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RESEARCH ARTICLE

Chimpanzee (*Pan troglodytes*) Responses to Caregiver Use of Chimpanzee Behaviors

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The relationships between captive primates and their caregivers are critical ones and can affect animal welfare. Friendly relationships can improve quality of life; adversely, agonistic relationships can decrease quality of life. Caregivers in and of themselves should not be stressful to their charges, instead the caregivers' behaviors and the nature of their interactions with captive primates is likely the basis for the stress. One method to promote positive relationships in the captive environment is for caregivers to employ species-specific behaviors in their interactions with their charges. This study tested the effect of caregivers' use of these behaviors with chimpanzees at The Zoo Northwest Florida in Gulf Breeze. The chimpanzee participants were three males. Data collection occurred during typical interactions between the human participants and the chimpanzees. Some days the caregiver presented chimpanzee behaviors and vocalizations (CB—Chimpanzee Behavior Condition) in the data collection interactions with the chimpanzees. On other days the caregiver presented human behaviors and used speech (HB—Human Behavior Condition) in the interactions with the chimpanzees. The interactions were videotaped. Data coders recorded the behavioral contexts for each chimpanzee as they occurred on the videotape and the time that each context began. Overall they engaged in significantly more friendly behaviors such as play in CB than in HB. They were significantly less interactive in HB than CB. Caregivers should understand and employ species-specific interactions with chimpanzees to promote friendly interactions and animal welfare. Zoo Biol 27:345–359, 2008.

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INTRODUCTION

The relationships between captive animals and their caregivers are critical ones and can affect animal welfare. Across taxa, friendly relationships can improve the quality of life; adversely, agonistic relationships can decrease quality of life. Hemsworth and Barnett [1987] compared domestic pigs who were stroked and petted by caregivers with pigs who were shocked and slapped by caregivers. The pigs in the friendly condition were more likely to approach caregivers. Those in the aversive condition showed decreased growth and reproduction rates and higher corticosteroid levels, even in the absence of humans. Similarly, cows produced more milk if their caregiver was friendly as determined by a self-questionnaire [Seabrook, 1984]. Laboratory rabbits exposed to systematic petting, holding, and play with a caregiver had reduced aortic atherosclerosis [Nerem et al., 1980]. In a comparison of laboratory macaques who were friendly versus aggressive toward caregivers, the friendly ones were less disturbed by daily laboratory activities [Waitt et al., 2002]. In another study, when caregivers spent 2 min per day interacting and distributing food treats to laboratory rhesus macaques, abnormal behaviors were reduced [Bayne et al., 1993]. Likewise, when chimpanzee caregivers spent 10 min a day engaging laboratory chimpanzees in play, grooming, and treat provisioning, the chimpanzees showed an overall increase in play and grooming and a reduction in abnormal behaviors [Baker, 1997]. A singly housed gorilla who had intensive one-on-one interaction with a caregiver had a complete reduction of aggressive behaviors and an increase in browsing behaviors over the 5 1/2-year study period [Pizzutto et al., 2007].

In terms of negative interactions, captive primates often react fearfully and aggressively toward their caregivers [Hemsworth and Barnett, 1987; O'Neil, 1989] and the mere presence of the caregiver can increase agonism [Bloomsmith et al., 1999]. In addition to quality of relationships, the activities associated with the captive environment can affect its residents. During husbandry activities chimpanzees have higher wounding rates [Lambeth et al., 1997]. Chimpanzees [Alford et al., 1992] and monkeys [McGrew and McLuckie, 1984] have more births over weekends when husbandry activities are decreased. Husbandry activities are associated with elevated heart rates in laboratory monkeys [Line et al., 1991]. Caregivers in and of themselves should not be stressful to their charges instead the caregivers' behaviors and the nature of their interactions with the residents are likely the basis for the stress demonstrated in these studies. This study investigates the effects of caregivers' behaviors on captive chimpanzees.

