



Grooming Behavior and Social Hierarchy in Long-Tailed Macaques

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INTRODUCTION

Grooming is a common behavior observed in primates. For some primates, grooming might be performed according to one's social ranking, with middle-ranking individuals grooming more often than both high and low-ranking individuals (Xia, *et al.*, 2021). In this hypothesis, individuals use grooming to establish rank within the social hierarchy. The steeper the social hierarchy is, the more time these middle-ranking individuals will spend grooming in an attempt to maintain their social ranking—by grooming the lower-ranking—or in an attempt to climb the hierarchy—by grooming higher-ranking (Xia, *et al.*, 2021).

A second hypothesis explaining allogrooming regards grooming as a hygienic behavior with primates primarily grooming in locations on the body where the individual being groomed cannot reach themselves (Pfoh, *et al.*, 2021). In long-tailed macaques, one study shows that female-to-female grooming interactions tended to be on the head or front, while male-to-male grooming interactions tended to be on the back or tail (Sonlanki, *et al.*, 2020). In our study, we define the head and back as being hard to reach locations, while the tail, arms, legs and front are easy to reach locations. Using our definitions, this means that Sonlanki, *et al.* (2020) suggests both males and female perform allogrooming for hygiene (hard to reach locations) and for another reason (easy to reach locations). Our study was conducted on long-tailed macaques (*Macaca fascicularis*), using sex and size as a proxy for dominance. Since troops typically consider the largest male the most dominant individual (Hakim *et al.*, 2023), larger individuals were considered “more dominant” than smaller individuals and males were considered the dominant sex. We predict intermediate-sized females will exhibit the most grooming behavior followed by medium-sized males. We also predict that intermediate-sized individuals will primarily groom individuals that are significantly larger or significantly smaller than themselves (Xia, *et al.*, 2021), primarily focusing on areas that individuals find difficult to groom independently (Pfoh, *et al.*, 2021).

Additionally, while grooming, primates use their hands and mouth to move fur and pick skin, insects, and other parasites off of the individual being groomed. Other studies of primate handedness have found a tendency toward left-handed priority (Zhao, *et al.*, 2012). In our study we also examined this tendency in Macaques.

This study aims to enhance our understanding of social grooming among macaques and primates overall. This specific behavior is crucial for understanding macaques more deeply, as it can reveal insights into their relationships, hierarchy, and communication patterns.

LONG-TAILED MACAQUES

•Macaques are primates from Southeast Asia, with males ranging in size from about 16-25 in. and weighing 10.4–18.3 lbs. Females' size ranges from about 15-19.8 in. and weigh 5.5-12.6 lbs. (Wisconsin National Primate Research Center).

•Troops are set up in a patriarchy, with one dominant (generally larger) male (Hakim *et al.*, 2023).

•The group of macaques we are studying consists of a troop of a few dozen individuals with one dominant male (Indianapolis, 2021).

•Other studies have found that grooming behavior plays both a hygiene and social role in Macaques (Kanggiesser *et al.*, 2010).

•Grooming behavior influences and indicates social status in many primates (Pfoh, *et al.*, 2021).

•Factors like sex and size are a proxy for dominance and can therefore be associated with grooming behavior (Sonlanki, *et al.*, 2020).

•Macaques are social animals and understanding their social behavior is a key factor in understanding their species.



METHODS

•Long-tailed macaques, *Macaca fascicularis*, at the Indianapolis Zoo, were observed for a total of 10 hours.

•A few dozen were in an enclosure with two tall wooden structures and a raised wooden platform.

•Focal behavior sampling was used to observe grooming behaviors (Pfoh, *et al.*, 2021)

•For every groomer and groomee, the data recorded included the length of time behavior was observed, sex and size of individuals involved, the location groomed, and what hand was used to do the grooming

•Size was defined as either small, medium, or large. Any juvenile macaque was considered small. There were only a few large macaques, who were noticeably larger than the others. The rest were considered medium-sized.

