



WICHITA STATE
UNIVERSITY

UNIVERSITY LIBRARIES

Levels of affiliation between members of a captive family group of white-faced Saki monkeys (*Pithecia pitheciay*)

| | |
|---------------|--|
| Item Type | Article |
| Authors | Toole, Angela |
| Citation | Toole, Angela. (2009). Levels of affiliation between members of a captive family group of white-faced Saki monkeys (<i>Pithecia pitheciay</i>). -- <i>Lambda Alpha Journal</i> , v.39, p.39-56 |
| Publisher | Wichita State University. Department of Anthropology |
| Download date | 2026-05-14 13:36:40 |
| Link to Item | http://hdl.handle.net/10057/3262 |

Levels of Affiliation between Members of a Captive Family Group of White-faced Saki Monkeys (*Pithecia pitheciay*)

Angela Toole
Department of Anthropology
University of Missouri- St. Louis

White-faced saki monkeys (Pithecia pitheciay are monogamous primates rarely studied in the wild. Little is known about their affiliative behavior. This study examined levels of affiliation between five members of a captive family group of white-faced saki monkeys at the St. Louis Zoo from October to November 2008. I collected twenty hours of data on the affiliative behavior of the five member group. This data consisted of focal animal samples, nearest neighbor focal animal samples, and interaction matrices of affiliative behaviors to determine the differences in levels of affiliation between male and female parent sakis, and male and female offspring. I found that male and female offspring tend to affiliate more than male offspring do with each other. The male parent rarely affiliated with his female offspring while the female parent affiliated with both her male and female offspring. The bonded pair affiliated infrequently and were rarely observed in proximity of each other (only 1 % of the observed time was spent in close proximity). These results differ from the findings of studies of the affiliative behaviors of the closely related titi monkeys (Callicebus sp.). Previous studies of captive titi monkeys show that affiliation tends to be higher between the bonded pair than between the parents and their offspring and that bonded pairs of titi monkeys display "jealousy behaviors" when intruders enter their group. The low level of affiliation between the white-faced saki bonded pair found in this study may be due to the fact that no new members have never been introduced to the family group at the St. Louis Zoo.

Introduction

White-faced saki monkeys (*Pithecia pitheciay are diurnal, medium-sized South American primates. Their numbers are abundant in the wild, and their habitats include the rainforests and dry tropical forests of Brazil, French Guiana, Guyana, Suriname, and Venezuela. There is very little sexual dimorphism within *Pithecia pitheciay-females average 1.7 kg and males average 2 kg while males tend to be no more than .4 in. longer than females (Norconk 2007). White-faced sakis are sexually dichromatic, however, with females having brownish-black facial pelage and males having white facial pelage. Sakis are also sexually dichromatic in their body hair coloration-females have orange-brown and black body pelage while males obtain black body pelage within the first three years of life (Kinzey and Norconk 1990).**

Sakis-as well as the closely related bearded saki and uakari monkeys (genera *Chiropotes* and *Cacajao*)-are referred to as seed predators as they have specialized incisor/canine dentition which allows them to break into the hard husks and shells of seeds and nuts (Kinzey and Norconk 1990). However, sakis also eat varying amounts of fruits, leaves and insects (Kinzey and Norconk 1993, Norconk 1996). White-faced sakis have also been observed eating the empty nests of various species of wasps (*Polistes* spp.), which are high in crude protein (Norconk 2007). The reliance on seeds by sakis may be an adaptive means of avoiding the seasonal fruit shortages experienced by frugivorous platyrrhines such as spider monkeys (genus *Ateles*) (Norconk 1996).

Additionally, these arboreal monkeys engage in two types of movement-above branch quadrupedal locomotion and long leaps similar to those practiced by vertical clinging-and-leaping primates. Saki monkeys have been observed making leaps as large as 10m., earning them the common name "flying monkeys" ("White-faced Saki"; Walker 1996).

Members of *P. pithecia* tend to form monogamous family groups, composed of an adult breeding pair and two to three offspring, and exhibit the territorial behaviors characteristic of monogamous primates. For white-faced sakis, territorial behavior includes the chasing of intruder conspecifics and vocalizations (Norconk 2007). Weaning and dispersal occurs after the age of three years, the age when both female and male sakis reach physical, social, and sexual maturity. Unlike other monogamous primates, however, saki monkey fathers have a somewhat ambiguous role in offspring-rearing. Some data suggest that white-faced saki monkey fathers carry their infants, but other data conflict with this finding (Ryan 1995; Norconk 2007). This confusion is probably due in part to the lack of behavioral studies of saki monkeys.

