

THE USE OF REMOTE VIDEO RECORDINGS TO STUDY THE USE OF AMERICAN SIGN LANGUAGE BY CHIMPANZEES WHEN NO HUMANS ARE PRESENT

DEBORAH H. FOUTS
Chimpanzee and Human Communication Institute
Central Washington University
Ellensburg, Washington 98926
USA

ABSTRACT. The method of remote video recording, with no humans present, was used in studies of chimpanzees Washoe, Moja, Tatu, Dar and Loulis for five consecutive years. We found that chimpanzees sign to each other, in a variety of contexts. The youngest, Loulis, signed more to his male peer Dar than to anyone else. The chimpanzees sign to themselves in the same contexts as humans do. Instances of imaginative play were also recorded.

1. Introduction

Four of the five chimpanzees, Washoe, Moja, Tatu and Dar who now reside at the Central Washington University's Chimpanzee and Human Communication Institute, were cross-fostered as infants at the University of Nevada, Reno (Gardner & Gardner, 1989, p. 1-28) Loulis, Washoe's adopted son, is the other member of the family. Loulis acquired his signs from Washoe, Moja, Tatu and Dar. Over the years, their behavior has been documented using 16mm film records as well as video recordings.

The four cross-fostered chimpanzees learned signs from friendly human companions. They signed to their human friends, to chimpanzee friends and to cats and dogs and even to toys. (Gardner and Gardner, 1989 p. 1-28). When Loulis joined the family, in 1979, the humans restricted their signing in his presence to see if Loulis would learn signs from his adoptive mother Washoe and the other cross-fosterlings. Washoe and the other chimpanzees were virtually the only source of conversational signing partners. As described in Roger Fouts' presentation at this conference, Loulis learned over 50 signs of ASL from them in the course of 5 years.

We began an observational systematic study of signed interactions between chimpanzees in May, 1981, when Dar and Tatu, each about five years old, came to the Central Washington University institute in Ellensburg to be integrated into the social group which consisted of sixteen-year-old Washoe, her three-year-old adopted son Loulis, and eight-year-old Moja. Dar and Tatu were cross-fostered together with Moja in Reno, but only met Washoe and Loulis in Ellensburg. From May until December, Tatu and Dar lived adjacent to Washoe, Moja and Loulis, but the two groups were separated by a wire mesh gate. In late December, 1981, the gate was opened and from then on the five chimpanzees lived together.

In 1983 we began using the remote video recording technique. Before I present the methods and findings of these studies, it is important to describe what life was like for these five chimpanzees in the Central Washington University institute when they were housed in a compound on the 3rd floor of the psychology building.

2. Procedure

Each day in the life of Washoe, Moja, Tatu, Dar and Loulis began around 8:00 A.M., when the human caregivers opened the laboratory and woke the chimpanzees with greetings. When greeting, the humans used both ASL signs and chimpanzee communicative gestures and vocalizations, such as head-bobs, pant-hoots, and bouncing (Goodall, 1986, pp. 144-145). Before breakfast, the chimpanzees were asked to help clean out their enclosures of sleeping blankets, dressup clothes and dinner bowls, spoons, magazines, and tree branches left from the evening before. The chimpanzees were thanked and encouraged for their help.

For breakfast, each chimpanzee was offered a fruit drink called a smoothie, which refers to its texture. They were also offered, depending on the season, fresh, frozen or dried fruit and occasionally an assortment of the three. The fruit smoothie contained a least two varieties of fruit, vitamin E, vitamin C and nutritional yeast, blended to make a tasty drink. Free ranging chimpanzees, eat over 140 different species of plants, as well as a variety of insects, birds' eggs, birds, and small mammals (Goodall, 1986, p. 232) as well as medicinal plants (Wrangham and Goodall, 1989, p. 32-33), and we tried to offer as much variety in the meals we provided. When breakfast was served, all the chimpanzees came into one room and drank smoothies from plastic beakers. During breakfast, the human server often gave the food-grunts that a good meal deserves. With smoothies as well as with the after breakfast fruit, Washoe was served first, as the eldest and most dominant member of the group. This was done out of respect for her social status in the group.

After breakfast, the humans cleaned the chimpanzees' compound, which consisted of four rooms and interconnecting tunnels. The chimpanzees had free access to the entire enclosure while cleaning commenced. Frequently, they chose to interact with the humans who were cleaning.

Interactions ranged from watching the humans at work, to attempts to engage them in games of tickle and chase. The chimpanzees requested DRINK from the nozzle of the hose and often Washoe and Tatu asked to CLEAN. We responded by providing them with a dish of soapy water and a scrub brush. The chimpanzees worked on the floor and inside of the enclosures as the humans cleaned the outside area. Although cleaning was a required daily maintenance activity, it also provided excellent opportunities for the humans and the chimpanzees to interact, and some of the best observations of the chimpanzees as individuals and as a group took place during this task.

