

Visitor effects on Western Lowland Gorillas (*Gorilla gorilla gorilla*)

by

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DEDICATION

For Juma

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ABSTRACT

Understanding visitor effects is vital to successful husbandry of great apes. Considering the unique difficulties that come from housing bachelor groups of gorillas in zoos it is vital to be able to address any behavioral concerns brought about by complications of visitor effects. Five male western lowland gorillas (*Gorilla gorilla gorilla*) were observed at the St. Louis Zoo between June and July 2014. Data were collected on gorilla activity as well as interactions between visitors and the gorillas. Visitors were classified by their perceived size, age, gender, race, and the type of behavior they were participating in (innocuous, negative, or positive). Age was significantly related with rates of disruptive behaviors. Likewise, perceived race was significantly related to visitor behavior. Size was a significant factor in predicting the type of motivational behavior of a visitor. Sex was insignificant as a predictor of whether or not the individual will provoke a response from the gorilla. Visitors overwhelmingly participated in negative behaviors (i.e. knocking and yelling) for 56% of samples. Visitors also perpetuate heteronormative perspectives while they interpret the bachelor group's familial makeup. In the future, improvements in education and marketing zoos as places of conservation instead of fun parks could create less disruptive patrons. With regard to animal husbandry, rotating which gorillas are on exhibit could help with the fission/fusion patterns of bachelor groups that are not being met in captive environments. Another possibility is using ambient, naturalistic sounds inside of the gorilla habitats to habituate their auditory expectations and, as such, reduce the effects of disruptive visitors.

CHAPTER 1

INTRODUCTION AND BACKGROUND

Research Question

The main goal of this research is to understand what type of behavior exhibited by zoo visitors causes the greatest disruption in species-specific behavior for captive gorillas (*Gorilla gorilla gorilla*) at the Saint Louis Zoo as well as which visitors are most likely to cause disruptions. The specific questions I propose to answer are whether agonistic behaviors are more frequent during times of higher levels of visitor activity and whether particular types of people (i.e. gender, age, size) cause more disruptions than others. I predict that the resulting gorilla behaviors will be effected by the individual relationships already formed between the gorillas, the direction of the activity in the public viewing spaces, and the individuals who are participating in the disruptive behavior.

Introduction

Western lowland gorillas are one of the most common apes in captivity (Ross and Lukas: 2005). Considering that they are the only subspecies of gorilla in captivity, zoos have gained notable knowledge of their behaviors. Research has identified issues that stem from housing gorillas in bachelor groups as well as how the apes interact in one male units (Stoinski, et al.: 2003, 2004a, 2004b). Most gorilla groups are housed in ‘family’ groups (i.e., a dominant silverback male, multiple females and non-dominant blackback (not yet mature) males, and offspring), but the study group of gorillas here focuses on an all-male group consisting of one silverback male and four blackback males (Stoinski: 2001). In addition to research on the social behavior of captive gorillas, studies pertaining to captive

management have largely focused on research on the physical environment, such as the size and complexity of ape habitats (Ross et. al: 2006, Lucas et. al: 2003).

Habitat construction varies between different captive institutions. There has been an observed preference in captive gorillas to being near structures and also on the lower levels of habitats (Stoinski: 2001). However, only 27% of habitats actually have structures that gorillas could reliably climb on considering their size (Stoinski: 2011). How much can actually be done to address these habitat preferences in enclosures that have already been built is complicated.

There is still much to be done to improve the lives of captive apes. Few studies have been done on how visitors affect western lowland gorillas in captivity (Keane and Marples: 2003, Wells: 2005, Carder and Semple: 2008, Kuhar: 2008, Stoinski: 2011, Stoinski: 2014, Bonnie, Ang and Ross: 2016). By understanding the intent and actions of visitors, which we already know greatly effects the behavior and presumably psychological well-being of apes (Wood: 1998, Burkett: 2011), zoos can then work on doing research to understand these potentially harmful visitor effects, educating their respective publics to improve visitor experiences, and creating a safe and psychologically enriching environment for the apes.

Objective and Hypotheses

The all-male bachelor group of western lowland gorillas at the Saint Louis Zoo spend the majority of their daylight hours inundated with the sounds and effects of the visitors surrounding one of two enclosures (Jungle of the Apes or outdoor Fragile Forest exhibit).

Questions I proposed to address in my research include:

- (1) How does this constant interaction with strangers affect the behaviors of the individual gorillas?
- (2) What type of human individuals (if any) cause the most disruptions to the troupe?
- (3) What behavior on the part of humans causes the most disruptions to the gorillas?

I predicted that the results would be influenced by the individual relationships already formed between the gorillas, the direction of the activity in the public viewing spaces (interspecific or intraspecific), and the type of visitor who may be participating in activities in the public space. My main goal is to understand what type of behavior exhibited by zoo visitors causes the greatest disruption in species-specific behavior for the gorillas (i.e., increased levels or intensity of agonism) and attempt to understand what type of culture in the public viewing space is permitting individuals to participate in such disruptions.

My hypotheses and associated predictions were as follows:

H_{1a}: The farther away from public viewing spaces the individual gorillas are the less affected by outside behavior they will be. Prediction: If the individuals are further removed from the disruption, then it should have less of an impact on their behaviors.

H_{1b}: The closer to the public viewing spaces an individual gorilla is, the higher the rates of agonistic behaviors. Prediction: If the gorilla is resting against the glass near a public viewing space, then they could be directly affected by the disruption and take out frustration on either the disturber or other members of the troupe.

H₂: More severe disruptions will cause a greater change in the behavior of the gorillas. Predictions: For example, a small child tapping on the glass would be less of a

disruption than a grown man banging on the glass. Likewise, one individual speaking loudly would cause less disruption than multiple people speaking loudly.

H₃: Larger groups of people will create a space for increased chances of disruption.
Predictions: If like-minded individuals are in a large group together they may be more likely to participate in actions that may be seen as negative by others (i.e. specifically behaviors that may disrupt the gorillas).

H₀: Visitor behavior will not affect the rates or severity of any specific behaviors of the individual gorillas.

Background and Significance

Gorilla Group Structure

In the wild, groups of gorillas are cohesive and relatively stable. Both sexes in gorilla troops disperse from the natal group, and females may change groups multiple times in their lives (Robbins: 2011). There are three types of gorilla social groups: one male units (OMU), multi-male/multi-female groups, and all male groups (Robbins: 2011). In Karisoke, 60% of the mountain gorilla groups (*G. berengei* [used by Gatti (2004) and Robbins (2011)]) were one male units, and 10% were all male units (Robbins: 2011). New groups can be formed when a female transfers from her natal group (or from an already formed group) to a lone silverback (Robbins: 2011). According to Robbins (2011), intergroup interactions occur between 0.58 and 4 times per month, but there are also times where months pass without interactions occurring. The interactions are not related to defense of food resources or home ranges and rarely become physically aggressive (Robbins: 2011). Females may use this chance to switch groups; however, there are benefits to remaining in the same group (i.e. protection from other males for her and her offspring) (Robbins: 2011). The number of

females in the two groups correlates positively to the rate of agonistic displays between the males during the intergroup interactions; this is possibly caused by perceived risk of females transferring groups and as a way to demonstrate a male's ability to protect their females.

Robbins (2011) also describes how lethal aggression between silverbacks has been inferred from these interactions between groups. This assumption stems from patterns of wounding that resemble large canine punctures and scrapes that would come from something the size of a silverback male, though there are no observed instances of this type of lethal aggression (Robbins 2011). Infanticide has been seen in instances where an OMU experiences the death of its silverback and a new male joins the group as the dominant male (Robbins: 2011). This evolutionary strategy could account for some of the increased agonism between males in these interactions.

Male Relationships in Gorilla Groups

According to Robbins (2011), male gorillas have weak relationships with other males due to the egalitarian dispersal from the natal groups. In general, individuals within a group are not related. Rank in male gorillas is not always equivalent to their age (i.e. in some cases a younger male might be the dominant male in a group; generally, older males are dominant over younger ones). (Robbins: 2011). Some silverbacks may be dominant for over 10 years, and it could take years of agonistic interactions with a challenger before any usurping would occur. All-male groups have less defined dominance within age parameters; they also have greater rates of aggressive displays but fewer instances of wounding than males do in the other two types of social groups (Robbins: 2011). These males play and groom with each other at much higher rates than the other groups, perhaps due to the lack of male-male competition over females (Robbins 2011). The social structure and behavior of gorillas in

their natural habitats is used to guide the management of this species in captivity in regard to social housing but also other aspects related to gorilla behavior, such as exhibit design.

Captive Western Lowland Gorillas and Exhibit Use Patterns

Considering the importance of replicating natural habitats and social behaviors, the topic of exhibit use is often a topic of research. A study was done by Stoinski et al (2001) on exhibit use by *G. g. gorilla* in three one-male units and one bachelor group at Zoo Atlanta in Georgia and how social variables played a part in space use. The authors noted that in previous studies gorillas avoided steep inclines and opted to pass their time near structures in the yard as well as near the holding area entrance (Stoinski et al. 2001). Stoinski et al (2001) found the gorillas spent on average 50% of their time in less than 15% of the exhibit and also spent more time near buildings and structures and less time away from structures than would be expected. There were observed group preferences in whether structure or building was preferred and little difference in preference among age, sex, and type of rearing (Stoinski et al. 2001). There was also no notable difference between the two types of social structures in the preference for space use; individuals who had lived their whole lives in the enclosure showed the same preferences as those who came into Zoo Atlanta later in age (Stoinski et al. 2001). Possible reasons for this could be the association of the holding area with positive situations (food and caregiving) and that building and structures could offer shade and other protection from the elements (Stoinski et al. 2001). With regard to gorillas, alternating their enclosures may simulate ranging patterns and increase positive natural behaviors (Stoinski: 2001).

Ross and Lukas (2005) performed a study on space use in *G. g. gorilla* in three one-male units, as well as chimpanzees (*Pan troglodytes*) at Lincoln Park Zoo in Chicago,

Illinois. Regarding gorilla space use, the researchers point out the unique difficulties in housing great apes in captivity due to their size, strength and intelligence. Studies have been done about the use of enrichment and its role in naturalistic behaviors in the great apes, but little work has apparently been done on the more long-lasting interaction between these species and their permanent captive environments (Ross & Lukas 2005). Ross and Lukas (2005) found that the males were surprisingly different in their preferences from the females' with regard to the amount of time spent on the ground (88% and 69% of the observed time in the habitat, respectively). Females showed little variability in the use of vertical space (Ross & Lukas 2005). The preference for low parts of the enclosure was greater than expected than if the individuals would have shown no actual preference at all (Ross & Lukas 2005). The researchers found that the preference for low levels of the habitat was unsurprising considering that gorillas in the wild are not often arboreal, but do occasionally spend time in tress (Ross & Lukas 2005). Ross and Lukas (2005) note that there is no apparent difference in arboreality between the different species of gorillas in the wild and so lacking the ability to be arboreal would be an artifact of captivity and not some biological factor. There may be many factors that influence this in the wild (e.g., body size, tree size); however, the ability of habitats to create substantial structures to climb on would mitigate these issues (Ross & Lukas 2005). The authors cite their unpublished work that examined the exhibits that actually had structures that the gorillas could climb on if they desired, noting that, of 25 gorilla exhibits at 12 North American zoos that are accredited by the association of zoos and aquariums (AZA), only 28% of the institutions had trees for the apes to climb (Ross & Lukas 2011). While work is being done to better understand habitat use for the betterment of managing captive gorilla wellbeing, the topic is still complex. Better understanding of habitat

use could help to manage agonism; arboreal escape routes are a potential tool that cannot be used by captive gorillas because so few of their habitats have the proper structures to utilize.

Visitor Effects

One external factor that must be managed in captive gorilla husbandry is the way in which the public affects the animals. Contrasting abnormal behaviors with the target naturalistic behaviors, Hosey (1987) found that higher rates of zoo patrons was positively related to more behaviors directed at the public in chimpanzees (Wood, 1998). Behaviors directed toward the public are classified as abnormal. This supports the idea that the closer to the public viewing shelters and the higher volume of traffic of individual patrons, the farther from naturalistic the behavior of the great apes will be. It seems that captive primates do not habituate themselves to human presence as easily as was once thought. Wood (1998) found that new enrichment (toys/food given to animals to stimulate naturalistic behaviors) and small crowds were the conditions that made the naturalistic behaviors of foraging and object-usage most likely. Wood (1998) also found that abnormal behaviors such as coprophagy (eating one's fecal matter), fecal smearing (wiping fecal matter on surfaces), and over grooming or hair plucking (pulling out one's own hair or the hair of another in a non-agonistic way) occurred 3.7 to 6.8 times more frequently with old enrichment, when controlling for public gathering levels. Despite the naturalistic habitats, the variable that actually determined if naturalistic behaviors occurred was the level of disruption that came from the zoo visitors (Wood 1998).

Bachelor Group Complications

An issue created by the pressures of captive animal husbandry is social structure in the apes. The gorillas at the St. Louis Zoo reside in a bachelor group (an all-male group).

Bachelor groups are artificially constructed in captivity. In the wild, the social structure of all male groups exists, but they are fission/fusion groups and considered transition states (Gatti et al.: 2004). In zoos the males do not participate in the fission/fusion behavior pattern. For wild gorilla males, these are transitory social groups between leaving the natal group and entering (or creating) a group as an adult (Gatti et al.: 2004). They do not have strict membership parameters, but rather the males come and go as they please. Given the cost of captive gorilla enclosures, it would be unreasonable to have a periodically empty space for some gorillas to wander into during times of fission. Consequently, there is no way for the males to leave in times where there is extra stress within the group; instead that stress becomes agonism (negative behaviors targeted toward another) and possible redirected aggression (a behavior that occurs when an individual is frustrated with an entity that they cannot retaliate against and instead vent onto an individual who is not involved).

Visitor Motivation

In this section I examine the zoological park from a museum studies perspective. It is arguable that a zoological park is a type of museum that houses living exhibits instead of paintings or sculptures. The top four reasons cited for going to museums were education, entertainment, social event, and life cycle (Falk, 2000). The first three are self-explanatory, while life cycle refers to the idea that going to the museum is a life marker experience. Another study showed that people expected to both learn and have fun at the museum (Falk, 2000). The author argues that museums should focus on engaging the public and letting them get out of it whatever they get out of it instead of attempting to either teach them or entertain them. Those who come with expectation of education and being entertained also

come out of the experience with more actual instances of learning than those who do not expect the two aforementioned major outcomes. I expand this argument to zoos.

The question is how to engage visitors in a location that does not have static exhibits (i.e., paintings do not move). Exhibit design would be one way to do so, but is easier said than done. One not only needs to engage the visitors with the exhibit design but also protect the wellbeing of the animals. Regarding motivation, the population of zoo and museum goers seem similar; however, the potential problems and the solutions to the problems that they present are very different in the two types of institutions.

Considering the general notion that humans have far removed themselves from nature, the public wants to be entertained by the exotic animals in front of them who are not doing anything. It would seem commonplace that the public taunts captive great apes (purposefully or unintentionally), causing possible stress upon the individuals in the groups. According to Watts (1988), multiple field sites with wild mountain gorillas reported their activity budgets as having anywhere between 0.7% and 4.7% of their total time being social and only 89.3% and 81.2% of time resting and eating (depending on habitat), which means that the majority of their activity would most likely be uninteresting to the average patron. As mentioned earlier, western lowland gorillas spend 67% of daylight hours feeding. If a person paid to come to a zoo to be entertained, they would want their money's worth and may be more likely to attempt to harass the apes into doing something exciting (even if that exciting thing is the ape banging on the glass at the person in an act of frustration).

Implications of a Free Zoo

On average, people who visit museums are more highly educated and of higher socioeconomic status than the average person (Falk, 2000). This is something that St. Louis

Zoo may see less of; this particular institution has in its charter that it will be “forever free”. This means that people of all ages and socioeconomic backgrounds can come to the zoo and appreciate the animals and also have different motivations than the museum or zoo goer that pays for such an opportunity. Presumably, this would result in variation in visitor demographics compared to what Falk (2000) reported as the average. Falk (2000) also ranks “experiences” as being the lowest ranked desire in times of economic hardships, which would again, be mitigated by the free admission at the zoo in Saint Louis.

To better understand free museums, a study was done in the United Kingdom by Martin (2002) to understand what happened to the number of museum attendants once a museum became free to attend. He found that the number of visitors increased among all ages. In 2000, 28% of people over 55 had reported visiting a museum in the last year; by 2002 that number had increased to 43% (Martin: 2002). Martin (2002) also saw an increase in visitors among social classes where the main source of income came from unskilled manual labor rose from 20% in 2001 to 25% in 2002. The increase was greater in skilled manual workers, increasing from 28% to 39% by 2002 (Martin 2002). However, there was an increase across the board in all socioeconomic classes who visited the museums. So, despite the great increase in these lower classes the “traditional visitor group” demographics remained the same. There were some encouraging changes for the institution from the move to free admissions, which could end up at a great monetary loss from this move to free admission. When museums had special exhibits which required additional payment for entry, one fourth of people reported being more willing to spend money on the attraction (Martin 2002). Also, because they no longer had to pay for their admission one fifth of those surveyed would be willing to donate more money to the location and one out of seven were

more willing to pay for a guide book or audio aid. On average, 47% of people planned on spending more money on their trip than they would have if they had to pay for admissions (Martin, 2002). In theory, by not having admission they could increase their profit, especially among the young to middle aged, the upper class, the educated, and women (these demographics reported at higher percentages that they would spend even more money than the average that was reported) (Martin: 2002). Saint Louis Zoo gets 70% of its income from donations, endowments and earned income. The other 30% comes from taxing the St. Louis area (St. Louis Zoo, 2013). The zoo functions well and has plans to create new exhibits in the near future, which also demonstrates the ability to make money without charging for admission (despite having to feed approximately 18,000 animals each day) (St. Louis Zoo, 2013).

Despite the seemingly good outcomes, Martin (2002) noted some potential issues. Social class was still a defining factor in those who visited and had knowledge of the museums. Individuals who have a degree are four times more likely than people without any formal education to have known that museums were free and their attendance was positively affected by the change (Martin 2002). This poses the question of how to transmit the information of changes in the museum structure to those who are not visiting more. Assumedly one would need to look up information on the museum to know of the changes. Another issue is that studies show that people do not spend more time in a museum when they did not have to pay to enter than if they had paid to enter, which means that they may not actually be spending more money (despite the results of the survey). The museums could suffer for it.

Thesis outline

In this chapter, I outlined the basics of the research questions and subsequent hypothesis that drove my data collection. I provided a summary of the behavioral ecology of captive gorillas tied in with the specific issues that face all-male gorilla groups in the zoos that care for them. The number of studies that have focused on visitor effects on captive gorillas are few, and the issues facing bachelor group husbandry are unique. Ultimately, this makes a case for the further research of captive bachelor groups and their use of environments as well as the effects that visitors may have on them. I reviewed the literature regarding the structure of gorilla social groups in the wild and how our understanding of these social units have changed through time. Additionally, the existence of naturally formed bachelor groups is described along with the types of relationships that exist between males in gorilla groups. Next, the ways in which captive western lowland gorillas use their habitat is described. The previous studies on visitor effects are discussed as well as the sorts of issues that face other captive great apes; the behavior of patrons is uniform regarding different effects on the species of great apes. Visitor motivations are described as well as the implications of having a museum-like institution (i.e. The St. Louis Zoo) having free admission for the public.

Chapter 2 describes the methods used in this research as well as a description of the study site and the demographics of the area. The history of the ape shows and cultural mythology of captive apes in zoos is presented. The habitat of the gorillas at the St. Louis Zoo is described and diagrammed. A description of the subjects follows with images of the males, their rearing history, and their specific inclusion in the 25-year history of bachelor gorillas being housed at the zoo. Data recording methods are described with reference to the

various aforementioned hypotheses. Visitor collection methodology is also detailed. Data analysis of each type of recorded data is described along with operationalization of the various notable behaviors that were recorded.

Chapter 3 focuses on the results of gorilla behavioral data. The activity budget of each individual male is broken down and shown in charts for each gorilla. Next, a discussion of various notable trends occurs. Individual differences between the males and their activity is laid out followed by contextualizing the social interactions among the subjects with data from previous studies. Avoidance behaviors are also discussed.

Chapter 4 consists of the data collected regarding zoo visitors. First, the relationship between visitor density and volume (i.e. decibel levels) is described. The types of visitors are categorized by their perceived age, race, gender, and size. Visitor motivation is revisited with the types of behaviors exhibited by the zoo patrons and the types of goals that seemed to be associated with those actions. The gorilla targets of disruptive behaviors are described. Behavioral differences between male and female visitors and the different age groups are examined. A theoretical analysis of heteronormative perspectives in zoo visitors follows.

Chapter 5 revisits the questions and hypothesis presented in Chapter 1. Next, effects of habituation and the differences between visitors and staff are described. The goals of zoo education are examined within the wider context of cultural understanding along with the possible success or failure of such programs. Lastly, limitations and areas for possible future research are laid out.

CHAPTER 2

METHODS

Study site

I conducted this study at the St. Louis Zoological Park, located in St. Louis, Missouri (38°37'38"N 90°11'52"W). As of 2010, the population of St. Louis was 319,294 people. A 2012 estimate put the population at 318,172, making it the 58th-largest U.S. city in 2012. The metropolitan St. Louis area is the 19th-largest metropolitan area in the United States with a population of 2,900,605. According to a 2014 census, the demographic spread in St. Louis City consists of 47.5% African Americans, 43.6% white/non-Latinos, and 3.8% Latino, as well as various smaller percentages of other racial groups. Additionally, 51.7% of the city's population is female. Median household income as of 2013 is reported to be \$34,582¹. St. Louis lies between the transitional zone between the humid continental climate type and the humid subtropical climate type, with neither large mountains nor large bodies of water to moderate its temperature. Summers are hot and humid; temperatures of 90 °F (32 °C) or higher occur 43 days a year². The daily average temperature in July is 80.0 °F (26.7 °C), July 2012 was the hottest month in the 138-year recorded weather temperatures in St. Louis history starting in 1874, with an average daily temperature of 31.2 °C (88.1 °F) (O'Neil, 2012).

