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Chimpanzee (*Pan troglodytes*) Responses to Visitors using Chimpanzee-Friendly Behaviors

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CHIMPANZEE (*PAN TROGLODYTES*) RESPONSES TO VISITORS USING CHIMPANZEE-FRIENDLY BEHAVIORS

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ABSTRACT

CHIMPANZEE (*PAN TROGLODYTES*) RESPONSES TO VISITORS USING CHIMPANZEE-FRIENDLY BEHAVIORS

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Many studies suggest that zoo visitors are a cause of stress among animals; among primates, visitor presence can lead to an increase in aggressive displays, time spent non-visible to the public, and a decrease in overall activity. This study tested the effectiveness of using species-specific behaviors among a group of captive chimpanzees. There were 2 conditions: a control, and an experimental condition in which visitors were asked to adopt a stooped posture or lean on the railing, and show a chimpanzee play face. The visitors stooped their posture, sat, and leaned on the railing significantly more in the experimental condition than the control condition. By manipulating visitors' behaviors to appear friendlier animal welfare can be improved.

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CHAPTER I

INTRODUCTION

The relationship between humans and nonhuman animals is a complex one that can have profound consequences on a nonhuman animal's life depending on how the animals perceive such interactions (Hosey 2008). The human-animal relationship has implications in numerous settings including farm living, laboratories, and especially zoos (Hosey 2008). Animals living in a zoo have 2 very different human-animal relationships: one with their caregivers, which has time to develop, and one with the strangers who visit daily.

The relationship between animals and visitors is one that impacts both parties. The effect that animals have on visitors is dependent on many variables, such as exhibit design, animal activity, and education available (Fernandez et al. 2009). After administering surveys regarding perceptions of zoos to both the general public and zoo visitors, Reade and Waran (1996) found that while most visitors still visit a zoo for entertainment purposes, many people are beginning to recognize the importance of conservation and education in zoos, too. Zoos must face the task of not only finding ways to attract visitors but also leaving them with a positive experience so they return, both of which generate more revenue for conservation and research goals (Fernandez et al. 2009). Unfortunately, keeping visitors happy and entertained can often come at the cost of increasing stressful behaviors, such as pacing and aggressive displays, among the animals.

Hosey (2000) suggested that zoo visitors can have 3 different impacts on zoo animals: stress, enrichment, or no effect at all. Yet few studies suggest visitors have no effect or an enriching effect on zoo animals. Nimon and Dalziel (1992) studied the behaviors of a long-billed corella, named Claude, when visitors were present and when visitors were absent. When visitors were absent, Claude spent 55.9% of his time in the front (interactive area) of the enclosure; when visitors were present he spent 93.8% of his time in the front of the enclosure. Claude only displayed certain behaviors when visitors were present, such as moving towards humans, bob/dancing, and face-to-beak (direct face-to-beak contact with humans). The results of the study suggest that Claude was attracted to humans, choosing to be more active when visitors were present.

Vrancken, Van Elsacker and Verheyen (1990) examined the effect of visitors on spatial distribution in a group of eastern lowland gorillas at a Belgian zoo. The presence of visitors did not have an effect on the distribution of the gorillas in the enclosure, except for 1 female adult who stayed near the window more often when visitors were present.

Most of the studies of the zoo visitor-animal relationship have found that visitors create a stressful environment. Although much of this research has focused on primates, there are a select number of studies on non-primates in zoos. Sellinger and Ha (2005) studied Jesse and her son Gordo, a pair of jaguars at the Woodland Park Zoo in Seattle, WA. The authors recorded the jaguars' behaviors and the time they occurred along with visitor density and noise level. Jesse's pacing behaviors significantly increased during periods of lower noise levels among the visitors, indicating higher levels of stress. Gordo

and Jesse also spent significantly more time non-visible to the public when noise levels and visitor density were low and both jaguars were affected by their inability to leave their enclosure during the day. Jesse spent significantly more time pacing as the time to go into the back room approached while Gordo's time spent non-visible increased when he was given the option to go inside. Carlstead and Brown (2005) studied 26 black rhino and 19 white rhino from several different zoos. The percentage of each enclosure's perimeter that was exposed to the public was measured and weekly fecal samples were collected in order to test corticoid levels (a measure of chronic stress). Individual differences in mean corticoid concentrations were strongly influenced by each rhino's exposure to zoo visitors. Higher corticoid levels among the rhinos were associated with fighting, stereotypic pacing, the absence of ovarian cycles, and higher mortality rates.