•The hand used for grooming was characterized by which was used for picking at the skin

•If an individual used both hands to pick at the skin, this was defined as both

FIGURES

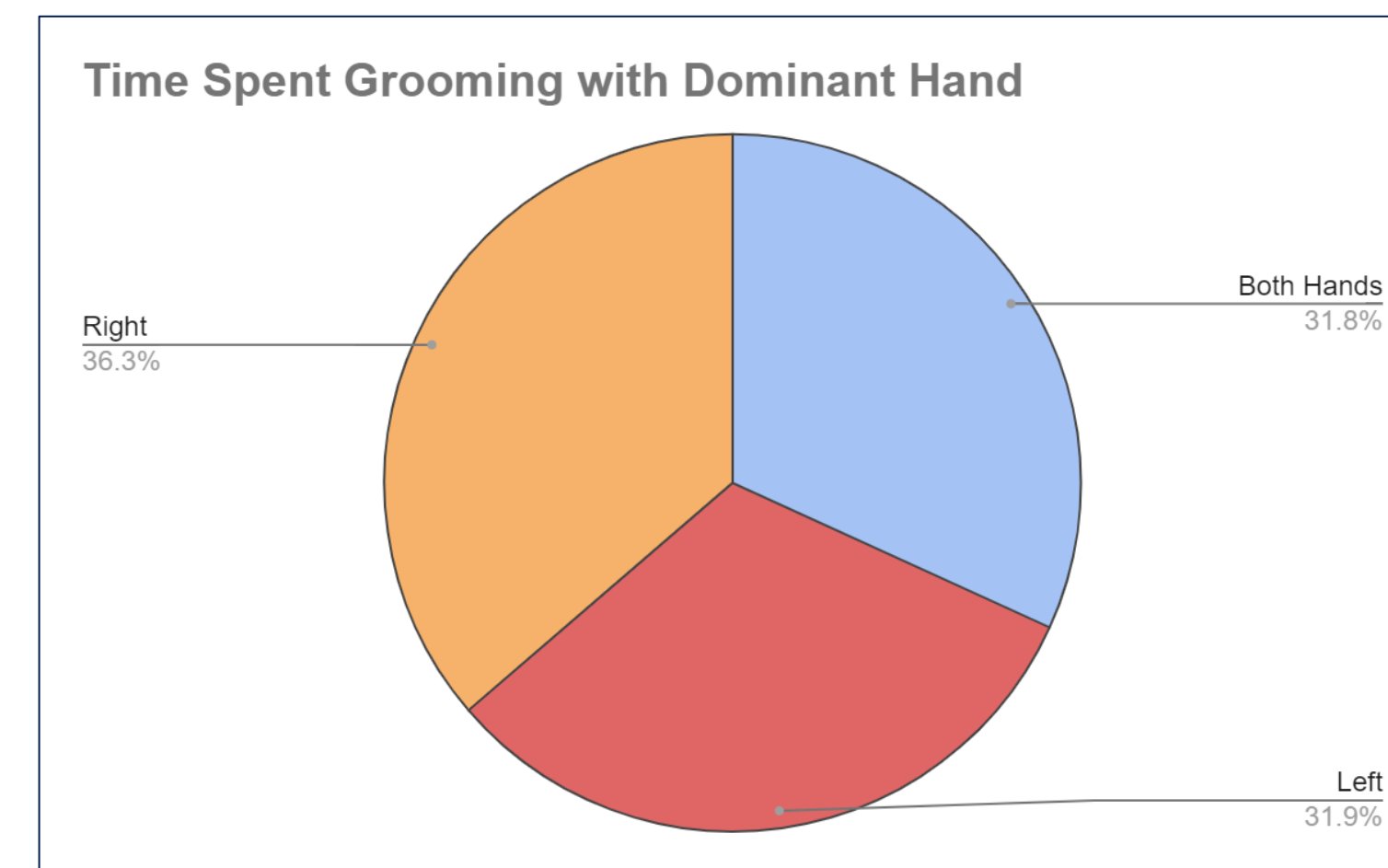


Figure 1
Time Spent Grooming with Dominant Hand

Note. Instances where the location on the body of autogrooming would be extremely difficult to reach with the other hand (for example, grooming the left arm with the right hand) were omitted from these data.