Due to their small group sizes and elusive and territorial nature, white-faced saki monkeys are difficult to habituate and little is known about their behavior. This research project aims to explore this gap in the literature. I studied the affiliative behavior of a captive group of five white-faced saki monkeys living in a natural monogamous group setting in the Primate House of the St. Louis Zoo. Specifically, I asked: What does affiliation resemble in this species? Do white-faced saki monkey parents living in captivity affiliate more with offspring of their own sex? Does more affiliation occur between parents than between offspring? Does affiliation between offspring vary between the sexes? Which affiliative behaviors are engaged in most frequently? The answers to these questions are not known for wild populations of *Pithecia*. Due to the fact that the captive group is composed of a monogamous bonded pair and their adult offspring, the affiliation patterns revealed by my data may shed some light on the possible affiliative behavior of wild white-faced saki monkeys.

Methods

To answer these questions about the affiliation of white-faced saki monkeys, twenty hours of data were collected on a five-member family group of white-faced saki monkeys at the St. Louis Zoo between October and November of 2008. Table 1 the group's demographics. These data were collected with focal animal samples, nearest neighbor focal animal samples, and interaction matrices of behaviors I defined as "intimate touching." Focal animal samples and nearest neighbor focal animal samples account for ten hours of the collected data and the interaction matrices account for the remaining ten hours. Additionally, five hours of ad libitum preliminary observation were used to construct an ethogram of affiliative behaviors. Table 2 includes the affiliative actions recorded as well as their definitions and abbreviations.

Focal animal samples and nearest neighbor focal animal samples were conducted simultaneously and focused on the same individual. Focal samples were thirty minutes each and divided into intervals of fifteen seconds. A stopwatch was used to mark the beginning of each fifteen-second interval. I alternated between the two types of data collection from interval to interval. At the start of one fifteen-second interval, the distance of the focal animal from the other four group members was recorded. An animal was recorded as being either directly next to the focal animal (in which case a zero was recorded for distance), approximately half a meter away (this distance was recorded by the number one), approximately one meter away (this distance was recorded by the number two), approximately one meter and half away (this distance

was recorded by the number three) or two or more meters away (this distance was recorded by the number four). If an animal was found at a distance between any of these categories, I estimated which distance the individual was closest to and recorded that category. A sample of the nearest neighbor datasheet is included in Appendix 1.

At the start of the subsequent fifteen-second interval, the affiliative activity of the focal animal was recorded. I also kept track of whether the focal animal was giving or receiving the affiliative action and which individual or individuals the focal animal was interacting with. If the focal animal was not engaging in affiliative behavior, the action was labeled "other" and described. I rotated which individual was used as the focal animal to avoid over-sampling one individual. Each individual was used as the focal animal four times adding up to two hours of focal data per individual and ten total hours of focal data. Table 2 shows the number of hours of each type of data taken for each individual. A sample of the focal animal datasheet is included in Appendix 2.

Interaction matrices were used to record the frequency of intimate touching and constitute the remaining ten hours of data. Samples were thirty minutes long and were not broken into intervals. During these samples, any occurrences of intimate touching between all five group members were recorded on interaction matrices, indicating which individuals engaged in the activity. For each instance of intimate touching, I recorded which individual was the "giver" of the intimate touch and which individual was the recipient. A total of twenty intimate touching matrices were collected for a total of ten hours. A sample of the interaction matrix datasheet is included in Appendix 3.

The St. Louis Zoo's group of white-faced saki monkeys is made up of five individuals—two parents and their three adult offspring. Hosmer, born in March of 1988, is the oldest male and the father of the group. Siga, born in February of 1994, is the oldest female and mother of the group. Their offspring include Thurlo (male, born in May of 1997), Nylon (female, born in 1998), and the youngest, Hanes (male, born in 2001). Due to the nature of my research question and to ensure that no individual was over-represented in the data, it was necessary for me to identify each member of the group and be able to recognize them.

Firstly, identifying sex was simple due to the differences in pelage coloration exhibited by female and male saki monkeys. More specific characteristics were used to distinguish the three males and two females from one another. Hosmer is missing hair on his tail, making the skin visible, and Siga is easily identifiable by her thinning tail hair and the tufts of white hair by her lips. Her daughter, Nylon, does not have these white tufts of hair but has light eyebrows that her mother lacks. Thurlo, the oldest male offspring, has an unusual orange tint to his facial hair while Hanes is distinguishable by his especially bushy tail. These characteristics proved to be easy to identify when selecting focal animals and identifying the individuals interacting with my focal animal as well as recording the activities of each individual during the scan samples and the completion of the interaction matrices.

The group's enclosure is small for a five-member group of monkeys capable of 10 m. leaps—it is approximately six meters in height (from the floor to the top of the highest rocky ledge) and four meters in width. In addition to rocks and ledges on which the sakis climb and leap to and from, the enclosure includes suspended tree branches for the monkeys to utilize. During my study, enrichment items—such as small mirrors and compact discs hung with string from the branches—were placed within the enclosure. Finally, the enclosure is also shared by a lone sixteen-year-old male golden-headed lion tamarin. While I did not include the tamarin in my data collection, I observed little interaction between the sakis and the tamarin. What interaction I did observe appeared to be affiliative in nature (for example, I witnessed one instance of inter-specific food sharing).