The St. Louis Zoo is located on 36 hectares in Forest Park (38.635°N 90.290°W); it began in 1904. The official charter of the zoo states that, "The St. Louis Zoo shall be forever

¹ <http://quickfacts.census.gov/qfd/states/29/29510.html>

² http://www.crh.noaa.gov/lx/?n=cli_of_stl

free.” The zoo is accredited by the Association of Zoos and Aquariums (AZA). According to the zoo, they house 655 species of animals with a total of approximately 19,000 individuals. The current President is Dr. Jeffrey P. Bonner³. The St. Louis Zoo is said to host approximately 3 million visitors per year⁴. St. Louis City is home to only just over 310,000 residents, meaning that a number of zoo patrons are from areas outside of its city of residence.

History of the zoo: Past Ape Shows⁵

At St. Louis Zoo, the animal shows in past years drew in thousands of visitors and were in the news all around the world. Even stars like Babe Ruth came to see the shows. According to the Zoo’s account, the animals were celebrities. The institution’s main attraction was Phil the gorilla. Phil arrived in 1941 after he was brought to Saint Louis Zoo from French Equatorial Africa (now Cameroon). He was one of four gorillas brought to the zoo. In 1952, Phil was in a multi-photo spread in *Life* magazine titled “A Rising Young Gorilla.” He was the biggest gorilla in the United States, weighing between 550 and 776 pounds. This did not have to do with being a King Kong like figure, but rather with being extremely obese. He was said to have drunk beer and eaten other food that humans may enjoy but is unhealthy for other primates. Phil died in 1958. Gorillas in captivity live well into their 50s in contemporary zoos (“Putting”: 2014); the fact that Phil died in his early 20’s is a telltale sign of his poor health. Phil underwent taxidermy and ‘lives’ in the education center (“Putting”: 2014). None of the current troupe has been involved in any ape shows;

³ <http://www.stlzoo.org/>

⁴ <http://www.stlzoo.org/about>

⁵ <http://www.stlzoo.org/about/history/puttingonashow/>

however, there is still a segment of the visitor population who would be old enough to remember a time in which there was a beer drinking gorilla.

Gorilla Habitats

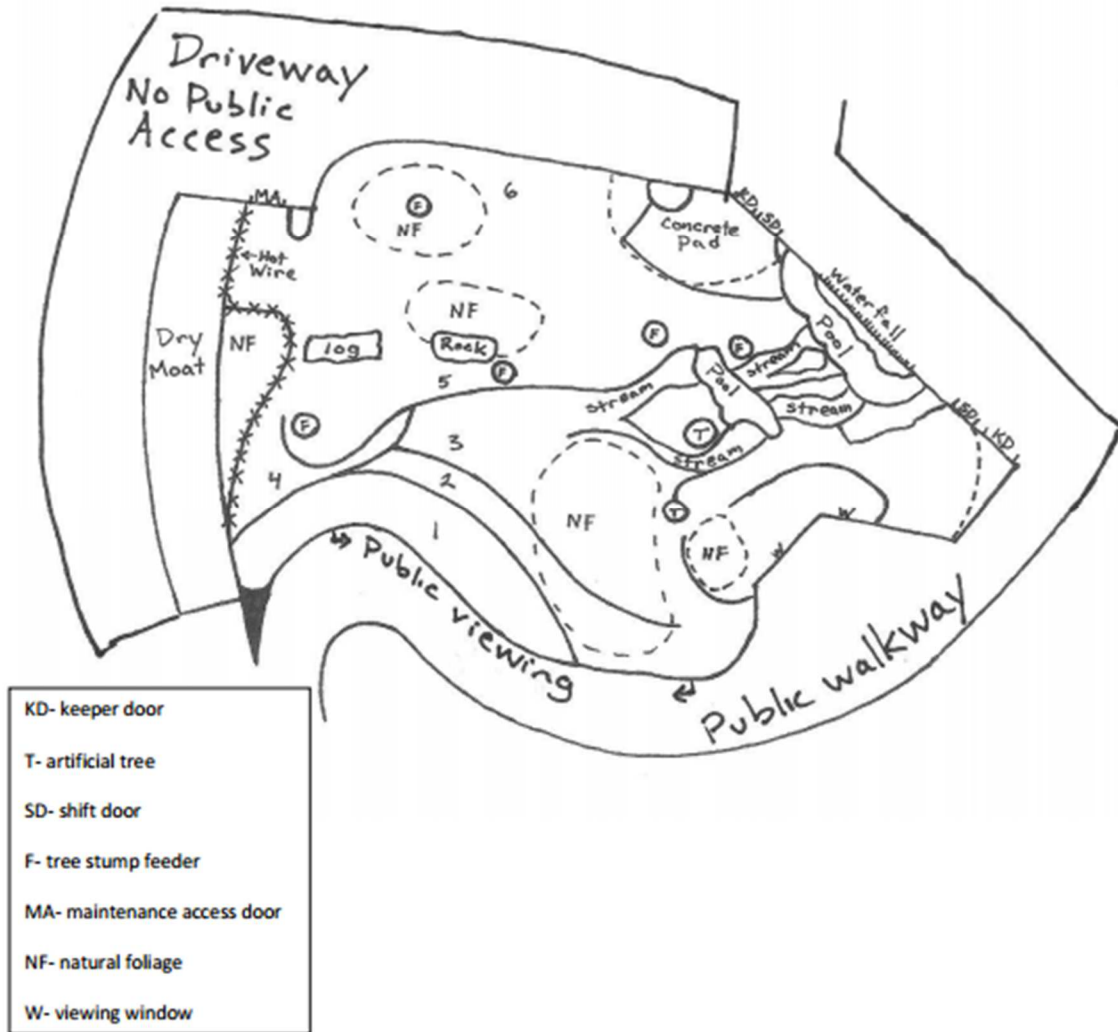


Figure 2.1: Diagram of gorilla's Fragile Forest

Two habitats are available to the gorillas depending on the ambient temperature; one is outdoors and one indoors. The outdoor Fragile Forest exhibit has four different areas available to the public to view the gorillas. It measures 180 by 110 feet. The habitat is ringed by naturalistic rock formations with a waterfall and pond. One side is broken up by viewing

shelters, and the final side is raised with a fully open viewing area. The enclosure is contained by a dry moat. There are tall grasses as well as trees dotted throughout the yard. Hammocks and simulated vines hang from the trees to create levels for the gorillas to ascend for rest and to use as vantage points.

The indoor Jungle of the Apes is completely simulated rock. Wood chips cover the floor. Patrons may view the gorillas from a raised walkway that surrounds three sides of the enclosure; the back wall is painted to mimic forest and rocks. There are artificial trees that house multiple rock cliffs and trees upon which to eat, rest, and sit. Multiple other enriching apparatuses are available in the enclosure as well (i.e. tires, and tubes made from plastic).

The Fragile Forest is a relatively successful attempt to reproduce the natural habitat of wild gorillas. The gorillas have had an outdoor yard since Fragile Forest was built in 1987. This habitat is an attempt to reproduce the gorillas' natural habitat, which consists of forest, deciduous woodland and mixed savanna (Saint Louis Zoo, 2013). The enclosure has a background of cliff like structures. The Fragile Forest, alone, cost over seven million dollars.

Subjects

Subjects at the Saint Louis Zoo are a bachelor group consisting of five males (Table 2.1). All of these western lowland gorillas were captive born. The males are (in order of age): Juma (the silverback), Jontu, Little Joe, Nadaya, and BaKari. All of the males were hand reared to some extent. Juma, Jontu, and Joe have spent the majority of their lives at the Jungle of the Apes, but Nadaya and BaKari only arrived in the summer of 2010; they were originally from Brookfield in Chicago.

In 1991, St. Louis was the first zoo to form a gorilla bachelor group. In 1998 the AZA gave the Saint Louis Zoo an award for its long-term success in forming an all-male group of

gorillas (St. Louis Zoo, 2013). The addition of both Nadaya and BaKari to the troupe at once was also a first for bachelor groups, which required an extensive amount of time for introductions and reforming of the social structure.

Identification of the male subjects is possible by noting specific features unique to each individual gorilla. Juma (Figure 2.2) has the most extensive greying on his saddle as well as hairier forearms and somewhat red eyes. Jontu (Figure 2.3) is by far the largest of the five males. Western lowland gorillas have a reddish crown of their heads (Robbins: 2011), but Joe's (Figure 2.4) crown is especially red and distinguishes him easily from the other males. Nadaya (Figure 2.5) is only starting to have a grey back and is smaller than the three older males (Joe, Jon and Juma). BaKari (Figure 2.6) is the easiest to identify as he is still physically a juvenile male with no developed crown or greying on his saddle.



Figure 2.2: Juma⁶

⁶ Photo credit: Carol A. Weerts⁷ Photo credit: St. Louis Zoo



Figure 2.3: Jon⁷



Figure 2.4: Joe⁸

⁷ Photo credit: St. Louis Zoo

⁸ Photo Credit : Rob Bulmahn



Figure 2.5: Nadaya⁹



Figure 2.6: BaKari¹⁰

⁹ Photo Credit: Carol Wertz

¹⁰ Photo Credit: St. Louis Zoo

Table 2.1. Gorilla Demographics

Name	Juma	Jon	Joe	Nadaya	BaKari
Rearing background	Human	Human	Human	Human and Mother	Human and Mother
Age	29	19	18	15	10
Dominance rank	Silverback	Non dominant Silverback	Non dominant Silverback	Blackback	Juvenile

Data Recording

My hypotheses were tested utilizing methods as follows:

H_{1a} and H_{1b} , H_0 : I collected scan samples at five minute intervals, following Stoinski (2012). Data were collected during 50-minute bouts between the hours of 10 a.m. to 3 p.m. for 33 days between June 2nd and July 24, 2014. Behaviors that were recorded in the scan samples include proximities between individuals as well as the state that each gorilla was in (i.e. rest, eating, solitary play). These behaviors are outlined in Appendix 1: Behavioral Catalog: Gorillas. Additionally, all-occurrence data on behaviors were collected on the entire group using continuous recording. I spent at least five hours at the zoo per observation bout, randomizing which day I attended. I visited the zoo four days during the week (days were randomly chosen) and one day during the weekend (alternating Saturdays and Sundays). This helped to mitigate any personal preference. It is feasible to see all of the individuals at once in the outdoor enclosure, which facilitated scan samples. Also, the scans were interrupted to record behaviors of note (i.e. redirected behaviors toward the public). The location where data were collected was limited to the outdoor habitat to avoid possible conflict in samples. When in the inside habitat the gorillas have access to the holding area

and the propensity to be out of sight for long periods of time. Also, the environment is smaller inside and the visitor space is comprised of glass windows. The public viewing space is at eye level for the gorillas. All of the aforementioned problems could be factors that influence the behavior of the bachelor group differently from the outdoor environment. The gorillas spend most of their time outside in the summer, and the two habitats have different limiting factors, i.e., vastly different public spaces.

Data collection on visitors

The number of visitors were noted at both the beginning and the end of the sample time. Keane and Marples' (2003), three levels of visitor numbers were grouped together for analysis: 0–3 visitors, 4–9 visitors; and >10 visitors. This breakdown is appropriate for small groups of visitors, but there are regularly more than 10 visitors at the gorilla enclosure. Mirroring Wood (1998), crowd density over 10 individuals was recorded as being at different densities: D1: under one third of the public viewing space is occupied, D2: two-thirds of the public viewing space is occupied, or D3: all of the public viewing space is occupied.

During the period of recording gorilla behaviors of note between scans, any human behaviors of note were also recorded. These behaviors can be found in Appendix 2: Behavioral Catalog: Humans. Age category (child, teen, adult, elderly), gender (male or female), size (small, medium, large, extra-large, meant to mirror common t-shirt sizing as a means of comparison.), and race (white or non-white) were recorded along with what behavior was being exhibited (e.g. shouting, making animal noises, knocking, reading), if that behavior was negative or positive, to what gorilla it was directed to, and if the gorilla responded in any sort of way. This was an attempt to understand multiple things: 1) who was the most disruptive with regard to age, gender, race 2), did size affect the magnitude of

response from the gorillas, and 3) what negative behaviors create the largest disturbance. It should be noted that race is not a biological reality, instead it is culturally constructed through perception of skin pigmentation (Jablonski: 2004). This study used the categories of white and non-white as demographic factors not only to assess possible cultural differences but also gorilla perception of individuals.

Active behaviors were prioritized over inactive ones. For example, if a gorilla were inactive near the upper shift door it would be recorded as him being at the physical location at the upper shift door; however if he were at the upper shift door *and* watching the public, he would be recorded as watching instead of where he was sitting.

H₃ and H₄: Every 50 minutes for 10 consecutive minutes I collected observational data on what was occurring in the public space (i.e., 10 minutes per hour). The focus of this collection was on behaviors that draw the attention or have the potential to draw the attention of the gorillas (e.g., shouting, quick movements, banging on the glass) as well as to assess the culture of the public space. Anecdotal evidence shows that people have a tendency to openly taunt the gorillas, but is that what the majority of patrons are doing or just a select, loud, few? Furthermore, these data show the demographics of the public in general.

Data Analysis

The scan samples were summarized, and behaviors were analyzed for each individual subject so as to prevent pseudoreplication. All-occurrence data were summarized as the rate per visible time for each individual (Stoinski: 2011). Stoinski (2011) combined all instances of aggression (contact and noncontact) in order to compare their results to Kuhar (2008); however, considering the difference in severity of these types of aggression. I felt it was best to have both the combined category for comparison (contact and noncontact), but also

analysis of each type of aggression (biting, displaying, chasing, hitting). In the end, this separation was unnecessary as there were very few instances of agonism in the study group.

General linear models were conducted to investigate potential behavioral differences according to the independent variables recorded. Stoinski (2011)'s primary GLMs used crowd size as the within-subjects variable and sex and rearing history as the independent variables, with age and group as covariates. Sex is not relevant in my study, and rearing history is more or less equivalent as well. There was also only one group, so age or rank would be more important in this study. Interaction effects between crowd size and the independent variables and covariates were also included in the analysis.

The human behavioral data was used to attempt to find patterns in the behaviors (i.e. size of group at times when most disruptive behaviors are occurring, or sex of individuals who cause the most disruption.) In accordance with Keane and Marples (2003), three levels of smaller visitor numbers were grouped together for analysis: 0–3 visitors, 4–9 visitors, and >10 visitors. Once greater than 10 visitors exist, Wood's (1998), crowd density was used: D1: under one third of the public viewing space is occupied, D2: two thirds of the public viewing space is occupied, or D3: all of the public viewing space is occupied. These trends were then mapped onto the behavior frequencies in order to see if there was any relationship present (i.e., on days where there are larger groups of people the gorillas have a tendency to display more agonistic behaviors). Wells (2005) used paired *t*-tests to determine if behavior was influenced by the visitor density. In accordance to Wood (1998), a written record of visitors' verbal and behavioral responses to the apes were analyzed using open and axial coding techniques for qualitative data [Strauss and Corbin, 1990 as cited by Wood]. Paired *t*-tests were also used to compare the categories of visitors during all-occurrence data

collection. This allowed for problems of visibility to be controlled for, such as more women were participating in negative behaviors than men, but were also more frequent visitors to the zoo than men were.

The behaviors of note were ones that pulled the focus of the gorillas, which are outlined in the gorilla behavioral catalogue. A topic of interest was whether there were trends in conversations or behaviors that led to problematic results; for example, if loud boasting is a precursor for a person to harass the gorillas. Also, distinct responses were noted along with trends. Responses by individual patrons as well as conversations between multiple patrons were counted as one instance.

CHAPTER 3

GORILLA BEHAVIOR: RESULTS AND DISCUSSION

In this chapter, I report the results of the gorilla focused data analyses. Individual gorilla activity rates based on focal scan sampling examine interactions between the males as well as their solitary behaviors. Analyses of *Ad libitum* data examines the ways in which the gorillas interact with the public and other non-gorilla stimuli in the public space as well as more detailed reports of space use. Finally, individual differences are discussed in detail.

Focal Sample Results

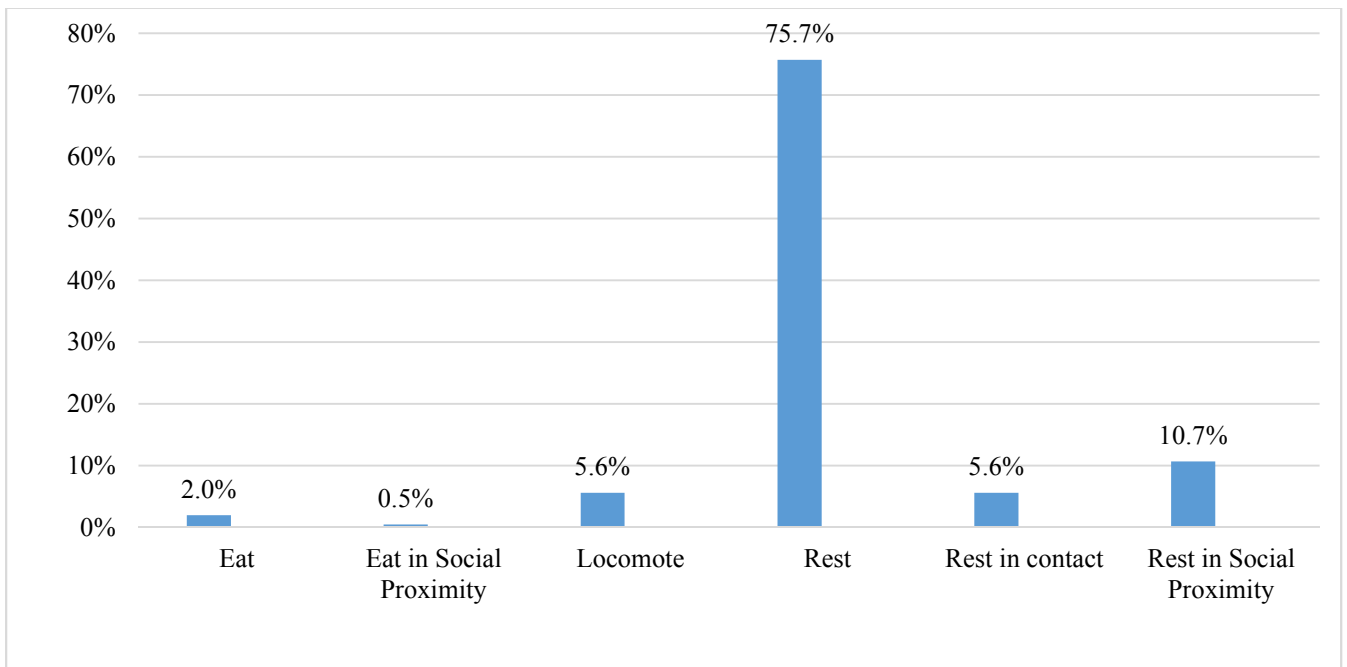
Joe

Figure 3.1. Joe's activity budget

Joe exhibited 12 different activities during 126.5 hours of observation (Figure 3.1 and Figure 3.2). The vast majority of Joe's time was spent resting (75.7% of time). The next most

frequent activities, respectively, make up 5.6% of observed time: locomoting, resting in contact with BaKari (Figure 3.2), and resting in proximity to BaKari.

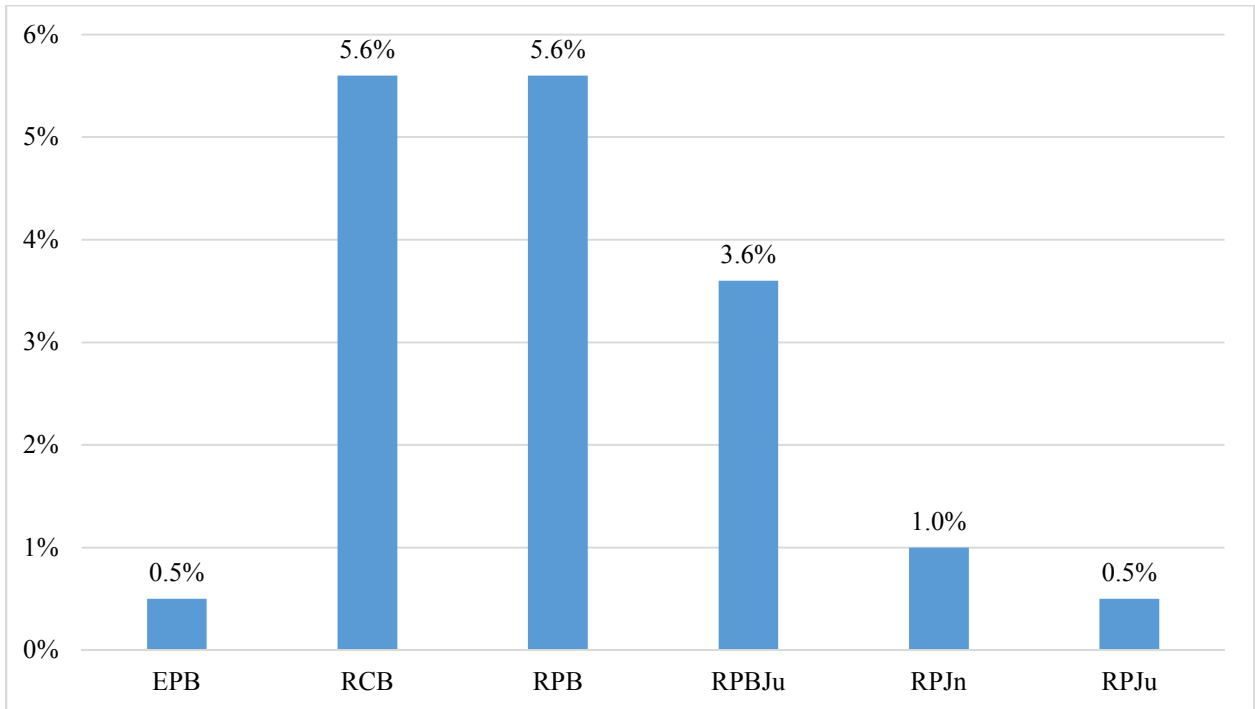


Figure 3.2. Joe's social partners

EPB-Eat in proximity to BaKari, RCB-Rest in contact with BaKari, RPB-Rest in proximity with BaKari, RPBJu- Rest in proximity with BaKari and Juma, RPJn-Rest in proximity with Jon, RPJu-Rest in Proximity with Juma

Sleeping accounted for 4.6% of time. Eating alone accounted for 2% of time. He rested in proximity to Jon 1% of samples. Eating in proximity to BaKari, and sitting in proximity to Juma all accounted for 0.5% of Joe's activity budget.