One method to mitigate potential negative effects of caregivers and promote positive relationships is for caregivers to employ species-specific behaviors in their interactions with their charges. At the Chimpanzee & Human Communication Institute (CHCI), all caregivers learn to identify chimpanzee behaviors and their contextual meanings. During husbandry activities caregivers use these behaviors in interactions. For example, when caregivers first see the chimpanzees each day, they present a pronated wrist, breathy pants, and head nods—all friendly greeting chimpanzee behaviors. When caregivers play with the chimpanzees, they present

playfaces, chimpanzee laughter, and playkicks and playslaps on the wall or floor. When the chimpanzees display aggressive behaviors, all caregivers use submissive chimpanzee behaviors such as crouching low and averting eyegaze [Fouts et al., 1994].

This study tested the effect of caregivers' use of these behaviors with chimpanzees at The Zoo Northwest Florida (ZNWF) in Gulf Breeze, FL. This study addressed improving conditions for captive chimpanzees; thus, no aggressive behaviors were used, only friendly and submissive ones. The caregivers had no previous training on chimpanzee behaviors and did not regularly use them in interactions with the chimpanzees. The investigator hypothesized that when caregivers use chimpanzee behaviors in interactions, there would be more time spent in affinitive contexts, such as play and grooming than when caregivers used human behaviors.

METHOD

Participants

Chimpanzees

The chimpanzee participants were three males: Mr. Zoo Good born on 26 October 1985; Zachary born on 31 December 1986; and Patrick born on 17 March 1987. All three came to ZNWF from Bush Gardens in Tampa, FL. They were half brothers and the only chimpanzees at the zoo. The methodology was approved by the Institutional Animal Care and Use Committee at Central Washington University, the investigator's home institution.

Humans

There were four human participants. Three were ZNWF ape caregiver staff: one male and two females. Their experience caring for chimpanzees ranged from 2 months to 16 years. The investigator also was a human participant; she had 20 years experience caring for other chimpanzees. All participants signed a consent form that was approved by the Central Washington University Human Subjects Review Board.

Training

The investigator trained the three NWZF caregivers in the meaning of chimpanzee behaviors and how to use these behaviors. For this training caregivers watched a 10-min DVD that included scenes of humans interacting with chimpanzees and a narrative that described the behaviors and the contexts in which they occurred. It included scenes and verbal explanations of behaviors in play, grooming, greeting, and meal service. See Appendix A for the DVD script. Caregivers also received a written description of behaviors that chimpanzees use in play, greeting, grooming, submission, and general friendly behaviors. This information appears in Table 1. This was accompanied by illustrations of chimpanzee facial expressions including playface, relaxed face, and various grins and their meanings. Caregivers were advised to use safe procedures in their interactions such as not penetrating the fencing with fingers.

TABLE 1. General behavioral descriptions for caregiver training

Context	Behaviors
Friendly Social	Head nods; quiet voice
Food Service	Food grunts and barks; pant hoots
Greeting and Reassurance	Head nods; pants; offer back of hand for contact
Grooming	Picking through chimpanzee's hair; offering elbow to chimpanzee; lipsmacking; toothclacking
Play	Play face; chimpanzee laughter; play slaps on wall; foot stamps on floor or wall; chase; tickling (safely with human hands outside of enclosure)
Submission	Low posture; avert gaze (used when chimpanzee exhibits aggressive display)

In the beginning of the study period during nondata collection interactions, the investigator offered verbal coaching and modeled behaviors for the caregivers. Sometimes the caregivers did not know the meaning of particular behaviors so the investigator described these as they occurred. Occasionally in this initial period she pointed out the appropriate chimpanzee behavioral responses to the chimpanzees' behaviors.

Facility

Enclosure

The chimpanzee enclosure consisted of a 6,244 m^2 inside area and a 1-acre outside island. The island contained tall pine trees and was surrounded by a water-filled moat and low electric fence in the moat. The chimpanzees had access to a portion of the inside area from 4:00 p.m. to 9:30 a.m. During this time four lowland gorillas occupied the other portion of the inside area. The chimpanzees and gorillas had visual and auditory access to each other. During most days from 9:30 a.m. to 4:00 p.m. the chimpanzees had access to the island only. Approximately 2 days per week they had access to the entire inside area and did not go onto the island.

