>FREQ. %</u>
NINI	373	30.5	189	15.5
OPHELIA	267	21.8	163	13.3
SAMANTHA	181	14.8	125	10.2
NAMELESS	263	21.5	122	10.0
WOLFGANG	94	7.7	123	10.1
JUVENILES	35	2.9	239	19.6
SLOAN	1	0.1	55	4.5
NIEVE	5	0.4	122	10.0
CENTURY	0	0.0	51	4.2
NORANDER	0	0.0	21	1.7
HOLLY	0	0.0	4	0.3
NON ID	3	0.2	8	0.7

TOTAL # OF GROOMS: 1222

FREQUENCY AND DURATION -- GROOMS 10 MIN. OR LONGER

	<u># GIVEN</u>	<u>FREQ. %</u>	<u>DUR. HRS</u>	<u># REC'D</u>	<u>FREQ. %</u>	<u>DUR. HRS</u>
NINI	11	35.5	2.3	3	9.7	0.5
OPHELIA	9	29.0	1.9	3	9.7	0.6
SAMANTHA	7	22.6	1.6	2	6.5	0.4
NAMELESS	3	9.7	0.6	4	12.9	0.8
WOLFGANG	1	3.2	0.2	7	22.6	1.8
JUVENILES	0	0.0	0.0	4	12.9	0.8
NIEVE	0	0.0	0.0	7	22.6	1.5
CENTURY	0	0.0	0.0	1	3.2	0.2

TOTAL # OF GROOMS: 31

TOTAL DURATION IN HOURS: 6.6

APPENDIX 4GROOMING DYADSGROUP ONE

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u>	<u>MIN</u>
THUMPER	DEBBIE	55	1.5	90.8	1.6	
	PUNKY	37	4.5	272.2	7.3	
	JULIUS	65	2.0	121.9	1.8	
	BOZ	2	0.1	2.0	1.0	
	FUZZ	2	-----	BRIEF	-----	-----
	NON ID	1	0.2	8.5	8.5	
<u>THUMPER</u>	<u>TOTALS</u>	<u>162</u>	<u>8.3</u>	<u>495.4</u>	<u>3.0</u>	

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u>	<u>MIN</u>
DEBBIE	THUMPER	125	3.0	178.7	1.4	
	MINDY	10	0.2	10.0	1.0	
	PUNKY	33	1.0	58.2	1.7	
	JULIUS	32	0.4	26.7	0.8	
	BOZ	32	0.2	13.2	0.4	
	FUZZ	126	2.9	176.0	1.3	
	OTTO	31	0.2	14.7	0.4	
	NON ID	1	0.1	2.5	2.5	
<u>DEBBIE</u>	<u>TOTALS</u>	<u>390</u>	<u>8.0</u>	<u>480.0</u>	<u>1.2</u>	

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u>	<u>MIN</u>
PUNKY	THUMPER	15	0.4	19.2	1.2	
	DEBBIE	49	1.8	111.0	2.2	
	OTTO	1	-----	BRIEF	-----	-----
<u>PUNKY</u>	<u>TOTALS</u>	<u>65</u>	<u>2.2</u>	<u>130.2</u>	<u>2.0</u>	

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u>	<u>MIN</u>
JULIUS	THUMPER	16	0.2	11.7	0.7	
	DEBBIE	1	-----	BRIEF	-----	-----
	MINDY	1	-----	BRIEF	-----	-----
	PUNKY	12	0.2	11.5	.9	
<u>JULIUS</u>	<u>TOTALS</u>	<u>30</u>	<u>0.4</u>	<u>23.2</u>	<u>.7</u>	

APPENDIX 4 CONT.

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u> <u>MIN</u>
BOZ	THUMPER	7	0.1	6.8	0.9
	DEBBIE	22	0.4	23.9	1.0
	PUNKY	10	0.2	12.0	1.2
	JULIUS	1	0.001	0.5	0.5
	FUZZ	1	-----	BRIEF	-----
	OTTO	8	0.01	1.8	0.2
<u>BOZ</u>	<u>TOTALS</u>	<u>49</u>	<u>0.7</u>	<u>45.0</u>	<u>0.9</u>

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u> <u>MIN</u>
FUZZ	THUMPER	2	-----	BRIEF	-----
	DEBBIE	10	0.1	4.5	0.4
	PUNKY	3	0.1	5.0	1.6
	JULIUS	1	-----	BRIEF	-----
	OTTO	1	-----	BRIEF	-----
<u>FUZZ</u>	<u>TOTALS</u>	<u>17</u>	<u>0.2</u>	<u>9.5</u>	<u>0.5</u>