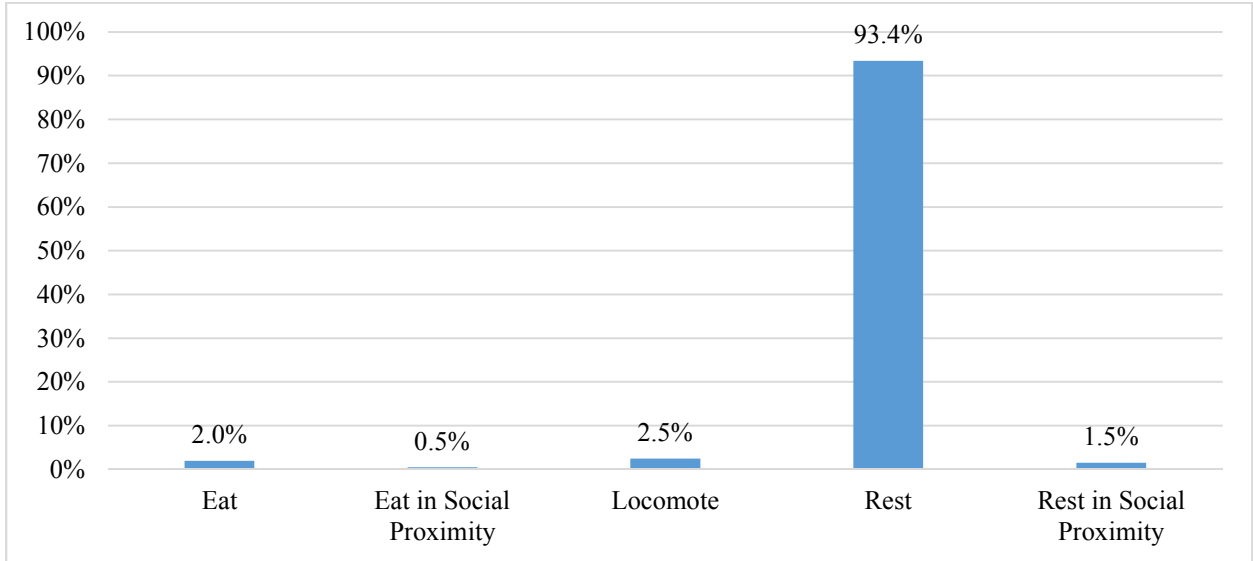
Jon

Figure 3.3. Jon's activity budget

Jon was observed to participate in eight activities (Figure 3.3 and Figure 3.4). Overwhelmingly, his time was spent resting (93.4% of time). The next most frequent event was locomoting (2.5% of time).

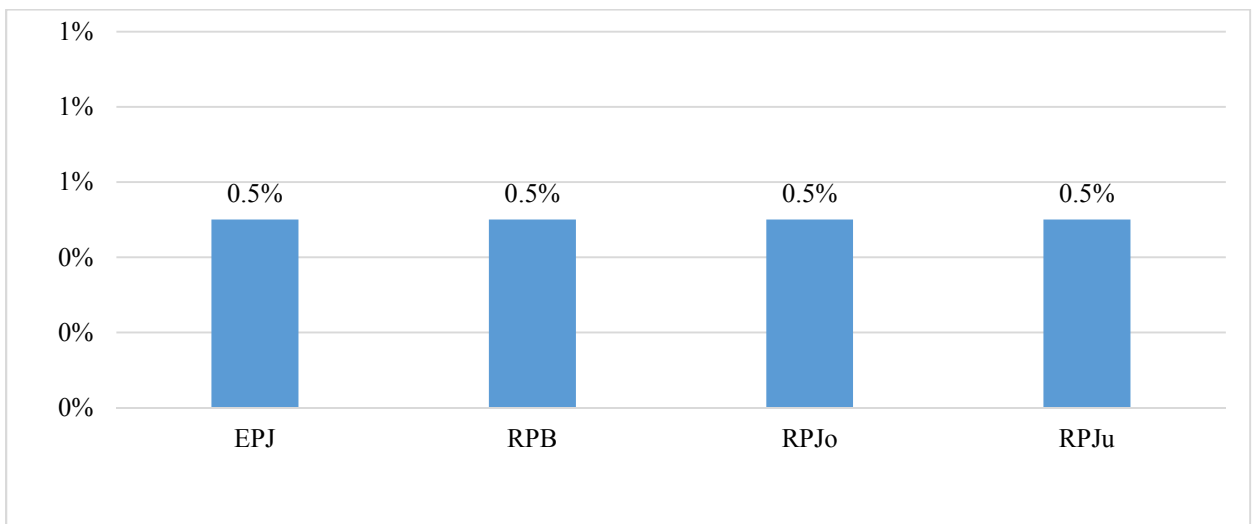


Figure 3.4. Jon's social partners

EPJ-Eat in proximity to Joe, RPB-Rest in proximity with BaKari, RPJo-Rest in proximity with Joe, RPJu-Rest in Proximity with Juma,

Eating made up 2% of Jon's activity. Lastly, eating in proximity to Joe, resting in proximity to BaKari, resting in proximity to Joe, and resting in proximity to Juma only made up 0.5% of Jon's observed time.

Juma

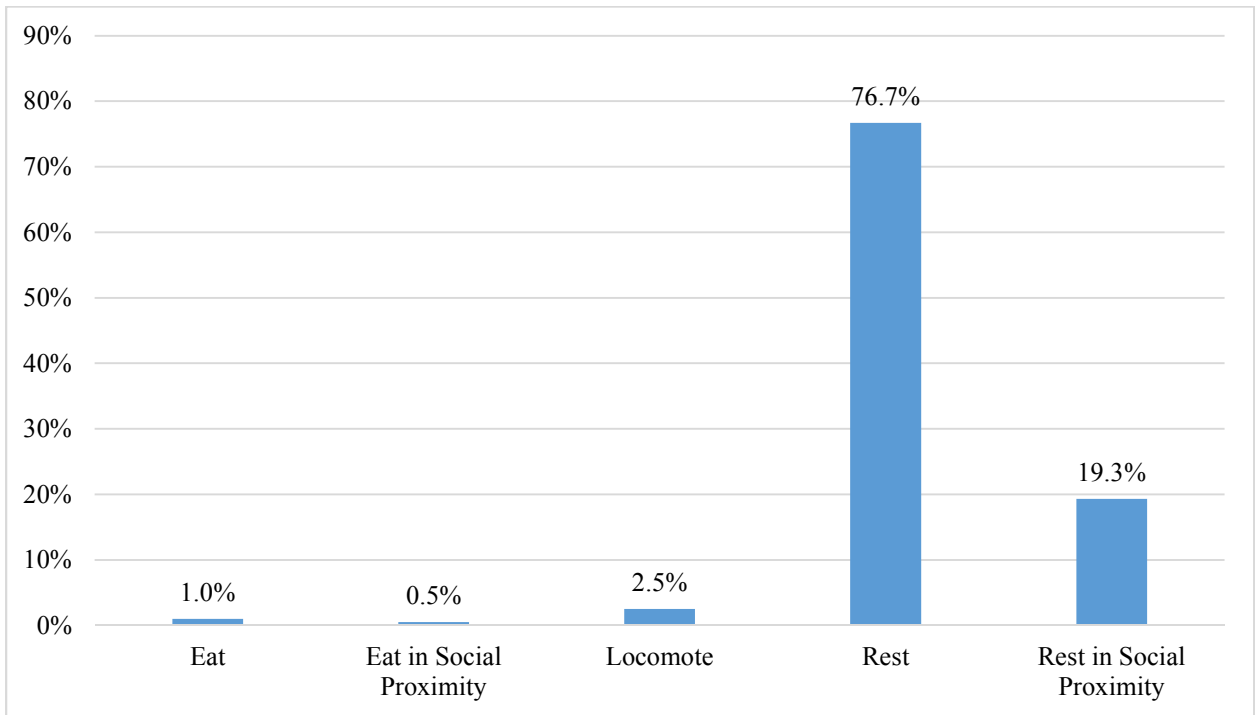


Figure 3.5. Juma's activity budget

Juma was observed in nine different activities (Figure 3.5 and Figure 3.6). Once again, rest took up the majority of his activity budget, at 76.7%. Resting in proximity to accounted for 14.7% of time. Resting in proximity to both Joe and BaKari comprised 3.6% of time, while 2.5% of time was spent locomoting. Juma spent 1% of his time eating alone. Lastly, eating in proximity to BaKari, resting in proximity to Jon and resting in proximity to Joe together accounted for only 0.5% of the observed activity budget.

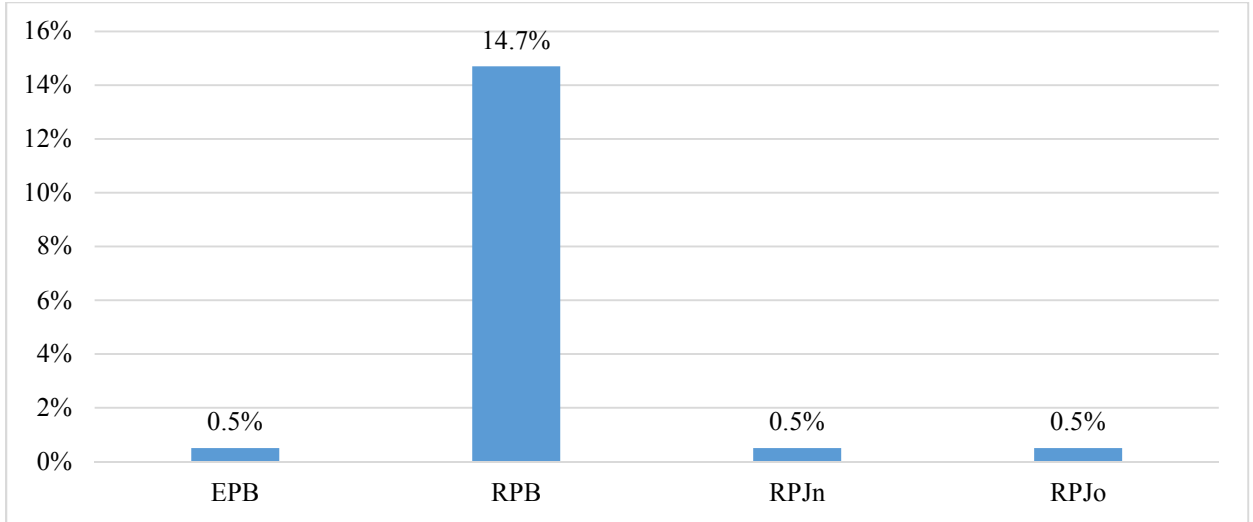


Figure 3.6. Juma's social partners

EPB-Eat in proximity to BaKari, RPB-Rest in proximity with BaKari, RPJo-Rest in proximity with Joe, RPJn-Rest in Proximity with Jon

Nadaya

Nadaya participated in fewer types of activities, with only seven different behaviors recorded (Figure 3.7 and Figure 3.8). He spent 79.7% of his time resting and 8.6% of time locomoting.

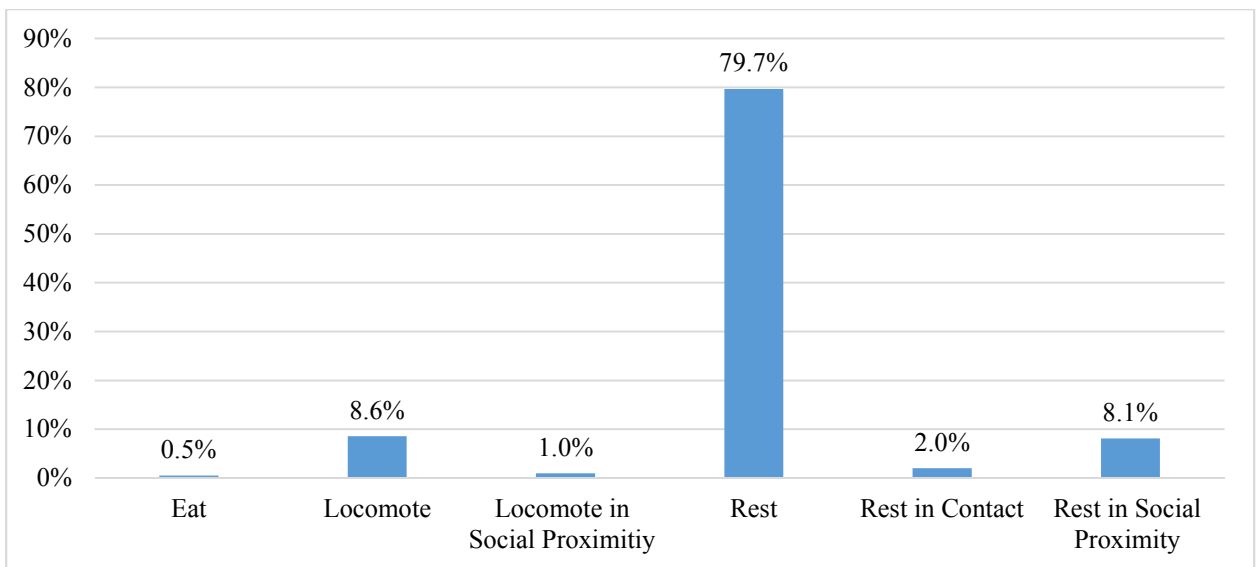


Figure 3.7. Nadaya's activity budget

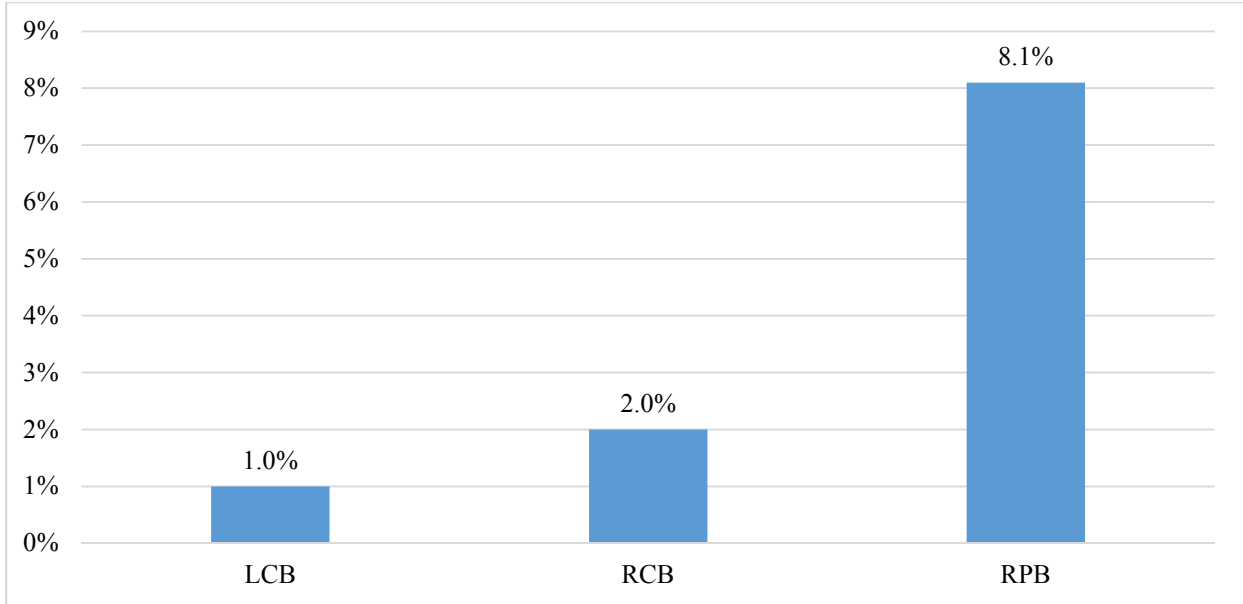


Figure 3.8. Nadaya's social partners

LPB-Locomote in proximity to BaKari, RPC-Rest in contact with BaKari, RPB-Rest in proximity with BaKari

Resting in proximity to BaKari made up 8.1% of recorded time. 1% of time was spent locomoting in proximity to BaKari. Eating accounted for 0.5% of time.

BaKari

BaKari participated in the largest number of behaviors, with 16 different activities being recorded (Figure 3.9 and Figure 3.10). He rested alone for 45.2% of the time. The next most frequent activity was resting in proximity to Juma (15.7% of time).

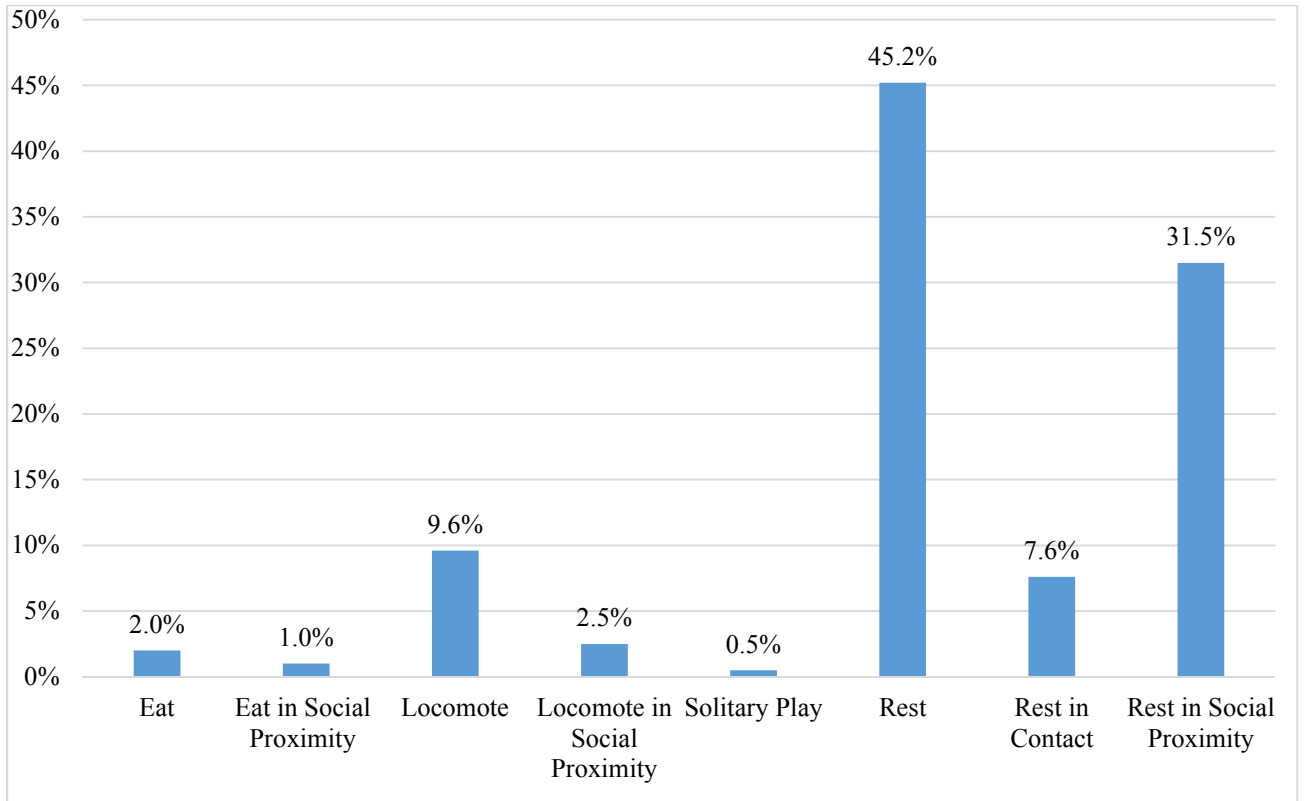


Figure 3.9. BaKari's activity budget

Eating and resting in contact with Nadaya accounted for 2% of recorded time. Locomoting in proximity to Joe as well as locomoting in proximity to Nadaya comprised 1% of BaKari's activity budget. Finally, 0.5% of time was spent eating in proximity to Joe, eating in proximity to Juma, and playing alone together. Locomoting occurred 9.6% of time. Resting in proximity to Nadaya (8.1% of time), resting in contact with Joe (5.6% of time), and resting in contact with Joe and Juma (4.1% of observed time) were the next most common behaviors

