TRANSMISSION OF A HUMAN GESTURAL LANGUAGE IN A CHIMPANZEE MOTHER-INFANT RELATIONSHIP

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ABSTRACT. Ten-months old Loulis was adopted by Washoe and acquired signing and other skills from her and the other signing chimpanzees in his community. To insure that Loulis would acquire his signs from the chimpanzees, the humans, in his presence, restricted their signing to seven specific signs or used vocal English to communicate with him. Washoe was observed to teach Loulis through modeling, molding and signing on his body. Most of his signs appeared to be delayed imitations of signs he had seen Washoe and the other chimpanzees use in similar contexts. We were able to examine the development of social behavior, communication, and other skills in Loulis without disrupting them. In this way, we obtained a comprehensive record of cultural transmission.

1. Introduction

When I was an undergraduate student, more than 30 years ago, I remember from my anthropology classes that culture was considered to be something quite unique to our human species. It was something we acquired and passed on from generation to generation. The idea that it might have biological basis was never entertained. If any of our fellow animals displayed any behavior that looked at all as if it might be cultural then the preface "proto" was added which robbed it of any consideration as an established behavior with some historical position.

I also remember that some of my anthropology professors maintained that what made culture so unique to our species was that a great deal of it was passed onto the next generation via our languages. Language had a very special position because it was not only the vehicle by which our culture was transmitted but it was itself also transmitted across generations this way. A popular notion at that time was that birds were born with their songs, and dogs with their barks, but only we humans had to acquire our language culturally from our parents and fellow humans. Much of this supposition was based on armchair speculation and ignorance where the absence of evidence was considered evidence of absence. However, much has changed since we started asking our fellow animals to tell us about themselves by studying them in the field and in the laboratory. It is no longer acceptable to base our assumptions about the capacities of our fellow animals on our armchair preconceptions of human nature.

In regard to the chimpanzee the last 30 years has been a veritable explosion of information that has required our academic community to continually readjust and rethink previous ideas that were considered to be inviolable. The chimpanzees that live in Africa have shown us some amazing cultural behaviors, that I am sure they have been doing all along. The following statement made by Jane Goodall (1986) was considered heresy or at least evidence of insanity 30 years ago: "The difference in cultural tradition between the

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chimpanzees of Gombe and those of the Mahale Mountains, only 100 miles away, has already proved to be very great" (p. xii). Others at this conference provide us with recent tangible evidence of the African chimpanzee's cultural prowess.

Research from the laboratory has proven to be just as profound in its implication for established thought. In Project Washoe, my professors Allen and Beatrix Gardner demonstrated that a young chimpanzee was receptive to the cultural transmission of gestural signs from humans (B. Gardner & Gardner, 1971). The Gardners (1989) went on to demonstrate that this was a robust phenomenon, because every chimpanzee that was raised in Washoe's fashion readily acquired the signs of American Sign Language (ASL). Their early research with Washoe is the necessary precursor to the research I will report. After Washoe had acquired the signs of ASL the question was still there: even if chimpanzees could acquire signs from humans, would they pass it on to the next generation themselves?

The Gardners began Project Washoe in 1966 at the University of Nevada at Reno and I came onto the project in 1967 as one of their graduate students. In 1970, at the Gardners request, I brought Washoe with me to the Institute for Primate Studies (IPS) at the University of Oklahoma. Because the IPS was a colony it often maintained about 20 or more chimpanzees of varying ages and backgrounds. We saw the IPS as an opportunity to expand the horizons in regard to signing chimpanzees. We could now address questions that were impossible to answer in Reno. Could chimpanzee other than Washoe acquire signs? Would Washoe use her signs to communicate with other chimpanzees? Would the chimpanzees in Oklahoma begin to pick up the signs from Washoe or human signers? One of the most interesting questions would have to wait until Washoe was old enough to have her own offspring. That question was: Would Washoe pass her signing skills onto her baby, or in other words, is the cultural transmission of ASL possible in chimpanzees?