Hosey and Druck (1987) published one of the first studies showing that visitors induce stress in primates. The authors carried out their research at the Chester Zoo in the United Kingdom, using 12 species of primates (monkeys and lemurs). Hosey and Druck examined 2 specific characteristics of the visitors: group size and group activity. Among the captive primates, they recorded the frequency of behaviors directed towards the visitors, the frequency of behaviors directed towards other group members, locomotion, and spatial dispersion within the enclosures. Overall, the primates directed significantly more behaviors at large active groups than small active groups, with no difference between large passive groups and small passive groups. Locomotion among the animals significantly increased from no visitors present to small active and large active groups. The primates also spent significantly more time in the back areas of the cage except when

large groups were present; this suggests that they directed more behaviors towards large, active groups as compared with any other groups.

Chamove, Hosey, and Schaetzel (1988) undertook a complex, four-part study examining visitor effects in 15 primate species. During the first study, the authors observed cotton-top tamarins, Diana monkeys, and ring-tailed lemurs. They recorded behaviors of each primate group when visitors were present and absent. When visitors were present, aggressive behaviors significantly increased, while grooming and affiliative behaviors significantly decreased. In a second study, the authors instructed the visitors to crouch, showing only their heads. There was more grooming and less activity and agonistic behaviors when visitors were crouching. In a third study, Chamove et al. recorded visitor effects in twelve more primate species, both lemurs and monkeys, to determine how visitor effects might differ between species. There was a strong, negative correlation between the level of activity when an audience was present and mean body weight of the primates. There was also a strong, negative correlation between behaviors directed towards the visitors and group size among the primates.

Mitchell et al. (1992) examined the relationship of visitor presence and location and aggressive displays in golden-bellied mangabeys at the Sacramento Zoo. The mangabey groups were moved from their original enclosures along the main path to enclosures along a secluded area, and vice versa. In the more secluded area, the mangabeys showed a significant decrease in aggressive displays toward visitors and enclosure mates. Along the main path, their aggressive displays significantly increased.

Mitchell et al. (1992) also examined whether specific human characteristics prompted aggressive displays from the mangabeys. Male visitors made threats towards male mangabeys significantly more than female mangabeys, though female visitors threatened male and female mangabeys equally. Adult male mangabeys threatened visitors significantly more than the adult female mangabeys, targeting their displays mostly at male visitors. Female mangabeys threatened female visitors twice as often as male visitors. Results from this study suggest that males threaten males and females threaten females, regardless of species.

Mallapur, Sinha, amd Waran (2005) examined lion-tailed macaques at 7 zoos in India while visitors were present and absent, and at an eighth zoo while on-exhibit and off-exhibit. When visitors were present, the macaques exhibited significantly higher levels of begging, self-biting, bouncing, and abnormal behavior. When visitors were absent they demonstrated significantly higher levels of social behaviors and were visible for a greater amount of time. When on-exhibit there were more abnormal behaviors, aggressive behaviors, yawning, and stereotypic pacing than when off-exhibit.

The behavior of apes when visitors are present makes up the biggest collection of such studies for any taxonomic group (Hosey, 2008). Kuhar (2008) conducted a study at Disney's Animal Kingdom Theme Park during the holiday season when visitor numbers can vary greatly each day. The subjects were 2 groups of western lowland gorillas: a bachelor group of 4 adult males and a family group consisting of 1 adult male, 2 adult females, and 3 juveniles. Data collection occurred over 2 months. Crowd size was based on turnstile counts of visitors exiting the trail where the gorillas' exhibits can be viewed.

Kuhar compared data from the 10 days with the smallest crowds to the 10 days with the largest crowds. The bachelor group was more likely to engage in abnormal behaviors and in the 'active other' category than behaviors in the affiliative or aggressive categories. Members of the family group were scored more frequently in the 'animal not visible' category than all other categories. Overall there were few behavioral differences between the 2 crowd size conditions, though both groups were scored in the 'animal not visible' category more often (suggesting that the gorillas avoided the crowds.) The differences in behavior displayed by the gorillas in Kuhar's study showed there are individual differences within a species.