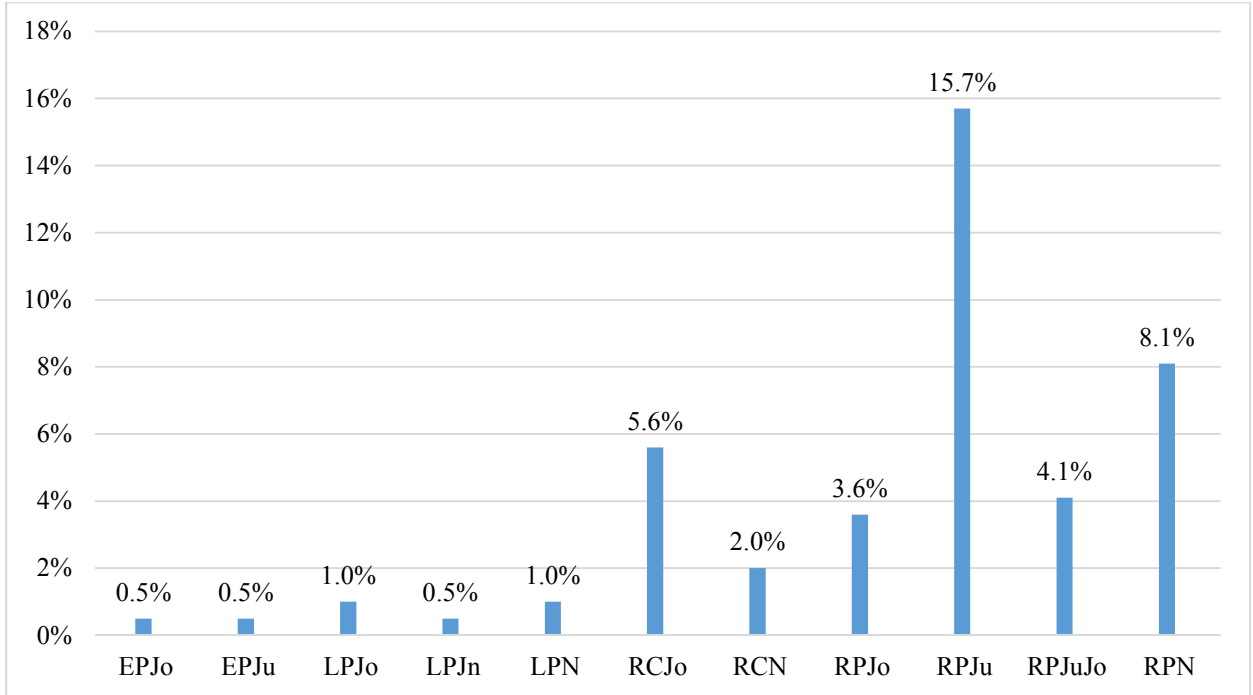


Figure 3.10. BaKari's social partners

EPJo-Eat in proximity to Joe, EPJu-Eat in proximity to Juma, LPJo-Locomote in proximity to Joe, LPJn-Locomote in proximity to Jon, LPN-Locomote in proximity to Nadaya, RCJo-Rest in contact with Joe, RCN-Rest in contact with Nadaya, RPJo-Rest in proximity to Joe, RPJu-Rest in proximity to Juma, RPJuJo-Rest in proximity to Juma and Joe, RPN Rest in proximity to Nadaya

Ad Libitum Results

Table 3.1. Ad libitum results

Behavior	Number of Occurrences	Percent of Total
<i>Public Viewing: General (Figure 3.11)</i>		
Subtotal Viewing General		26.19%
<i>Behaviors Directed at Researcher</i>		
Joe Directing Behaviors at Researcher	179	12.58%
Jon Directing Behaviors at Researcher	57	4.01%
Juma Directing Behaviors at Researcher	6	0.42%
Nadaya Directing Behaviors at Researcher	36	2.53%
Subtotal Directing Behaviors at Research		19.54%
<i>Behaviors Directed at Staff</i>		
Joe Directing Behaviors at Holding Area	12	0.84%

Table 3.1. (continued)

Jon Directing Behaviors at Holding Area	4	0.28%
Juma Directing Behaviors at Holding Area	55	3.87%
BaKari Directing Behaviors at Holding Area	15	1.05%
Subtotal Directing Behaviors at Staff		6.04%
<i>Agonistic Behaviors: Intraspecies (Table 3.2.)</i>		
Subtotal Intraspecies Agonism		16.72%
<i>Agonistic Behaviors: Interspecies</i>		
Joe Display at Visitors	40	2.81%
Jon Display at Visitors	5	0.35%
Nadaya Display at Visitors	8	0.56%
BaKari Display at Visitors	11	0.77%
Jon Avoid Visitors	5	0.35%
BaKari Avoid Visitors	13	0.91%
Nadaya Avoid Visitors	24	1.69%
Subtotal Interspecies Agonistic Behaviors		7.14%
<i>Public Viewing: Attention</i>		
Jon Watch Strollers/Vehicles/Child on Shoulders	7	0.49%
BaKari Watch Strollers/Vehicles/Child on Shoulders	4	0.28%
Nadaya Watch Strollers/Vehicles/Child on Shoulders	8	0.56%
Joe Watch Camera	12	0.84%
Jon Watch Camera	8	0.56%
BaKari Watch Train	10	0.70%
Jon Watch Train	4	0.28%
Subtotal Public Viewing Attention		3.71%
<i>Affiliative: Intraspecies (Table 3.2)</i>		
Subtotal Intraspecies Affiliation		0.84%
<i>Non-Human Disruptions</i>		
Audible Chimp Vocalizations	2	0.14%
Peacock on Wall	1	0.07%
Total Samples:	1771	100.00%

Public Viewing: General

During the five minute bouts of collecting *ad libitum* data, instances of the gorillas watching the public were recorded. This grouping accounts for unfocused and sedentary viewing of the public by the bachelor males; specifically there was no single individual or disruptive behavior that appeared to have caught the attention of the gorilla, but rather they

were observing unprovoked. In Figure 3.11, Joe (3.65%) watched the public in general most often during times where Density 1 occurred (i.e. 1/3 of the public viewing space was occupied). Jon (3.16%) and BaKari (0.63%) watched the public during Density 2 conditions (i.e. 2/3 of public viewing space was occupied) the most during their general viewing time. Nadaya spent equal time (3.37%) watching during Density 1 and Density 2 conditions.

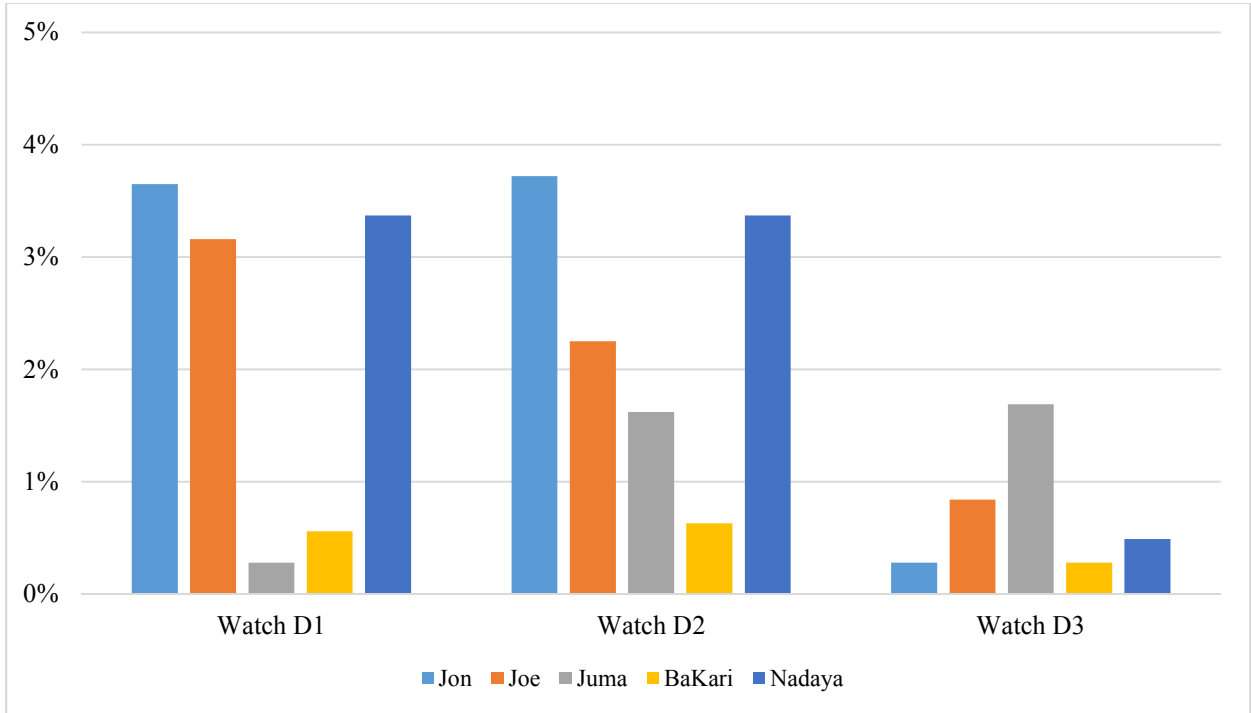


Figure 3.11. Public viewing ad libitum results

Overall, Jon spent the most time (7.66%) during the samples watching the public while BaKari had the fewest instances of watching the public (1.48%). Nadaya was nearly as attentive (7.24%) as Jon (discussed below). Juma (1.69%) was the only individual who paid the most attention to the public during Density 3 (i.e. the entire viewing area was occupied by visitors).

Behaviors Directed at Researcher

Behaviors directed at the researcher were those that were intentionally and specifically targeted toward me. Some examples include displaying, charging, following, watching, and vocalizing. This (along with the section regarding behaviors directed at zoo staff) shows that there was a notable difference in the ways at least some of the gorillas interacted with me and with the public in general. According to Table 3.1, Joe was the most disrupted by my presence in the public space (12.58%). He directed behaviors at me four times as often as any other visitor. It is also of note that he was the only one who directed agonistic behavior. All other males, if directing actions toward me, did nothing more than watch or follow. BaKari had no recorded instances of reacting to me or seeking to target me with his behaviors. Jon had the next most frequent behaviors directed toward me (4.01%).

Behaviors Directed at Staff

This category refers to behaviors that were specifically directed through doorways that led back into the gorilla's holding area. Through these mesh covered openings, one can see back into the space where care staff are working while the gorillas are out in the yard. These behaviors ranged from watching to agonistic displays. Juma participated in these behaviors most frequently (3.87%). BaKari directed behaviors at staff 1.05% of samples. Joe, despite his focus on me, only spent 0.84% of samples directing behaviors toward his usual care staff. Jon only spend 0.28% of samples focusing on staff areas. Nadaya did not have any instances of directing behaviors toward staff in holding areas.

Agonistic Behavior: Intraspecies

Agonistic behaviors are outlined in the gorilla behavioral catalog (i.e. avoiding, hitting, chasing, etc.). In this category, agonistic behaviors between the gorillas were

recorded (Table 3.2). Joe was the main individual who was included in the majority of these bouts of agonism (10.82%). He engaged with all of the males in these samples: Juma (3.72%), Jon (3.44%), BaKari (2.25%), and Nadaya (1.41%). Jon engaged the next most frequently (7.10% including his interactions with Joe, also included in his reported total); he engaged most frequently with Joe and second most with Juma. In general, the pattern with Joe's agonism would be an initial interaction between Jon and Joe, which would result in Joe then immediately targeting Juma. Instances of agonism between Nadaya and BaKari (2.25%) were milder than between any of the older males, which could have to do with their relatedness and younger ages.

Table 3.2: Gorilla specific ad libitum results

<i>Agonistic Behaviors: Intraspecies</i>		
Jon Agonism with Juma	40	2.81%
Jon Agonism with BaKari	12	0.84%
Joe Agonism with Juma	53	3.72%
Joe Agonism with Jon	49	3.44%
Joe Agonism with Nadaya	20	1.41%
Joe Agonism with BaKari	32	2.25%
Nadaya Agonism with BaKari	32	2.25%
Subtotal Intraspecies Agonism		16.72%
<i>Affiliative: Intraspecies</i>		
BaKari and Nadaya Play	12	0.84%
Subtotal Intraspecies Affiliation		0.84%

Stoinski (2004) found that non-contact aggression (agonism) occurred eight times more often than contact aggression. In my samples, there were no instances of actual contact aggression; all forms of agonism were some form of displaying, charging, or avoidance. The behavioral results of Stoinski's (2004) study were consistent with wild behavioral patterns of mountain gorilla bachelor groups (there is very little information about wild western lowland gorilla

bachelor groups available). Agonism is a behavioral category that occurs in the wild and helps to maintain social boundaries between individuals (Robbins: 2011); some amount of agonism would be expected in captive gorilla groups as a healthy naturalistic behavior. These data show that the bachelor males at St. Louis Zoo at least fall in line with previously studied rates of agonism, if not exhibit less instances of contact aggression than other bachelor groups do.

Agonistic Behavior: Interspecies

Agonistic behaviors targeted toward the public are outlined in this section. These are different from the general public viewing and the specific public viewing attention due to the type of behaviors occurring. In the former, the gorillas were unprovoked and were inactive during their time of observation; the latter encompasses their attention being drawn by specific types of things (i.e. strollers or the zoo train). According to Table 3.1, Nadaya participated in avoidance behaviors in 1.69% of samples. Juma and Joe did not exhibit avoidance behaviors. Joe did, however display at the public (2.81%) at a higher rate than any of the other males. Jon avoided (0.35%) and displayed (0.35%) in equal amounts toward the public. BaKari avoided (0.91%) as well as displayed (0.77%) when he was the focus of the public. Two instances of Nadaya's display (0.56%) came in rapid succession when a group of teenagers harassed him at higher decibel levels, left, and then came back to repeat their behaviors.

Public Viewing: Specific

There are specific stimuli from the public that drew the attention of the gorillas during the *ad libitum* collection time. Here, samples specifically refer to cameras with flash, strollers, wheelchairs, and adults carrying children on their shoulders. Another instance

covered here is the existence of the zooline railroad that has a stop in front of the gorilla habitat. BaKari was the most distracted by the train (0.70%) while Jon noted it 0.28% of samples. The first is a sudden visual cue that is targeted at a specific male. Joe (0.84%) and Jon (0.56%) both had instances where their attention was drawn by this process. The last three cases are all a way in which a visitor would take up a larger amount of visual space. Nadaya was most drawn by this (0.56%). Jon (0.49%) and BaKari (0.28%) both watched these individuals as well. All of these were less frequently sampled than any other interaction with the public, but were also extremely specific (i.e. did not occur regularly and were of an unmistakable stimulus).

Affiliative Behaviors: Intraspecies

The only play that occurred was between BaKari and Nadaya (0.84%) and even these bouts were sparse (Table: 3.2). Stoinski (2004) found a rate of 1.1 instances of affiliative interactions between bachelor males per hour in her study group; however, being in social proximity was included as an affiliative behavior where proximities were more not in my study.

Non-Human Disruptions

Gorillas are not the only animals at the St. Louis Zoo. In fact, peacocks are allowed free range of the grounds (along with many other bird species) (St. Louis Zoo: 2016). This was how a Peacock ended up on the wall of the gorilla enclosure (0.07%). No actual disruption occurred. Another instance of zoo specific conspecifics are the chimpanzees who are also housed in the Jungle of the Apes complex. There were two occasions (0.14%) when chimpanzee calls could be clearly heard from their adjacent outdoor housing.

Discussion

Individual differences

Joe

Joe's activity budget was similar to previous studies of gorilla behavior in that he spent a large amount of time resting (75.7%) and eating (2.5%) (Robbins: 2011). Time that Joe spent in proximity to Jon often resulted in agonism such as display behavior (this is further discussed in *Interactions*). Out of the five male subjects, Joe was by far the most affected by the goings on of the public space. Joe showed agonism toward me and staff but did not outwardly react toward disruptions by the visitors. Even while my attention was not focused on the gorillas (i.e. recording data on humans), Joe would follow me through the yard, moving through his space in parallel with me. On multiple occasions, Joe charged at me despite the fact that I was in the public space on a higher level than the habitat he was in. Not only would he beat his chest as part of a display, but he also threw large chunks of dirt and grass from the ground in my direction. Joe has a history of throwing things from the habitat, which led to mesh being put up around the enclosure in order to prevent him from actually hitting anyone with projectiles. Visitors occasionally were extremely disruptive—taunting with shouts, and other loud noises—but Joe was consistently more disturbed by slower moving, quieter stimuli in the form of keepers and myself. The fact that Joe was more aroused by staff and myself than visitors could be explained by a number of reasons. It is possible that the permanent existence of staff and extended stays of researchers allows them to somewhat permeate the boundaries of the troupe and become pseudo members. This could potentially lead to Joe asserting his dominance over these newer and smaller members of the social circle just as he would any gorillas who would have transferred into his group.

Something of note is that the vast majority of care staff have been female and these male gorillas are in a bachelor group. Perhaps there is some complicated sexual frustration being transferred onto the staff that manifests into agonistic displays or attention focused on the opposite sex as captive apes mature, which is also seen in chimpanzees in captivity (J. Pruett, pers. comm.).

Jon

Jon varied little regarding his activity budget. He spent all but 2% of his time alone and resting. According to Gatti et. al. (2004), wild bachelor groups are fission-fusion groups that could be considered transition states between being in the natal group and forming one's own unit. A problem of having bachelor groups in zoos is that these males cannot fission or fusion from the social group. Rather than having the loose social membership parameters, groups are strictly constructed and unchanging. This issue is apparent in the way that Jon interacts with the rest of the troupe. Based on the low levels of interaction between Jon and the rest of the males, it could be argued that he is as fissioned from the group as he possibly could be within this particular captive living environment. The recorded proximity interaction between Jon, Joe and Juma ended in dominance displays, which shows that even the small amount of minimal social behavior that he participated in was met with tension from the other males.

Juma

Juma spent more time with BaKari than I would have predicted. Most of his time was spent parked at the upper shift door resting, which prior research had shown to be his preference (Lovett, unpublished data). In the past (before BaKari and Nadaya joined the

troupe), Juma spent more time moving through his habitat in what appeared to be patrolling behavior. Instead, he spent more time resting in the shade.

Nadaya

Nadaya had the least variety of activities recorded. He spent 11.1% of his time around his younger half-brother, BaKari, but otherwise he was on his own. I had expected that the familial relationship would increase the time that the siblings would spend together, but instead BaKari spread his time out among the other males as well (Figure 3.4). Nadaya was then left on his own. His isolation was not nearly as extreme as Jon's but followed similar patterns. It is possible that Nadaya spends his time in chosen isolation that is not reinforced by the relationships between him and the older males.

BaKari

The variety and even spread of activities in BaKari's activity budget seems to be an expected difference based on age. He is a juvenile male who, based on my data, seemed to be more playful than the other, older, individuals studied (Figure 3.5). I was surprised to see that he spent more time with Juma (20.8%) than with his biological half-brother, Nadaya (11.1%). Based on the age group that BaKari is in, it is possible that his time spent with Juma was a sort of foster father situation; Juma was the silverback of the troupe as well as the oldest. Presumably, there would be benefits to having the protection and social affiliation of Juma.

Social Interactions among Subjects

According to Robbins (2011), males in wild bachelor groups play and groom with each other at much higher rates than in other social groups, which might be due to the lack of courtship pressure. These increased grooming rates would help in solidifying and

maintaining social relationships between the bachelor males. I did not observe any instances of grooming between any males within this study; in fact, the amount of time spent in proximity or contact with another male gorilla was relatively low in all individuals except for BaKari, who spent 42.6% of his recorded time in some sort of proximity or contact with the older males. With regard to general time spent in proximity or contact with another male the percent time spent is as such: 11.1% for Nadaya, 19.8% for Juma, 2% for Jon, and 16.8% for Joe. BaKari is a juvenile male and as such his increased sociality is unsurprising if a larger percentage of activity budget than I would have anticipated.

In the case of Joe, nearly any amount of proximity he had with Jon (1% of time) ended in some sort of agonistic dominance display between the two (these data were tabulated in separate *ad libitum* analysis). Within peer groups in bachelor groups, there is less defined dominance structure (Robbins: 2011), which could help to explain the consistent tension between Jon and Joe, who are only one year apart in age.

In a similar vein of agonism and interactions between the males, Joe would seem to set up situations in which he would end up supplanting Juma. There were a handful of times where Jon would come near the upper shift door (the preferred spot of Juma) and Joe would meet him. The two males would stand stiffly in a dominance posturing display. If Jon got too close to Juma's place Juma would charge him away. It is of note to mention that in those instances BaKari was already in proximity to Juma when the interaction between Joe and Jon would begin. It could be argued that this was a sort of tool/distraction aided supplant; Joe was using the knowledge that Juma would keep Jon away from BaKari in order to force Juma from his place at the upper shift door and then take it for himself. This spot is more often

contested among the males and offers a line of sight into the holding area where keepers are working during the time that the gorillas are in their outdoor habitat.

Stoinski et al (2001) found that with regard to space use in captive apes, gorillas were seen on average to spend 50% of their time in less than 15% of the exhibit. The gorillas also spent more time near buildings and structures and less time away from structures than would be expected. There might be some sort of association with doors and shift gates with food or the safety of their holding areas. In this particular group of males, they all seemed to have preferred locations within the environment to spend their time. These spaces, were in fact, all associated with the inner holding areas and the passages that could lead to them.

Juma spent nearly all of his resting time (76.7%) between the upper shift door and a staff door that remained open to the keeping areas; this space is also completely paved and houses a lixit for drinking. Joe, in past observation (Lovett, unpublished data), claimed the lower shift door, but in this study was seen to spend time near Juma and the upper doors. He was not in proximity as defined here, but showed a preference for that space. On some occasions, he would move in on Juma's preferred space when the silverback patrolled or moved for any other reason. Currently, Nadaya has taken up the lower shift door as being his space to rest. Jon was generally found in a small alcove created by large "kong" doors that can be opened to let in large machinery to the exhibit. In that space, there is also a fan to help cool off during the humid summer days. BaKari did not seem to have a preferred location but would move from male to male and spend time with that individual.

Avoidance Behavior

Both Nadaya and BaKari participated in a specific type of locomotion that seemed to be a form of avoidance when there was a higher density of visitors. They would move

quadrupedally and every other extension, would look under a forearm back at the visitors.

The brothers did not appear to make any sort of eye contact with the public space, but rather were avoiding with their gaze while they were leaving the location. This suggests that there was some sort of disturbance from the visitors for the males, but that it was not as visible as Joe's responses to the care staff and researchers.

CHAPTER 4

VISITOR RESULTS AND DISCUSSION

This chapter reports the results of visitor based data, specifically, effects of visitor density on decibel levels and the types of visitors at the zoo. Each category of visitor identification is discussed in detail. In discussion, visitor motivation is examined within the context of recorded behaviors. Behaviors of men and women as well as between age classes are examined. Finally, problems of diversity and heteronormativity are scrutinized.

Densities and Volume

There was no specific relationship between decibel levels and visitor densities. Density 1 and density 2 conditions have similar decibel ranges; however Density 2 has a cluster of louder instances.



Figure 4.1. Distribution of decibel levels across visitor densities

This shows that individuals can create louder ambient sounds in a way that overrides the average for the density overall. The Density 2 cluster in the 80s is, in fact, higher than the topmost end of the decibel levels on Density 3. The densest group, Density 3, did have higher average decibel levels in general.