2. Expanding Horizons

The horizons really did expand. We found that signing was not something unique to Washoe, but that other chimpanzees could acquire the signs. With the help of other human caregivers the young chimpanzees Booee, Bruno, Cindy, and Thelma acquired signs (Fouts, 1973). Other chimpanzees associated with the IPS who were being home-reared by humans, such as Lucy and Ally (aka Ali) were also taught the signs of ASL. Ally was able to comprehend and produce novel prepositional phrases demonstrating his ability to use sign order (Fouts, Shapiro & O'Neil, 1978). In a study with Lucy it was found that she was able to categorize and conceptualize fruits as different from vegetables and that she would describe novel objects by combining signs already existing in her vocabulary. For example, Lucy referred to a watermelon as a CANDY DRINK and a DRINK FRUIT, and she called an old bitter radish a CRY HURT FOOD after she took a bite of it and spits it out (Fouts, 1975). Ally also demonstrated that he could be taught ASL signs using vocal English words as exemplars and then in a blind condition transfer these signs to their physical referents (Fouts, Chown & Goodin, 1976). In addition to these new chimpanzees, Washoe continued to learn new signs. For example, we did a follow up on my dissertation (Fouts, 1972) examining the relative efficacy of the procedures of modeling and molding for teaching new signs. In my dissertation, with a 3 to 4-year-old Washoe, molding was the superior technique. In the follow-up study with a nine-year-old Washoe and an eight-year-old Lucy the two procedures were found to be equally effective (Fouts & Goodin, 1974). Like Lucy, Washoe also combined signs to produce novel phrases to describe objects for which she did not have signs in her vocabulary such as WATER BIRD for a swan on lake, and ROCK BERRY for Brazil nuts (Fouts & Rigby, 1977).

3. Washoe

3. Washoe Converses with Chimpanzees

Before Washoe went to Oklahoma she had not been around chimpanzee since she was an infant. At Oklahoma she initially did not seem to like the chimpanzees, in fact during her first introduction to them she referred to them as BLACK CATS, and BLACK BUGS neither of which animals she cared for at all. In other words, she did not apparently put them in her own class of being. However, we humans insisted that she live with them and she was housed in the colony inside a laboratory building that contained a complex of interconnected enclosures.

In addition to the laboratory there was also a 1/3 acre artificially moated island where she spent considerable time with other juvenile chimpanzees. My students, Debbi and I continued to sign with Washoe as well as with some of the other young chimpanzees that were familiar with human contact. Because Debbi and I were the only humans fluent in ASL and my students were learning and all of the other personnel at the IPS did not sign, Washoe was exposed to spoken English as well as ASL. When she first arrived in Oklahoma I had to act as interpreter for her with the IPS personnel.

One indication that Washoe began to accept the IPS chimpanzees as peers was that it was not long after her arrival that she was observed to sign to the other chimpanzees. None of the chimpanzees at that time had acquired or even been taught any ASL signs and they did not appear to understand her or attempt to respond to her signed remarks. Washoe would often sign COME HUG when some of the other juvenile chimpanzees became upset. One young chimpanzee, Manny, was not used to human contact because he was being raised by his mother in the adult colony. When Washoe was in the adult colony enclosures she would play with him through the chain-link fence that separated their enclosures. When Washoe would attempt to end the interaction and move away Manny would throw himself on the floor in a tantrum, screaming. Washoe would respond to his tantrum by signing COME HUG to him and then approach and comfort him through the wire once more. Manny began to use her COME HUG sign to replace his tantrums. Manny also began to use it in appropriate contexts as when greeting or comforting another chimpanzee (Fouts & Rigby, 1977).

Another similar incident was observed when Washoe was on the island with the other juveniles shortly after her arrival at IPS. On this occasion she was with three juveniles on the island and was grooming the young colony-born home-reared male in the middle of the island. The two juvenile female chimpanzees apparently discovered something at the east end of the island (most probably a water snake) and began giving alarm calls. Washoe stood up bipedally and watched the two females move toward the west end of the island, while they continued to give occasional alarm calls. Washoe started in that direction as well, but her young friend remained lounging on the ground. When Washoe was approximately four meters away, she turned and signed to him, COME HUG COME HUG, but he remained where he was. Washoe then went back to him, took his hand, and led him to the safe west end of the island.