Frequently, after cleaning, a snack was served. Sometimes, the chimpanzees requested food or non food treats during cleaning. At other times, we offered a SURPRISE and each of them would respond with joyful and excited hooting. Treat items included toothpaste on toothbrushes, flowers, leaves, snow, ice cubes and water balloons (occasionally filled with fruit juice) as well as food treats. A special treat item was the raisin board, a six-inch-long board with approximately twenty holes drilled through it, which were stuffed with raisins and sometimes marshmallows. This was offered together with a willow or an apple branch that served as a tool to extricate the food, as in termite fishing in the wild (Goodall, 1986, pp. 248-249).

During the time period before lunch, play objects were brought out and offered to the chimpanzees: magazines, hair brushes, plastic mirrors, sunglasses, perfume samples, lipstick samples, paper feed sacks, Halloween masks, shirts, skirts, and so on. Some of the simplest objects were used the most, such as the empty paper sacks that were popular for games of chase. The chimpanzees covered the head with a sack and then engaged in a game similar to the children's game of "blind man's bluff."

At 12:00 lunch was served. Washoe, Moja, Loulis, Tatu and Dar were offered a choice of cooked soups such as split pea, bean, or lentil. These soups were flavored with

different vegetables, as well as spices. Other proteins, such as tuna, beef, or chicken were offered occasionally for some variety, but only one of the chimpanzees, Tatu is particularly fond of meat. The lunch meal was served in bowls or cups, with spoons for utensils. If a chimpanzee requested MORE, they were served second helpings. We also provided opportunities for foraging, by putting lettuce leaves mixed with other vegetables on top of the chain link cover of the largest enclosure.

Lunch was followed by quiet activities, among the chimpanzees or interactions with the human caregivers. For quiet activities, the chimpanzees were given drawing materials, as well as small colorful magazines or picture books to look at alone or together with a human caregiver. The caregivers also played active games of tickle and chase with them. Because the humans always remained outside the enclosure, physical contact during these games was minimal and hard plastic toys or long branches were used to tickle and playfully touch the chimpanzees. There are other ways of maintaining contact, and dedicated human play partners frequently used chimpanzee gestures and vocalizations, such as breathy laughter, play-faces, food stomping, and walking with extra large slow movements and so on. Grooming and brushing was another interaction that helped to build good relations between the chimpanzees and their human caregivers. Caregivers could offer their arms and legs for grooming by placing an elbow, an arm, calf of the leg, or sole of the foot next to the chain link enclosure. A good indication of acceptance was when two or even three chimpanzees joined in a grooming session with the human caregiver. Acceptance into the group was important not only in terms of social relations, but also because it led to better opportunities to observe subtleties and individual differences in the behavior of these chimpanzees.

In the late afternoon, the compound was cleaned once more. Again, the chimpanzees were free to be passive observers or to take an active role as helper or play partner. Dinner, served around 4:00 P.M. consisted of rice, cooked cereal, or steamed vegetables, or a combination of cooked grains and cooked vegetables. For variety, we also provided sandwiches, egg salad, tortillas and beans, pizza and occasionally popcorn feasts. After dinner had been served and the enclosure was made tidy, each chimpanzee received a blanket for nesting and sleeping. During some seasons, we provided straw, willow branches, corn stalks and other vegetation for bedding.

In these ways, we attempted to break the routine of an institution, to make each meal an interesting and enjoyable social event, and each day special with many different activities and many opportunities for social interaction. We also celebrated the birthdays of each chimpanzee and the most significant caregivers, as well as most of the holidays on the calendar, which made at least one, and usually more, days of each month extra special. Thus the Christmas celebration started soon after Thanksgiving, when we set up a tree in a room through which a tunnel ran, and began to make garlands of edible ornaments for the tree and the hallways. We always get the tree and decorate it on the weekend following Thanksgiving. By mid-December the halls and tree were decorated with strings of special treats, nuts, popcorn, cranberries, dried fruit, gum and raisins. Throughout this period, the tree was a popular topic of conversation between chimpanzees and their human companions. On Christmas Day, the chimpanzees are given the ornaments to eat and because there are so many, they continued to receive the treats daily until New Year Day. In 1986, the first snowstorm of the season came on the day after the Thanksgiving celebration. Thanksgiving was celebrated with the chimpanzees and the human caregivers, before the students left for home. The holiday meal was a favorite of Tatu's, roast turkey, BIRD MEAT as well as POTATO SWEET, BERRY SAUCE and PUMPKIN SWEET. The following morning the laboratory seemed especially quiet, with the snow on the ground, visible from the laboratory windows. As was usual during college vacations, the students were away, and only the Foutses were in the lab. Perhaps all of this reminded Tatu of Christmas past, or perhaps she thought the Foutses needed to be reminded to set up

a tree. During the cleaning routine, she followed them around signing SWEET SWEET SWEET TREE. Deborah Fouts answered Tatu, YOU MUST WAIT FOR SANTA.

3. Observer Training

There were strict prerequisites and requirements as well as a training regimen for prospective participants in this research. Before being admitted to the training program, prospective participants (for the most part CWU students) completed at least one university level class in ASL. The training program began with a three-month introductory course, which included reading books and journal articles pertinent to this field, as well as viewing films and video tapes of captive and wild chimpanzees.