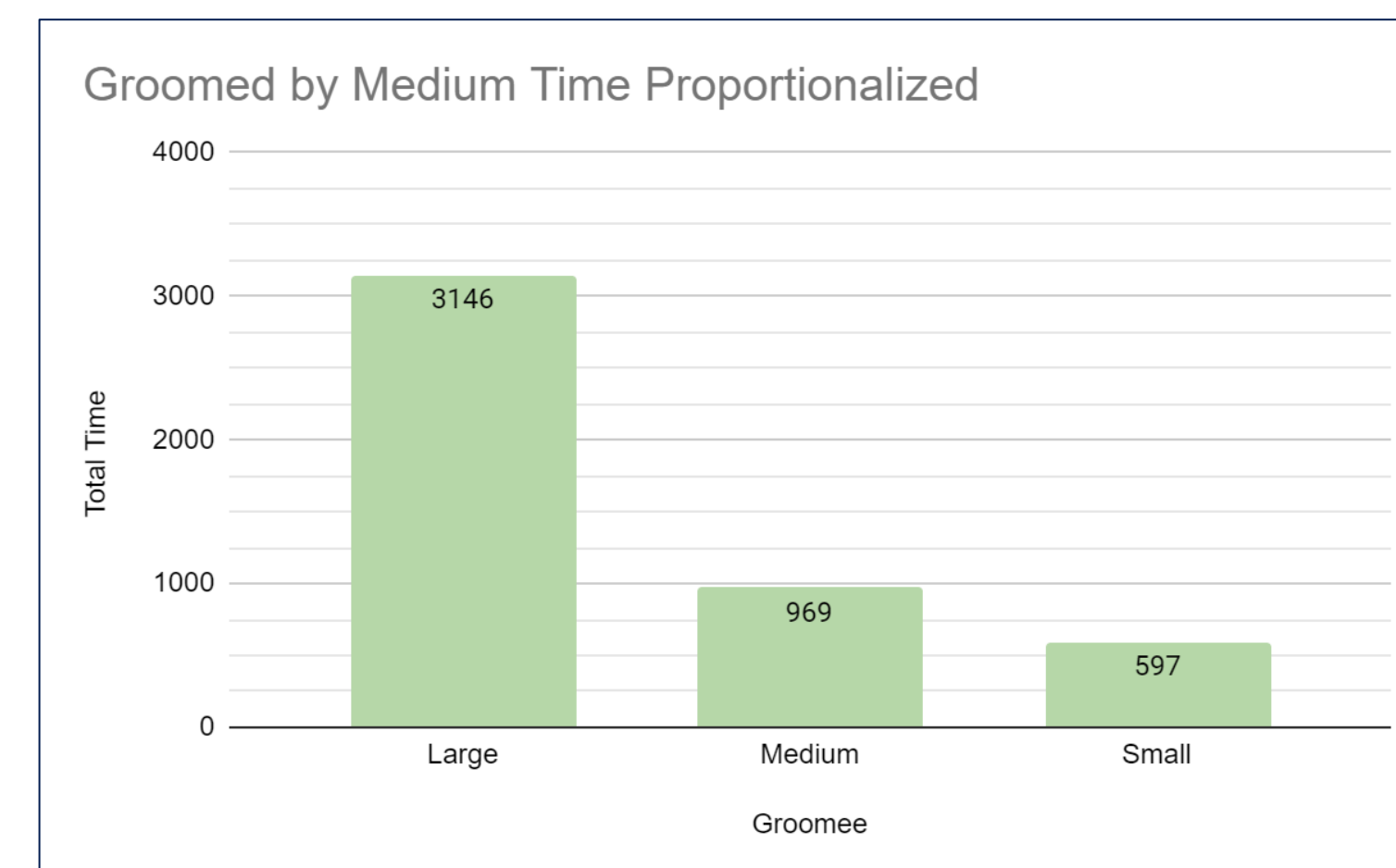


Figure 2
Groomed by Medium Time – Proportionalized

Note. The data was proportionalized via dividing each time collected by the equivalent value for each size population. Since large was the least common size, it was assigned a value of 1.00. There were 28 medium and 8 small, receiving 9.00 and 2.67 eq. respectively. This was done so each second was proportional to the number available