<u>GROUP ONE</u>	<u>TOTALS</u>	<u>713</u>	<u>19.7</u>	<u>1183.5</u>	<u>1.6</u>
	<u>INCOMPLETE</u>	<u>18</u>			
	<u>TOTAL</u>	<u>731</u>			

APPENDIX 5GROOMING DYADS -- GROOMS 10 MINUTES AND LONGERGROUP ONE

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS.</u>	<u>DUR.</u> <u>MIN.</u>	<u>MEAN</u> <u>DUR.</u> <u>MIN.</u>
THUMPER	PUNKY	11	3.0	177.5	16.1
	JULIUS	1	0.3	15.5	15.5
<u>THUMPER</u>	<u>TOTALS</u>	<u>12</u>	<u>3.3</u>	<u>193.0</u>	<u>16.1</u>

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS.</u>	<u>DUR.</u> <u>MIN.</u>	<u>MEAN</u> <u>DUR.</u> <u>MIN.</u>
DEBBIE	THUMPER	1	0.2	12.0	12.0
	PUNKY	1	0.2	10.5	10.5
	FUZZ	1	0.2	10.0	10.0
<u>DEBBIE</u>	<u>TOTALS</u>	<u>3</u>	<u>0.6</u>	<u>32.5</u>	<u>10.8</u>

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR.</u> <u>MIN.</u>	<u>MEAN</u> <u>DUR.</u> <u>MIN.</u>
PUNKY	DEBBIE	2	0.4	22.5	11.3
<u>PUNKY</u>	<u>TOTALS</u>	<u>2</u>	<u>0.4</u>	<u>22.5</u>	<u>11.3</u>

APPENDIX 6GROOMING DYADSGROUP TWO

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u> <u>MIN</u>
NINI	OPHELIA	83	2.4	146.2	1.7
	SAMANTHA	82	1.8	109.1	1.3
	NAMELESS	45	0.7	39.5	0.8
	WOLFGANG	30	0.8	47.5	1.5
	JUVENILES	145	3.6	216.5	1.4
	SLOAN	6	0.1	4.8	0.7
	NIEVE	177	6.0	357.2	2.0
	CENTURY	4	0.02	1.0	0.2
	NORANDER	33	0.5	29.6	0.8
	NON ID	11	0.1	8.8	0.7
<u>NINI</u>	<u>TOTALS</u>	<u>616</u>	<u>16.0</u>	<u>960.2</u>	<u>1.5</u>

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u> <u>MIN</u>
OPHELIA	NINI	78	3.2	192.8	2.4
	SAMANTHA	36	1.2	73.2	2.0
	NAMELESS	68	2.5	147.3	2.1
	WOLFGANG	57	2.2	134.2	2.3
	JUVENILES	60	1.9	115.8	1.9
	SLOAN	2	-----	BRIEF	-----
	NIEVE	3	0.1	0.7	0.2
	CENTURY	59	1.9	112.2	1.9
	NORANDER	3	0.03	2.0	0.6
	NON ID	1	-----	BRIEF	-----
<u>OPHELIA</u>	<u>TOTALS</u>	<u>367</u>	<u>13.0</u>	<u>778.2</u>	<u>2.1</u>

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u> <u>MIN</u>
SAMANTHA	NINI	57	1.6	93.5	1.6
	OPHELIA	22	0.4	26.7	1.2
	NAMELESS	21	0.2	10.0	0.4
	WOLFGANG	42	3.2	190.5	4.5
	JUVENILES	47	1.2	71.3	1.5
	SLOAN	75	2.7	163.3	2.1
	NIEVE	2	0.01	0.6	0.2
	CENTURY	4	0.02	1.0	0.2
	NORANDER	2	-----	BRIEF	-----
	NON ID	3	0.01	0.5	0.1
<u>SAMANTHA</u>	<u>TOTALS</u>	<u>275</u>	<u>9.3</u>	<u>557.4</u>	<u>2.0</u>

APPENDIX 6 CONT.