Next, the participants were trained to recognize specific chimpanzee behaviors, both verbal and nonverbal, as well as the individual traits and habits of the chimpanzees in this group. Their training in ASL was extended to include the criteria of form and usage that had to be met for a gesture to be recorded as a sign and the PCM method of describing signs (Stoke, 1965). A PCM description specifies the place where the sign is made, the hand configuration used to make the sign, and the movement involved in making the sign. Trainees had to master a manual of descriptive terms and abbreviations for nonverbal behavior as well. The majority of the 338 terms in this 40-page manual are based on Goodall's (1968) classification of the facial expressions, vocalizations, postures and actions of wild chimpanzees. All of the trainees had to pass a formal one-hour test on such terms as play-face, pant-hoot, bipedal swagger, and back-hand thump.

After this, each trainee viewed video-taped interactions of the chimpanzees, together with an experienced observer. The experienced observer, a research participant who had at least two years experience with ASL and with these five chimpanzees, identified each behavior as specific examples appeared on the video screen. The trainees recorded observations of taped interactions in longhand, and then practiced identifying signs and transcribing nonverbal behavior into the abbreviations of the manual of nonverbal behavior (NVB).

Finally, each trainee recorded ongoing chimpanzee interactions together with the experienced observer and their records were compared for inter observer reliability. Problem areas were reviewed and there was further individualized instruction until the inter observer agreement was greater than 80%. Only then were the new research participants scheduled for data collection on their own.

Nonverbal behavior, such as the backhand thump or the bipedal swagger, was described with terms from the NVB manual which included 49 terms that referred to facial expressions and vocalizations, 30 that referred to postures, and 117 that referred to actions. An English word gloss was used to describe such gestures that qualified as a sign. The specific word such as FOOD, HUG, HURRY, or COME corresponded to a distinctive combination of place, hand configuration, and movement.

4. Study 1: Conversations Between Chimpanzees

4.1 VARIABLES IN CONVERSATIONAL INTERACTIONS: ADDRESSEE, CONTEXT, DURATION

All interactions that included signing were classified as conversations, and the first chimpanzee to use signs within an interaction was classified as the initiator of that conversation. The addressee was determined on the basis of body and head orientation.

Thus, if Loulis was signing while his body and his head or his head alone was directed toward Dar, then Dar was considered to be Loulis' addressee.

Interactions were classified into one of six behavior contexts, of: reassurance, grooming, play, discipline, eating/feeding, and social interaction. (Fouts & Fouts, 1989 p.299).

Signed conversations consisted of one or more signed utterances and two or more turns. All of the signed conversations included some communicative behaviors in addition to signs (Fouts, Fouts, & Schoenfeld, 1984). For example, the following is a conversation that occurred during a play interaction between Loulis and Dar:

Turn 1: Utterance 1: Loulis solicited a water balloon from Dar by signing HURRY HURRY while holding his hand toward the balloon.

Turn 2: Dar moved away from Loulis.

Turn 3: Utterance 2: Loulis signed WANT to Dar.

Turn 4: Dar again moved away

Turn 5: Utterance 3: Loulis signed HURRY HURRY GIMME to Dar.

Turn 6: Dar terminated the interaction by putting the balloon into his mouth and turned away from Loulis who also withdrew. (Later, in reference to the same piece of balloon, Loulis signed GUM GUM, placing the sign on Dar's cheek, and then signed GUM on his own cheek. Dar continued to chew on the balloon and Loulis did not get his share.)

This conversation has six turns and three signed utterances HURRY, WANT, and HURRY GIMME. Both in Turn 1 and Turn 5, HURRY was counted as a reiterated sign and not as two separate HURRY signs, since reiteration is a way of modulating semantic meaning (Van Cantfort & Rimpau, 1982).

4.2 SYSTEMATIC LIVE OBSERVATION SAMPLES OF CONVERSATIONS

Prior to the introduction of the remote video recording the chimpanzees' use of signs in the course of the daily routine was recorded over a period of 21 months (5/81-1/83).

Comprehensive sampling sessions, 40-minutes in duration, were scheduled five times daily, five days per week (excluding weekends and school holidays). In each sampling session, the behavior and signs that occurred during interactions were recorded by an observer, sometimes by an observer and a trainee, standing just outside the enclosure. The observer assigned each interaction to a context, such as reassurance, play, feeding, mutual grooming, or discipline.

Of course, the chimpanzees also signed at other times and such observations of signing were recorded in the daily log that was kept for the individual chimpanzees. Records of interactions obtained outside of the systematic sampling sessions will be referred to as adventitious. The systematic sampling sessions accounted for 76.4% of the reports that were analyzed, while the adventitious samples accounted for 23.6%.

Daily records showed that the introduction of Dar and Tatu to Washoe, Loulis and Moja produced a dramatic effect on the incidence of signing. In the eight-month period just prior to the introduction of Dar and Tatu (May, 1981-Dec.1981), the monthly totals of conversations between chimpanzees ranged from 12 to 85, with a mean of 37.75.

However, during the 13-month period after Dar and Tatu were allowed physical contact with the other chimpanzees (Jan. 1982-Jan. 1983), the monthly totals for conversations ranged from 118 to 659 with a mean of 378.15.