Carder and Semple (2008) examined the association between visitor numbers and the anxiety behavior of self-scratching in gorillas at Port Lympne and Chessington, 2 zoos in the United Kingdom. At Point Lympne, during periods of no feeding enrichment, there was a positive association between the average number of visitors to the enclosure and the duration of self-scratching. There were no associations during feeding enrichment for either group of gorillas. Carder and Semple again demonstrated that individual groups might vary in how their behavior, in this case the anxiety behavior of self-scratching, is impacted by visitors, suggesting a need for more research.

Cook and Hosey (1995) conducted a study examining interactions between chimpanzees and visitors in a zoo setting. They recorded who initiates interactions (humans or chimpanzees) and if chimpanzees prefer a certain type of human to interact with. Chimpanzees were most likely to respond to men who were carrying objects and least likely to respond to women who were not carrying anything. Of 130 attempted

interactions initiated by the chimpanzees, 79 were initiated by females and 51 by males. Perhaps most importantly, while chimpanzee responses to humans were random with the exception of men carrying objects, human responses were significantly associated with the chimpanzees' behaviors; the humans would often imitate the chimpanzees.

Wood (1998) compared the effects of visitors and the type of chimpanzee enrichment on the chimpanzees. There were 4 experimental conditions: large crowds/new enrichment, large crowds/old enrichment, low crowds/new enrichment, and low crowds/old enrichment. Chimpanzees were significantly less likely to groom, forage, play, and use objects when large crowds were present. Paradoxically, when the chimpanzees did engage in such behaviors, it tended to draw the attention of more visitors therefore creating larger crowds.

Given the accumulating research showing the negative effects of visitors on zoo animals, the research focus should shift from determining if there is a problem to finding a way to actually fix the problem. One potential way to reduce visitor impact is by creating a greater distance between animal and visitor, or using some sort of visual screening without obscuring the visitors' views. Blaney and Wells (2004) tested the use of camouflage netting to reduce a visitor effect among 6 western lowland gorillas at the Belfast Zoological Gardens in the United Kingdom. The gorillas were observed for 1 month prior to the netting installation to create a control condition and again for 1 month when the netting was in place. The netting covered the entire viewing area. When the netting was in place, the gorillas displayed significantly less aggressive behaviors than during the control condition and also showed significantly less abnormal behaviors (i.e.,

body rocking, spinning or teeth clenching). In a survey, visitors indicated the gorillas were more exciting and less aggressive when the netting was in place.

Another potential way of reducing visitor effects on the animals is by increasing the education available to visitors. Kratochvil and Schwammer (1997) studied the effectiveness of sign usage at an aquarium in hopes of reducing knocking behavior on aquarium windows. Before the study began, the average knocking rate was almost 2 knocks per 100 visitors; the number of total knocks could reach several hundred on high-attendance days. The authors used 3 signs: Sign 1 stated the harm of knocking, placing responsibility on the visitor ("Knocking kills fish"), Sign 2 was directed at the visitors' pride ("Only loonies would knock"), and Sign 3 simply asked politely ("Please do not knock on the glass"). Sign 2 was most effective at reducing knocking while Sign 3 was the least effective. However, even usage of Sign 3 still reduced the knocking rates from 2 knocks per 100 visitors to 1 knock per 200 visitors.

Sanz and Jensvold (1997) studied the effectiveness of educating visitors on chimpanzee behaviors and facial expressions at the Chimpanzee and Human Communication Institute (CHCI) in Washington. There were 5 chimpanzees residing at CHCI; 4 had been cross-fostered by humans and one had been raised by fellow chimpanzees. In the educated condition, docents demonstrated and encouraged visitors to use chimpanzee behaviors and facial expressions. In the naïve condition, visitors were not shown chimpanzee behaviors. There was also a control condition in which no visitors were present. When visitors were encouraged to use chimpanzee behaviors, the chimpanzees overall responded with fewer territorial behaviors. There were also

individual differences among the chimpanzees when visitors were educated, naïve, or not present. One female chimpanzee demonstrated more affinitive social behaviors when visitors were educated (as opposed to naïve or absent) and another chimpanzee was more visible in the viewing area when visitors were absent. These results suggest that although each chimpanzee responded differently to visitors, the visitors had an impact nonetheless.