<u>GROOMER</u>	<u>GROOME</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u> <u>MIN</u>
NAMELESS	NINI	71	2.4	145.9	2.0
	OPHELIA	91	2.7	165.1	1.8
	SAMANTHA	43	1.3	77.9	1.8
	WOLFGANG	27	1.1	65.8	2.4
	JUVENILES	113	3.1	185.7	1.6
	SLOAN	3	0.01	0.5	0.1
	NIEVE	9	0.2	11.3	1.2
	CENTURY	14	0.2	11.5	0.8
	NORANDER	1	-----	BRIEF	-----
	HOLLY	8	0.1	3.8	0.4
	NON ID	6	0.1	6.8	1.1
<u>NAMELESS</u>	<u>TOTALS</u>	<u>386</u>	<u>11.2</u>	<u>674.3</u>	<u>1.7</u>

<u>GROOMER</u>	<u>GROOME</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u> <u>MIN</u>
WOLFGANG	NINI	25	0.4	22.8	0.9
	OPHELIA	35	0.7	41.0	1.1
	SAMANTHA	42	1.1	62.1	1.4
	NAMELESS	50	1.5	91.1	1.8
	JUVENILES	6	0.2	14.5	2.4
	NIEVE	1	-----	BRIEF	-----
	CENTURY	1	0.01	0.5	0.5
	NORANDER	2	-----	BRIEF	-----
<u>WOLFGANG</u>	<u>TOTALS</u>	<u>162</u>	<u>3.9</u>	<u>232.0</u>	<u>1.4</u>

<u>GROOMER</u>	<u>GROOME</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u> <u>MIN</u>
JUVENILES	NINI	17	0.3	19.5	1.1
	OPHELIA	9	0.1	6.8	0.7
	SAMANTHA	7	0.1	7.0	1.0
	NAMELESS	20	0.3	18.2	0.9
	JUVENILES	3	0.1	6.8	2.2
	NIEVE	2	0.1	1.8	0.8
<u>JUVENILES</u>	<u>TOTALS</u>	<u>58</u>	<u>1.0</u>	<u>60.1</u>	<u>1.0</u>

<u>GROOMER</u>	<u>GROOME</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN</u> <u>DUR</u> <u>MIN</u>
SLOAN	OPHELIA	1	0.01	1.0	1.0
	SAMANTHA	1	-----	BRIEF	-----
<u>SLOAN</u>	<u>TOTALS</u>	<u>2</u>	<u>0.01</u>	<u>1.0</u>	<u>0.5</u>

APPENDIX 6 CONT.

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN DUR MIN</u>
NIEVE	NINI	1	0.03	2.0	2.0
	SAMANTHA	1	-----	BRIEF	-----
	NAMELESS	1	-----	BRIEF	-----
	JUVENILES	1	0.03	2.0	2.0
	CENTURY	1	0.01	0.8	0.7
	NORANDER	1	0.02	1.0	1.0
	HOLLY	1	0.03	1.5	1.5
<u>NIEVE</u>	<u>TOTALS</u>	<u>7</u>	<u>0.1</u>	<u>7.3</u>	<u>1.0</u>

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS</u>	<u>DUR</u> <u>MIN</u>	<u>MEAN DUR MIN</u>
NON ID	NINI	2	0.01	0.5	0.2
	SAMANTHA	1	0.1	7.0	7.0
	NAMELESS	2	0.05	3.3	1.6
	JUVENILES	1	-----	BRIEF	-----
<u>NON ID</u>	<u>TOTALS</u>	<u>6</u>	<u>0.2</u>	<u>10.8</u>	<u>1.7</u>

<u>GROUP TWO</u>	<u>TOTALS</u>	<u>1879</u>	<u>54.7</u>	<u>3280.7</u>	<u>1.7</u>
	<u>INCOMPLETE</u>	<u>61</u>			
	<u>TOTAL</u>	<u>1940</u>			