Routine

Each morning at approximately 9:00 a.m. the caregiver arrived at the chimpanzee enclosure and greeted the chimpanzees and gorillas. On days when the chimpanzees had access to the island, the caregiver served a portion of breakfast in the inside area. The caregiver distributed the remainder of the breakfast on the island, which the chimpanzees ate when they gained access to that area at approximately 9:30 a.m. On days when the chimpanzees remained inside the caregiver served the entire breakfast inside. The caregiver served dinner to the chimpanzees when they returned to the inside area at the end of the day.

Data Collection

Condition selection

The investigator used random selection without replacement for each human participant to determine the schedule of condition presentation. Each individual human participant participated in an equal number of each condition. Before the daily data collection session, the investigator informed the caregiver which condition to present.

Interactions

Data collection interactions occurred during the morning routine before the chimpanzees went outside. In addition, data collection interactions sometimes occurred during meal service or breaks in the cleaning routine if the chimpanzees remained inside for the day. On typical days the caregiver interacted first and then while she or he was cleaning the outside enclosure, the investigator interacted. During data collection, interactions were the same as interactions outside of data collection in that the typical routine was followed and interactions occurred naturally; they were not forced or scripted. Human participants followed the lead of the chimpanzee or the normal routine. This included grooming, playing, serving meals, presenting enrichment, or simply observing the chimpanzees as part of the daily check. The chimpanzees were never forced to participate. The human participant could end the session at any time but was encouraged to interact for at least 10 min.

Conditions

Some days the human participant presented chimpanzee behaviors and vocalizations as the Chimpanzee Behavior Condition (CB) in the data collection interactions with the chimpanzees. For example, when a human participant groomed a chimpanzee, she lip smacked and made other grooming noises. During greetings, she presented head nods, pants, and offered the back of the wrist for a kiss. During times of excitement, she pant hooted and head nodded. When the chimpanzees were served food, she food grunted. On other days the human participant presented human behaviors and used speech as the Human Behavior Condition (HB) in the data collection interactions with the chimpanzees. In this condition, during grooming, she only examined the hair without lip smacking. During greeting, she smiled, talked, and occasionally touched but did not head nod or pant. When serving food, she did not use food grunts and only used speech.

Videotaping

A camera person videotaped all data collection interactions. The investigator videotaped the caregivers' interactions and another individual recorded the investigator's interactions. They used a Cannon Camcorder and mini digital videotapes to make the recordings.

Data coding

Data coders recorded the behavioral contexts for each chimpanzee as they occurred on the videotape. They also recorded the time that each context began. There were 12 behavioral contexts: Affinitive Social, Agonistic, Greeting, Grooming, Nonaffinitive Social, Noninteractive, Play, Reassurance, Serving, Threat, Multiple Interactive, and Not Visible. The definitions of the contexts appear in Table 2. Each time the context shifted for more than 5 sec, the coder recorded the new context and its start time.

The two data coders independently coded portions of the data. To establish inter-observer reliability they each coded the same 20% of the data. They agreed on 85% of the times and 81% of the context codes.