The objective of this study was to investigate visitor effects in a group of captive chimpanzees by combining the work done by Sanz and Jensvold (1997) and Kratochvil and Schwammer (1997). The bared-teeth display is often referred to as a "fear grimace" among nonhuman primates because it is associated with tense and fearful social situations (Preuschoft and van Hooff 1997). This facial expression in human primates is a smile, so often visitors unknowingly present a fear face. In contrast, a relaxed open mouth, or "play face" is highly correlated with play elements among nonhuman primates (Waller and Dunbar 2005). In this study in an experimental condition visitors were encouraged to cover their teeth thus displaying a chimpanzee play face. Among nonhuman apes bipedal standing and swaggering are postures displayed in threat (Jablonski and Chaplin 1992). When humans stand upright, they appear threatening. In this study, in the experimental condition, visitors were encouraged to sit or stoop, thus appearing smaller and non-threatening to the chimpanzees.

The investigators hypothesized that visitors would use more stooped postures and playfaces in the experimental condition and that the chimpanzees would spend more time engaged in affiliative, grooming, and play behaviors and less time engaged in aggressive behaviors in the experimental condition than in the control condition.

CHAPTER II

METHODS

Participants

Chimpanzee Participants

There were 5 chimpanzee participants in this study living together at the Oakland Zoo in Oakland, California. Each chimpanzee's biography appears in Table 1. The methodology was approved by the Institutional Animal Care and Use Committee at Central Washington University, the investigators' home institution.

Table 1 Chimpanzee Biographical Information

Chimpanzee	Sex	Birth Date	Birthplace	Move to Oakland Zoo
Moses	Male	April 18, 1993	YPRC	June 1997
Andi	Female	November 9, 1992	YPRC	June 1997
Caramia	Female	September 2, 1995	YPRC	February 1996
Abby	Female	April 14, 1983	Potawatomi Zoo	August 1987
Amy	Female	November 4, 1995	Oakland Zoo	

YPRC= Yerkes Primate Research Center

Human Participants

All visitors who approached the chimpanzee viewing area during data collection were participants. The methodology was approved by the Human Subjects Review Board at Central Washington University.

Facility

The chimpanzee exhibit is 278.7m3 with a perimeter of caging and glass. The chimpanzees also had access to portions of their night house during times when the zoo was open.

Data Collection

Conditions

There were 2 conditions in this study: experimental and control. In the experimental condition, the investigator (DB) was present at the viewing area of the chimpanzee enclosure. She encouraged visitors to use a play face, sit, stoop, or lean on the railing. A sign also was present, hung on a railing in front of the enclosure at waist-level of adults. The sign contained visual examples of the behaviors and explanations of which facial expressions and body postures are appropriate to use and why. Figure 1 shows an image of the sign, which was 4 x 3 ft. In the control condition, the environment around the chimpanzee enclosure was not altered. The experimenter was present but did not interact with guests or the chimpanzees.

Data Sessions

Conditions were presented 6 days a week between 10:30am and 2:30pm in May 2010. Each condition was presented 3 times per week on 2 weekdays and 1 weekend. The first day was randomly assigned and after that conditions alternated each day. Two video cameras mounted on tripods recorded behaviors. One was aimed at visitors and one at the chimpanzees. At the beginning of each data session the investigator set up the cameras and pressed the record button. She changed videotapes when needed.