Table 1: Group demographics

| Name | Age (years) | Relationship |
|--------|-------------|-----------------------|
| Homer | 20 | Adult breeding male |
| Siga | 14 | Adult breeding female |
| Hanes | 7 | Male offspring |
| Nylon | 10 | Female offspring |
| Thurlo | 11 | Male offspring |

Table 2: Ethogram for *Pithecia pithecia*

| Affiliative Action | Abbreviation | Definition |
|--------------------|--------------|--|
| Chase/Play | CP | animal pursues another individual with no visible signs of aggression |
| Groom | G | animal picks through the hair of another individual with hands or teeth |
| Intimate Touching | IT | animal touches mouth/face to the mouth/face/body of another individual |
| Take Food | TF | animal removes food from the hands or mouth of another individual |
| Share Food | SF | animal stops eating a piece of food, sets it down and allows it to be taken by another individual |
| Sleep in Proximity | SP | animal rests in a stationary position with weight on rear with closed eyes within half a meter of another individual |

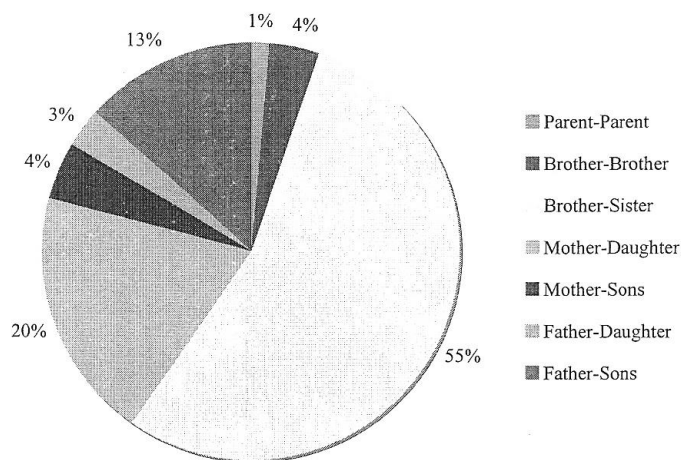
Table 3: Number of hours of data collected on each group member

| Group member | Type of Data | | Freq. of Intimate Touching |
|--------------|--------------|------------------|----------------------------|
| | Focal Sample | Nearest Neighbor | |
| Hosmer | 2 | 2 | 10 |
| Siga | 2 | 2 | 10 |
| Thurlo | 2 | 2 | 10 |
| Nylon | 2 | 2 | 10 |
| Hanes | 2 | 2 | 10 |

Results

My results show differences in levels of affiliation between male and female parents, and male and female offspring. For the purposes of answering this study's research questions, data on affiliative behavior has been categorized into the categories of parent-parent, mother-sons, father-daughter, mother-daughter, father-sons, brothers-sister, brother-brother affiliation. Figure 1 shows the results for the interaction matrices of intimate touching. In this chart, no distinction is made between who initiated and who received the intimate touches. During my study, I observed that most intimate touches from one individual were reciprocated.

Figure 1: Frequency of Intimate Touching



Intimate touching was most frequent between brother and sister white-faced saki monkeys, constituting 55% of the total observed intimate touches, followed by mother-daughter intimate touching at 20% and father-sons intimate touching at 13%. Intimate touching in brother-brother, mother-sons, and father-daughter categories was infrequent, with each group constituting under 5% of the total observed intimate touches. The bonded pair themselves rarely engaged in intimate touching-their intimate touching constitutes only 1 % of the total samples collected.

Similar results were found when analyzing the nearest neighbor data. Figure 2 illustrates the amount of time the monkeys were recorded as being in touching proximity during the focal animal samples. Figure 3 illustrates the amount of time the monkeys were recorded as being approximately 0.5 m. apart.

As I found with the frequency of intimate touching, the father-daughter and parent-parent spent the least amount of time in contact. During focal sampling, Hosmer (the adult breeding male) was never observed sitting in contact with his daughter Nylon. The same was observed during focal animal samples of Nylon. Likewise, during their individual focal animal samples, Siga (adult breeding female) and Hosmer were never observed sitting in close contact. However, unlike the results of the interaction matrices, the father-son, brothers-sister, and mother-daughter pairings were found in touching proximity almost an equal amount of the observation time-24%, 22%, and 18% respectively. Thurlo (older male offspring) and Hanes (younger male offspring) were observed in touching proximity 14% of the ten hours of focal animal observations-a high level of affiliation when compared to the low level of intimate touches exchanged between the two.