On another occasion, when she was in a group of chimpanzees who were being given fruit, Washoe indicated a water spigot (aka licksip) in a corner and signed GO DRINK to one of her competitors. She often signed HUG to the young chimpanzees, but after Washoe was introduced to the adult population, the sign she used most was TICKLE. If, as was often the case, the other chimpanzees did not respond to her sign, Washoe pursued them until a tickle game was started.

The fully adult alpha male in the colony even began to use the FOOD sign. I presume that he learned it from watching Washoe. He would sign FOOD repeatedly to humans, but it was interesting when we would go and get some food for him and return with it he would stop signing, and cling to the chain-link fence with his mouth open ready to receive it. I would even hold the food out and ask in ASL "WHAT THAT", but he would only continue to stare at the food with his mouth ready to receive it.

Another incident of transmission was reported to me by Lucy's human parents. Her parents were planning to send Lucy back to Africa and in preparation they obtained a young female chimpanzee by the name of Mary Ann in the hopes that Mary Ann would supply some comfort to Lucy when she was sent to Africa. Because Lucy was being sent away I was not giving her any signing lessons, but Lucy was still a prolific and spontaneous signer with her human friends. Her human parents rarely used any sign, because they had always used vocal English to communicate with Lucy which she understood very well. Her human parents told me that Mary Ann was beginning to pick up signs from Lucy, but that Lucy apparently did not approve of this because every time Mary Ann would sign Lucy would threaten or discipline the smaller chimpanzee. Her parents were amused by the fact that Mary Ann would try to sign to them when Lucy was not looking at her, and if Lucy did turn when Mary Ann was making a sign, Mary Ann would try to disguise what she was doing by turning the sign into a scratch or a rub.

The fact that chimpanzees could so easily acquire signs from humans as well as other chimpanzees made the prospect of seeing if Washoe's infant would acquire signs from her even more promising.

4. Birth, Death and Adoption

Washoe's first infant was born in August of 1976, but the baby only lived four hours because of a congenital heart defect. Her second infant was born in January 1979 and was named Sequoyah. Unfortunately Sequoyah was also a sickly infant and died of pneumonia when he was two months old. Washoe's short time with Sequoyah showed that she had excellent maternal skills, and she had become so attached to him that she became very depressed when he died (Fouts, Hirsch & Fouts, 1982). For several days after his death Washoe would ask me "BABY?" using the questioning modulation of raising her eyebrows and holding the cradled "baby" sign in its final position. I would answer her "BABY DEAD, BABY GONE, BABY FINISHED". In response to my answer Washoe would then drop her cradled arms to her lap and break eye contact and slowly move away to a corner of the enclosure. For the next three days after I had announced his death, Washoe would greet me each morning with the question "BABY?" and I would sign to her again as I had before. In the following days she continued to isolate herself from any interactions with her human caregivers and her signing dropped off to almost nothing. Her eyes appeared vacant or distant. We put Ally, a slightly younger adult male, in with her in hopes that his active nature would serve to distract her from her obvious depression.

In order to relieve Washoe's depression and continue our study to see if Washoe would pass her language skills to her offspring we contacted several primate facilities around the country in hopes of finding an infant that could replace Washoe's dead baby. The Yerkes Regional Primate Research Center at Emory University in Atlanta Georgia kindly agreed to provide the project with a ten-month-old male. On March 24, 1979, 15 days after the death of Sequoyah, Loulis arrived at IPS. I left Loulis in the car with a student and went in to see Washoe first, and I signed to her "I HAVE BABY FOR YOU". This simple announcement seemed to snap Washoe out of her severe depression. For the first time since Sequoyah's death she became very excited. Every hair on her body stood on end. She began to pant hoot and swagger bipedally while signing "BABY, MY BABY" repeatedly. I went out to the car to fetch Loulis and returned carrying him in my arms. When I entered Washoe's enclosure and got close enough to her for her to get a good look at Loulis her high excitement disappeared immediately. I had expected her to reach for Loulis, but instead she sat down, looked at him and very calmly signed "BABY". I had expected Loulis to want to go to her because he had been away from his chimpanzee aunt only 27 hours, but instead he clung even more tightly to me as he peaked around at Washoe. I managed to pull him off me by his arms and turn him around and offer him to Washoe. The minute she took him I let go and beat a hasty retreat. No sooner had I left