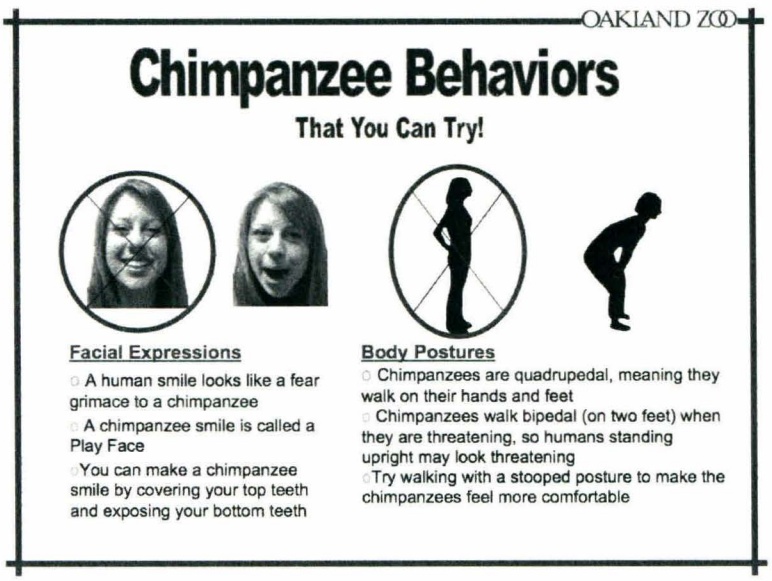

Figure 1 Sign present at the enclosure

Data Coding

Chimpanzee Behaviors

From the videotape, data coders independently recorded the begin and end times that visitors were present at the enclosure. The segments of videotape with visitors present were selected for subsequent coding. Next data coders recorded the behavioral contexts for the chimpanzees as they occurred on the videotape and the time that each context began. The chimpanzees were collectively coded as 1 individual because the quality of videotape did not allow for each chimpanzee to be identified separately. If chimpanzees simultaneously engaged in different behavioral contexts, both contexts were recorded and it was noted that the times overlapped. There were 9 behavioral contexts: Affinitive Social, Affinitive Social with Keepers, Aggressive, Bad Observation, Greeting, Grooming, Non-Interactive, Play, and Reassurance. The definitions of the contexts appear in Table 2.

Two coders independently coded the same 20% of the data to establish inter-observer reliability. Inter-observer agreement was 93% for context and 96% for start time.

Table 2 Context definitions

Context	Definition
Affinitive Social	Behaviors in this context included embraces, following another chimpanzee, holding hands, kisses, smell, or touch another chimpanzee. Includes solicite an object or contact from another chimpanzee. The chimpanzee could deliver or receive these behaviors. ASK- AS behaviors when interacting with keepers ASV- AS behaviors when interacting with visitors
Aggressive	Behaviors in this context included aggressive physical contact such as biting, charging, hitting an individual with an object or with a hand, kicking, poking, or punching. Threatening behaviors included bipedal or quadrupedal swagger, display, foot stamp, or flail objects. The chimpanzee could deliver or receive these behaviors.
Bad Observation	When a chimpanzee was partially visible chimpanzee's actions were unclear.
Greeting	An interaction between individuals who meet after a separation. Behaviors in this category include pant, bob, head nod, arm stretch, kiss, and wrist bend. The focal chimpanzee could deliver or receive these behaviors.
Grooming	The inspection or the manipulation of the skin or hair of another chimpanzee. Behaviors include part the hair or pick the skin with the free hand or lips. May also include inspect or reposition. The chimpanzee could either deliver or receive these behaviors.
Non-Interactive	Behaviors when a chimpanzee was not involved in an interaction. May include eat, lone play, rest, self-groom, stereotypic behaviors, or traveling.
Non-Visible	When a chimpanzee was not visible.
Play	Behaviors in this context are accompanied by a play face and may include chase, object play, play walk, poke, or wrestle. Movements are often exaggerated.

Visitor Behaviors

Coders used 1/0 sampling every 30s to code 4 behaviors among the visitors. These behaviors were stooped posture, play face, sitting, or leaning on the railing and are defined in Table 3. Two coders independently coded the same 20% of the data to establish inter-observer reliability with an agreement of 97.5%.

Table 3 Behavior definitions

Behavior	Definition
Stooped posture	Hunched at the shoulders and slightly bent at the waist.
Play face	Open mouth with covered top teeth and top lip and display bottom teeth.
Sitting	Visitors sit on the bench in front of the enclosure.
Leaning on the Railing	Visitors hunch at the shoulders and slightly bent at the waist with their hands or forearms resting on the top of the railing.

Analysis

Context Duration

There were 20h 47m of videotape data in the control condition and 25h and 36m of videotape data in the experimental condition. The difference in time between conditions was due to inclement weather affecting data collection. There were 17 data collection sessions; the average length of a data session was 3.2h. The contexts Affinitive Social, Greeting, Reassurance, and Play were combined into a larger context, Friendly, for the analyses due to a small number of seconds in each context.

Keepers periodically appeared at the exhibit throughout the day. Analysis of the videotape showed when keepers were present the chimpanzees always interacted with them. Since the keepers' presence was not controlled and affected the data, the time

coded as Affinitive Social with Keepers was removed from analysis. This resulted in 18 hours and 28 minutes in the control condition and 23 hours and 50 minutes in the experimental condition.

CHAPTER III

RESULTS

Chimpanzee Behaviors

Table 4 shows the number of seconds each chimpanzee spent in each behavioral context and in parenthesis is the percent of time the seconds occurred in that condition. A Mann-Whitney U test showed there was no significant difference in the number of seconds in the experimental condition versus the control condition, $z = -0.21$, $p > .05$.