Figure 2: Time Spent in Close Proximity (Touching)

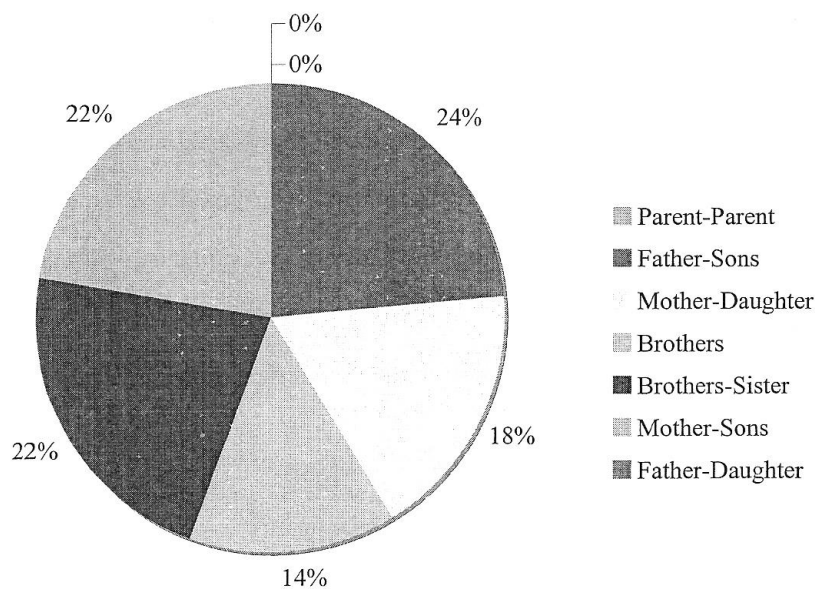
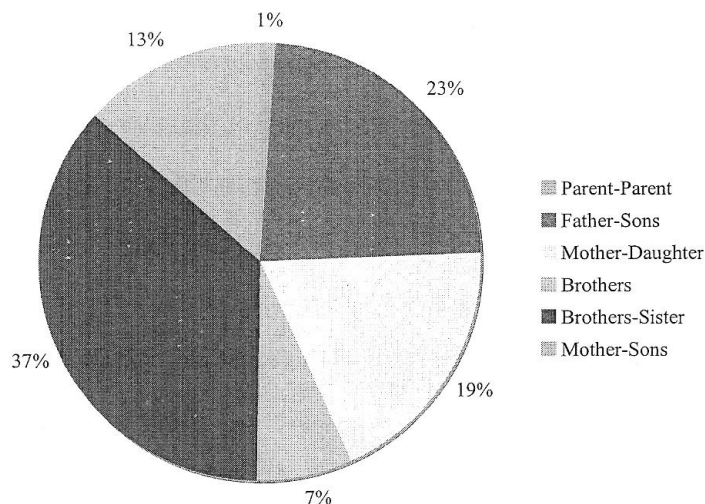
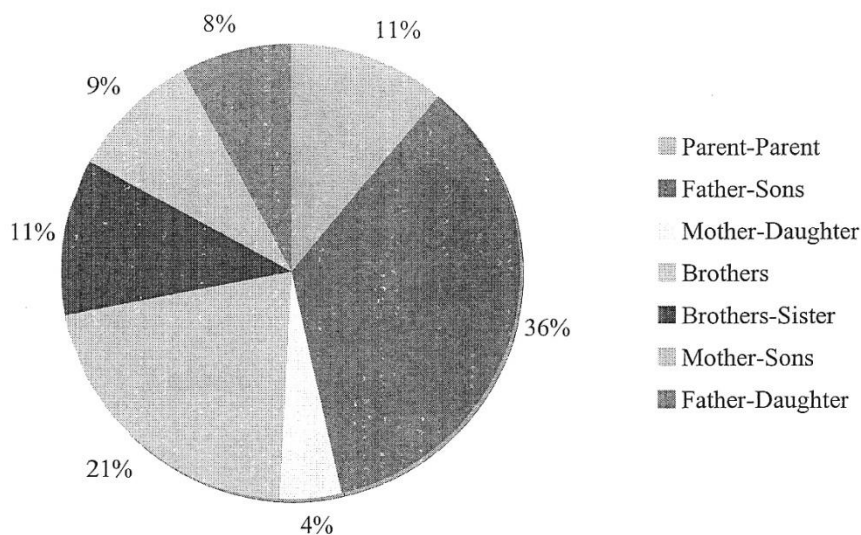


Figure 3: Time Spent in Close Proximity (.5 m. Apart)



Brother and sister pairings spent more time approximately .5 m. apart than any other social category, followed by father-son pairings at 23%, mother-daughter pairings at 19%, and mother-son pairings at 13%. When the data taken during Thurlo's and Hanes's focal animal samples are combined, the brothers were observed in close .5 m. proximity 7% of the total focal observation time. Parents, once again, were rarely observed affiliating-Hosmer and Siga were only seen in close .5 m. proximity 1 % of the time each individual was observed in focal animal samples. Figure 4 illustrates the amount of time the monkeys spent approximately 1 m. apart.