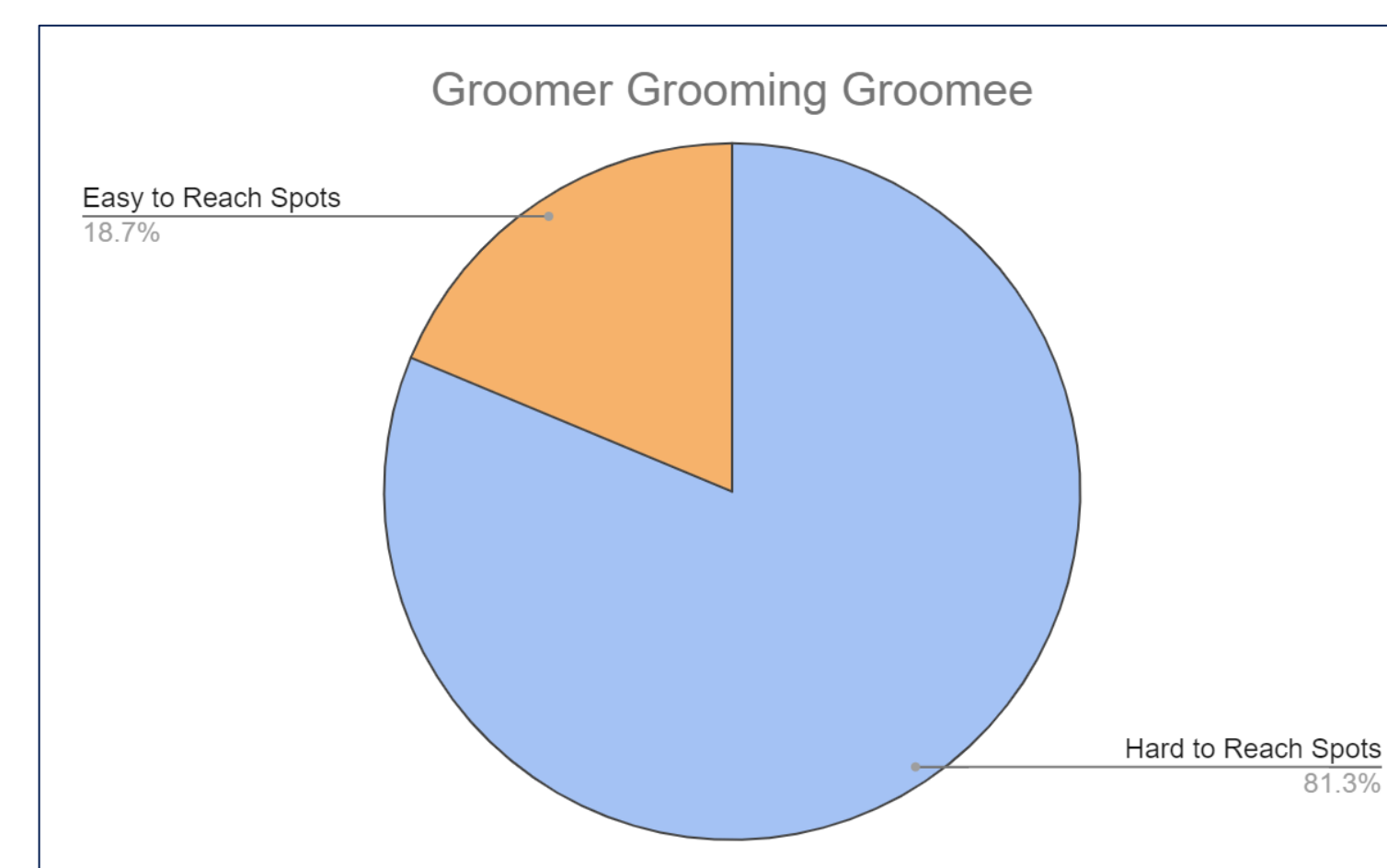


Figure 3
Groomer Grooming Groomee

Note. This graph depicts the percentage of time hard and easy to reach spots were groomed during allogrooming.