when Loulis struggled out of Washoe's arms and approached the enclosure fence to get near to me. Both he and Washoe set a short space from each other, looking out, and in Washoe's case, interacting with the humans outside her enclosure.

After the first hour together, Washoe began to approach Loulis playfully, touching him gently and then moving away, in an attempt to start a tickle game or play chase. Loulis did not respond, but would turn away from her advances. He continued to sit alone on the floor and look at his new human friends just outside his enclosure. When night came, Washoe tried to get Loulis to sleep in her arms, as her own infant had done. But Loulis refused her attempts to pick him up, and chose instead to sleep alone, on the only bench available in the enclosure, the same one Washoe was on. At 4:00 A.M. the next morning, Washoe woke up, stood bipedally, swaggered, and signed COME BABY to Loulis, slapping her arms loudly as she made the "baby" sign. This commotion woke Loulis, and no doubt frightened him. He jumped into Washoe's arms and they both went back to sleep. From then on they have slept together at night. Thus within 24 hours, Washoe had begun to care for Loulis as if she were his mother, and he too, began to depend on her mothering. According to plan, the human caregivers restricted their signing in Loulis's presence and the cultural transmission study was begun.

5. Project Loulis

5.1. SIGNING CONTROLS

To make sure that Loulis would learn his signs only from chimpanzees, the human beings did not use ASL signs in his presence (with the exception of seven question signs, WHO, WHAT, WHERE, WHICH, WANT, SIGN and NAME). Instead of signing to Washoe in Loulis' presence we used vocal English which Washoe had been exposed to for nine years at IPS, and which Loulis had been exposed to since his birth at Yerkes. In addition to vocal English we also communicated using a rich repertoire of human and chimpanzee nonverbal gestures, postures, and vocalizations to interact with Washoe and Loulis. When Washoe would sign to us we would respond appropriately: for example, if she signed DRINK, we would give her a drink, or tell her in English that she would get a drink in a little while. If anyone erred and signed when Loulis was present, the instance was recorded. In the more than five years of the experiment, there were fewer than 40 such instances.

While we humans refrained from signing to Loulis, his fellow chimpanzees were not bound by this rule. In the five years and three months of this project, in addition to his adoptive mother Washoe, three other signing chimpanzees interacted with Loulis. In December 1979, seven-year-old Moja, who had been reared in the Gardners' cross-fostering laboratory (Gardner & Gardner, 1989, p.1-28) joined Washoe and Loulis at IPS. The following year, Washoe, Loulis, and Moja, along with Debbi, three students and me moved to Central Washington University. The three chimpanzees were housed in a complex of interconnected enclosures. In May 1981, Washoe, Loulis, and Moja were joined by five-and-a-half-year-old Tatu and five-year-old Dar, who had also been cross-fostered in the Gardners' laboratory.

5.2. CRITERIA FOR FORM AND USAGE

In order to qualify as a sign, a gesture that Loulis made had to resemble the form of an actual ASL sign in regard to the place where it was made (e.g., where on the body or in relation to the body of signer), the configuration of the hand, and the movement of the sign. In addition, before it was counted as a sign in Loulis' vocabulary, the gesture had to be reported by three different observers as occurring in an appropriate context. The observers recorded the gesture, the context, and the accompanying nonverbal behavior.