APPENDIX 7GROOMING DYADS -- GROOMS 10 MINUTES AND LONGERGROUP TWO

<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS.</u>	<u>DUR.</u> <u>MIN.</u>	<u>MEAN</u> <u>DUR.</u>	<u>MIN.</u>
NINI	OPHELIA	1	0.2	10.0	10.0	
	SAMANTHA	1	0.2	10.0	10.0	
	JUVENILES	2	0.4	28.0	14.0	
	NIEVE	7	1.5	88.0	12.6	
<u>NINI</u>	<u>TOTALS</u>	<u>11</u>	<u>2.3</u>	<u>136.0</u>	<u>12.4</u>	
<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS.</u>	<u>DUR.</u> <u>MIN.</u>	<u>MEAN</u> <u>DUR.</u>	<u>MIN.</u>
OPHELIA	NINI	1	0.2	11.0	11.0	
	SAMANTHA	1	0.2	12.0	12.0	
	NAMELESS	3	0.6	37.7	12.6	
	WOLFGANG	2	0.5	33.3	16.6	
	JUVENILES	1	0.2	12.5	12.5	
	CENTURY	1	0.2	10.0	10.0	
<u>OPHELIA</u>	<u>TOTALS</u>	<u>9</u>	<u>1.9</u>	<u>116.5</u>	<u>12.9</u>	
<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS.</u>	<u>DUR.</u> <u>MIN.</u>	<u>MEAN</u> <u>DUR.</u>	<u>MIN.</u>
SAMANTHA	NINI	1	0.2	10.0	10.0	
	OPHELIA	1	0.2	12.0	12.0	
	WOLFGANG	4	1.0	63.5	15.9	
	JUVENILES	1	0.2	10.0	10.0	
<u>SAMANTHA</u>	<u>TOTALS</u>	<u>7</u>	<u>1.6</u>	<u>95.5</u>	<u>13.6</u>	
<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS.</u>	<u>DUR.</u> <u>MIN.</u>	<u>MEAN</u> <u>DUR.</u>	<u>MIN.</u>
NAMELESS	NINI	1	0.2	11.3	11.3	
	OPHELIA	1	0.2	13.0	13.0	
	WOLFGANG	1	0.2	11.5	11.5	
<u>NAMELESS</u>	<u>TOTALS</u>	<u>3</u>	<u>0.6</u>	<u>35.8</u>	<u>11.9</u>	
<u>GROOMER</u>	<u>GROOMEE</u>	<u>#</u>	<u>TOTAL</u> <u>HRS.</u>	<u>DUR.</u> <u>MIN.</u>	<u>MEAN</u> <u>DUR.</u>	<u>MIN.</u>
WOLFGANG	NAMELESS	1	0.2	12.5	12.5	
<u>WOLFGANG</u>	<u>TOTALS</u>	<u>1</u>	<u>0.2</u>	<u>12.5</u>	<u>12.5</u>	

APPENDIX 8The Return of Nameless
Wednesday October 3, 1990

Nameless, an adult female, was removed from the group at the Monkey House on Tuesday September 25, 1990. This was the result of a gash inflicted to her left rib-cage area, probably due to a conflict with another group member. The wound required stitches and she was separated from the group for a period of eight days.

On Wednesday morning, Nameless rejoined the group in the outside enclosure. As soon as she entered the cage, she walked around the outside of the enclosure at a fairly brisk pace with all the group members following her. Little contact was made; primarily, it was the juveniles who made an attempt to touch her and mount her briefly. Shortly after Nameless came into the cage, Sloan and Century, two infants, both ran to their mothers. I did not observe Nieve, another infant, running to her mother.

There was considerable movement by all individuals when Nameless rejoined the group. The only facial expression I noted was that of Nameless as she approached the individuals on the rear platform. She exhibited a type of half "grin" or grimace. It was not a lipsmack, although it could have been part of that expression as I could not see her face at all times. I could not detect any sound, although if it were very low I probably would not have been

able to hear it.

Nameless entered the outside enclosure at 10:20 a.m. and her first groom occurred at 10:32 a.m. Nameless approached Samantha (I did not note any initiation sequence) and started to groom her back and head area. The groom lasted for 2 1/2 minutes.

In total, Nameless was engaged in 31 grooming bouts. Eight took place with Nameless as the groomer and 23 occurred with Nameless as the groomee. Her grooming lasted 19 minutes and she was groomed for a period of 26 minutes. Her role as groomee was greater than that as the groomer.

The breakdown of grooming bouts with Nameless as groomer:

<u>Groomer</u>	<u>Groomee</u>	<u># of bouts</u>	<u>Total Duration</u>	<u># of brief</u>
Nameless	Nini	1	3 min. 45 sec.	0
"	Wolfgang	0	0	0
"	Ophelia	2	4 min.	1
"	Samantha	1	2 min. 30 sec.	0
"	juveniles	3	5 min. 30 sec.	2
"	infant*	1	3 min. 15 sec.	0

-- # of brief refers to grooms of less than 30 seconds.

The breakdown of grooming bouts with Nameless as groomee:

<u>Groomer</u>	<u>Groomee</u>	<u># of bouts</u>	<u>Total Duration</u>	<u># of brief</u>
Nini	Nameless	9	2 min. 45 sec.	6
Wolfgang	"	5	9 min.	1
Ophelia	"	5	6 min. 30 sec.	2
Samantha	"	1	0	1
juveniles	"	2	4 min.	0
infant*	"	1	3 min. 15 sec.	0

* during the bout between Nameless and the infant who I could not identify, the groom was a mutual one -- the

infant was grooming Nameless but at a much slower, less intense rate.