TABLE 2. Context definitions

Context	Definition
Affinitive Social	Interactions often accompanied by embraces, open mouth kisses, touching, or following another chimpanzee or human. Includes soliciting an object or contact from another individual; approaching another individual that results in an affinitive social interaction; when the focal is displaced by another chimpanzee or displaces another chimpanzee. Includes receiving affinitive interactions. For example, a chimpanzee allows another individual to take an object or another individual touches the focal chimpanzee. The focal chimpanzee may be either delivering or receiving these behaviors.
Agonistic	Interactions that have aggressive physical contact. This includes poking, kicking, biting, spitting (with contact), throwing an object at another individual, or hitting another individual with an object. The focal chimpanzee may be either delivering or receiving these behaviors.
Greeting	An interaction between individuals who meet after a separation. Behaviors in this category include panting, bobbing, head nodding, arm stretching, kissing, and wrist bending. The focal chimpanzee may be either delivering or receiving these behaviors.
Grooming	A variety of skin-care patterns directed at another individual. Includes behaviors such as parting the hair with the lips, fingers, or objects, inspecting another individual's body, lip smacking, and teeth clacking. The focal chimpanzee may be either delivering or receiving these behaviors.
Multiple Interactive	When two interactive contexts occur simultaneously. For example, the focal greets one individual and is groomed by another. If one context is interactive and the other is noninteractive, only the interactive category is coded.
Nonaffinitive Social	Mildly aggressive interactions including behaviors such as blocking passage or screaming in the absence of submissive gestures or postures. The focal chimpanzee may be either delivering or receiving these behaviors.
Noninteractive	The focal chimpanzee is not engaged in an interaction. Includes copraphagy, eating, lone play, masturbation, object manipulation, rest, self-groom, stereotypic behaviors, and travel. Also includes when the chimpanzee is showing signs of arousal such as piloerect hair or swaggering but is clearly not interacting with another individual.
Play	Interactions are marked by specific behaviors such as play face, laugh, play walk, tickling, or chasing. May include object play, head butts, dragging, or pinching. The play face and exaggerated behaviors are key indicators of this category. The focal chimpanzee may be either delivering or receiving these behaviors.
Reassurance	An interaction in which one individual calms another after a high arousal situation. Behaviors include hug, kiss, hand hold, whimpering, and crouching. The focal chimpanzee may be either delivering or receiving these behaviors.
Serving	The focal chimpanzee receives food from the caregiver. Includes approaching the caging to be served or positioning self to receive food. The context must be interactive; simply eating food is not included in this category.
Threat	An interaction with aggressive behaviors and no contact. Threat behaviors include display, bipedal swagger, back hand thump, cough bark, spitting, or poking. The focal chimpanzee may be either delivering or receiving these behaviors.
Not Visible	No data are available because the focal chimpanzee's behavior is not visible for longer than 3 sec.

RESULTS

There were 3 hr 46 min 42 sec of videotaped sessions in the CB and 2 hr 28 min 51 sec in the HB. The discrepancies in time were simply because the human participants continued to interact longer in the CB data collection interactions. The sessions ranged in length from 2 min 19 sec to 38 min 33 sec. The average length of an interaction was 15 min 8 sec in CB and 9 min 55 sec in HB. This was largely a result of the zoo staff, the average duration of their CB interactions was 17 min 33 sec and HB was 8 min 55 sec. The investigator's sessions were more equal: 11 min 29 sec in CB and 11 min 5 sec in HB. Although the caregivers were encouraged to interact for 10 min they were free to continue for longer or end early. The number of seconds in each context for each chimpanzee appears in Table 3.

There was a large difference in the sample size between the two conditions so the investigator controlled for this by comparing the distribution of seconds only for the first 5 min of each interaction. Some interactions did not last 5 min, so for these sessions the entire interaction time was used. Still the total number of seconds in each condition for each chimpanzee was unequal because the chimpanzees were free to participate or not. 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 for that chimpanzee. To address these inequities of seconds and allow for comparison of proportions, χ^2 Goodness of Fit tests were calculated on the distribution of seconds in CB versus HB for each chimpanzee. To calculate expected frequencies for CB, the proportion of seconds in each cell in HB to the total seconds in HB was used. Pairwise comparisons were calculated using the observed frequency in a cell versus the expected frequency for that same cell.

Patrick had a significant difference in the distribution of seconds in CB versus HB χ^2 $(5,\ N = 2{,}216) = 210.97,\ P < .0001$. Threat and Reassurance were combined for this analysis. Pairwise χ^2 comparisons showed that Patrick spent significantly more time in CB than HB in Affinitive Social ($P < .0001$). He spent significantly more time in HB than CB in Noninteractive ($P = .0043$). Threat and Reassurance overall were very low but only occurred in the HB. Figure 1a shows the percent of time he spent in each context for each condition.

TABLE 3. Seconds in each context for all data collection interactions

	Patrick		Zachary		Mr. Zoo Good	
	CB	HB	CB	HB	CB	HB
Affinitive Social	427	179	220	259	386	121
Groom	443	345	371	250	917	761
Noninteractive	1,262	1,137	1,266	1,357	885	538
Play	545	297	1,466	530	869	21
Reassurance	0	9	0	0	0	0
Serving	87	84	68	113	74	26
Threat	9	29	0	0	0	0
Total	2,773	2,080	3,391	2,509	3,131	1,467

CB, Chimpanzee Behavior Condition; HB, Human Behavior Condition.