They also noted whether Loulis was oriented toward someone (e.g., toward Washoe, or Dar, or a human caregiver), and whether he was looking someone in the face, when he made the sign. Either or both of these behaviors were used to determine the addressee. In addition, level of arousal was scored as high, medium, or low by noting the degree to which his hair was piloerected. Loulis' body postures and facial expressions were recorded as well, as were any vocalizations (e.g., laughs, screams, or pant-hoots). If the sign and the nonverbal behaviors were consistent with each other and with the referent, then the sign was judged to have been used appropriately by Loulis.

Gestures developed into signs gradually, as in the case of COME/GIMME, which Loulis started to make soon after he joined Washoe. In early COME/GIMMEs, Loulis extended his arm in front of himself, palm up, for one to three seconds. In the following months, the form of the sign improved, as Loulis began to flex the extended hand. He also began to babble or play with this sign, making it in a variety of unrelated contexts. By August 1980, he was using COME/GIMME almost entirely in appropriate contexts, and at this time, his nonverbal behavior started to complement the COME/GIMME signs. For example, when offered a highly preferred food or drink, Loulis now looked directly at the object while he food-grunted and signed GIMME. He began to orient the sign toward humans or chimpanzees, and he gazed at the face of the addressee. During the second meeting of Loulis and Moja, when the connecting cage door was opened, Loulis oriented toward Moja and signed COME directly to her. Moja approached the signing infant, and initiated a play interaction. COME/GIMME became a distinct sign for Loulis, quite separate from reaching or the natural chimpanzee begging gesture. In approximately 25% of the COME/GIMME signs that Loulis made, he used one hand to sign and the other hand to reach or to make the begging gesture.

In a number of cases, such as the signs TICKLE, DRINK, and HUG, there was an initial period during which Loulis used the correct form in a variety of contexts before he restricted their use to appropriate contexts. Loulis was not credited with these signs until there were three observations, by different observers, of his use of the sign in appropriate contexts. In the case of TICKLE, for example, Loulis had many opportunities to observe Washoe soliciting tickling from the human caregivers. Washoe would first sign TICKLE, then press her side against the wire of her enclosure so that the person could tickle her. Initially, Loulis imitated Washoe by pressing his body to the wire of the enclosure, without making the sign, and almost always the caregiver would tickle him when he did this. Later, Loulis began to make TICKLE signs, but did not press his body to the wire of the enclosure. Then he went through a period of signing TICKLE repeatedly to himself, without approaching the human caregiver. Finally, he began to incorporate the nonverbal elements that Washoe used in signing TICKLE. Thus, he would approach persons with a play-face, slightly bipedal, and sign TICKLE either on himself or on the person, and then press his side or bottom against the wire of the enclosure for tickling. Thirteen of Loulis' first 22 signs went through a transition of this sort, before he began to use them in their appropriate contexts (Fouts, Hirsch & Fouts, 1982; Fouts, Fouts & Van Cantfort, 1989).

5.3. LOULIS' SIGN VOCABULARY

The first sign to appear in Loulis' vocabulary was the name sign that Washoe used for George Kimball. Loulis was first observed to use this sign eight days after his introduction to Washoe. George's name sign was made by moving the open hand down the back of the head, indicating the long hair, fashionable for men in the 1970's. However, Washoe changed the form of the sign in a very effective way. George was in charge of serving Washoe and Loulis breakfast, so his attention was much in demand. If George had his back turned, he could not tell that Washoe was signing. Washoe's response to this was to make his name sign into a noisy sign, by slapping the top of her head. The sign proved to be so effective in getting George's attention, that Washoe began to use it to refer to persons who did not have name signs, and finally, to anyone who was not looking at her. We

glossed this noisy attention-getting sign as the PERSON (or "Hey you!") sign. In addition to Loulis, Moja, Tatu, and Dar also acquired this unusual sign from Washoe, and all used it in the same way as Washoe did.