Types of Visitors

Overall, visitors generally seemed to be in mixed groups of adults and children, with groups of teens and the occasional older individuals visiting as well. Perceived age, gender, and size were all assessed when an individual was participating in a behavior of note whether positive (i.e. reading), negative (i.e. yelling at the gorillas), or innocuous (i.e. a baby crying). This was an attempt to find any patterns between the various types of people visiting the zoo and the different behaviors exhibited. It should be noted that these graphs account for neither entire zoo attendance nor complete rates of individuals who visited the Fragile Forest. These are only representative of the people who participated in notable behaviors during the times when I was collecting data.

Visitor Perceived Age

Adults (n = 522) and children (n = 624) made up the majority of visitors. Teens accounted for 208 sampled individuals, while older adults were 88 of the individuals sampled. This pattern points to the idea that the majority of people who are coming to visit the zoo in groups are doing so in some sort of familial pattern evidenced by the large number of children and adults who were, presumably, their parents or some other relations responsible for them. A total of 128 individual samples were undefined; this means that when a behavior occurred either I was unable to assess their status quickly enough or that they were out of sight at the time of their disruption.

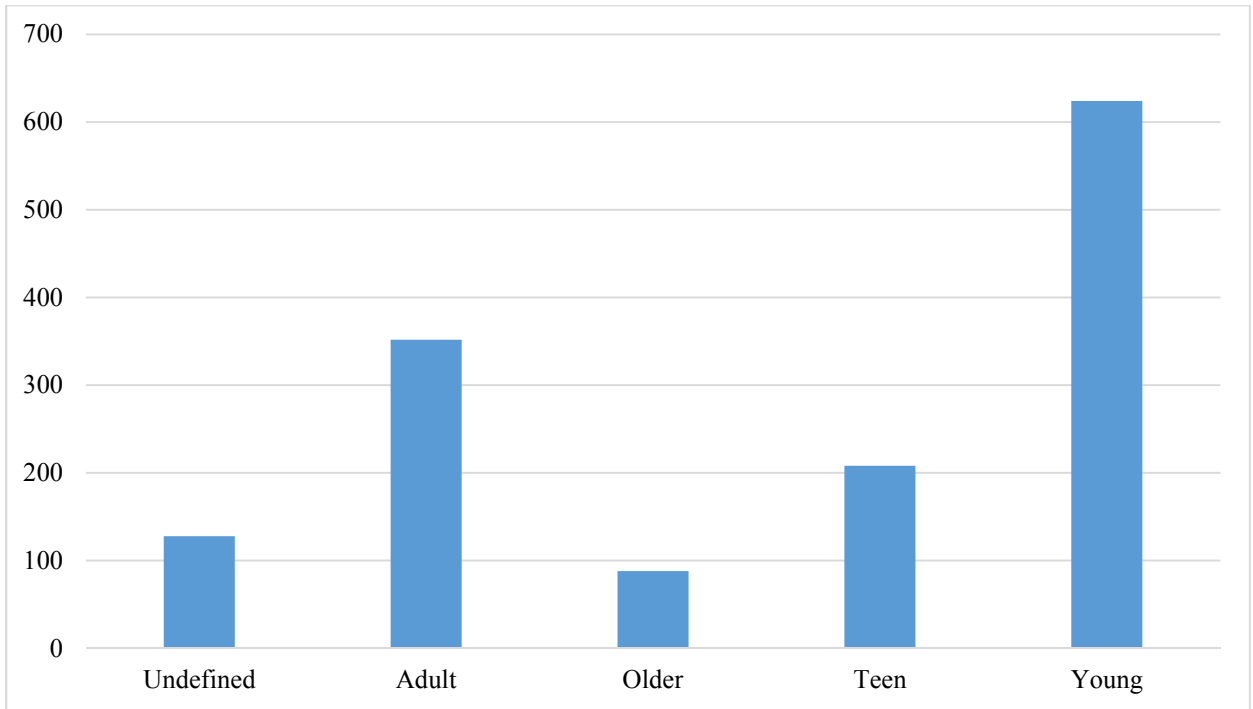


Figure 4.2. Distribution of perceived age across the samples.

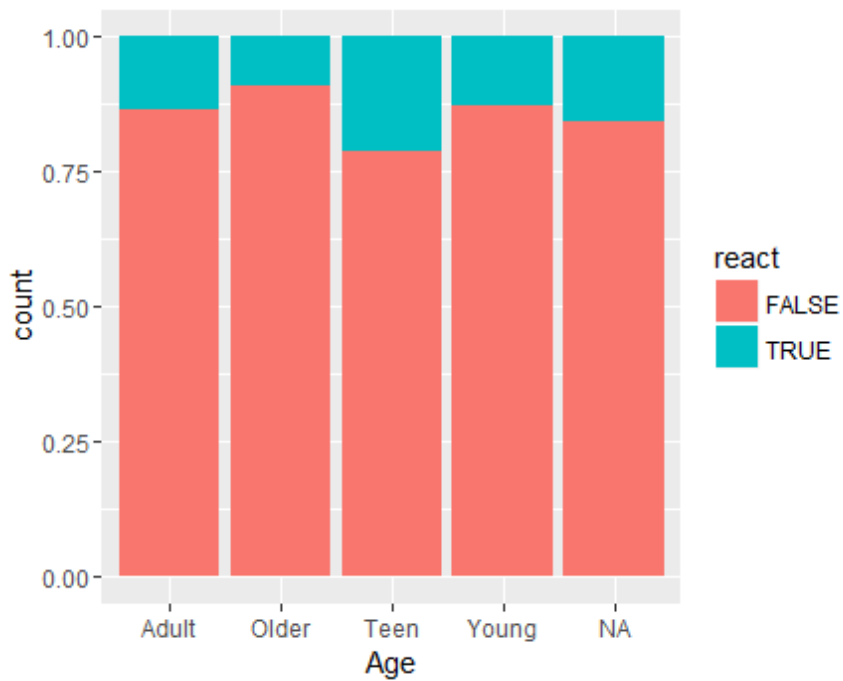


Figure 4.3. Likelihood of age group eliciting a gorilla reaction.

Teens were by far the group who disrupted (i.e. garnered a reaction from) the gorillas. They were the second least frequently occurring group ($n = 208$), but their behaviors were notably more predictive of causing gorillas to react than the more frequent visiting age groups who were more often in situations where they could have been disrupting the gorilla group.

Visitor Percieved Race

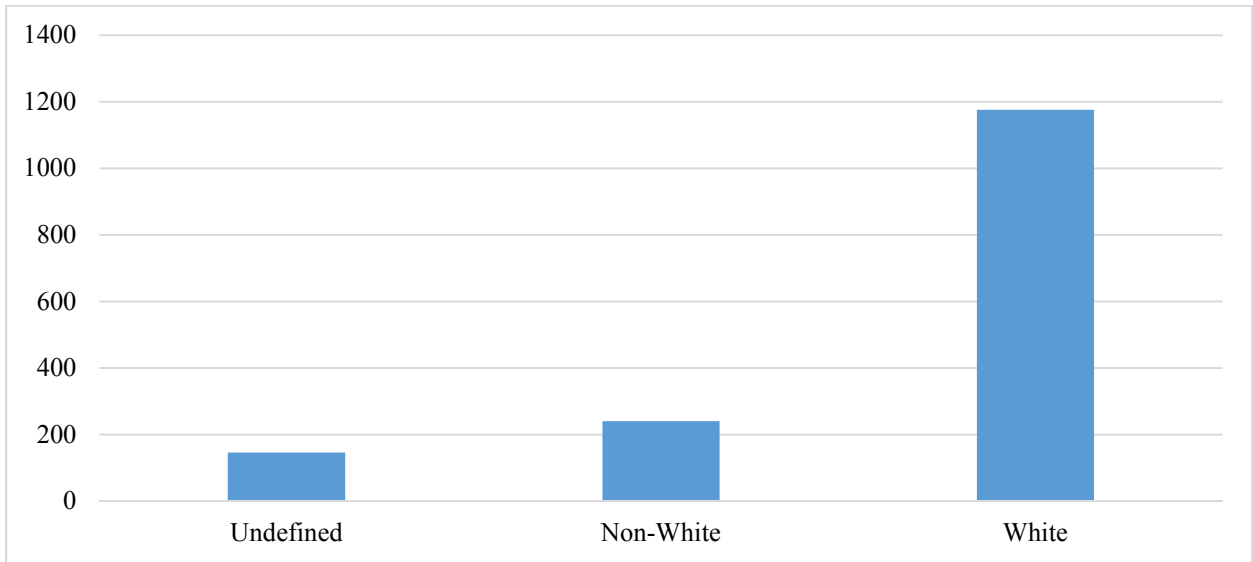


Figure 4.4. Distribution of percieved race across the samples.

Overwhelmingly, the individuals who were recorded participating in the behaviors of note were white ($n = 1196$), making up 73% of data points. Non-white individuals, predominately African Americans ($n = 240$) were only 15%, and Undefined ($n = 164$) individuals were 10%.

Despite the fact that non-white visitors accounted for less than a quarter of visitors, they were nearly twice as likely to draw the attention of the gorillas. Perhaps this is due to the fact that so few visit the exhibit; gorillas are more habituated to seeing caucasian persons and therefore are more likely to take note of non-white patrons.

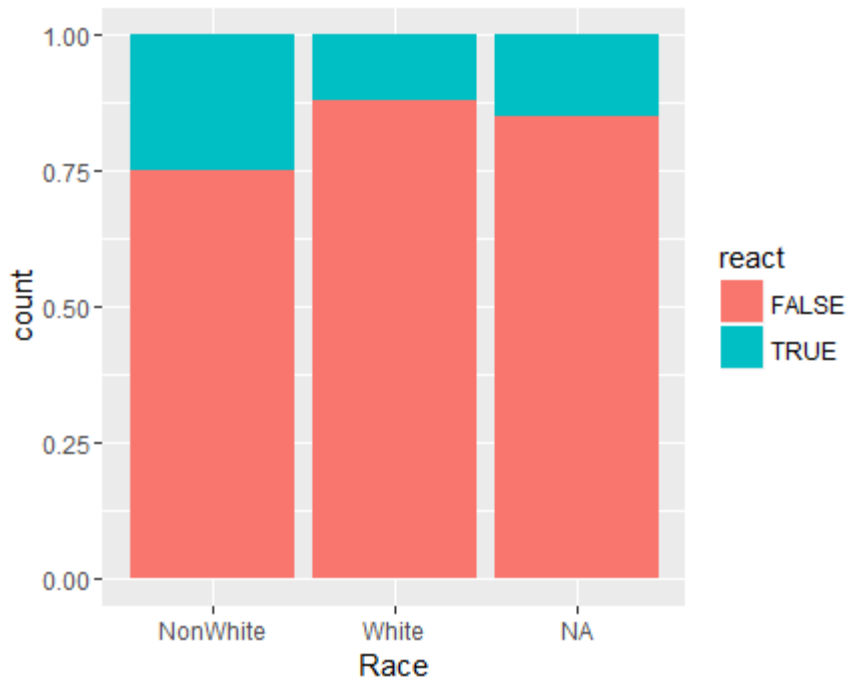


Figure 4.5. Likelihood of racial group eliciting a gorilla reaction.

This category is a significant predictor of whether or not an individual will cause disturbance ($\chi = 42.9$, $p < 5.49 \times 10^{-11}$), however both white ($z = 2 \times 10^{-16}$, $p < 0.001$) and non-white ($z = 9.88 \times 10^{-12}$, $p < 0.001$) categories are significantly predictive at the same amount. Arguably this is an unhelpful predictor in predicting that action taken by anyone is a significant predictor of a gorilla reaction/disruption.

Visitor Perceived Gender

The perceived gender results show that there were more males ($n = 863$) involved in notable behaviors than there were females ($n = 596$). That being said, this graph is not a comprehensive account of all of the individuals who spent time at the Fragile Forest during my time of observation, but only shows the visitors who were part of my sample. This perceived gender spread consists of all age groups mentioned above in Figure 4.4.

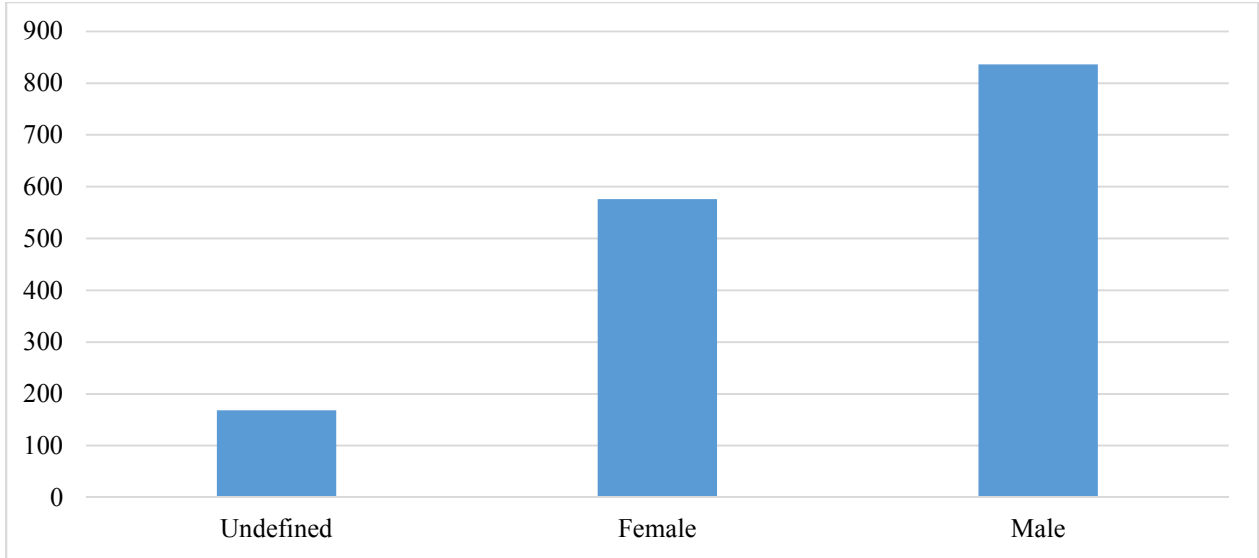


Figure 4.6. Distribution of perceived gender across the samples.

Once again, the undefined category ($n = 168$) includes people who participated in a behavior while either out of sight or the instance was too quick for everything to have been recorded.

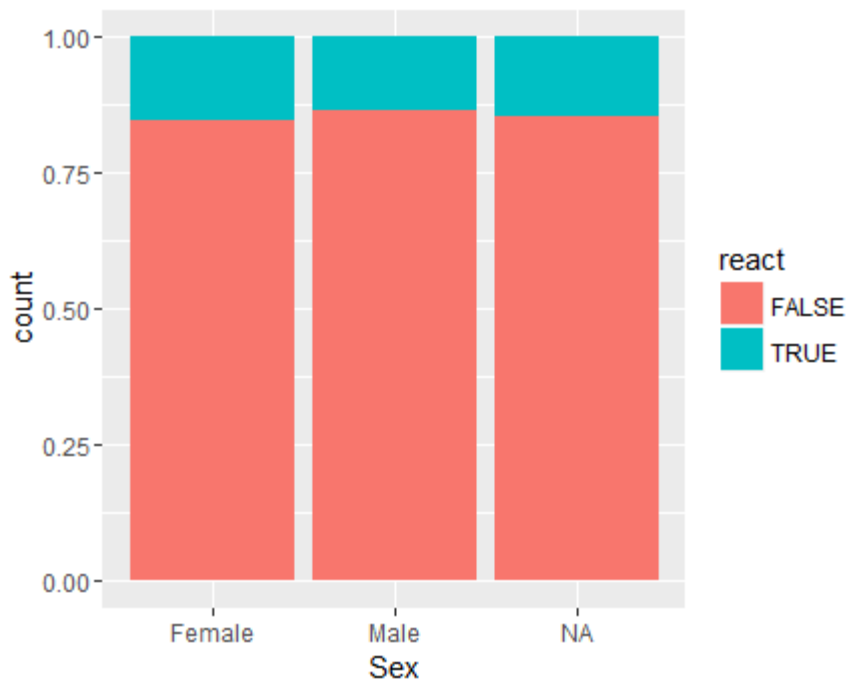


Figure 4.7. Likelihood of gender group eliciting a gorilla reaction.

Males and females are virtually equally likely to have gorillas react to their behaviors.

Visitor Perceived Size

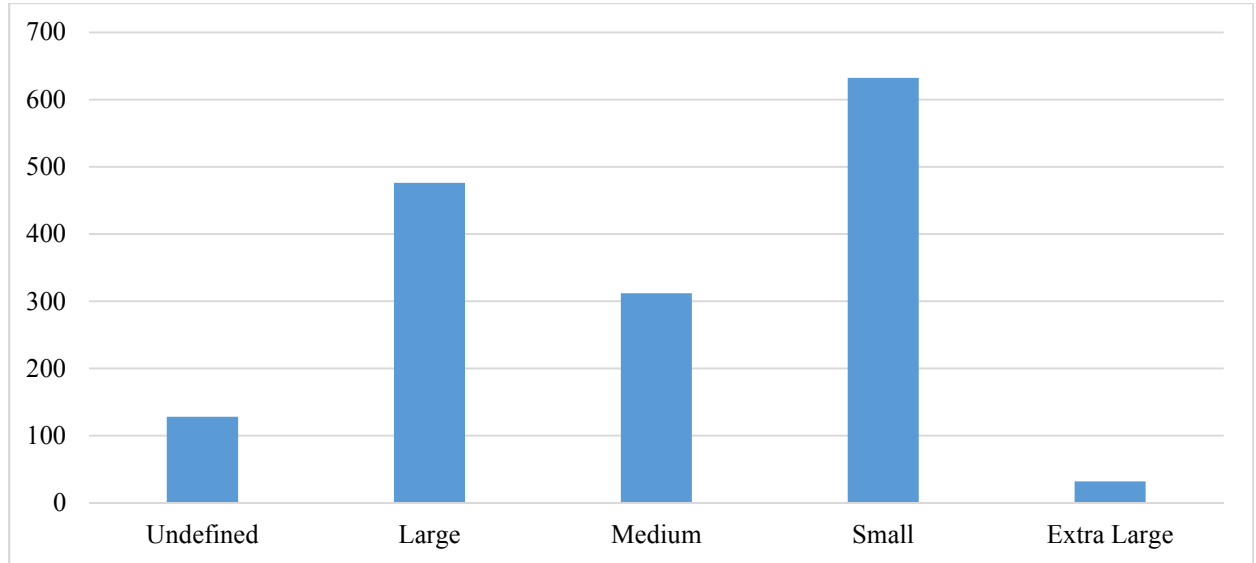


Figure 4.8. Distribution of visitors according to perceived size.

Perceived size was recorded in order to see if larger individuals had higher rates of disruption than visitors who were smaller. It might be predicted that people who were larger could be more often seen as a threat to the gorillas than smaller ones. The size scale: small, medium, large, extra-large, is meant to mirror common t-shirt sizing as a means of comparison. Again, the pattern of adults with children can be seen here with the high amounts of large ($n = 484$) and small ($n = 632$) categories. Medium was in the middle with 324 samples and extra-large only accounted for 32 individuals sampled. Undefined individuals occurred 128 times. The medium category generally consisted of teenagers and adult females while the large and extra-large groupings were mostly males. Children of all ages (i.e. infants to pre-adolescence) were all classified as being small, which creates a large amount of variance between the largest small and the smallest small. I would argue that the

difference between a toddler and a middle schooler, while extremely different for humans, would be negligible threats for gorillas. Adults who are on the larger size of the scale, however, could pose an additional threat.

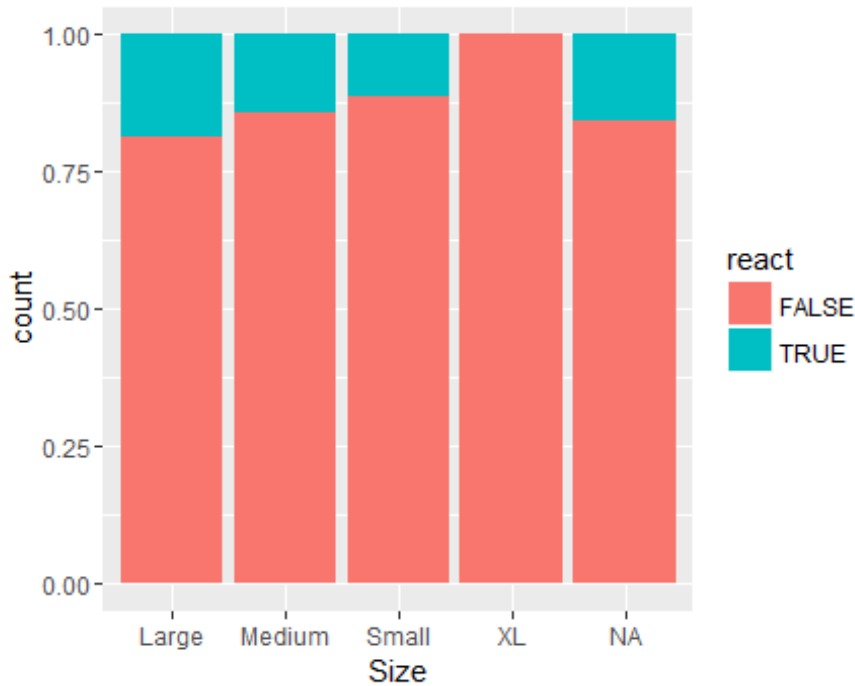


Figure 4.9. Likelihood of size group eliciting a gorilla reaction

Larger people are more likely to cause the gorillas to react than those in the small category. The steady increase of disruption from small to large would make sense with the idea that larger individuals could be seen as being more threatening to gorillas than smaller ones. The extra-large (XL) category is unexpectedly low. In fact, there were no instances of a visitor classified as extra-large eliciting any response from the gorillas. I would argue that this has to do with how few extra-large samples exist in the data ($n = 32$). If there were more data points, it is possible that the steady rate of change between categories would continue into the extra-large demographic range.