TABLE 4. Seconds in each context for the first 5 min of each data collection interaction

	Patrick		Zachary		Mr. Zoo Good	
	CB	HB	CB	HB	CB	HB
Affinitive Social	158 (16)	73 (6)	75 (6)	100 (8)	28 (2)	37 (3)
Groom	138 (14)	157 (13)	299 (24)	139 (11)	1,203 (64)	1,060 (76)
Noninteractive	517 (52)	746 (61)	450 (36)	730 (56)	315 (17)	305 (22)
Play	157 (16)	163 (13)	393 (31)	271 (21)	295 (16)	0
Reassurance/Threat	0	38 (3)	0	0	0	0
Serving	30 (3)	39 (3)	45 (4)	67 (5)	30 (2)	0
Total	1,000	1,216	1,262	1,307	1,871	1,402

Note: In each cell the number in parenthesis is the percent of time the seconds in that cell occurred in that condition for that chimpanzee. CB, Chimpanzee Behavior Condition; HB, Human Behavior Condition.

Zachary had a significant difference in the distribution of seconds in CB versus HB χ^2 $(4,\ N = 2{,}569) = 371.20,\ P < .0001$. Pairwise χ^2 comparisons showed that Zachary spent significantly more time in CB than HB in Groom ($P < .0001$) and Play ($P < .0001$). He spent more time in HB than CB in Noninteractive ($P < .0001$). Figure 1b shows the percent of time he spent in each context for each condition.

Mr. Zoo Good had a significant difference in the distribution of seconds in CB versus HB χ^2 $(4,\ N = 3{,}273) = 4{,}133.18,\ P < .0001$. Mr. Zoo Good engaged in Play and Serving contexts only in CB. Pairwise χ^2 comparisons showed that he spent significantly more time in HB than CB in Groom ($P < .0001$) and Noninteractive ($P = .0034$). Figure 1c shows the percent of time he spent in each context for each condition.

DISCUSSION

All of the chimpanzees were significantly more interactive in CB than in HB. They all played more in CB than in HB; this difference was significant for Zackary and Mr. Zoo Good. Individual patterns of response were also apparent. Patrick was affinitive more often in CB than in HB. Zackary groomed and played significantly more in CB than in HB. Likewise Mr. Zoo Good only played in CB and never played in HB. In addition, Mr. Zoo Good was the only one who groomed significantly more in HB than in CB.

The difference in the total number of minutes of data for each condition is in and of itself interesting. Excluding the investigator's session, the zoo staff caregivers' sessions lasted on average 8 min 38 sec longer in CB than in HB. For these caregivers this was the first time they had used chimpanzee behaviors in their interactions. They reported that the chimpanzees were much more responsive during CB and this perhaps maintained the interactions. This is verified by the decrease in Noninteractive in the CB.

Patrick was the only chimpanzee who demonstrated aggressive behaviors during data collection sessions and there were more in HB than in CB. At CHCI, where chimpanzee behaviors are routinely used in interactions, wounding rates were