At 15 months of age, Loulis started to use combinations of two signs, such as HURRY GIMME and PERSON COME. By 29 months, Loulis was using at least 17 different signs (Fouts, Hirsch & Fouts, 1982). By age 63 months, his vocabulary had grown to 47 signs (Fouts, Fouts & Schoenfeld, 1984). On June 24, 1984, after five years and three months of the experimental procedure, we ended the restriction on human signing in Loulis' presence, because, in essence, it was a form of deprivation for Loulis as well as for the other chimpanzees. At that time Loulis was 73 months old, and his vocabulary consisted of the 51 signs shown in Table 1 (Fouts, Fouts, & Van Cantfort, 1989). A few of his signs, such as FLOWER/DEB and HAT/PERSON, appeared to be homonyms, and the form described in the table was assigned two different English glosses, for the two distinct contexts in which it was used. If the signs that are homonyms in form are counted as separate signs, then his vocabulary was 55 signs at that time.

Table 1 shows that the vocabulary of Loulis included signs from several different categories: names (e.g., ALAN, DAR), pronouns (ME, YOU), nouns (e.g., BALL, BIRD), verbs (e.g., CHASE, HUG), locatives (e.g., IN, OUT) and such markers and traits as NO, SORRY, and WANT. This last sign has two distinct forms in ASL--a one-handed version, placed on the signer's chest, and a two-handed version, made in the space before the signer's body (cf. DESIRE and WANT in Stokoe, Casterline, & Croneberg, 1976, Dictionary of American Sign Language). Washoe used the first of these forms, while one of the few signs used by human signers in Loulis' presence was the other form of WANT. Even though Loulis was exposed to both forms of the sign, the WANT that he acquired was the one used by his mother.

In June 1986, the policy of speaking and signing in the presence of the chimpanzees was changed. From that time on, only signing was used in the presence of the chimpanzees with few exceptions (e.g., experiments that demonstrated that the chimpanzees continued to understand spoken English and could actually translate vocal English words into their ASL glosses, See H. Shaw, 1989, "Comprehension of the spoken word and ASL translation by chimpanzees (Pan troglodytes)", Friends of Washoe Newsletter, 9, No.1/2, 8-19.) and vocal speech was used only outside the chimpanzee living area. Since that time Loulis' observed vocabulary has increased by another 18 signs. Eight of the signs have met the three observation criteria (BABY, CRY, GROOM, ORANGE, QUIET, SODAPOP, STUPID, and YES) and other have not (BERRY, BITE, BOY, HAIR, HOOD, KATHLEEN, KISS, LOOK, RED, and SMELL). Of course we cannot be sure if he acquired these signs from humans or chimpanzees.

5.4. WASHOE TEACHES SIGNS

When Washoe was an infant in Reno, her human foster family taught her signs by modeling, molding, and signing on her body the way human parents teach deaf infants (Gardner & Gardner, 1989; Maestas & Moores, 1980; Schlesinger & Meadow, 1972). She used all of these methods with her own infant, Loulis. Teaching has also been observed between mothers and their infants among wild chimpanzees in regard to tool use (Boesch, 1991).

During the first three days that they were together, Washoe often turned toward Loulis, signed COME, approached, and then grasped his arm and retrieved him. During the next five days, she signed COME, and only approached Loulis. Then after eight days, Washoe no longer approached but only signed COME while orienting and looking at Loulis until he responded by coming to her. COME was among the first signs that Loulis came to use.

Parents of deaf children often mold the infant's hand into the configuration and then put the hand through the movement of the sign (Gardner & Gardner, 1989, pp. 18-19; Maestas y Moore, 1980, pp. 5-6). Washoe also molded Loulis' hands. For example, while

waiting for a candy bar that a human friend was bringing her, Washoe signed FOOD repeatedly with much excitement and food-grunts. Loulis was sitting next to her, watching. Washoe stopped signing, took Loulis' hand, molded it into the FOOD configuration, and put it through the FOOD movement several times. In a similar context, Washoe formed the sign GUM, but with her hand on Loulis' cheek. During the first few months after his arrival, Washoe was also observed to place DRINK on Loulis' lips and HAT on his head, the way parents of deaf children place signs on their infants (Gardner & Gardner, 1989, p. 19; Maestras y Moores, 1980, p. 5; Rimpau, Gardner & Gardner, 1989, pp. 249-250; Schlesinger & Meadow, 1972, pp. 67-68).