Figure 4: Time Spent in Proximity (1 m.)



The trends in the proceeding data are less apparent when examining the amount of time the white-faced sakis spent approximately 1 m. apart. Father-son pairings are the most frequent in this distance category, followed by brother-brother pairings. Hosmer and Siga were observed at a 1 m. distance from each other 11 % of time. Nylon and either of her brothers were also observed approximately 1 m. from each other 11 % of the time. Mother-son pairings were found in 1 m. proximity 9% of the time while Hosmer was observed at a 1 m. distance from Nylon 8% of the time. During the focal animal samples, Siga and Nylon were observed at 1 m. apart 4% of their total observation time. Figures 5 and 6 illustrate the amount of time the monkeys were observed not in proximity approximately 1.5 to 2 or more meters apart.

Figure 5: Time Spent Approx. 1.5 m. Apart

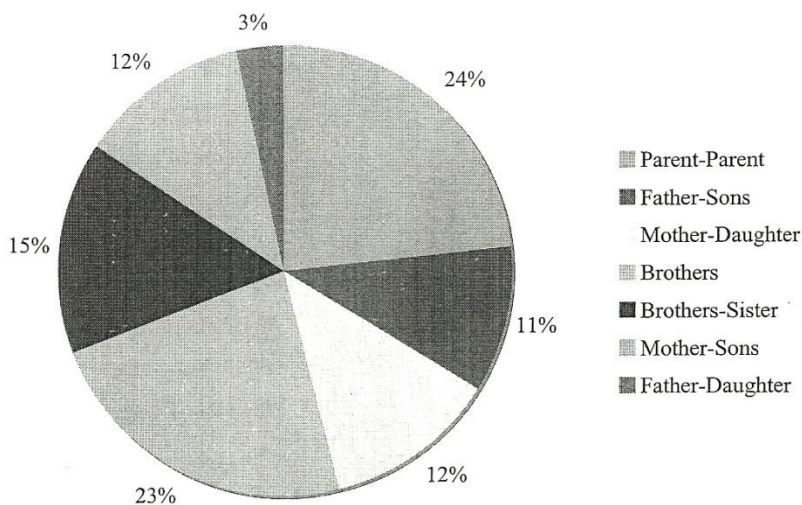


Figure 6: Time Spent Approx. 2 m. (or More) Apart

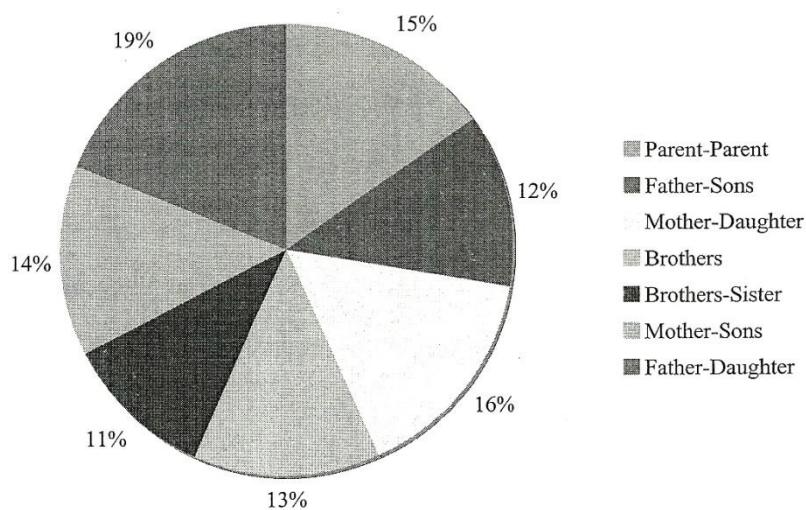


Table 3 details which affiliative behaviors were engaged in most by each individual (I distinguished between grooming and being groomed by another individual) and which dyads engaged in these behaviors most often. The affiliative behaviors observed most often were grooming, being groomed by another individual, and sleeping in proximity. Chase/playing was observed during my preliminary observations, but not during the focal animal samples, while food taking was only observed a total of four times (these instances occurred between Siga, Thurlo, and Nylon). Food sharing was observed once during the focal samples (Nylon shared her food with Hanes).

Hosmer and Thurlo interacted by grooming and sleeping in proximity often-Thurlo was the individual with whom Hosmer was affiliating (i.e.: affiliation partner) during all of Hosmer's focal samples, while Hosmer was Thurlo's affiliation partner in 65% of Thurlo's affiliative encounters (Thurlo affiliated with Hanes another 20% of the time, with Siga 11.25%, and with Nylon 3.75% of the time). Hanes and Nylon also showed a high level of affiliation. During focal animal samples of Hanes, Nylon was always his affiliation partner while during Nylon's focal samples, she affiliated with Hanes 76.15% of the time (Nylon was also observed affiliating with Siga 14.68% of the time and with Thurlo the remaining 9.2%). Siga groomed and slept in proximity a total of 21.67% of the total time she was observed and most of this affiliation-90%-occurred with her son Thurlo (Siga also affiliated with Nylon 7.04% and Hanes 2.82% of the Siga's focal observation time).