Before the introduction of Dar and Tatu, Loulis was the primary initiator of signing and he addressed 90% of his conversations to his adopted mother, Washoe. As he grew older and became more familiar with his new peers, Loulis addressed an increasing proportion of signs to Dar, his only male peer, and a decreasing proportion to Washoe, his mother.

During the final ten months of this sample (April, 1982-Jan., 1983), Loulis initiated 1,292 conversations and addressed 54% of these to Washoe, 27% to Dar, but only 10% to Tatu and 9% to Moja. Similarly, Tatu and Dar, closest in age to Loulis, initiated most of the signing addressed to Loulis during the same period.

In this sample, 88% of the conversations occurred in just three contexts: social interaction (39%), reassurance (29%) and play (20%). Only 5% of the conversations occurred in a feeding context (Fouts, et al. 1984).

4.3 REMOTE VIDEO RECORDS OF CONVERSATIONS

4.3.1 Method. In addition to live observations, we have found remote videotaping (RVT), without humans present, to be an excellent way to begin to understand how and where the chimpanzees use their signs.

We first used RVT during a 15-day period at the end of July and the beginning of August, 1983 in a study that focused on Loulis' use of signs with his chimpanzee family. During this time video cameras and remote video recorders monitored the chimpanzees' interactions with no humans present (D.Fouts, 1984). There were three video cameras, each focused on a portion of the enclosure. There was some overlap of the areas covered by the three cameras, but only 75% of the total enclosure area was covered. The three cameras were connected to video recorders located in a separate recording room. Every day during the 15-day period, the video cameras were turned on for three 20-minute recording periods between the hours of 9:00 A.M. and 5:00 P.M. Forty-five recording periods were scheduled so that each hour of the day was sampled randomly without replacement either five or six times.

During these recording sessions no one entered the chimpanzee quarters, surrounding hallways, and adjacent rooms. Everyone stayed out of view and kept silent, and all activities in the laboratory that might be a distraction were stopped—even the cooking of meals was forbidden, because the cooking odors as well as the preparation and monitoring of the food might distract the chimpanzees from their interactions.

4.3.2 Reliability. To determine inter observer reliability, five of the 45 video-taped samples were scored independently by two experienced observers, who had studied ASL, the NVB manual, and the chimpanzees for two and a half years and five years respectively. An agreement was counted when these two observers agreed on all six aspects of the interactions: (1) context category; (2) initiator; (3) terminator; (4) gloss and form description of signs; (5) the number of signs; and (6) the number of turns. If any of these six aspects of an interaction was scored differently, it was counted as a disagreement. In the five segments, there were forty interactions. For 93% of the interactions, the two observers agreed in their reports for all aspects of the interaction. Disagreements were excluded from the final analysis of the data.

4.3.3 Conversation results. The 45 video-taped sessions randomly sampled each hour of the daily routine. The amount of signing varied from sample to sample. As many as 29 different conversations were recorded in a single 20-minute session, but in some sessions the chimpanzees rested or groomed during the entire 20 minutes. The 451 interactions that Loulis initiated accounted for 4 hours, 13 minutes or 28% of the total 45-hour video record. The 54 conversations (interactions containing signs) that Loulis initiated accounted for 43 minutes, 20 seconds.

Table 1 shows that the majority of the interactions (signed conversations and nonsigning interactions) that Loulis initiated were directed to Dar, his male peer. Of the 451

interactions, 40% (181) were addressed to Dar, while between 19% and 21% were addressed to each of the other three chimpanzees, Washoe, Moja, and Tatu. Loulis' preference for Dar as an addressee is even more marked when we consider that of the 54 conversations that he initiated, 50% were addressed to Dar and between 5% and 2.2% were addressed to the other three chimpanzees. Table 2 also shows that, in the context of play, Loulis initiated 4.8 times as many interactions with Dar as with his mother Washoe (101 vs 21), and 11.2 times as many with Dar as with Moja, another female peer (101 vs 9). He only initiated one play interaction with his other female peer, Tatu. In the social context, Loulis initiated a sizable and roughly equivalent number of interactions with each of the other chimpanzees. There were less than ten conversations in four of the six contexts (reassurance, grooming, discipline, and eating/feeding), too few to make comparison of Loulis signing to his mother and to his three peers.