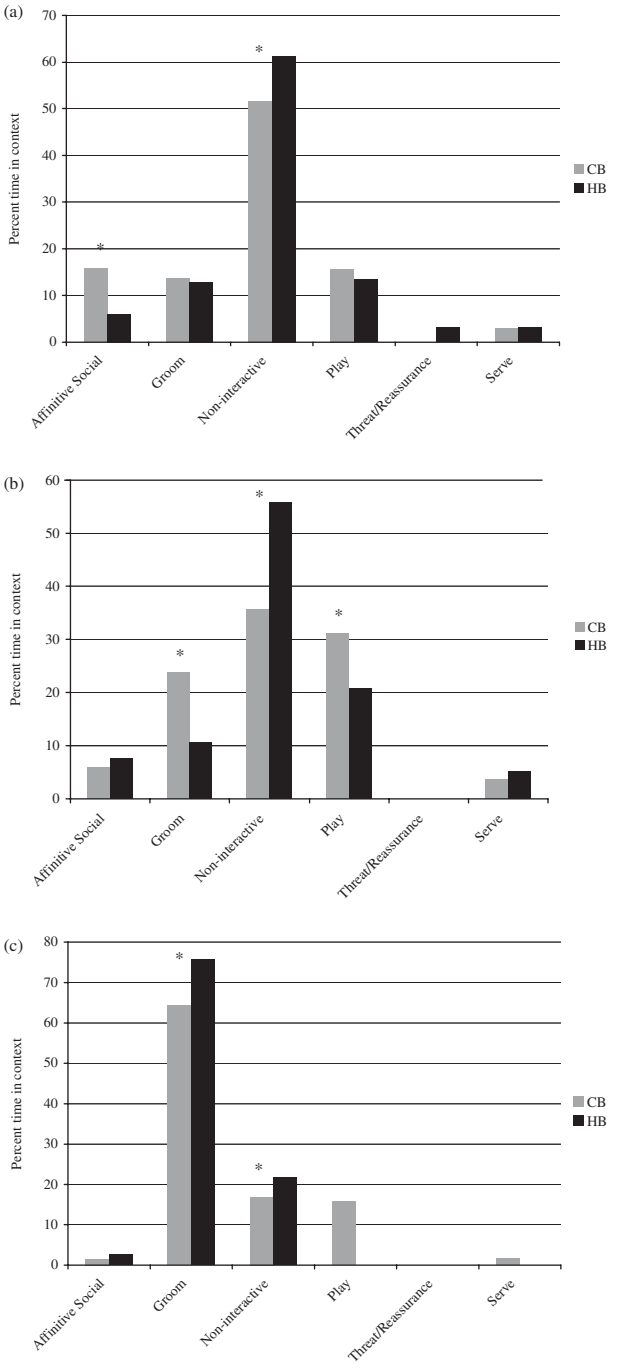

Fig. 1. (**a**) Percent of time Patrick spent in behavioral contexts; (**b**) percent of time Zachary spent in behavioral contexts; and (**c**) percent of time Mr. Zoo Good spent in behavioral contexts. *indicates significant differences at $P < .05$. See the text for exact P-values.

much lower than at laboratories where these behaviors are not used [Jensvold et al., 2005]. At CHCI caregivers react submissively to chimpanzee aggression by getting low and averting their eyegaze. This puts humans as the lowest individuals in the CHCI hierarchy as compared with the ranking of the chimpanzees [Sanz et al., 1996; Hayashida et al., 2002]. At CHCI following conflicts the chimpanzees are more likely to display aggressive behaviors toward humans rather than the other chimpanzees [Malone et al., 2000]. Meanwhile those humans are always outside of the enclosure so that injury to humans cannot occur. Standard recommendations for chimpanzee care advise using force when chimpanzees aggress toward each other [Fritz and Howell, 2001]. Yet at CHCI as members of the chimpanzees' extended social group, the caregivers are able to respond as other chimpanzees would in conflict situations. The ability of caregivers to understand the chimpanzees' signals and to convey their own messages about the stability of the social environment may help to reassure recent conflict participants. Furthermore, by allowing the chimpanzees to direct their aggression toward humans who are outside of the enclosures, caregivers provide a safe outlet for natural chimpanzee aggression. Thus, the use of submissive behaviors may contribute to the decreased wounding at CHCI and the reduction of aggression in this study.

The use of submission behavior can extend beyond the familiar human caregivers; in both laboratory [Lambeth et al., 1997; Maki et al., 1987] and zoo [Chamove et al., 1988; Davey, 2007] settings visitors can increase aggression in chimpanzees. Typical visitor behaviors such as grins and standing bipedally are either friendly or benign human behaviors, but signal aggression among chimpanzees [Goodall, 1986]. Public visitors at CHCI are trained to use nonthreatening behaviors such as sitting, instead of standing, and showing playfaces, instead of grins. To test the efficacy of this policy, Sanz and Jensvold [1997] eliminated this training with some groups of visitors (naïve). They compared the chimpanzees' responses with both groups of visitors and found that the chimpanzees showed less aggression to educated than to naïve visitors. Thus, the use of chimpanzee behaviors can be extended beyond caregivers to visitors. These studies indicate that when humans display potentially threatening behaviors to captive chimpanzees, aggression increases.