Table 3:

| Group member | Most Common Affiliative Behavior | Percent of Time | 2nd Most Common Behavior | Percent of Time | Affiliative Partner | Percent of Interaction with Partner |
|--------------|----------------------------------|-----------------|--------------------------|-----------------|---------------------|-------------------------------------|
| Hosmer | Groomed by another | 9.17% | Grooming | 4.17% | Thurlo | 100% |
| Siga | Groom | 13.75% | Sleeping in Prox. | 7.92% | Thurlo | 90% |
| Thurlo | Sleep in Prox. | 21.25% | Grooming | 6.67% | Hosmer | 65% |
| Nylon | Groomed by another | 20.83% | Grooming | 20.42% | Hanes | 76.15% |
| Hanes | Groomed by another | 16.67% | Grooming | 5% | Nylon | 100% |

Discussion

These results suggest that affiliation between bonded pairs of white-faced saki monkeys in captivity tends to be low, while affiliation between parents and offspring is frequent. Additionally, my study indicates that male parents affiliate more with male offspring while female parents frequently affiliate with offspring of both sexes. Furthermore, I found that affiliation tends to be higher between male and female offspring than between male offspring.

These results differ from those conducted on the affiliative behavior of wild and captive titi monkeys. Titi monkeys, members of the genus *Callicebus*, are closely related to white-faced saki monkeys (both *Callicebus* and *Pithecia* belong to the family *Atelidae*) (Nystrom and Ashmore 2008). Like sakis, titi monkeys form monogamous family groups composed of a bonded pair and their offspring. However, titis are better studied than saki monkeys and more is known about their affiliative behavior. For example, bonded pairs of titi monkeys are known to have close relationships. Mated adult titis engage in the same activities at the same time as well as spend time in proximity (Anzenberger et al. 1986; Mendoza et al. 2002). Affiliation behaviors include tail twining, hand holding, cuddling, grooming, and sitting close together (Fernandez-Duque et al. 1997).

Titis also display "jealousy behaviors," such as increased affiliation with mates and agonism toward others, when outsider males intrude into established family groups (Cubicciotti and Mason 1977). Data on captive family groups of titi monkeys show that bonded pairs prefer to affiliate and groom each other more than other family members (Welker et al. 1998), suggesting that bonds between parents remain strong in captive situations. Additionally, Fernandez-Duque et al. found that captive titi monkeys tend to affiliate more with each other when intruding adults, males especially, are present (2000).

These results differ sharply from my data on levels of affiliation between white-faced saki monkeys. While affiliation tends to be high between breeding adults for both wild and captive titi monkeys, the lowest levels of affiliation found in my study were between the bonded pair. This is possibly the result of the stable conditions of the St. Louis Zoo's family group of white-faced saki monkeys. No new adult members of *P. pithecia* have been introduced to this family group. This may lead to a sense of security and a reduced need to affiliate between the bonded pair.

Another element to consider when interpreting this study is the evidence for friendships among captive white-faced saki monkeys. While the data suggests certain trends when combined—for example, the tendency of male parents to affiliate with male offspring more than female offspring—when examined on an individual basis, it becomes apparent that the results could be in part due to close friendships. For example, while Hosmer appeared to spend more time affiliating with his male offspring, this time was not distributed evenly between his sons. During Hosmer's focal sample, Thurlo, Hosmer's older son, was his affiliation partner for every instance of affiliation recorded. Furthermore, while brother-sister interactions were more frequent than brother-brother interactions, Nylon, the female offspring, affiliated with her younger brother Hanes, rather than her older brother Thurlo, 76.15% of the time while Hanes was only recorded affiliating with Nylon.

While these results are interesting, my study had several key limitations which should be noted. Firstly, only twenty hours of data were collected. With more time, I would have had an increased chance of observing instances of food taking and sharing as well as chase/playing and a larger amount of data would have given me a stronger sense of the differences in levels of affiliation between group members. Also, data collection was halted during the study for approximately three weeks due to the temporary removal of Siga and Nylon. The majority of the data (fifteen hours) was taken after the group had been reunited. This separation and subsequent reunion could have had unknown effects on my data. Additionally, as mentioned above, the sakis' enclosure is small, which could have affected my data as it is possible that time spent in proximity is the result of a limited amount of space to utilize rather than friendships or affiliation. Furthermore, agonistic behavior was not examined. During a conversation with

a zoo keeper that took place near the end of my study, I was told that hair-shaking was a saki threat behavior. Hair-shaking was something I noticed often but did not recognize as a threat display and did not record.