Although Nini had the most bouts grooming Nameless, Wolfgang groomed her for the longest period. Both Ophelia and Wolfgang had the longest single groom involving Nameless -- the longest grooms were 5 minutes from both individuals. The groomers appeared to concentrate their efforts around the wounded area so this may be one reason for the increase in grooms given to Nameless. She was out of the group for eight days so the increase may involve the reestablishment of certain bonds.

The longest grooms given to Nameless were from Wolfgang and Ophelia and these occurred at the same time -- they were both grooming different areas. The grooms ended when Samantha approached the threesome. As she joined them, Nameless walked away.

Note: The above material on the re-introduction of Nameless was prepared initially as an addition to the records of the two zookeepers who care for Group Two.

APPENDIX 9

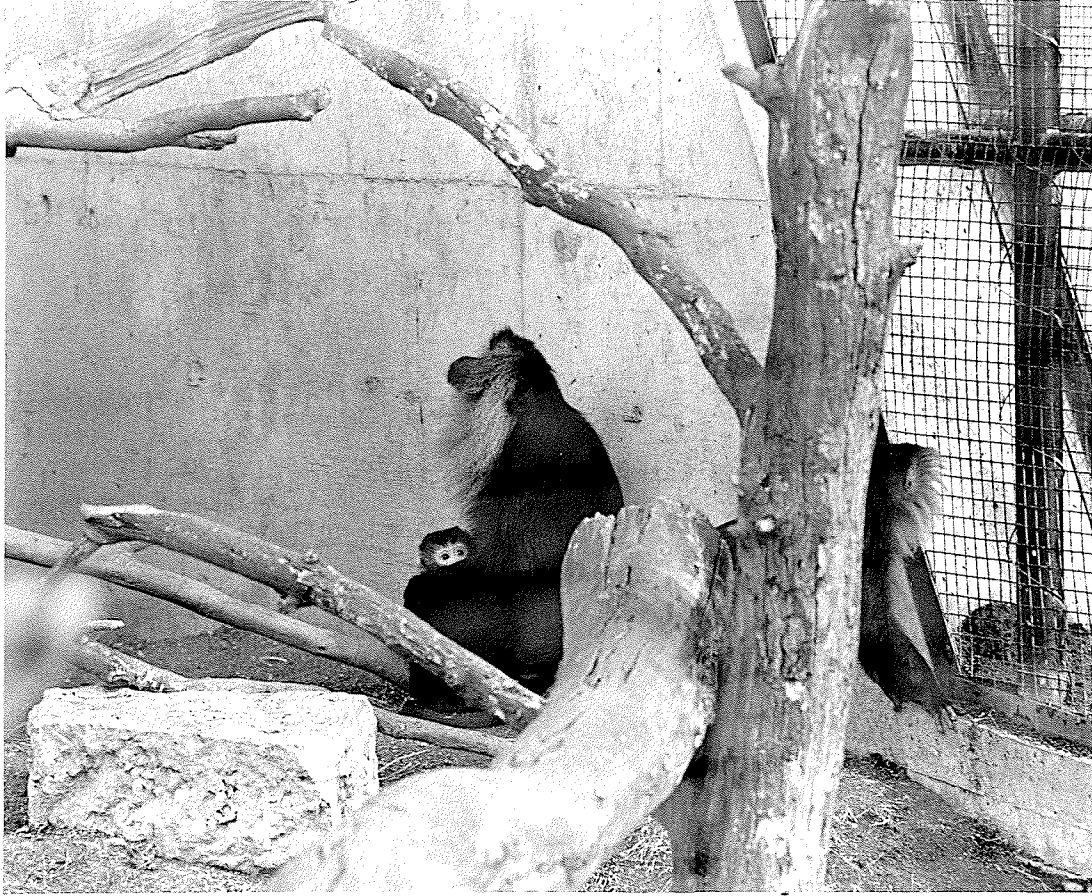
PHOTOGRAPHS OF THE TWO GROUPS



PUNKY ADULT MALE GROUP ONE



THUMPER ADULT FEMALE GROUP ONE



DEBBIE ADULT FEMALE OTTO INFANT MALE GROUP ONE



OPHELIA ADULT FEMALE GROUP TWO



SAMANTHA ADULT FEMALE SLOAN INFANT MALE GROUP TWO



NAMELESS ADULT FEMALE GROUP TWO



NINI ADULT FEMALE GROUP TWO



WOLFGANG ADULT MALE GROUP TWO

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