Discussion

Visitor Motivation

I argue that conventional museums and zoos are similar enough to have the same sort of analysis applied to both. In short, a zoological park is a museum with animals instead of paintings, but the premise and setup are basically the same and the visitor motivations for museums hold based on my research, i.e. entertainment (negative or attention seeking behaviors toward gorillas), education (reading signs and asking questions), social events (visiting with friends), and life cycle events (summer camp). Martin (2002) showed that the four aforementioned categories were the major reasons that people attended museums, and it seems to follow that the same hold true for zoo patrons as well. One could argue that a number of activities could be described as having motivations tied into entertainment, education, social events or life cycle events. Regardless of this, it is vital for better understanding the individuals who are in the public space interacting with animals. Any improvement in knowledge of visitor behavior could improve educational and conservation focused efforts by zoos. Presumably, the way a person who was seeking entertainment would behave differently than one who ultimately wanted a learning outcome. Admittedly, social events and life events were more difficult to quantify than the former two.

Observed behaviors put people into at least one of these categories in finite ways. Behaviors of people were divided into positive, innocuous, and negative behaviors. Positive behaviors were most closely related to education. People who read signs, asked me questions, and verbalized positive questions or information about the gorillas generally seemed to be at the exhibit with a goal of coming away with more than just seeing the animals. This is not to say that these statements were necessarily in line with primatological studies or basic biology

and ecology, but rather there was some sort of understanding and passivity to the words that leaned toward the positive. Their active seeking out of information about the animals, whether through signs, zoo staff, or myself, is indicative of acquiring knowledge. What those people then do with that knowledge is not covered in these data.

On the other hand, negative behaviors in this study were associated with goals of entertainment. Overwhelmingly, the individuals who displayed behavior that was negative were somehow trying to get the attention of the gorillas. For example, knocking on the glass, making seemingly random animal like noises, and waving arms around would be instances of these negative entertainment-seeking behaviors. Almost all of the negatively classified statements from visitors were things like complaining about the visibility of the gorillas or shouting their names so that they might provoke some sort of reaction. In one instance, I made the mistake of answering some questions for a family who then took the information provided to harass the animals. (This instance is a rare complication to the positive/negative behavioral dynamic. People were first recorded as exhibiting positive behaviors, but then a few minutes later, were recorded as being participating in negative behaviors. As mentioned above, internal motivations are not something I recorded data on.) The names of the bachelors are displayed visibly around the habitat along with pictures, which is a usual part of habitat design; however, this allows for visitors to grab on to one or a few names of the gorillas and then repeatedly yell them until either some sort of desired result occurs or the visitor gives up. Consistently, the name that was retained was "Joe". This was the same male who had a history of throwing things into the public space as well as stalking the staff (and researchers) along the yard. Perhaps his name is the one that sticks with people because it is the most common western name of the males. Presumably, these individuals are not entirely

interested in the conservation or well-being of the gorillas at the time of their observation; instead they are wishing to see some sort of show. With the long history of animal shows at zoological parks and the prevalence of primates in media, this is an understandable, if misguided, way to approach the exhibit. Phil, the gorilla on show at the St. Louis Zoo, is still present in the form of taxidermy that spends its time in the education center of the zoo (“Putting”: 2014). The problematic history of animals as entertainment is still visible to visitors. This could make them feel like their seeking of attention is permissible or the norm. These were the most frequently recorded types of behaviors in my behavioral catalogue, but these attention seeking behaviors are more visible than the quieter and subtler learning behaviors. This is not to say that the goal of individuals who are participating in these disruptive, entertainment-focused behaviors are intending harm or discomfort for the gorillas. Instead, it seems their own particular need for stimulation is causing outward behaviors to draw exciting behaviors that can also be potentially disruptive to the gorillas.

The third category, social events was difficult to categorize with the data available. Presumably, most all of the people were at the zoo for some sort of social purpose. As such, this was not a noteworthy part of my analysis.

Lastly, events regarding life milestones (life cycle events as defined by Martin: 2002) were present in the individuals who were at the zoo in a very specific way. St. Louis hosts a summer camp for children where they learn about the captive animals and ecology. Part of the day camp is that they get to visit the animals at one point during the children’s stay there. Arguably, this could be classified as some sort of life cycle event. It was the least frequent in Martin’s (2002) study and it also appears to be very specific with the data I acquired as well.

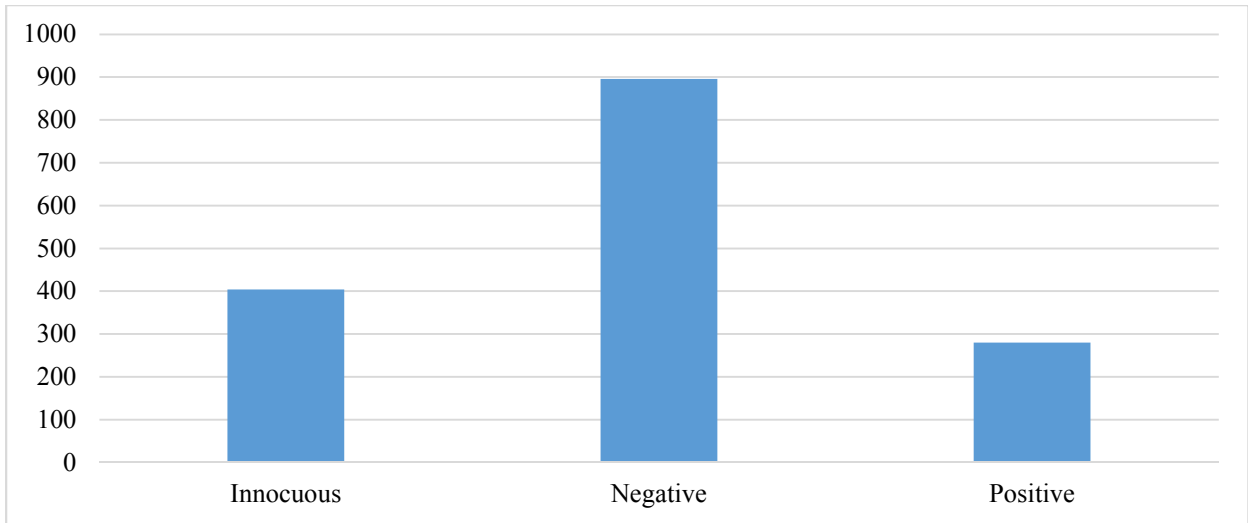


Figure 4.10. Distribution of types of visitor behavior

Figure 4.6 shows the distribution of innocuous, negative, and positive behaviors across the recorded samples. Negative behaviors (i.e. yelling, gesturing, reaching into the enclosure) are twice as frequent as any other category ($n = 896$). Innocuous behaviors (i.e. children crying, idle conversations, any behavior that was potentially disruptive but not intentionally targeted toward the gorillas) were the most frequent ($n = 416$). Positive behaviors (i.e. reading signs, making inquiries) only occurred in 288 samples, which is nearly half as many times as the undirected innocuous behaviors and nearly four times less frequently as the negative behaviors. There is a strong possibility that there are other types of positive behaviors that were not recorded during this project. Standing silently and watching the gorillas could easily be indicative of the aforementioned educational motivation but would have no notable outward signs that were recorded.

No positive behaviors caused the gorillas to react (Figure 4.11). This is arguably a relic of how positive behaviors were outlined in the research; positive behaviors, by nature, would not be potentially disruptive to the gorillas.

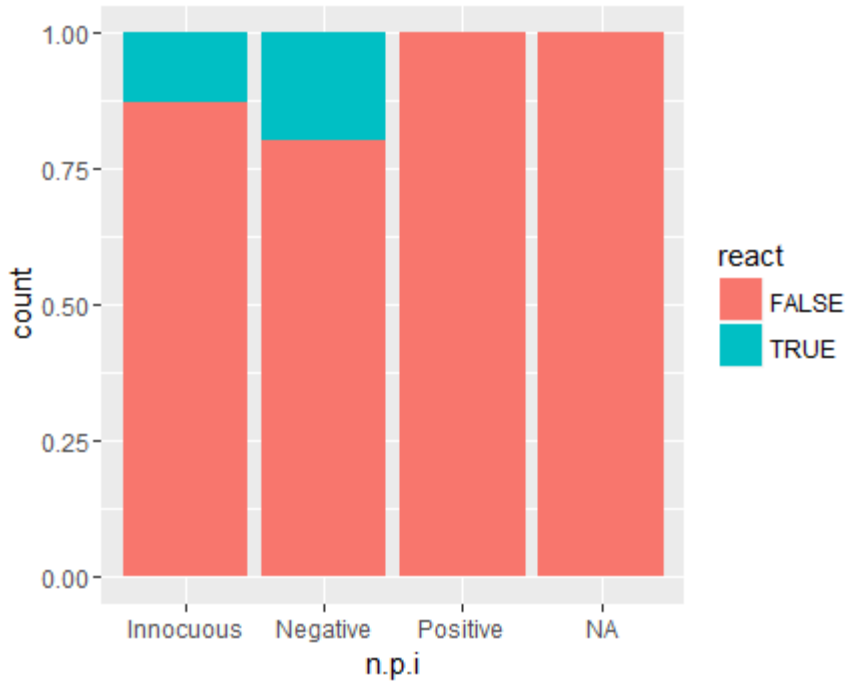


Figure 4.11. Likelihood of behavioral classification eliciting a gorilla reaction.

Negative (attention seeking) behaviors were the most likely to cause gorilla behavioral reactions, which is also predictive of behaviors that would be purposefully attempting to create some sort of gorilla actions toward the visitor. Innocuous stimuli that were not directed at the gorillas, but could have still been somewhat disruptive were predictive of gorilla reactions, however, they were not as disruptive as stimuli directed toward the gorillas specifically.

Figure 4.12 shows the percentages of time that the different individual gorillas were the targets of negative behaviors. What is specifically shown is which gorilla was the target of the visitor's yelling, gesturing, or knocking. Jon was the target during 44% of disruptive behaviors. Jon is the largest of the gorillas, weighing nearly 550 pounds, which could make

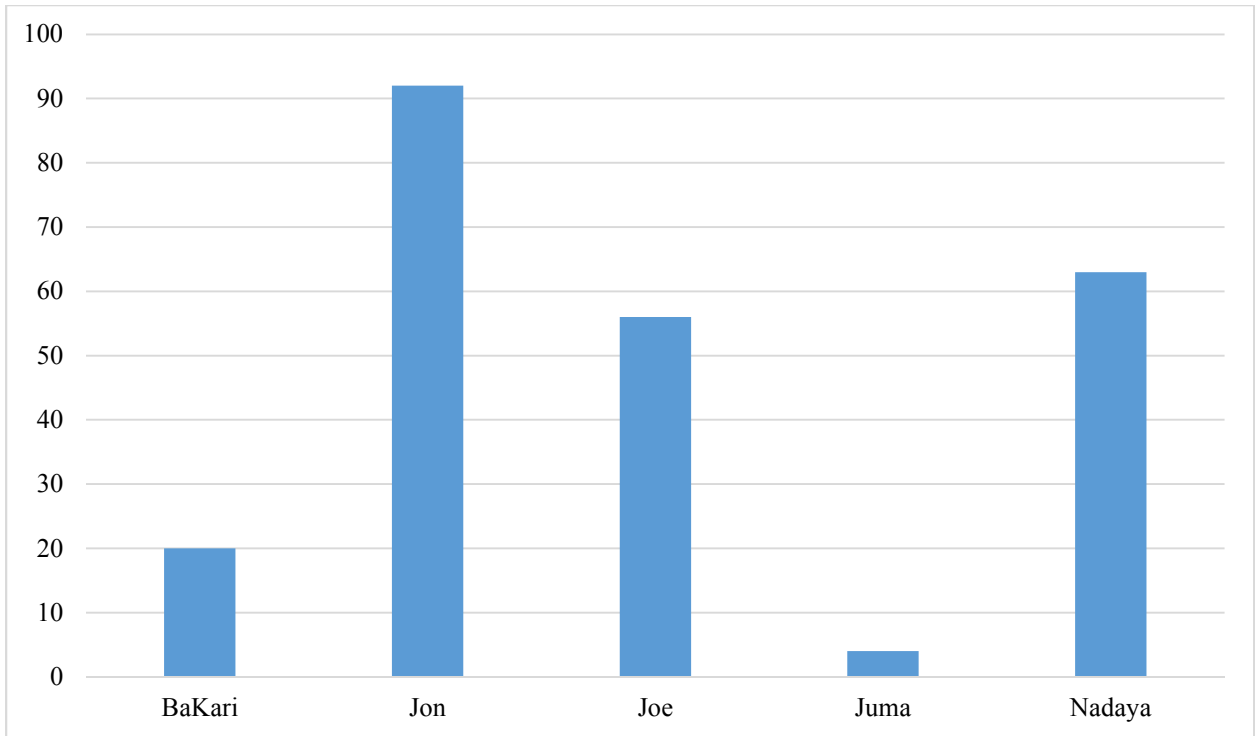


Figure 4.12. Negative Behavior Targets.

him seem more threatening or lumbering than the other males; he is also almost always easily visible up at the Kong doors. Ninety-eight percent of Jon's activity budget was spent alone and in some form of low key activity. This calls into question the motivation for why visitors target him at twice the rate of any other gorilla. Despite being the name that was most often called, Joe was only targeted 27% of the samples. Nadaya was the next most frequently targeted, with 17% of samples. Bakhari was only targeted 9.5% of the time despite the fact that he was by far the most active male. Perhaps his higher activity levels allowed for him to escape the prompting because he was already active (i.e. entertaining). Juma was mostly left alone, only being the focus of the negative behaviors in 1.9% of recorded samples. It is possible that by spending his time in the farthest away part of the gorilla habitat he was

unnoticed by some of the visitors and as such was not specifically picked out as a gorilla of interest.

Behavioral Differences between Male and Female Visitors

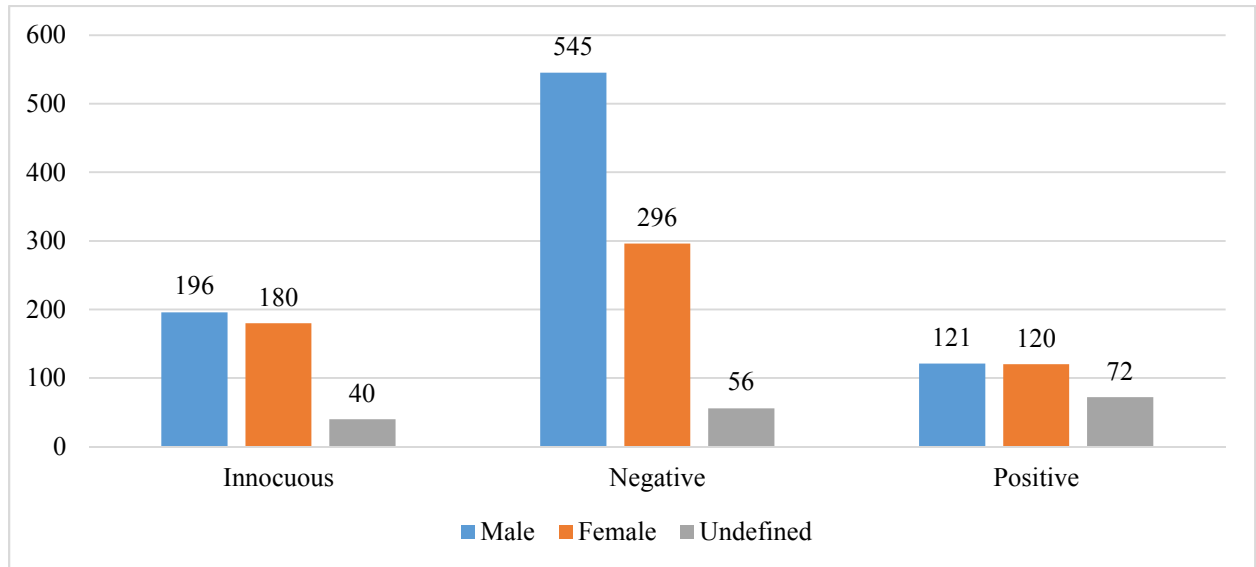


Figure 4.13. Frequency of innocuous, negative, and positive behaviors across perceived gender.

Figure 4.13 shows the within-group ratios of perceived gender and the types of behavioral categories their behaviors were classified as. The only group to have positive behaviors most frequently was the undefined individuals category, with 43% of their total behaviors being positive. This category generally accounted for inquiries made by groups of people during my observations, which was a positive behavior. Even so, their negative behaviors consisted of 33% of the samples. In both males (65%) and females (50%), negative behaviors were more frequent than positive or innocuous ones. Males participated in negative behaviors six times more often than positive ones and three times more frequent than innocuous ones. Females did not have as disparate categories, but they behaved negatively (50%) twice as often as they were positive (20%); their innocuous behaviors were 30% of

their samples. This large number of negative behaviors could harken back to the fact that positive behaviors were more difficult to notice than negative ones.

Despite the large number of negative behaviors that occurred over all and the frequency of negative behaviors exhibited by men, there was no notable difference in the amount of disruption caused by either gender as shown in Figure 4.11. However, according to a model where sex was set to the independent variable and gorilla reaction was dependent (Table 4.1) there were sex differences in disruption. Females were significantly ($z < 2e^{-16}$, $p < 0.001$) more likely to disrupt the gorillas than males were ($z = 0.189$, $p < 1$).

Table 4.1. General linear model relating sex to gorilla disruption

	Estimate	Std.Error	z value	Pr(> z)
Females(Intercept)	-1.71324	0.08745	-19.592	< 2e-16 ***
Males	-0.15264	0.11618	-1.314	0.189
Significance '***' $p < 0.001$				

Within the negative behavior category, I labeled specific instances as being aggressive as well as being generalized as negative. These samples had a patron making blatant or veiled physical threats to the gorillas. For example: a teenaged boy yelling "Let's see how it would go if you were here!", and an adult male yelling "Every zoo is a petting zoo if you're not a girl", and an adult female happily shouting "Wrestling at the ape arena, we came on a good day". Men were three times as likely as women to say aggressive statements as shown in Figure 4.14. The differences between the two genders and the frequency of their use of aggressive comments was significant ($\chi < 37$, $p < 0.001$). Males are significantly more likely to make aggressive comments toward the gorillas than females. Mac an Ghail (1996), suggests that aggression is a way for males to reassert their masculinity in times where they

might feel it is being threatened. Perhaps the massive muscled gorillas somehow threaten the feeling of masculine dominance in these men and provoke an encultured reaction of verbalizing one's masculine prowess.

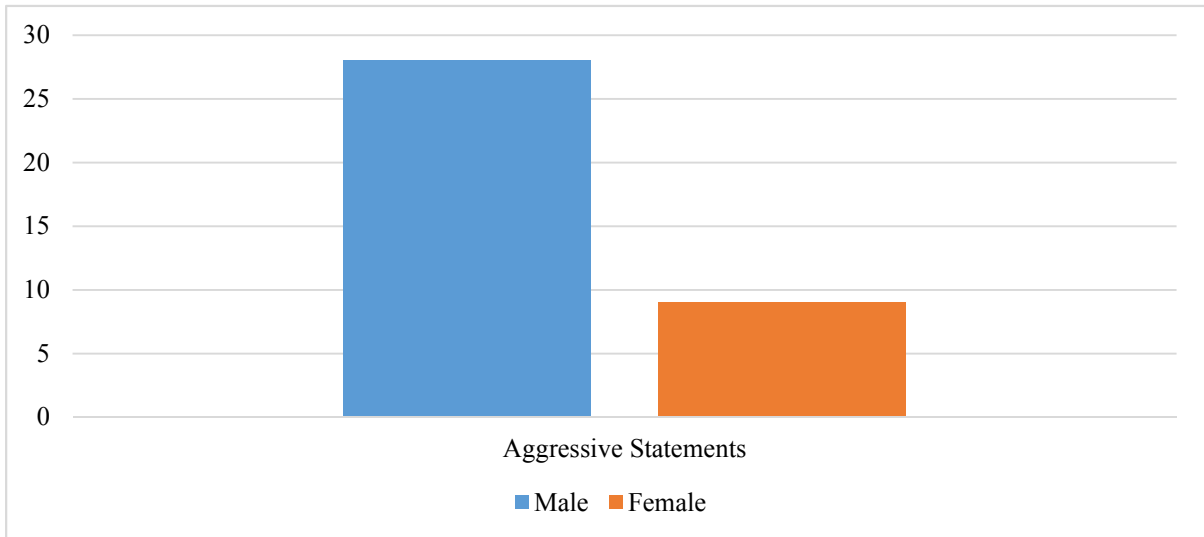


Figure 4.14. Frequency of aggressive behaviors across perceived genders.

In one instance, a trio of seemingly unrelated males gathered together and bantered back and forth about how all three of them together could take on the gorilla and win; one of them had an infant strapped to his chest. Bason et al (2009), suggest that these aggressive (or pseudo-aggressive) displays may aid to downregulate any negative effects of masculinity being threatened in some way.

Relationship between Age and Behavioral Types

Age seems to be a reliable predictor of what type of motivational behaviors will be exhibited by the visitors at the zoo (Figure 4.15). As age increases, negative behaviors decrease.