Although this study found a general increase in friendly behaviors in CB for all three chimpanzees, individuals also reacted distinctly to the same treatments. For example, Mr. Zoo Good never played in HB, whereas Zachary and Patrick played in both conditions. Likewise, Baker et al. [2003] exposed rhesus monkeys to different amounts of caregiver interaction and training. Monkeys who often engaged in self-injurious behaviors were more sensitive to the varying level of treatment than nonself injurious monkeys. Waitt et al. [2002] also found that monkeys reacted differently to the same caregiver treatment; monkeys who were rated as unfriendly reacted aggressively to caregivers based on differences in monkeys' temperament. Suomi [1991] also found differences in how "uptight" versus "laidback" monkeys responded to social changes. For example, young "uptight" monkeys became withdrawn after a separation from the mother, whereas "laidback" monkeys adjusted quickly. Consideration of individual temperaments should be considered in care protocols. Future studies could replicate this research with other groups of chimpanzees. Additionally, factors such as group size, hierarchy, and caregiver's gender could be examined.

When humans interact they exhibit postural congruency; partners' head, body, and limbs match each other. For example, both partners may cross legs or tilt heads. Additionally, their movements are synchronized and coordinated [Condon and Ogston, 1967; Kendon, 1970]. Both naturalistically [Charney, 1966; LaFrance and Broadbent, 1976] and experimentally [Trout and Rosenfeld, 1980] when postures match between partners, observers judge the partners as having high rapport. When individuals experience partners who match their behavior, they report increased liking for the partner. This has implications for improving therapeutic [Maurer and Tindall, 1983] and teacher–student relationships [Bernieri, 1988]. Postural congruency also occurs among chimpanzees [Jazrawi, 2000] and Toque macaques [Boyd, 1997]. In this study when caregivers show species-specific behaviors, they were matching the behaviors of the chimpanzees thus potentially increasing rapport between chimpanzees and their caregivers.

Training in the meaning and use of chimpanzee behaviors is not standard protocol at all facilities, it is not required by USDA and is rarely discussed in the literature. Instead, positive reinforcement training for specific procedural behaviors such as presenting an arm for injection is emphasized [Laule and Whittaker, 2001, 2007; Reinhardt and Reinhardt, 2000]. Typical caregiver chimpanzee interactions are reminiscent of human interactions with their pets [Bayne, 2002; Leavens et al., 2004] or human infants. Putting nonhumans in a diminutive class is often based on a lack of knowledge of the species' behaviors; instead, some caregivers place the chimpanzees in a diminutive class. Additionally, this dearth of knowledge leads to misunderstandings of behavior. For example, dolphins' open mouths are often interpreted as smiles when they really are dominance challenges [Pryor, 1981]. Humans tend to imitate chimpanzee behaviors, such as swaggering, when a chimpanzee does so. A swagger is an aggressive chimpanzee behavior but if humans do not know that, they are responding to an aggressive behavior with another one, which then escalates the situation. Thus, by recognizing behaviors, humans can understand the behavior and respond appropriately.

The implications of this study are that if caregivers change their interaction style and use species-specific behaviors, they will increase friendly relationships. These results are supported by Bayne et al. [1993], which showed that caregivers' use of species-specific behaviors decreased abnormal behaviors in monkeys. Upright postures in kangaroos are threats and Hediger [1965] described a reduction in kangaroo aggression when caregivers bowed. Similarly, Lott and Hart [1979] described how the Fulani herdsmen in Africa use cattle behavior to manage the herd. The herdsmen take the role of dominant cattle by breaking up fights within the herd and take on the role of the leader to guide the herd's movements. Additionally, to strengthen bonds they stroke cattle on the inside of the rear leg, a place where mothers lick their calves. The cattle in return approach and lick the herdsmen indicating a friendly relationship. These men are able to manage with cooperation by using their knowledge of cattle and incorporating their behaviors. Species-specific behaviors incorporate the human into the nonhuman animal's social structure. If affinitive behaviors are used, this creates friendly relationships. Relaxed friendly relationships are a critical aspect of life in captivity [Poole, 1996; Reinhardt, 1992] and there is physiological as well as behavioral evidence that friendly interactions are beneficial [Hemsworth and Barnett, 1987; Seabrook, 1984; Nerem et al., 1980; Baker, 1997; Pizzutto et al., 2007]. Indeed humans with more friends have reduced stress

[Taylor et al., 2000], more health benefits [Costanzo et al., 2005], and live longer [Giles et al., 2005] than those with less friends. Thus, friendly relationships can improve quality of life and this study demonstrates a way to attain this.