Table 4 Number of seconds in each context and percent in parenthesis

Condition	AG	FR	GR	NIN	NV
Control	204 (0.38)	34 (0.06)	1,398 (2.6)	47,188 (89.2)	4079 (7.7)
Experimental	285 (0.39)	395 (0.55)	1,471 (2.0)	59,067 (82.7)	10210 (14.3)

AG, Aggressive; FR, Friendly; GR, Grooming; NIN, Non-Interactive; NV, Non-Visible

Visitor Behaviors

There were 2171 30s intervals in the control condition and 2909 30s intervals in the experimental condition. The total number of scans for each behavior in each context appears in Table 5; the percentage that each behavior occurred in the total scans for each condition is in parenthesis. A 2 x 1 Chi Square Goodness of Fit was used to compare the number of scans in each condition for each behavior. Pairwise comparisons showed the visitors leaned on the railing χ^2 $(1, n = 1996) = 83.56$, $p < .0001$, had a stooped posture χ^2 $(1, n = 360) = 1013.92$, $p < .0001$, and sat χ^2 $(1, n = 2{,}789) = 363.92$, $p < .0001$

significantly more often in the experimental condition than in the control condition. A play face never appeared in the control condition.

Table 5 Number of scans for each human behavior

Condition	Stooped Posture	Leaning on Railing	Sitting	Play Face
Control	47 (2.16)	752 (34.68)	973 (44.82)	0
Experimental	313 (10.75)	1244 (42.76)	1816 (62.42)	53 (1.8)

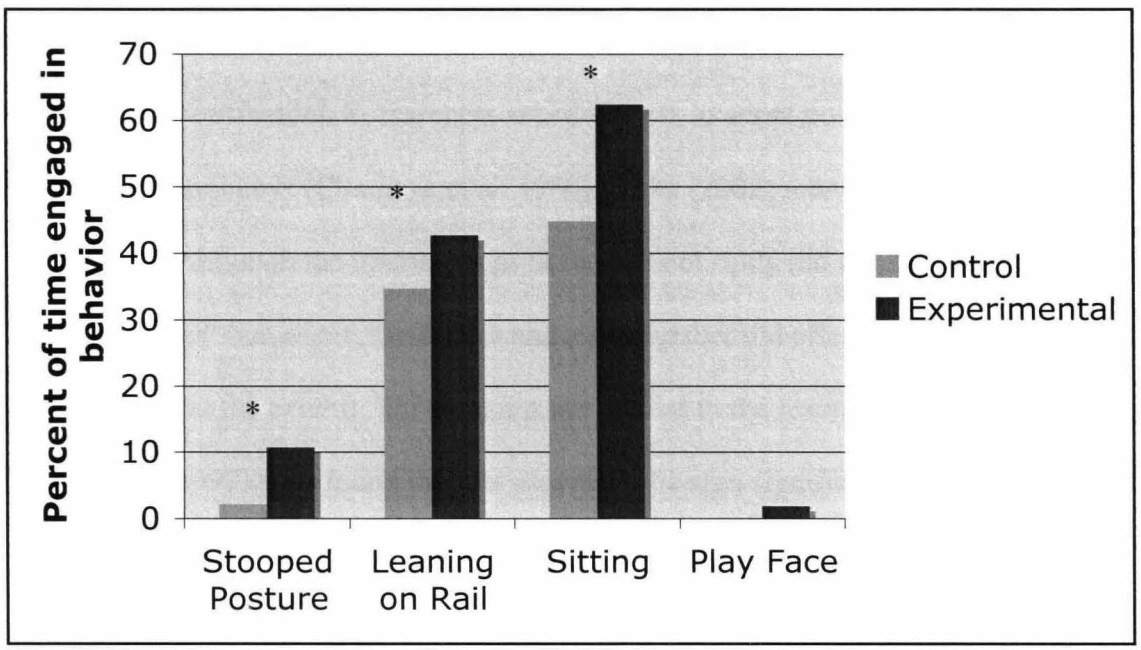

Figure 2 Percent of time visitors spent engaged in each behavior. *indicates significant differences at $p < .0001$. See the text for exact p values.

CHAPTER IV

DISCUSSION

Visitors sat, stooped, and leaned on the railing significantly more in the experimental condition than the control condition. Play faces occurred in the experimental condition 53 times versus never in the control.

The time the chimpanzees spent engaged in Aggressive, Friendly, Grooming, Non-Interactive, and Non-Visible did not significantly differ between the control condition and the experimental condition.