Table 1
Contexts and Addressees for Interactions Initiated by Loulis

Context	Addressee					Total
		Washoe	Moja	Tatu	Dar	
Social	S	3	0	6	10	19
	NS	54	66	53	52	225
Play	S	1	3	0	16	20
	NS	20	6	1	85	112
Grooming	S	0	0	6	1	7
	NS	3	12	18	13	46
Reassurance	S	8	0	0	0	8
	NS	3	0	2	1	6
Discipline	S	0	0	0	0	0
	NS	0	0	0	0	0
Feed/Eat	S	0	0	0	0	0
	NS	3	2	0	3	8
Total	S	12	3	12	27	54
	NS	83	86	74	154	397
Total Interaction		95	89	86	181	451

S= interactions with signing; NS=nonsigning interactions

Table 2
Number of Signs Used by Loulis as a Function of Context and Addressee

Context	Addressee				
	Washoe	Moja	Tatu	Dar	Total
Social	6	0	25	68	99
Play	2	9	0	43	54
Grooming	0	0	23	3	26
Reassurance	27	0	0	0	27
Discipline	0	0	0	0	0
Feed/Eat	0	0	0	0	0
Total	35	9	48	114	206

Table 2 shows that Loulis used more signs in his interactions with Dar than with any other chimpanzee; 55% of the 206 signs Loulis used during interactions were addressed to Dar, 23% to Tatu, 17% to Washoe, and 4% to Moja. When we compared these findings to earlier samples of conversations initiated by Loulis, it was seen that the focus of his signing shifted from Washoe to Dar. Goodall has described a similar shift from mother to peers in the social development of wild chimpanzees (1971, p 156-157, 170 & 215; 1975, p. 137; 1986, p. 81 & 166). At the time of this video sample Loulis' total vocabulary consisted of 43 signs. Table 2 lists the signs that appeared in the sample and the frequencies of each. Most of Loulis' signs were addressed to one of the other chimpanzees. At other times, his head and body were oriented away from his companions and he appeared to be signing to himself. Table 3 lists separately the signs used in interactions and in private signing.

Table 3
Signs Used by Loulis During Interactions and When Signing to Himself

	Interactions	Private signing
HURRY	134	6
BALL	-	59
ME MINE	17	24
HAT	-	16
GOOD	11	4
COME	13	-
MORE	7	-
DRINK	6	1
WANT	4	-
PEEKABOO	4	-
GUM	3	-
PERSON	3	-
GIMME	2	-
OUT	-	2
SHOE	1	1
FOOD	-	1
MASK	-	1
TICKLE	1	-
Total frequency	206	115

4.3.4 Findings, other behaviors recorded in the RVT sessions. Examples of meaningful modulations (Van Cantfort & Rimapu, 1982) of the shapes of the signs appeared in the remote video taping of chimpanzee-to-chimpanzee signing. For example, during an interaction before lunch Tatu used repetition for emphasis together with questioning modulation. Tatu approached Washoe and signed TIME TIME TIME TIME EAT EAT. As she signed, Tatu looked steadily into Washoe's eyes while holding the last sign, EAT.

Signs for actions are placed on the addressee, to indicate agent-of-action. For example, we have recorded Dar making the TICKLE sign on Loulis' hand followed by a tickle game between the two young males. Dar often uses yet another inflected form of TICKLE when he signs TICKLE on one of his toys, and then gives the toy to a human who is expected to tickle him with it. Incidentally, at this writing Dar's favorite toy to be tickled with is still a plastic dinosaur.

During a remote video-taping session Loulis used a social strategy that resembles one commonly used by human children. We recorded an instance of this, following a fight between Loulis and Dar. After the fight subsided, Dar moved away from Loulis, while continuing to scream. At the same time that Dar was screaming, Loulis approached and sat quietly behind Washoe and signed GOOD GOOD GOOD to her. Much like a human child, he seemed to be assuring his mother that he was good. Dar soon learned to use this strategy as well. We have recorded Dar, soon after Washoe entered the room to settle a fight between Loulis and he, throwing himself on the floor near Washoe, signing HUG HUG HUG to her and then screaming as he looked toward Loulis.

In some interactions recorded by remote video tape, signing appeared to reduce aggression. There were several instances in which Loulis was harassing both of his female peers, Moja and Tatu, until either Washoe or Dar distracted Loulis by signing TICKLE, CHASE, GROOM or COME to him. This signed invitation to play or groom was often effective in distracting Loulis from further aggressive behavior. In one such incident, Loulis harassed Moja and Tatu by rushing at them and hitting them both as they sat grooming. Moja and Tatu moved away and began to resume grooming. When Loulis started to charge them again, Dar reached out and touched Loulis on the arm. Loulis ignored this touch, and continued his charge. Moja and Tatu moved away from Loulis once more. Now Washoe reached out and touched Loulis on the leg and Dar signed TICKLE on Loulis' arm. Loulis responded to Dar by turning toward him and wrestling with him. Washoe joined in this game by tickling Loulis with her hand, as Dar wrestled with him. Subsequently, Loulis withdrew from the area where Moja and Tatu were, and no further aggression occurred. Thus, these chimpanzees used signs to initiate a distraction which in turn served to inhibit aggression.

During the remote video-taping sessions we recorded three different instances of Loulis using a stick to groom an infection in Tatu's foot. In each case, Loulis held Tatu's foot and then picked up a willow branch from the floor. Next, Loulis used his teeth to break off a portion of the branch, and chewed the open end of the branch until it was pointed. He inserted the pointed end of the branch in the wound, and moved it around in the wound. If Tatu attempted to remove her foot Loulis sometimes signed GIMME, COME, or HURRY to solicit the wounded foot, or merely grabbed the foot and began again. Washoe seemed to disapproved of this method of grooming. She removed the grooming stick from Loulis each time she saw him use it, or begin to fashion it with his teeth. On two occasions, after removing the stick, Washoe took Tatu's foot and groomed it with her lips and fingers, which is her standard method of grooming and used as well by free-living chimpanzees in Africa (Goodall, 1989). Loulis continues to use both methods to groom wounds of his own and others. Tatu's wound was such an attractive target for grooming that the frequency of grooming interactions among all of the chimpanzees increased during the period we were video taping.