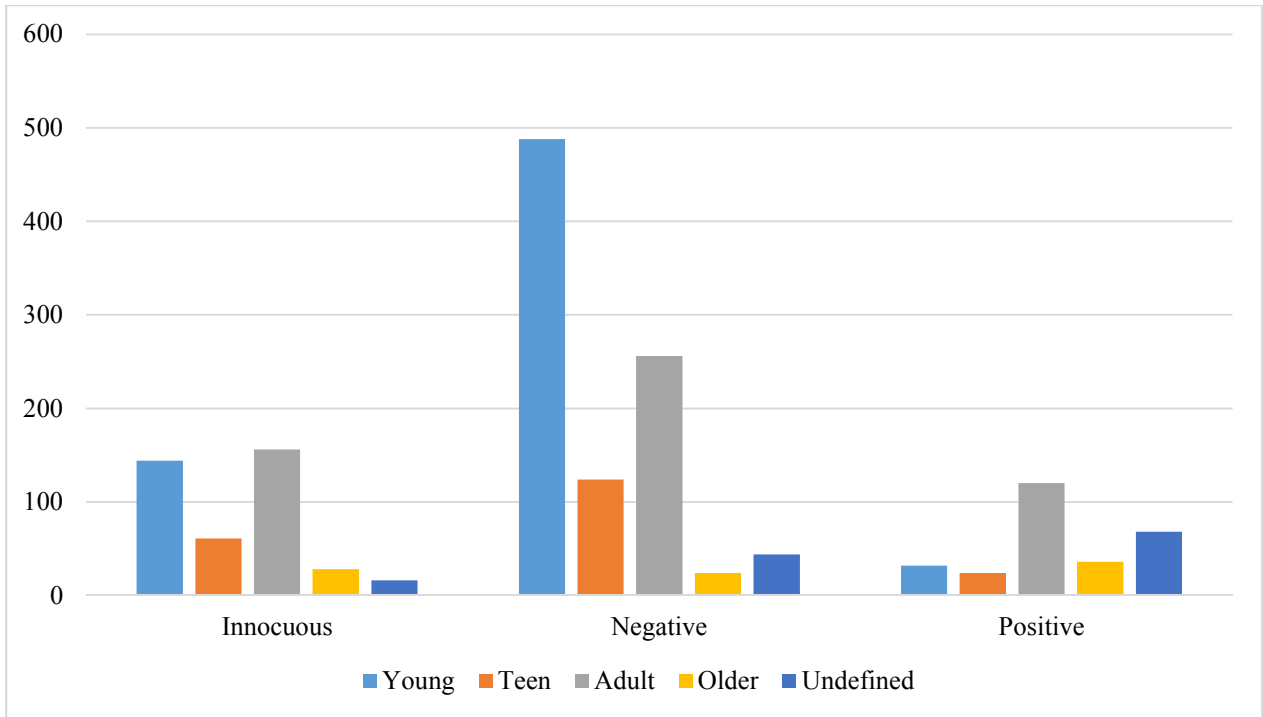


Figure 4.15 Frequency of innocuous, negative, and positive behaviors across perceived age

Young individuals (i.e. children) participated in the most negative/entertainment seeing behaviors (73.19%). It is possible that this age group is unaware of or unconcerned with the conservation and behavioral ecology of the gorillas during the time at which they are viewing. An astonishingly low amount of sampled time was spent with children participating in education driven or positive behaviors (4.82%). A portion of this group might not have the capacity to reliably read any of the posted educational materials around the exhibit. However, teens overwhelmingly participated in negative behaviors (59.62%). Generally, these individuals were in peer groups and seeking excitement from the gorilla group. They were also the most likely to illicit a reaction from the gorillas (Figure 4.3). Adults, who were the second most frequently recorded visitors, still had nearly half of their occurrences count as negative behaviors (48.12%). Their positive behaviors (22.56%), however, were double that of the teenagers (44.54%). Older individuals were the only solidly defined group to have

positive behaviors (40.91%) outnumber their negative ones (27.27%); in fact, they were twice as likely to seek education as entertainment from their experience. The undefined group consisted of individuals who were out of sight at the time of their disruption (i.e., man yelling at gorillas from behind a wall), but it also accounts for individuals or groups of visitors who actively sought out educational information from me. Generally, this occurred in mixed category groups of people and sometimes occurred too fast for me to be able to record the specific demographics of each member of the inquiry group. This is why questions were added to the aggregate of positive behaviors.

General linear modeling found that age was a significant predictor of gorilla disruption (Table 4.2). Adults ($z < 2e^{-16}$, $p < 0.001$) and teens ($z = 0.0007$, $p < 0.001$) are significantly more likely to garner a response from the gorillas than older individuals and children. Despite the fact that children are most consistently engaging in negative and innocuous behaviors, they are not having the same effect that less frequent disruptions from teens and adults are. In the case of adults, I believe size has something to do with their increased disruptions.

Table 4.2. General linear model relating age to gorilla disruption

	Estimate	Std. Error	z value	Pr(> z)	
Adult (Intercept)	-1.83690	0.09551	-19.232	< 2e-16	***
Older	-0.45464	0.29113	-1.562	0.118379	
Teen	0.54326	0.15979	3.400	0.000674	***
Young	-0.08583	0.13291	-0.646	0.518437	
Significance ‘***’ $p < 0.001$					

Relationship between Size and Behavioral Types

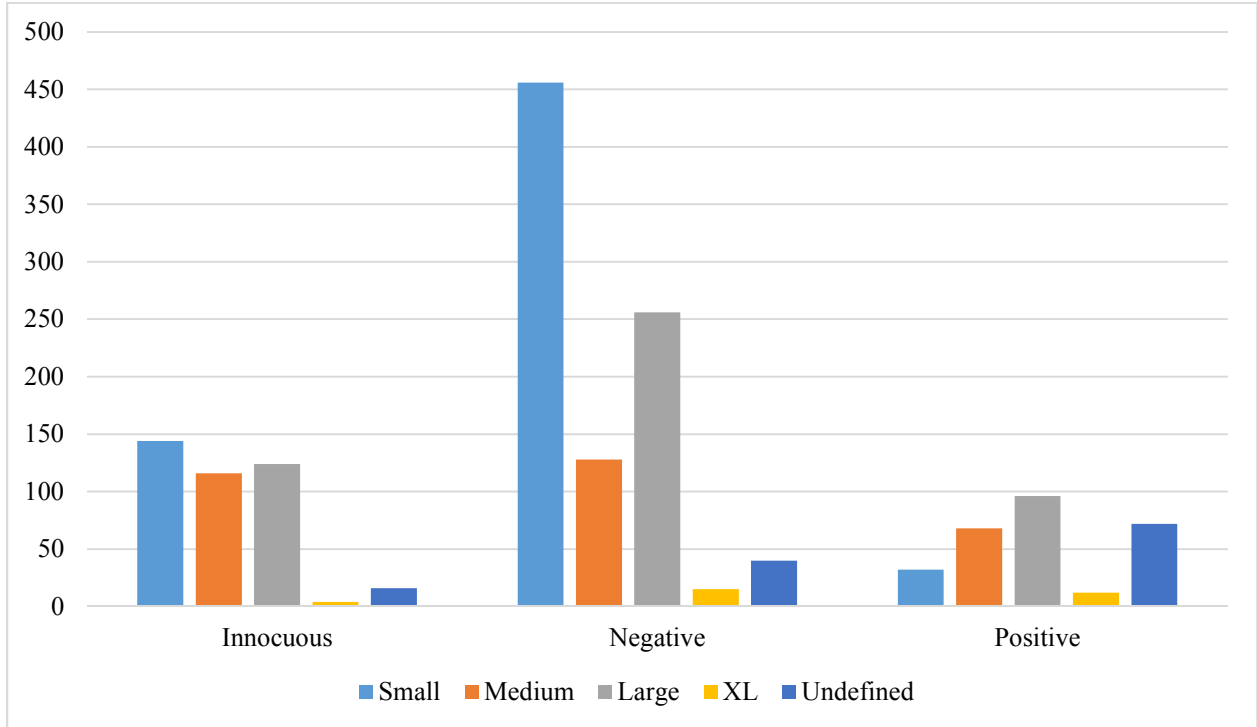


Figure 4.16. Frequency of innocuous, negative, and positive behaviors across perceived size

Size as a predictor of disruption (Figure 4.16) is nearly identical to age spread (Figure 4.15). Nearly all children were all categorized as small and as such their negative behaviors is nearly identical to those in Figure 4.15 (72.15%). The medium category mostly consisted of teenagers as well as some adult and older women, which lowered the negative samples (41.03%) in that category from those reported in Figure 4.15 and doubled the amount of positive/education seeking behaviors (21.79%). Extra Large and Large categories made up of the rest of the adults and older individuals who were sampled.

Size was shown to be a steady indicator of whether or not gorillas would react to a visitor's behavior (Figure 4.9); the larger the person the more probable a reaction. Despite the fact that small individuals are participating in far more negative behaviors than larger ones, the larger ones are garnering greater response from the gorillas. All size categories were

significant predictors of disruption (Table 4.3), however their levels of significance varied. Medium individuals (generally women) were the least ($z = 0.05$, $p < 0.1$) and the large category was the most significant predictor ($z < 2^{-16}$, $p < 0.001$). The size demographic is significant as a whole ($\chi = 36.89$, $p < 4.863 \times 10^{-8}$), but with all groups showing some level of significance in individually it may not be the most useful predictor.

Table 4.3. General linear model relating size to gorilla disruption

	Estimate	Std. Error	z value	Pr(> z)	
Large (Intercept)	-1.47803	0.08923	-16.565	< 2e-16	***
Medium	-0.29693	0.15160	-1.959	0.0502	.
Small	-0.58477	0.13170	-4.440	8.99e-06	***
Extra Large	-3.63860	1.53857	-2.365	0.0180	*
Significance '***' $p < 0.001$, '*' $p < 0.05$, '.' $p < 0.1$					

Diversity in Zoo Attendance

In 2014, St. Louis City was reported to have 47.5% African Americans, 43.6% white/non-Latinos, and 3.8% Latinos¹¹, as their major racial categories. Figure 4.3 shows the demographic racial spread of visitors at the St. Louis Zoo, where 73% of people who were sampled were white/non-Latino. Of note, in St. Louis the 2013 reported median household income was \$34,582¹². The median household income for the state of Missouri in 2013 was \$49,403¹³ putting this area's income as being lower than the state's average at the same time. Furthermore, national median household income was \$51,939¹⁴. This shows that the people who live around the zoo are not only in an area that is nearly equally populated by white and non-white individuals, but also that both the state and the city are well below national

¹¹ <http://quickfacts.census.gov/qfd/states/29/29510.html>

¹² Ibid

¹³ <https://www.census.gov/hhes/www/income/data/statistics/>

¹⁴ Ibid

averages for household income. This economic lack in the city could have effects on who is going to the zoo, what sorts of resources they are willing to use in order to visit, and what they would be looking to get out of their experience.

According to Falk (2000) and Martin (2002), socioeconomic status could have an effect on the demographics present at museums and zoos. More highly educated, affluent, professionals are the average visitors to these institutions. St. Louis Zoo has always and will always charge no admission fee for visitors as stated in their mission statement. This should increase the visiting rates across all age and socioeconomic groups (Martin: 2002), specifically allowing unskilled laborer headed households to represent approximately 25% of individuals who visit museum-like institutions. Something that was not accounted for in my research was the number of visitors who may have been from outside the home county of the zoological park. The St. Louis Zoo is a nationally and internationally recognized institution; it was ranked number four in the world by TripAdvisor¹⁵ in 2014. This high standing of the zoo makes it a place for tourists to spend time during their visits to the area. Individuals who have leisure time would be able to pass their time in the zoo without negative effects. Generally, these individuals are the same people who are mentioned by Martin (2002) as the average museum patrons (i.e. ones who have the resources to not be working for periods of time).

None of these factors completely explain the large disparity between the minority and white individuals who were sampled. Once again, this did not account for every person who attended the zoo during times of data collection; however there seems to be a notable difference between the numbers of visitors in each of the two groups.

¹⁵ <http://www.cnn.com/2014/08/05/travel/tripadvisor-best-zoos/>

Heteronormative Perspectives in Zoo Patrons

Why is it that upon viewing a set of animals, humans automatically create a story of gender roles in which to insert the creatures? During my tenure at the zoo where I was conducting this study it was normative for individuals to spend large amounts of time picking out who was the ‘mama’ and who was the ‘daddy’ and which was their baby. Something causes these individuals to feel the need to argue amongst themselves about which gorilla is which in the family and how “it is so obvious” which animal belongs to which gender. Bem (1981, 1983) would argue that this is part of gender schema theory and that using the identity of self and creation of the other becomes linked to sex-linked traits and creates this social world where interpretation of systems is based on these distinctions. People cluster everything into gender including words (Bem: 1981), so the gendering of living apes is not unexpected. Little did the voyeurs know that all of the gorillas are males (and their schemas were extremely incorrect). If the patrons had paid attention upon entering into the exhibit space they would have noticed that there were signs with pictures of the five males as well as their names: Joe, Nadaya, BaKari, Juma, and Jontu. The four oldest, despite being different sizes, all have the clear markers of their secondary sex characteristics. Bkari is a juvenile and as such has yet to develop his crest. The littlest male is always assigned the spot of the baby in the created family, which makes sense seeing as he is (more or less) the baby. However, there is no rhyme or reason to the assigning of the other gendered roles. Jontu, who is approximately 550 pounds, has been assigned the part of mother along with Joe who is actually smaller. There is little care or notice of actual size difference in the animals for the sake of creating this separation. None of their behaviors were particularly genderable either. The delineation of their genders was completely arbitrary. Note that the term gender is being

used here and not sex. The viewers are in no way actually assessing the biological sex of the individual gorillas, but instead are gendering them into the roles that humans create for their family units.

These particular humans followed a common western understanding of a family being a nuclear family (a mother, a father, and their biological children) (Lorber: 1993). Gorillas generally live in harems in the wild (i.e. multiple females with one dominant male and their offspring) or occasionally in groups with multiple silverbacks (Robbins: 2011). Regardless, a nuclear family is not a social structure existent in wild gorillas. This could most commonly be known as polygyny—the family unit of one man, multiple women, and their offspring in the human world. Polygyny has been the most common form of marriage in human history, however in the west the nuclear family is seen as being normative; so normative that this schema is projected onto other species. One may argue that it is sensible for an individual to attempt to conceptualize the world in ways that he or she has the ability to understand it. This is in some cases true. However, if that were the case, then there would need to be some sort of consistent, cohesive, perspective among those native to the western world. One may see the world as not having amphibians simply because he cannot understand what it is like to live both in water and on land. While this example seems absurd, simply because one does not understand what it is like to have many wives does not mean that it is sensible to completely ignore the possibility. The quandary comes down to is what the motivation of the person in question is.

The idea of gender is socially constructed and unique to each culture: in some African and American Indian societies there can exist a third gender, where in the United States it is commonly only seen as having two (Lorber: 1993). The lengths that people will go through

in order to justify their assertions of gender for the gorillas is astonishing—full of faulty logic and facts that are simply made up on the spot. One gentleman was actually offended/upset when I informed him (and the group he had been “educating”) that all of the gorillas were male. He had been insistant that BaKari was the baby, Joe was the dad, and Nadaya is the mom—at least his assessment of size was logical. The adamant use of misinformation created a space for actual education on sexing gorillas as well as bachelor groups both in the wild and in captivity. The man in question was still put out by the correction. This disruption of his fantasy gorilla family was in some way offensive to his view of the world or perhaps his masculinity.

His type of behavior reflects the way in which people are bent on gendering every other person that they meet. It is the same reason why parents dress baby girls in pink and put flowers in their (lack of) hair; there is something uncomfortable and embarrassing about incorrectly gendering a baby (Lorber: 1993). According to Lorber (1993), knowledge of gender forms the way humans speak-- pronouns, subtle actions, etc. If one does not know the gender of another individual with which they are interacting, then he cannot act in a way that is culturally appropriate. If these animals are living together, then they must be and behave like family, but not just any family--the family which the viewer is accustomed to.

Bales and Parsons (2014) argue that this process of gendering within the contexts of the nuclear family begins when children form bonds with their mothers in infancy. This creates the family as a sort of social system where the mother and father’s physical bodies are representative of the stability of the structure. As children, this is the social structure that individuals are patterned on and, once understood, is how children start to socialize themselves (Bem: 1981). At its most basic, a functional group would have the gendered

bodies and division of labor that their natal group has. As nuclear families become less strictly gendered in the United States, then arguably children will start of have different basis for their primary understanding of social systems. This is the pattern that is still seen in adults who are viewing the gorillas. Perhaps they are helping children to pattern their worlds consistently with the nuclear family as a frame of reference or perhaps they are creating some convenient narrative. On the other hand, this narrative of the nuclear family could prove useful for captive conservation efforts. We know that emotional messages resonate more clearly with visitors (Packer and Ballentyne: 2010). By allowing visitors to form their own understanding of the gorilla family they may be more personally invested in their conservation efforts as well as the success of the zoo's animals. The visitors may not understand how gorilla's live in the wild or at other captive institutions, but they might form connections with that particular group of gorillas. It would take a great deal of time and effort for zoos to correct these misunderstandings of gorilla behavioral ecology through educational efforts or signage. Therefore, it could be argued that zoos are better off ignoring these biologically relevant facts in favor of patrons making their own connections to the animals no matter how fictive their realities are.

CHAPTER 5

SUMMARY AND CONCLUSIONS

This chapter revisits the guiding hypotheses and predictions from the first chapter and reports them as either supported or unsupported. Data from general linear models helps to make a case for the final outcomes. Next, the effects of habituation and visitor disturbances are synthesized. Gorilla behavior and a fire at the zoo is described to illustrate a true disturbance for the gorillas. Possible reasons for differences in gorilla reactions to visitors and researchers and care staff are connected. An examination of zoo marketing and mission is connected with visitor motivations and behaviors. The argument for the possible benefits of habituation is posed next. Then, limitations to the research are pointed out including decibel measures and exhibit type.

Summary

Hypotheses and Prediction Outcomes

This project was driven by the following hypotheses and associated predictions pertaining to both gorilla and human behavior:

- (1) H_{1a}: The farther away from public viewing spaces the individual gorillas are the less effected by outside behavior they will be. Prediction: If the individuals are further removed from the disruption, then it should have less of an impact on their behaviors.

AND

H_{1b}: The closer to the public viewing spaces an individual gorilla is, the higher the rates of agonistic behaviors. Prediction: If the gorilla is resting against the glass near a public

viewing space, then he could be directly affected by the disruption and take out frustration on either the disturbance or other members of the troupe (i.e., redirected aggression).

Supported: The gorillas were almost always situated as far away from the viewing spaces as possible, and there were no behaviors that were notably different between distant and closer occupied areas. However, when a model was created with visitor densities being an independent variable and all five individual gorilla activity budgets as covariates, a relationship was elucidated. In general, gorilla behavior was significantly negatively affected by outside visitor densities ($F = 8.34, p < 0.0001$), it explained a large amount variance in the number of individual behaviors ($R^2 = 0.29$). I am unsure if this is truly a measure of behavioral variety reducing when densities increase as a result of high visitor density alone. In general, the gorillas become less active as the day goes on and there seem to be more visitors at the zoo later in the day. It is possible that this reduction in behaviors at times of increased densities is a result of time of day and not directly a result of density.

(2) H₂: More severe disruptions will cause a greater change in the behavior of the gorillas. Predictions: A small child tapping on the glass would be less of a disruption than a grown man banging on the glass. Likewise, one individual speaking loudly would cause less disruption than multiple people speaking loudly.

Supported: The gorillas, as a group, were all affected by individuals who were directing disruptive behaviors toward them. It is of note, however, that particular groups of visitors (i.e. children) were more likely to engage in disruptive behaviors than others, but that did not necessarily mean that they were the most disruptive. Age was significantly related with rates of disruptive behaviors ($\chi = 19.8, p < 0.0002$). Likewise, perceived race was significantly related to visitor behavior ($\chi = 42.9, p < 5.49 \times 10^{-11}$). Size was a significant factor

in predicting the type of motivational behavior of a visitor ($\chi = 36.8, p < 4.87 \times 10^{-8}$). Sex was insignificant as a predictor of whether or not the individual will provoke a response from the gorilla ($\chi = 1.7, p < 0.19$).

(3) H₃: Larger groups of people will create a space for increased chances of disruption. Predictions: If like-minded individuals are in a large group together they may be more likely to participate in actions that may be seen as negative by others.

Unsupported: Gorillas paid more attention to the lower density levels of visitors than when visitors occupied the entirety of the viewing space.

H₀: Visitor behavior will not affect the rates or severity of any specific behaviors of the individual gorillas.

Partially supported: There was evidence of behaviors directed toward the public, but the majority of agonistic behaviors were either directed at other gorillas, the researcher, or the care staff. Visitors were mostly ignored by the males.

Results in context

Previous studies that observed visitor effects on captive gorillas did not record visitor demographics (Stoinski: 2011, 2014, Kuhar: 2008), instead they focused on rates of aggregate aggression (Kuhar: 2008), general densities of people (Keane and Marples: 2003), and gorilla behavioral differences (Stoinski: 2014). By observing what sorts of people are creating disturbances or what categories of people draw the attention of the gorillas more often, we can improve educational efforts to focus in on those groups and create habitat interventions to mitigate their effects. Due to the fact that larger people garner more reactions from gorillas, perhaps future habitats should be built in a way that uses perspective to make

all of the visitors appear smaller. Zoos should also make more of an effort to educate adults when creating their programs; if only children are being actively educated then adults may not be listening to conservation messages. This lack could be adding to the frequency of negative behaviors exhibited by adults and their rates of disrupting the gorillas.

Habituation

When people made animal or ‘monkey’ noises at the gorillas, often it seemed most similar to a chimpanzee pant hoot (Nishida *et al.*: 1999). Throughout my study, as well as my time working in zoo environments, no one (visitors or care staff) has been able to mimic anything like a gorilla vocalization. It is possible that when people are making animal noises at the gorillas it would be ignored simply because whatever would be being ‘said’ would not be in a language relevant to the gorillas. On a handful of occasions, the chimpanzees who are housed near the gorillas would all begin to vocalize; this usually happened around the time when they were first allowed into their outside yard or during afternoon enrichment. If there were to be any sort of reaction to environmental noises by the gorillas, it made sense that it would be to the captive apes who have holding areas across from theirs, the chimpanzees. However, there was no reaction.

The gorillas, having few active behaviors that seemed to be triggered by the visitors’ disruptions, appear to be mostly habituated to the captive environment. There were very few instances of decibel level effecting in behaviors; however there was a relationship between densities and activity budget ($F = 8.34, p < 0.0001$) that did count for a majority of variance in gorilla behavior ($R^2 = 0.29$). Generally, the gorillas would remain at locations in the habitat that were as far away from people as possible, but these favored spaces also may have been some sort of power and/or comfort to them as well. In the case of Jon, his usual position

at the Kong doors comes with a large overhead fan to help beat the humid, hot summers in St. Louis. It is possible that these locations, being far from the visitor space, could be an already established avoidance behavior that is practiced on a daily level that prevents disruptive behaviors from causing discomfort for the gorillas on a more proximal level. This idea does not, however, account for the times in which Nadaya, BaKari, or Joe would sit by the glass of the viewing space.