Finally, there is a lack of wild data on affiliative behavior, so I am not able to draw conclusions on the effect captivity may or may not have on levels of affiliation within a captive group of white-faced saki monkeys. In addition, my research was limited in its ability to predict the affiliative behavior of wild saki monkeys due to the ages of the offspring of the St. Louis group. While the group is a natural family group in its composition, saki offspring are weaned around three years of age in the wild (Norconk 2007), whereas these offspring have remained in their natal group well into adulthood. Future research should include both wild and captive studies of both the affiliative and agonistic/threat behaviors of white-faced saki monkeys. Comparisons between the behavior of wild and captive groups should be made in order to assess whether the low level of affiliation between the bonded pair in this study is natural or the result of captivity.

Conclusion

This study sought to investigate the affiliative behaviors of a captive group of white-faced saki monkeys in the absence of data on levels of affiliation in wild family groups of white-faced saki monkeys. Results show high levels of affiliation between offspring, between male and female offspring in particular, and between parents and offspring, especially between the male parent and his male offspring. The level of affiliation between the mated pair was consistently low during the study, indicating a departure from the literature on emotionally bonded wild and captive monogamous titi monkeys. This departure may be the result of stable group conditions within the St. Louis Zoo. My data also suggests that white-faced saki monkeys form close friendships. While it would not be wise to make broad generalizations about the behavior of saki monkeys from this limited study, these data does encourage further research which could illuminate the variety in the affiliation behavior of monogamous New World primates. Additionally, this study sheds some preliminary light on patterns of affiliation of captive white-faced saki monkeys living in natural family groups.

Works Cited

- Anzenberger, G., S.P. Mendoza, W.A. Mason. 1986. "Comparative Studies of Social Behavior in *Callicebus* and *Saimiri*: Behavioral and Physiological Responses of Established Pairs to Unfamiliar Pairs." In *The American Journal of Primatology*, Vol. 11, pp. 37-51.
- Cubicciotti, D.D. and W.A. Mason. 1978. "Comparative Studies of Social Behavior in *Callicebus* and *Saimiri*: Heterosexual Jealousy Behavior." In *Behavioral Ecology and Sociobiology*, Vol. 3, pp. 311-22.
- Fernandez-Duque, E., W.A. Mason, S.P. Mendoza. 1997. "Effects of Duration of Separation on Responses to Mates and Strangers in the Monogamous Titi Monkey (*Callicebus moloch*). In *The American Journal of Primatology*, Vol. 43, pp. 225-37.
- Fernandez-Duque, E., c.R. Vaggia, W.A. Mason. 2000. "Effects of Pair-bond and Social Context on Male-female Interactions in Captive Titi monkeys (*Callicebus moloch*, Primates: *Cebidae*)". In *Ethology*, Vol. 106, pp. 1067-1082.
- Kinzey, W.G. and M.A. Norconk. 1990. "Hardness as a Basis of Fruit Choice in Two Sympatric Primates." In *The American Journal of Primatology*, Vol. 81, pp. 5-15.
- Kinzey, W.G. and M.A. Norconk. 1993. "Physical and Chemical Properties of Fruit and Seeds Eaten by *Pithecia* and *Chiropotes* in Suriname and Venezuela." In *The international Journal of Primatology*, Vol. 14, pp. 207-227.
- Mendoza SP, D.M. Reeder, W.A. Mason. 2002. "Nature of Proximate Mechanisms Underlying Primate Social Systems: Simplicity and Redundancy." In *Evolutionary Anthropology*, Vol. 11(suppl1), pp.112-6.
- Norconk, M.A. 2007. "Sakis, Uakaris, and Titi Monkeys: Behavioral Diversity in a Radiation of Primate Seed Predators." In *Primates in Perspective*, edited by C. Campbell et. al., pp. 123-138. Oxford University Press, New York.
- Norconk, M.A. 1996. "Seasonal Variation in the Diets of White-faced and Bearded Sakis (*Pithecia pithecia* and *Chiropotes satanas*) in Guri Lake, Venezuela." In *Adaptive Radiations of Neotropical Primates*, edited by M.A. Norconk, AL. Rosenberger, and P.A. Garber, pp. 403-423. Plenum Press, New York.
- Nystrom, Pia and Pamela Ashmore. 2008. *The Life of Primates*. Pearson, Upper Saddle River, New Jersey.
- Ryan, K.M. "Preliminary Report on Social Structure and Alloparent Care on an Island in Guri Reservoir." In *The American Journal of Physical Anthropology*, Vol. 20 (suppl.), pp. 187.

Walker, S.E. 1996. "The Evolution of Positional Behavior in the Saki-Uakaris (*Pithecia Chiropotes* and *Cacajao*)." In *Adaptive Radiations of Neotropical Primates*, edited by 1v1.A. Norconk, A.L. Rosenberger, and P.A. Garber, pp. 335-367. Plenum Press, New York.