5. Study II: Private Signing by Chimpanzees

5.1. PREVIOUS FINDINGS: RENO LABORATORY AND CWU INSTITUTE

Since the beginnings of Project Washoe in the Reno laboratory, in the mid-1960's instances of private signing have been observed and recorded. When Washoe was young, her private conversations were truly private. If caregivers tried to eavesdrop she would turn away; and if they persisted and continued to try and see what she was signing, she would get up and move to a more secluded location. Washoe leafed through magazines and named pictures of things that she saw or merely signed to herself. She did this while

alone in her bedroom, or sometimes she took a magazine up to the top of a 30-foot-high willow tree and signed to herself (Gardner & Gardner, 1989). In later studies, involving all five chimpanzees we recorded private signing. In a study with over 5200 instances of chimpanzee conversations we found that 119 of them were private (Fouts, Fouts, & Schoenfeld, 1984).

5.2. REMOTE VIDEO RECORDS OF PRIVATE SIGNING

5.2.1 Bodamer's analysis of RVT records of conversations. Following this analysis of remote video tape recording, which primarily focused on Loulis' conversations with his mother and peers, we collected video records for five consecutive years.

We noted on those tapes, in addition to the chimpanzee-to-chimpanzee sign language conversations, there were also instances of the chimpanzees signing to themselves. Mark Bodamer (1987) analyzed 45 hours of existing tapes that focused on chimpanzee-to-chimpanzee conversations for private signing. He found 90 instances of private signing on these tapes that he could classify into categories used for private speech in human children (Furrow, 1984). Our concern with this sample, was that it was biased against private signing because the tapes were originally made with the purpose of recording chimpanzee-to-chimpanzee conversations. For example, whenever we had a choice between recording two chimpanzees or one chimpanzee we would choose two chimpanzees in hopes of taping chimpanzee-to-chimpanzee conversations. With the help of a National Geographic grant we went on to record another 56 hours of remote video recordings, but this time we used criteria that would increase the likelihood of recording chimpanzees signing to themselves.

5.2.2 RVT sample focused on private signing. In the Bodamer et al (Bodamer, Fouts, Fouts & Jensvold, in press) study focusing on private signing we collected 12 minutes of tape per day five days a week for a total of 56 weeks which gave us 56 hours of new tape to analyze. But this time if we had a choice between recording two chimpanzees as opposed to a single chimpanzee, we would choose the later. As compared to the sample used in Mark Bodamer's thesis, this procedure increased the instances of private signing by threefold, and yielded 368 instances for the 56 hours. One of the more common categories of signing used by chimpanzees and humans as well, was referential signing. Recorded examples include Washoe naming the pictures in a magazine, and Dar signing DOG when he noticed a dog running by outside the building. Of the 368 instances of private signing that were found 218 (59%) were categorized as referential. This was the largest category. An utterance of private signing was categorized as informative signing if the chimpanzees signed about something not in their present environment. The instances we have recorded refute the claim that chimpanzees only sign about things in their immediate environment and that for them "out of sight, is out of mind". For example, Tatu sat in the enclosure with a bowl of bean soup, signing MEAT MEAT MEAT. Bean soup is not a favorite food for Tatu, and as was reported earlier, any type of meat is. Again this shows that just like us, the chimpanzees talk about things that are not present. In other examples, Washoe signed about DEBBI even though she was not present, Loulis signed about a DOG that wasn't there and Moja signed about absent BIRDS. We found that this category accounted for 44 of the 368 instances (12%) and was the second largest category observed. This again demonstrates the rich mental life of the chimpanzee. Expressive signing was popular with Washoe. This is a category of signing that is used more commonly by adult humans than by children. It occurs when humans become upset or excited by something. Thus, if you accidentally struck your thumb with a hammer, even though you were alone you might say something very expressive. Or in less emotional situations, when the traffic light changes to red as you enter the intersection and you happen to notice a police car observing you,

you might say something even more expressive. During one RVT session, Washoe was being recorded as she was lying on a bench looking at a magazine. Loulis came running into the room and into the camera frame from an overhead tunnel. He was running very fast and Washoe ignored him. As he ran under the bench where she was lying he reached up and took her magazine and then ran immediately out of the room using the overhead tunnel again. By the time Washoe got to her feet, Loulis was gone and as she walked off, she signed DIRTY DIRTY to herself. Washoe uses the DIRTY sign as an insult. This category accounted for 10 of the 368 instances (3%). Instances of private signing that were categorized as Regulatory, Attentional, Interactional, Instrumental, Describing own Activity, and Imaginary ranged from 4 instances (1%) to 31 instances (8%). Two categories, Self-regulatory and Question were not observed in this study but had been observed in the 90 instances Mark Bodamer analyzed for his thesis. The Imaginary category accounted for 17 instances (5%) and it was this behavior that was examined by Jensvold and Fouts (1993). This study focused on imaginative private signing as well as other imaginative behaviors by chimpanzees.