Unusual auditory stimuli

On June 9, 2014, there was a fire at a snack stand at the St. Louis Zoo near the South Entrance of the zoo¹⁶. Data collection was occurring during this time. The sounds of sirens were clearly audible from the gorilla habitat to both humans and, presumably, gorillas. All of the males kept looking off toward the south as if trying to see what was making the sound. With the zooline railroad being so close to their habitat, train whistles do not usually draw their attention, and no specific visitor behavior consistently caught their attention, but this high pitched wailing did. None of their other behaviors changed. There were no increased rates of agonism or affiliation following this stimulus. This rare instance supports the idea that the bachelor group is at least mostly habituated toward things occurring in the visitor space. Constant noise and disruption while in their habitat is normal for the gorillas.

Staff (and Researchers) vs Visitors

The data show that there is a clear difference in the way that the gorillas react to care staff and researchers and how they react to visitors. Rates of redirected behaviors toward the more familiar humans were higher compared to visitors who were mostly ignored. As mentioned when discussing Joe's interactions with me, it is possible that humans who more

¹⁶ <http://fox2now.com/2014/06/09/fire-at-the-st-louis-zoo/>

frequently exist in or near gorilla designated spaces could be seen as being members or pseudo-members of the gorilla social group or even as neighboring apes (which is technically true). Agonism is a way of asserting dominance and social roles between individuals, which could be true if the males were seeing staff and researchers as true conspecifics. Arguably, the gorillas would not participate in agonistic displays at staff and researchers unless there was something to gain from it (i.e. dominance or warding off a threat). Considering that the individuals who interact with the gorillas on a regular basis are likely established as being non-threatening, it is likely that these displays are a way of managing the social relationships between the gorillas and humans.

Education and Entertainment

In order to create a public space that reduces the amount of intentional disruptions, theoretically, educating the patrons about respectful behavior and animal ecology would be the ideal method of intervention. Consistently observable behaviors are usually associated with entertainment motivations (i.e. gesturing, yelling). As mentioned in Chapter 4, it is possible that simple, unassuming observation is related to educational attainment goals while visiting the zoo but was unaccounted for during this particular study. According to Falk (2000), museums should focus on engaging the public in general and allow individuals to take away whatever messages they would like instead of actively attempting to teach or entertain them. In other words, the institution cannot force people who want to be entertained to learn and cannot make those who wish to learn only engage for entertainment purposes. This is a problematic view when the museum in question is a zoo. Instead of poking fun at an exhibit in a museum of natural history, visitors are engaging with living animals. Allowing visitors to take away their own message from zoo visits could be potentially harmful to

conservation efforts (things that museums are not required to engage with in their education initiatives). Nonetheless, motivations cannot be forced on the public. It then becomes the responsibility of zoos to manage successful completion of patron's motivational goals while also creating an environment that is safe and as undisturbed as possible for the animals on display.

As a way to manage this interaction between education and visitor motivation, Packer and Ballentyne (2010) tried to understand learning outcomes from visitors at zoos and aquariums. They found that visitors were more interested in social aspects of their time at the institution than learning; however, visitors to museums or art galleries showed the opposite motivations. Part of this study examined how much information that was learned after trips to wildlife institutions was retained in 1000 individuals after four months: 39% were able to remember new knowledge they had retained as a result of experience, 5% said they had questioned or changed their values and attitudes, and 7% took some new actions to support the environment. Zoos hold a unique and critical place in teaching conservation to the public and as such have a responsibility to do so (Patrick et. al: 2007).

Educational messages that have the greatest lasting impact, according to visitors, are ones with an emotional impact. These stories or methods allow for patrons to internalize the messages of conservation and environmental changes, which then leads to a higher rate of success in education (Packer and Ballentyne: 2010). Educational programs that are set up by zoos have a tendency to target young children (i.e. below middle school ages) (Carr and Cohen: 2011). The St. Louis Zoo, however has a large network of education programs for all ages. Specifically, they have resources and camps for children as young as preschool, which transition into teen volunteer opportunities, and easily available teaching materials for

educators. Adults are still not the target of these programs, but they are more comprehensive than suggested by Carr and Cohen (2011). By creating and reinforcing conservation and behavioral ecology messages before patrons reach the public spaces: zoos, the habitats, and animals on exhibit are reinforcing the messages that were already taught. People who are already interested in the environment and conservation and also have a motivation to learn are the ones who are most likely to gain anything from the experience at the zoos (Packer and Ballentyne: 2010). According to Patrick et. al. (2007), people need to understand basic concepts of behavioral ecology and biology (i.e. behaviors, habitats, interactions) before they can understand changes in populations in recent history as well as the reasons for the changes

The message of conservation is listed as being important to zoos in a number of their mission statements (Patrick et. al.: 2007); however it is not usually the main thing on the mind of the visitors during their visits (Packer and Ballentyne: 2010). This brings into view the conflict that zoos must manage: they are required to meet the needs of the visitors who keep the zoo running with donations and purchases while also keeping a focus on animal welfare and conservation messages (Carter and Cohen: 2011). It is important for zoo administrators to remember this formal focus on education and conservation when creating programs and materials for the public (Patrick et. al.: 2007). However, according to Carr and Cohen (2011), the idea that conservation is the main role of contemporary zoos is one that is supported by a number of academics as well as the World Association of Zoos and Aquariums (WAZA). They argue that the difference in ways that zoos have been marketing themselves (i.e. places of education and conservation rather than entertainment and exploitation) is more of a cultural shift in order to make patrons feel more justified in coming to see the exotic animals on display. They can then feel that their attendance is helping rather

than hurting the animals. This segment of visitors does not automatically fit into having motivations of education or conservation, but rather they seek entertainment without the feeling of guilt that comes from openly exploiting animals (i.e. Phil the gorilla).

Patrick et. al. (2007) examined 136 mission statements from zoos in the United States that were accredited by the American Zoo and Aquarium Association (AZA). They found that education and conservation were the main themes of these statements. These statements are declarations of purpose that are used to guide decisions made by the institution, focusing their resources and goals. It also is intended to guide administrators and planning along with communication between all sections of the institution. Twenty-two mission statements used only the word 'education', while 118 specifically mentioned 'conservation'. Twenty-eight used the word 'conservation' without defining what that meant. Something lacking from mission statements is how the zoos will implement the goals of conservation education. Patrick et. al (2007) suggest that zoos focus on basic understandings of conservation in order to best serve the public as well as reach their own goals of education and conservation.

One way that zoos can try to address these challenges is in the way that they market themselves to the public. Carr and Cohen (2011), analyzed websites of 54 zoos and found that the dominant imagery showed zoos as being places of entertainment. They avoid the word "entertainment" itself, but instead refer to what "fun" is going on at the zoo or what "attractions" are currently available. Despite the fact that zoos are attempting to legitimize themselves as places of education and conservation, they are putting out a dominant message of entertainment to the public. Zoos also seem to target young families with children with their birthday party options and play areas; this group has traditionally been the dominant

visitors and is supported by my data in Chapter 4 with the large number of adults and youth who participated in behaviors of note.

For a species like western lowland gorillas who spend large amounts of their time (67%) participating in food related activities in the wild, there are few instances of behaviors that could be seen by the public as being entertaining (Robbins: 2011). Furthermore, in this study, Jon spent 98% of his time away from the other males. One fifth of the gorillas on display was virtually inactive throughout the entire time data were collected. If someone were visiting for a fun day or entertainment, then it is unsurprising that they might feel some desire to prompt desired diverting behaviors through means of their own.

It is worth pointing out that what counts as being entertaining is arguably dependent on individuals as well as time. In the past, people enjoyed watching Phil drink beer and smoke cigarettes (“Putting”: 2014). In the present, individuals are looking for the gorillas to exhibit some sort of behavior that would be exciting to them. As time progresses and more animals are driven to extinction in the wild just the act of seeing the sedentary gorillas may be entertaining enough for people. According to the IUCN, western lowland gorillas are listed as being critically endangered (Walsh: 2008), which means that they are facing an extremely high risk of becoming extinct in the wild.

Benefits of Habituation

The conflict between education and entertainment ultimately creates a disruptive public space around the animal habitats. This is unsurprising, if a cause for frustration for care staff, researchers, and individuals who are motivated by education. When first tabulating my results, the fact that gorillas were ultimately undisturbed by noise levels and only rarely drawn by disruptive behaviors (i.e. knocking and yelling), I thought negatively about the

possibility that habituation to the loud and inconsiderate environment was normal for the males. After looking in to the problematic set of explanations set forth by the zoos espousing conservation and education while at the same time marketing themselves as family fun parks, it might be the case that this level of habituation is beneficial to the gorillas. If the troublesome behaviors of the public are normal, then there are fewer things that could cause abnormal or harmful behaviors in the gorillas in this study. Other possible causes of these potentially negative behaviors could, ideally, be managed through steps taken by zoo staff. It is known that various primates, including bonobos and chimpanzees can develop stereotypic, self-harming behaviors while in captivity (Burkett and Newton-Fisher: 2011), while gorillas often engage in regurgitation and reingestion (Lukas: 1999).

Burkett and Newton-Fisher (2011), surveyed 40 chimpanzees from six different zoos in the United States of America and the United Kingdom, and they found that all chimpanzees in six different troupes presented abnormal behaviors that were independent of the possible effects of their different living situations. A full list of abnormal behaviors in their article includes actions such as slamming one's self into a wall, rocking, and hair plucking. These actions are analogous to acts of humans who are under mental stress. There were variations in the number of behaviors that could be linked to different demographic information such as number of years old or housing size; none of the actions were gendered or age specific. (Birkett and Newton-Fisher, 2011) Such abnormal behaviors are a detriment to the captive populations. According to the researchers, these behaviors may be symptoms of compromised mental health or signs of mental illness. None of the hours of wild chimpanzee observational data presented any abnormal behaviors (Birkett and Newton-Fisher, 2011). Gorilla social structure is different from that of chimpanzees, and the males at

the St. Louis Zoo appear to be even less social or engaged with one another and the public than other study groups of gorillas (Robbins: 2011). A behavior that is classified by some researchers as being abnormal (Hosey: 1987, Wood: 1998, Birkett and Newton Fisher: 2011) is watching, which occurred in this study. I would argue that apes within captive exhibits would occasionally watch visitors in the public space, however, extended bouts of watching (i.e. fixating on patrons instead of eating or resting) would be abnormal. Hosey (1987) found that higher rates of zoo patrons corresponded with more behaviors directed at the public. If habituation can limit the possible negative behaviors caused by stress, then perhaps it is a benefit as opposed to a detriment.

Possible Considerations and Solutions

Auditory Habituation

Perhaps instead of minimizing the presence of visitors, habit design should make use of habituation. Studies show that increasing the amount of noise within gorilla habitats it decreases the negative effects of visitors (Ogden et al.: 1994). If naturalistic sounds or white noise in general can maximize naturalistic or undisturbed gorilla behavior then it should be more widely utilized. By making sound and some amount of disruption part of the habituation process gorillas would be less phased by visitor behaviors; this could minimize some of the aforementioned abnormal behaviors.

Individual Differences

New studies have begun to analyze gorilla personalities and how they affect individual behavioral differences (Stoinski: 2012, Schaefer and Steklis: 2014). These analyses show that different personality types react to visitor effects differently. If more zoos could quantify the personality differences they already see anecdotally in their gorillas, then

maybe they could receive support from institutions to create individualized interventions for each gorilla's coping preferences.

In this study group, Joe was the most openly responsive to human disruptions; he was also the individual who was shouted for the most (despite the occasions of misidentification, his name was the one being called). Jon rarely responded to human stimuli despite having similar rearing conditions, being in the same age range, and having spent the same amount of time at the St. Louis Zoo. Individual differences are what explain the differences in behaviors. There is a mesh around the top of the enclosure that was put up once it was discovered that Joe had a tendency to throw things at people who were being disruptive. This is a back end way of dealing with these behavioral tendencies. If it is known that Joe will be the most disrupted and that he is likely to react it would be better to somehow intervene before a reaction (i.e. throwing dirt) occurs, however, there is no clear way to prevent Joe from being in a position to be yelled at by visitors aside from taking him off exhibit. Increasing the amount of enrichment given to the gorillas on days where visitor attendance is historically high (i.e. times when school is not in session) could be a way to distract the gorillas and buffer against visitor disruptions.

Habitat Restructuring

Ultimately, bachelor groups are necessary aspect of the way captive gorillas are kept in zoos, however, this normally transitional life stage needs to be properly and continuously managed. In many captive groups gorillas do not have the ability to fission from the main group as they would in the wild. More consistently there need to be spaces available for gorillas to escape to/from. In indoor housing, it is necessary to create roundabouts or escape areas in the event of a chase or other agonistic events.

In the case of the St. Louis Zoo, gorillas have partial access to their behind the scenes holding area when they are in their indoor exhibit. This is not the case in their outdoor exhibit. Considering the nearly constant avoidance behaviors with regard to visitors and occasionally other gorillas, it could be argued that having access two separate space away from others away from stressors would be beneficial for the health of gorillas. Understandably, there are resource limitations to this set up, however something could be done to create some solution that is more reasonable than building a second outdoor enclosure. They could alternate which gorillas are in the outdoor exhibit every other day or depending on which individuals are willing to go out into the yard.

Limitations

Decibel Levels

Ultimately, I believe that measuring decibels in the visitor space did nothing for better understanding gorilla behavior and disruptions. My data did reveal that decibel levels are not necessarily directly affected by the number of people around an enclosure. A single loud individual can be just as disruptive as a number of visitors speaking in a dull roar. Considering the fact that the gorillas are below visitor eye level and they are in a completely open air habitat, it would make sense that the visitor space would have no real effect on the gorilla's environment in terms of noise levels. Nothing is funneling the noise from patrons into a place where the gorillas must hear it; instead, the sounds are being dissipated into the air. In order to achieve a better understanding of how the decibel levels are translating into the ape space, it would be ideal to put some sort of meter within the actual habitat to measure. However, due to the strength and curiosity of gorillas, this would be a complicated,

but not impossible, task for future research to accomplish. This would allow for an accurate reading of how the gorilla's space is being affected by visitor noise.

Outdoor Exhibit vs Indoor Exhibit

Considering the differences between an enclosed and open habitat, I think that the results of this study would be notably different if it were conducted in the Jungle of the Apes (the indoor habitat for the gorillas). Anecdotally, during the times where the gorillas were inside there were more instances of behaviors directed toward the public. In a number of cases, I had to tell patrons to leave the area and lock up the ape house in order for the gorillas to shift back into their holding area. The area is conducive to echoes making it much louder than the outside visitor space. The amount of noise could possibly be creating a larger amount of disruption for the gorillas and causing them to increase their rates of agonism toward the visitors. Arguably, gorillas were unwilling to shift back into their holding area because there was an active disruption going on outside of their indoor exhibit, an area that they have as a territory. Another possible problem with the design of this exhibit is that people and gorillas can be on eye level with one another more consistently than in the Fragile Forest. The outdoor Fragile Forest is somewhat depressed and that allows the gorillas to be placed below the public space in the locations where the two meet. This could be reducing the size and noise of the people on the other side of the barrier. Jungle of the Apes, however, is all one height at the public viewing space. People can effectively loom over a gorilla that is sitting at the glass. The visitors are allowed to be closer to the gorillas, perhaps increasing the frequency of their negative/attention seeking behaviors even more than those in the outdoor area, and certainly increasing the rates of disruption. If this study were replicated in the Jungle of the Apes, I predict that there would be higher rates of agonism between gorillas and

humans as well as between the gorillas themselves. I would also assume that the significant predictors of whether or not a person would cause a disruption of the gorillas would remain the same, if not become more significant.

Visitor Motivation

There is no proven way to assess people's motivations. In this study I used the framework from Martin (2002) and Falk (2000) where people who were surveyed responded with why they were at the museum that day. Due to my observational methods I did not ask any visitors what their motivations were, instead I observed their behaviors and assessed their motivations based on their actions. Arguably there is overlap in motivations. Someone could be at the zoo to spend time with friends and be entertained or educated by the exhibits. This complexity is unaccounted for in my data. That being said, I believe that this assessment is useful to zoo institutions because there were no published studies readily available that attempted to understand who was disrupting the animals and why. If these motivational categories hold up for a portion of visitors it could be vital in designing conservation education materials.

Note¹⁷

¹⁷ Since the completion of this study, Juma, the silverback died due to complications from a preexisting heart condition. I am unaware of how the dominance hierarchy has shifted since September 2015 and the loss of Juma. Some sort of competition for the dominant spot likely occurred between Jon and Joe, but the results of such a situation would not have been clear at the time of data collection

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APPENDIX A

BEHAVIORAL CATALOG: GORILLAS

Adapted from Lukas, K. E., Hoff, M. P., & Maple, T. L. (2003). "Gorilla behavior in response to systematic alternation between zoo enclosures." *Applied Animal Behaviour Science*, 81(4), 367-386.

Behavior	Definition
Posture	
Rest	Laying down; contact with horizontal substrate or at rest on buttocks or on feet with knees bent in crouched position
Stand	A quadrupedal, tripedal, or bipedal stance with two to four extremities in contact with substrate
Locomote	Forward quadrupedal, tripedal, or bipedal movement; must move at least one body length
Individual behaviors	
Forage	Includes searching for or processing food items; consumption of food or water; and chewing what is known to be a food item (excluding regurgitated matter)
Examine	Carrying, holding, intently looking at (within arm's reach), or actively manipulating (with hands or mouth) a free standing item, environmental element, or substrate (does not include feeding)
Solitary play	Frivolous, exaggerated movements or actions exhibited primarily by infants, juveniles, or young adults such as rolling, twirling, clapping, arm flapping, etc. does not include efforts to solicit social play when not reciprocated by potential partner (score as social play)
Self-directed behavior	Scratching, autogrooming, anogenital examination, or otherwise manipulating own body (pinching, licking, picking at hair, etc.); does not include stereotypical behavior, e.g., overgrooming, stereotypical pinching
Abnormal behavior	Coprophagy (consuming feces), regurgitation/reingestion (rumination of food items followed by reconsumption of regurgitated matter), self-clasping (wrapping arms across chest, may include rocking), etc.
Re-directed behavior (Interspecies)	Hitting glass in visitor space, or any other overt behaviors directed toward the public
Re-directed behavior (Intraspecies)	Focusing agonsim at other gorilla directly after being disrupted by a higher ranking male or the public.

Inactive Resting, may be actively or passively attending to environmental elements; sleeping

Social proximity

Contact Physically touching nearest neighbor

Proximate Within 1 m of nearest neighbor

Distant Within 5 m of nearest neighbor

Social interactions

Approach Decreases social distance by moving from 5m separation to 1m of separation or closer

Leave Increases social distance by moving away greater than 1m

Affiliative category (Friendly or non-threatening interaction with another gorilla including social play)

Groom picking through hair or skin of another gorilla to remove dirt or parasites potentially; also serves as a social bonding mechanism

Play other non-aggressive interactions between two or more gorillas, including wrestling, chasing, etc.; may be accompanied by laughter or play-face

Agonistic category (Contact or non-contact aggressive interaction with another gorilla)

Displaying Behaviors such as tight-lip, quadrupedal stance, banging on objects, chest beat, lunging. These may be directed at other gorillas or at humans

Chasing An animal runs in fast locomotor pursuit of another running individual (excluding a play situation) with no contact.

Hitting An animal hits another individual with an appendage and an apparent intent to inflict injury (i.e. no restraint).

Biting An animal bites another individual with apparent intent to inflict injury (i.e. no restraint).

APPENDIX B

BEHAVIORAL CATALOG: VISITOR BEHAVIORS

Behavior	Definition
Positive	
Reading	When a visitor spends time at any of the educational materials posted around the gorilla habitat's public space
Inquiry	When a visitor asks questions directly to a researcher or care staff
Talking	Speaking or conversation at a reasonable level (below 60 decibels) that is educational in nature
Crouching	Assuming a proper body position to view gorillas as detailed on multiple educational signs around the visitor space
Negative	
Knocking	Contacting one's hand with glass or railing surrounding the habitat in a way that creates a potentially disruptive sound
Animal Noise	Modulating one's voice in order to mimic non-human vocalizations.
Yelling	A raised verbal vocalization that lasts for any amount of time and is directed at gorillas. (Generally over 65 decibels).
Reaching into Enclosure	Putting any object or part of a body over railing or mesh in order to extend object in question over the gorilla's habitat.
Whistle	A high- pitched sound made by forced breath through one's lips.
Climbing	Scaling any part of the walls or rails around the gorilla enclosure
Gesturing	Disruptive motioning: e.g. waving and pointing.
Beat Chest	Making one's hands come into contact with the chest to produce a sound while mimicking the display behavior of gorillas.
Talking	Speaking or conversation at an unreasonable level (above 60 decibels) that has a negative or aggressive connotation concerning the gorillas.
Innocuous	
Scream	A single non-verbal yell that lasts for any amount of time and is not directed at any particular stimulus
Running	An individual locomoting quickly in the visitor space

Child on Shoulders	Anytime an adult was carrying a child above the level of their back
Flash Photography	Pictures directed at the gorillas where a bright flash accompanied the picture
Talking	Speaking or conversation at a reasonable level (below 60 decibels) that is not aggressive or directed toward the gorillas
Wheelchair or Stroller	The use of a wheelchair or stroller while in the public space

APPENDIX C

VISITOR CLASSIFICATIONS

Classification	Definition
Size	
Small	Individuals who appeared to fit into a standard unisex small t-shirt
Medium	Individuals who appeared to fit into a standard unisex medium t-shirt
Large	Individuals who appeared to fit into a standard unisex large t-shirt
Extra Large	Individuals who appeared to fit into a standard unisex extra large t-shirt
Age	
Young	Children from infancy to prepubescence
Teenager	Adolescents
Adult	Fully matured individuals
Older	Individuals who looked like stereotypical grandparents
Gender	
Male	Individuals who appeared, by western standards, to be masculine
Female	Individuals who appeared, by western standards, to be feminine
Race	
White	Individuals with low levels of melanin; would fit classification of Caucasian
Non-White	Individuals with higher levels of melanin; would fit classification of anything other than Caucasian