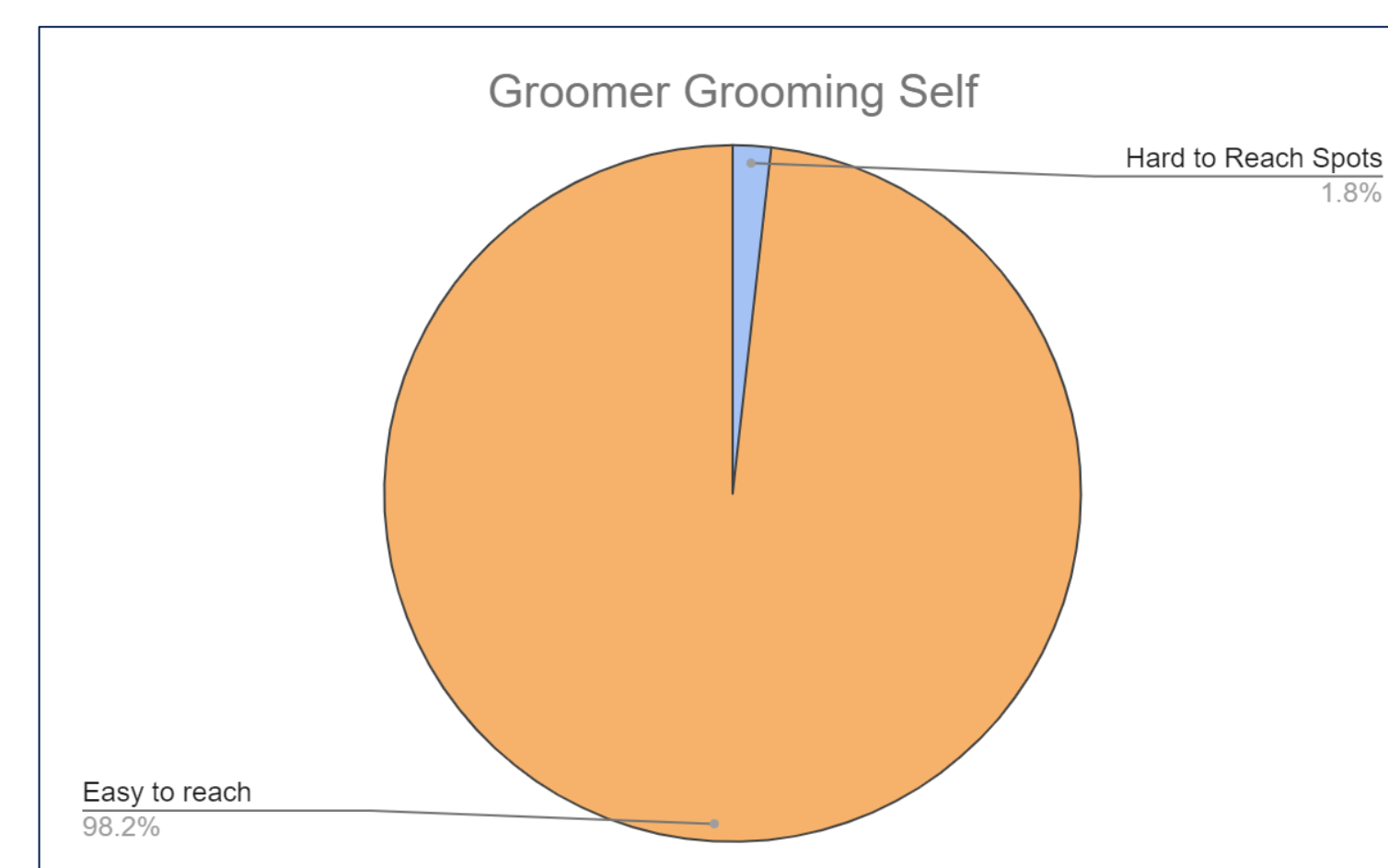


Figure 4
Groomer Grooming Self

Note. This graph depicts the percentage of time hard and easy to reach spots were groomed during autogrooming.

CONCLUSIONS

Social Hierarchy Hypothesis vs. Hygiene Hypothesis

Our data did show hierarchy trends among the macaques. The hypothesis that medium sized macaques would disproportionately groom larger sized macaques was supported, as shown in **Figure 2**. This potentially could be to adhere to the social hierarchy or as a means to climb up it, as seen in (Xia, *et al.*, 2021). However, the hypothesis that medium sized macaques would also groom smaller macaques at a higher rate was not supported. Proportionally, the medium macaques groomed the similar sized macaques at a higher rate than small macaques.

The hygiene hypothesis was also confirmed in our data. During allogrooming, macaques had a much larger tendency to groom hard to reach places than easy, shown in **Figure 3**. Moreover, when autogrooming took place, the macaques essentially only groomed places deemed easy to reach (a staggering 98.2% as seen in **Figure 4**). These results greatly follow results from previous studies such as Pfoh, *et al.*, 2021, which demonstrated allogrooming behavior primarily focused on hard-to-reach places. Unfortunately, we were unable to consistently identify the macaques' sex during our observations, so grooming tendencies between sexes could not be studied.

Handedness Hypothesis

Our data did not show a significant handedness preference for the macaques during grooming. This does not align with previous studies that show nonhuman primates generally being left-handed (Zhao, *et al.*, 2012). However, handedness is a difficult thing to test and measure as most primates use both hands for lots of the tasks they perform. Studies have also found that a handedness bias may exist for different behaviors within a population. For example, chimpanzees prefer to use their left hand to fish for termites, and they prefer to use their right hand for nut-cracking (Lonsdorf & Hopkins, 2005). In the future, we could look into handedness more by testing whether different tasks evoke different handedness behaviors in Macaques.

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