6. Study III: Imaginative Play and Signing by Chimpanzees

Imagination is another of those special behaviors that have been considered unique to our species. In the private signing study, we used definitions of types of imaginative play developed by Matthews (1977) for human children to identify instances of imaginative play and signing in the RVT records and we found that 5% of the utterances were imaginative. For example, rhythmic movements of signs or form alliteration of signs can be considered comparable to vocal singing or poems. One example, Loulis played with a block of wood by placing it on his head and then referring to it as a HAT. Another instance was when Moja produced an alliteration by rhyming signs that all used the same initial hand configuration. Moja sat by herself and signed RED RED RED CRY CRY CRY FUNNY and then lay down.

Earlier reports of chimpanzee play revealed that chimpanzees engaged in all six categories of imaginative play identified for children (Hayes, 1952; Goodall, 1986; Gardner & Gardner, 1989; Savage-Rumbaugh, 1988).

Jensvold and Fouts (1993) study expanded on this to include play behaviors as well as signing. Fifteen hours of behavior were recorded over a three week period. Data was collected for one hour per day between 9 a.m. and 3 p.m. for 15 days, Monday through Friday. Eight sessions were in the morning and seven in the afternoon. The cameras were turned on only when at least one chimpanzee was present. Objects were placed in the enclosure each day to simulate a playroom environment.

Inter observer reliability was obtained by having two independent observers with at least one year experience with the chimpanzees, analyze 10% of the data. Three measures were analyzed: identification of the individual chimpanzees, the behavior that occurred, and the occurrence of any signs. Each measure was scored one time every minute. The percent agreement of the scores for each minute were calculated. Inter observer reliability for the data analysis was 98% for identification of the individual chimpanzee, 97% for identification of the behaviors, and 100% for the occurrence of signs. The total reliability for data analysis was 98%. Reliability for the occurrence of imaginative play was 90%. Inter observer reliability for the categorization of instances of imaginative play was 100%.

Jensvold and Fouts (1993) found that chimpanzees when playing with toys would treat them as if they were alive. Here, imagination involved attributing certain properties to situations or things that they do not actually possess. Using the remote video recording technique they recorded six instances of imaginative play during 15 hours of RVT, these

fell into two categories, Animation and Substitution. Dar showed a type of imaginative play referred to as Animation when he signed PEEKABOO to a stuffed teddy bear.

Animation (Matthews, 1977) is defined as acting toward an object as if it were alive, and includes speaking or signing to an object. In another instance, Dar signed TICKLE to a stuffed bear and then positioned the bear between his body and the wire. Dar often presses his own body against the wire in this same fashion when being tickled by a human friend. Dar also signed TICKLE on a puppet as though it were capable of playing a game of tickle with him. Washoe demonstrated a different instance of Animation by using a chimpanzee killing gesture to "hit away" a stuffed animal. Moja displayed a type of imaginative play referred to as Substitution when she began to treat a purse as if it were a shoe. The recording of six instances in 15 hours is impressive when one considers that in the Fouts, Fouts, and Schoenfeld study (1984) over 5200 instances of chimpanzee signed conversation yielded only 2% (119) that were classified as private signing, and in the private signing study only 17 of the 368 instances (5%) fell in the Imaginative category.

Examples for all six categories of imaginative play have been observed in these and other chimpanzees. The category Attribution of Function is defined by behavior that appears to attach a new functional property to an object although the object still retains its original identity. One example was recorded in our laboratory, Washoe picked up a toothbrush signed HAIRBRUSH and then brushed her hair with it. The toothbrush retained its original identity yet Washoe had given it a new function. The category of Insubstantial Material Attribution is defined by the individual acting as if there is an object there when there is none. A fine example of this category was reported for the chimpanzee, Viki (Hayes 1952 p. 81). Cathy Hayes described Viki behaving as if she had an imaginary pull toy, walking around the house trailing her arm behind her. At times she acted as if it had gotten stuck and made tugging motions that culminated in a jerk and then she went on her way trailing her arm behind.

Another category, Insubstantial Situational Attribution, includes word play, rhymes, and songs (Furrow, 1984). This was demonstrated when Moja in the instance of private signing described earlier signed RED RED RED CRY CRY CRY FUNNY to herself. All three signs were made with the same handshape which is analogous to alliteration rhyming in spoken word and the repetition of the signs added to the song like quality of the utterance. A final category is Character Attribution, a young Washoe was recorded bathing and feeding her dolls. She was taking on the characteristics of her caretakers who normally fed and bathed her (Gardner & Gardner, 1989). These observations indicate that chimpanzees engage in all of the types of imaginative play as human children do. Imaginative play is a behavior that is rarely observed compared to all the other things the chimpanzees do, just as it is with our species.