This study and others show interventions to encourage visitors to behave in certain ways are effective. Researchers asked visitors to adopt postures so visitors appear smaller to the monkeys (Chamove et al. 1988). Birke (2002) reduced noise levels from loud to quiet. Although the interventions in the present study did not significantly affect the chimpanzees' behaviors, the docent and sign together did effectively change visitors' postures when at the exhibit. These results are similar to the results of Kratochvil and Schwammer (1997) who found that the presence of a sign significantly reduced visitor knocking on an aquarium.

There are possible reasons why changing the visitors' behaviors did not significantly affect the chimpanzees' behaviors. The Oakland Zoo exhibit has places for the chimpanzees to escape the public. These include landscape barriers and escape routes, which Swaisgood and Shepherdson (2005) found, after a review and meta-analysis of literature regarding zoos and stereotypic behaviors, can improve social interactions and reduce stress. Thus, as in Kuhar (2008), the chimpanzees may have avoided the public.

The zoo also used environmental and social enrichment on a daily basis. The chimpanzees had access to blankets, toys, food puzzles, and interactions with their caregivers frequently. Enrichment can have many positive effects on captive animals including improved reproduction, increased activity, and reduced stereotypic behaviors (Carlstead and Brown 2005; Carlstead and Shepherdson 1994; Renner and Kelly 2006; Swaisgood and Shepherdson 2005). The aim of the present study was to increase play and affiliative behaviors, which are only present when there is an absence of stress (Loizos 1966; Merrick 1977). The access to privacy and enrichment at the zoo may have successfully reduced stress in this group, thus the manipulation couldn't further reduce stress by increasing play and affiliative behaviors.

Reducing and maintaining low levels of stress among captive chimpanzees can have many benefits. Among primates stress can lead to higher wounding rates (Lambeth, Bloomsmith and Alford 1997), lower frequencies of object using and foraging (Wood 1998), and an increase in aggression (Glatston, Geilvoet-Soeteman, Hora-Pecek and van Hooff 1984). Since animal welfare is one of the primary goals of zoos (AZA 2009; Reade and Waran 1996) decreasing stress among zoo animals is especially important.

The relationship between nonhuman animals and their caregivers are critical ones in which the interactions can also be manipulated to decrease stress among the animals. When caregivers increased the amount of positive interactions with chimpanzees, including play bouts, grooming, giving treats, and talking, levels of abnormal behavior dropped, the chimpanzees spent less time idle, showed higher levels of affiliative behavior, increased grooming, and reduced non-contact aggressive interactions (Baker 2004). When a solitary-housed gorilla had 3 "social sessions" a week with his caregiver,

abnormal behaviors such as coprophagy, self-mutilation, regurgitation/re-ingestion, and aggression all decreased after the first year of sessions, and maintained low levels for the duration of the study (Pizutto et al. 2007). These studies showed an increase in positive healthy behaviors and a decrease in negative behaviors associated with an increase in caregiver interactions.

Specific caregiver behaviors also can affect the types of interactions with apes. During interactions with 3 chimpanzees, caregivers at a Florida zoo presented chimpanzee behaviors and vocalizations such as head nods, food grunts, play faces, and chimpanzee laughter (Jensvold 2008). The chimpanzees were significantly more interactive in play, grooming, and affinitive social when chimpanzee behaviors were used as opposed to human behaviors and speech. Chimpanzees at a sanctuary were exposed to similar conditions: chimpanzee behaviors versus human behaviors among the caregivers (Jensvold, Buckner and Stadtner 2010). Two of the 3 chimpanzees played significantly more when their caregivers presented chimpanzee behaviors. These studies show chimpanzees are responsive to the specific kinds of behaviors that are used in interactions.

Future studies investigating the effects of visitors on the behaviors of chimpanzees have several directions to take. In addition to examining if chimpanzees spend more or less time in behavioral contexts, a future study could analyze location to determine if the chimpanzees sit closer to visitors when their behaviors are manipulated and sit farther away during the control condition. A study with a similar design to the present study completed at a location with less landscape barriers and more visitor exposure could yield different results as well.

Conclusion

While visitor presence is an inevitable aspect of zoos, this study shows the behavior of the visitors can be changed. By manipulating the visitors' behaviors to appear friendlier to the specific species, the levels of stress among the animals may significantly decrease. The chimpanzees at the Oakland Zoo serve as a model for future studies examining visitor effects on a captive primate population and as an example of how educating visitors can have such an effect.

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