Welker, c., B. Jantschke, A. Klaiber-Schuh. 1998. "Behavioural Data on the Titi Monkey *Callicebus cup reus* and the Owl Monkey *Aotus azarae boliviensis*: Living in Family Groups. In *Primate Report*, Vol. 51, pp. 29-42.

"White-faced Saki," Bristol Zoo Gardens,
<http://www.bristolzoo.org.uk/learning/animals/mammals/saki-monkey>.

Appendix 1

NEAREST NEIGHBOR (30 SECOND INTERVALS)

Focal Animal _____

Date _____ Start Time _____ End Time _____

| Interval | Subjects | | | |
|----------|----------|--|--|--|
| :00 | | | | |
| :30 | | | | |
| 1:00 | | | | |
| 1:30 | | | | |
| 2:00 | | | | |
| 2:30 | | | | |
| 3:00 | | | | |
| 3:30 | | | | |
| 4:00 | | | | |
| 4:30 | | | | |
| 5:00 | | | | |
| 5:30 | | | | |
| 6:00 | | | | |
| 6:30 | | | | |
| 7:00 | | | | |
| 7:30 | | | | |
| 8:00 | | | | |
| 8:30 | | | | |
| 9:00 | | | | |
| 9:30 | | | | |
| 10:00 | | | | |
| 10:30 | | | | |
| 11:00 | | | | |
| 11:30 | | | | |
| 12:00 | | | | |
| 12:30 | | | | |
| 13:00 | | | | |
| 13:30 | | | | |
| 14:00 | | | | |
| 14:30 | | | | |
| 15:00 | | | | |
| 15:30 | | | | |
| 16:00 | | | | |
| 16:30 | | | | |
| 17:00 | | | | |
| 17:30 | | | | |

| | | | | |
|-------|--|--|--|--|
| 18:00 | | | | |
| 18:30 | | | | |
| 19:00 | | | | |
| 19:30 | | | | |
| 20:00 | | | | |
| 20:30 | | | | |
| 21:00 | | | | |
| 21:30 | | | | |
| 22:00 | | | | |
| 22:30 | | | | |
| 23:00 | | | | |
| 23:30 | | | | |
| 24:00 | | | | |
| 24:30 | | | | |
| 25:00 | | | | |
| 25:30 | | | | |
| 26:00 | | | | |
| 26:30 | | | | |
| 27:00 | | | | |
| 27:30 | | | | |
| 28:00 | | | | |
| 28:30 | | | | |
| 29:00 | | | | |
| 29:30 | | | | |
| 30:00 | | | | |

Appendix 2

30 MINUTE FOCAL ANIMAL SAMPLE

Focal Animal _____

Date _____ Start Time _____ End Time _____

| 2 | Activity | Notes |
|-------|----------|-------|
| :00 | | |
| :30 | | |
| 1:00 | | |
| 1:30 | | |
| 2:00 | | |
| 2:30 | | |
| 3:00 | | |
| 3:30 | | |
| 4:00 | | |
| 4:30 | | |
| 5:00 | | |
| 5:30 | | |
| 6:00 | | |
| 6:30 | | |
| 7:00 | | |
| 7:30 | | |
| 8:00 | | |
| 8:30 | | |
| 9:00 | | |
| 9:30 | | |
| 10:00 | | |
| 10:30 | | |
| 11:00 | | |
| 11:30 | | |
| 12:00 | | |
| 12:30 | | |
| 13:00 | | |
| 13:30 | | |
| 14:00 | | |
| 14:30 | | |
| 15:00 | | |

| | | |
|-------|--|--|
| 16:00 | | |
| 16:30 | | |
| 17:00 | | |
| 17:30 | | |
| 18:00 | | |
| 18:30 | | |
| 19:00 | | |
| 19:30 | | |
| 20:00 | | |
| 20:30 | | |
| 21:00 | | |
| 21:30 | | |
| 22:00 | | |
| 22:30 | | |
| 23:00 | | |
| 23:30 | | |
| 24:00 | | |
| 24:30 | | |
| 25:00 | | |
| 25:30 | | |
| 26:00 | | |
| 26:30 | | |
| 27:00 | | |
| 27:30 | | |
| 28:00 | | |
| 28:30 | | |
| 29:00 | | |
| 29:30 | | |
| 30:00 | | |

Appendix 3

FREQUENCY OF AFFILIATION

Date _____ Start Time _____ End Time _____

INTIMATE TOUCHING

| | Hosmer | Thurlo | Hanes | Siga | Nylon |
|--------|--------|--------|-------|------|-------|
| Hosmer | X | | | | |
| Thurlo | | X | | | |
| Hanes | | | X | | |
| Siga | | | | X | |
| Nylon | | | | | X |