7. Conclusions

Using remote video recording we have demonstrated that the chimpanzees Washoe, Moja, Tatu, Dar and Loulis sign to each other and to themselves when no humans whatsoever are present. We have demonstrated that chimpanzee-to-chimpanzee signing was rich enough to provide texts that could be analyzed for context, initiator, addressee, number of signs and number of conversational turns. We have demonstrated that the signs used during interactions between chimpanzees were clear enough so those independent observers, fluent in ASL, agreed in their identification of more than 90% of the signs. We have also found that the instances of private signing by chimpanzees can be classified into the eleven categories used to classify private speech in humans. Video records of imaginative play and signing by chimpanzees have been obtained as well.

8. References

- Bodamer, M. (1987). Chimpanzees signing to themselves. Unpublished master's thesis, Ellensburg, Washington: Central Washington University.
- Bodamer, M., Fouts, R.S., Fouts, D.H., & Abshire, M.L. (1994). Functional analysis of chimpanzee private signing. In Press, *Human Evolution*.
- Boehm, C. (1989). Methods for isolating chimpanzee vocal communication. In P.G. Heltne & L. A. Marquardt (Eds.) *Understanding Chimpanzees*, pp 38-60. Cambridge, MA: Harvard University Press.
- Campbell-Jones, S. (Producer & Director) (1974). *The first signs of Washoe*. (Film). Boston, MA: WGBH Nova series.
- Eibl-Eibesfeldt, I. (1970). *Ethology, the biology of behavior*. New York: Holt, Rinehart & Winston.
- Fant, L. (1972). *Ameslan: An introduction to American Sign Language*. Northridge, CA: Joyce Media, Inc.
- Fouts, D.H. (1984). Remote video taping of a juvenile chimpanzee's sign language interactions within his social group. Unpublished master's thesis. Ellensburg, WA: Central Washington University.
- Fouts, R.S., Fouts, D.H., & Schoenfeld, D. (1984). Sign language conversational interactions between chimpanzees. *Sign Language Studies*, 34, 1-12.
- Fouts, R.S., Fouts, D.H. & Van Cantfort, T. (1989). The infant Loulis learns signs from cross-fostered chimpanzees. In R. A. Gardner, B.T. Gardner & T. E. Van Cantfort, (Eds.) *Teaching Sign Language to Chimpanzees*, (pp. 280-292). Albany: State University of New York Press.
- Fouts, R.S., & Fouts, D.H. (1989). Loulis in conversation with the cross-fostered chimpanzees. In R.A. Gardner, B.T. Gardner & T.E. Van Cantfort, (Eds.) *Teaching Sign Language to Chimpanzees*, (pp. 293-306). Albany: State University of New York Press.
- Furrow, D. (1984). Social and private speech at 2 years. *Child Development*, 55, 355-362.
- Gardner, R.A., & Gardner, B.T. (1973). Teaching sign language to the chimpanzee, Washoe. (16-mm sound film). State College, PA: (Psychological Cinema Register).
- Gardner, R. A. & Gardner, B.T. (1978). Comparative psychology and language acquisition. *Annals of the New York Academy of Sciences*, 309, 37-76.
- Gardner, R. A. & Gardner, B. T., (1989). A Cross-Fostering Laboratory. In R.A. Gardner, B.T. Gardner & T.E. Van Cantfort, (Eds.) *Teaching Sign Language to Chimpanzees*, (pp.1-28). Albany: State University of New York Press.
- Goodall, J. van Lawick (1968). The behavior of free living chimpanzees in the Gombe Stream Reserve. *Animal Behavior Monographs*, 1, 163-311.
- Goodall, J. van Lawick (1971). *In the shadow of man*. Boston, MA: Houghton Mifflin Company.
- Goodall, J. van Lawick (1975). The chimpanzee. In V. Goodall (Ed.), *The quest for man*, (pp. 131-169). London: Phaidon
- Goodall, J. (1986). *The chimpanzees of Gombe*. Cambridge, MA: Harvard University Press.
- Hayes, C. (1952). *Ape in our house*. New York: Harper & Brothers.
- Jensvold, M.L.A., & Fouts, R.S. (1993). Imaginary play in chimpanzees. *Human Evolution*, 8, No.3, (pp. 217-227).
- Matthews, W.S. (1977). Modes of transformation in the initiation of fantasy play. *Developmental Psychology*, 13, 212-216.

- Stokoe, W.C., Casterline, D., & Croneberg, C.G. (1965). A dictionary of American Sign Language on linguistic principles. Washington, D.C.: Gallaudet College Press.
- Savage-Rumbaugh, S., & McDonald, D. (1988). Deception and social manipulation in symbol-using apes. In R.W. Byrne, & A. Whiten (Eds.), *Machiavellian Intelligence* (pp. 224-237). Oxford: University Press.
- Van Cantfort, T.E., & Rimpau, J. B. (1982). Sign language studies with children and chimpanzees. *Sign Language Studies*, 34, 15-72.
- Wrangham, R.W. & Goodall, J. (1989). Chimpanzee use of medicinal leaves. In P.G. Heltne & L.A. Marquardt (Eds.), *Understanding chimpanzees*. Cambridge, MA: Harvard University Press.