By understanding the species and using their behaviors appropriately, caregivers can insert themselves into the chimpanzees' social network, creating a cooperative relationship. This in turn can be used to manipulate the situation as do the Fulani herdsmen [Lott and Hart, 1979] and maintain friendly relationships. Traditional methodologies in Western science attempt to objectify the research subject and eliminate the relationship between scientists and their research subjects [Estep and Hetts, 1992]. Relationships between researchers and their subjects were ignored or considered a nuisance that needed to be controlled. Nonetheless these relationships are unavoidable in laboratory and zoo settings as humans must care for the research subject. Estep and Hetts [1992] point out that instead of a nuisance, these relationships provide a research opportunity and an avenue to improve animal welfare. This research supports their point and provides evidence for a method to improve the quality of relationships.

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APPENDIX A

Training DVD Script

Caregivers can learn to recognize chimpanzee behaviors and employ those in their interactions with chimpanzees. This video will show chimpanzee behaviors and the contexts in which they occur. It also will show video segments where the caregivers at CHCI use the behaviors when interacting with the chimpanzees there. The purpose of this research project is to examine how the use of these behaviors effects the interactions between caregivers and chimpanzees. You will be asked to use these behaviors or not in your interactions during daily care routines such as shifting, cleaning, meal service, or simply saying "Hi". These 15 min sessions will be videotaped and you will be involved in multiple sessions. Your participation is voluntary.

Greeting behaviors occur when chimpanzees meet a friend after a separation. These behaviors are good ones to use when first seeing chimpanzees at the beginning of the day or after a separation during the day. These behaviors are also good ones to use when the chimpanzees are excited about something and come to you for reassurance. The following segments are behaviors in the greeting and reassurance contexts. Rachel provides an example of a pronated wrist and breathy pant. Mary Lee greets Dar by signing "friend" and then offers the back of the hand. He kisses it

and then she head nods and pants. Mary Lee greets dominant chimpanzee Washoe with the back of a hand and breathy pants and head nods. When Washoe touches her hand, Mary Lee continues to pant.

Grooming behaviors are very calming and reinforce friendships between friends. These behaviors include parting the hair and inspecting the skin. They also include mouth sounds–toothclacking, lipsmacking, Bronx cheers. Note the lipsmacking as Washoe grooms Mary Lee's knee and later her hand. Mary Lee makes these sounds as well.

Play behaviors include facial expressions such as chasing, foot stamping, playkicking, playslaps, playwalking, rolling, tickling, and laughter. A playface, in which the lower teeth are exposed and the upper teeth are covered, almost always accompanies these behaviors. Rachel gives an example of laughter. Dar tickles Mary Lee's knee as she demonstrates a playface and laughs. She then signs to him "funny" and head nods at her friend. Loulis tickles Hannah's hand and she laughs and head nods. She then playslaps the ground and he playkicks the fence. Hannah meanwhile is telling him. "It's time to eat." Loulis knuckle knocks on the ground and Hannah reciprocates with playslaps. Loulis head nods and signs "chase" and invites Hannah for a tickle by reaching towards her. Hannah and Loulis play chase. Note Hannah's use of playslaps, playface, and playkicks. She offers a wrist and he tags the back before chasing.

During meal prep and presentation food vocalizations are the things to use. Pant hoots precede exciting food events and food grunts occur during the eating phase. Caregivers can use these behaviors when preparing and presenting meals. Sam uses food grunts as she serves breakfast smoothie and Dar reciprocates. Hannah has a quieter food grunt.

Aggressive behaviors should be responded to by the caregiver getting small. Try to complete your tasks making your body smaller by crouching or squatting. Additionally avoid eye contact with the aggressive chimpanzee.

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