Sometimes the first observation of a new sign involved direct imitation. For example, Loulis first used DRINK during a meal after Washoe used this sign in answer to a human caregiver who had asked WHAT about a drink. As Washoe was signing DRINK, Loulis watched her and signed DRINK, himself. Washoe also modeled directly for Loulis. For example, she signed BRUSH and then brushed Loulis with a hairbrush. On another occasion, Washoe placed a small plastic chair in front of Loulis, and then signed CHAIR/SIT to him several times in succession, watching him closely throughout.

It is important to remember that Washoe and Loulis were not under constant observation. Funds available in those critical early days permitted only four hours per day of scheduled observation by trained observers. In only a handful of cases could we be sure that we had observed the events surrounding the first use of a sign by Loulis. In most cases Loulis' signs appeared to be delayed imitations of signs that he had seen Washoe or another signing chimpanzee using in similar context (Fouts, Hirsch & Fouts, 1982).

5.5. CULTURAL TRANSMISSION OF NON-SIGNING SKILLS

In addition to signs, Loulis acquired other skills from the cross-fostered chimpanzees. He learned to use bowls and spoons as feeding implements, just as Washoe, Moja, Tatu, and Dar used them. He learned to build a sleeping nest with blankets in Washoe's unique way. Washoe builds a nest by taking her blanket and swirling it around herself on the floor, and sometimes she wraps herself in it. Then she collects toys and other objects and places them in her nest. For many months, Loulis simply watched Washoe, or played by himself, although occasionally he helped by giving her a toy. Then, Washoe began to hold Loulis as she built her nest. Eventually, Loulis learned Washoe's nesting methods and when given his blanket at night, he swirled it around himself as she did.

Note that Washoe's tutoring did not always work. Debbi Fouts in her paper presented at this conference reports an instance where Loulis is grooming a cut on Tatu using a stick. Washoe was observed to take the stick away from him, break it, discard it, and then demonstrate how to groom a cut with her lips. Her attempt was in vain because he continued to try to use the stick.

5.6. WASHOE LEARNS FROM THE OTHER CHIMPANZEES

Washoe herself has learned new signs from Moja, Tatu, and Dar. Because the Gardners could not find the BLANKET sign in the sign language manuals then available, Washoe was taught to use the noun/verb COVER for blankets (Gardner, Gardner & Nichols, 1989, pp. 60-61). Later in Reno, Moja, Tatu, and Dar were taught BLANKET, which differs in place, configuration, and movement from COVER. After these younger chimpanzees joined her, Washoe came to use both signs for blankets. From Moja, Washoe acquired a more precise form of the sign APPLE, and used it for apples, only. She continued to use the earlier form of her sign for several different kinds of fruits (cf. B. Gardner & Gardner, 1975, p.261).

TABLE 1. The f

SIGN
ALAN
APPLE/FRUIT
BALL
BANANA
BIB
BIRD
BLANKET
BOOK
BRUSH
CATCH
CHASE
CLEAN
COMB
COME/ GIMME*

TABLE 1. The form of signs in Loulis' vocabulary

SIGN	PLACE	CONFIGURATION	MOVEMENT
ALAN	Temple	Fist	Index edge contacts
APPLE/FRUIT	Cheek	Curved hand palm up	Knuckles rub down
BALL	Fingertips	Both curved hands, facing palm up	Fingertips of opposite hands contact
BANANA	Tip of index, extended from fist	Hooked index, extended from fist	Fingers hook and pull apart
BIB	Chest	Both open hands, palms to signer	Fingertips contact and move down
BIRD	Lips	Pincer hand palm to signer	Index and thumb grasp repeatedly
BLANKET	Underside of chin	Both fists, palms to signer and forearms vertical	Knuckles contact
BOOK	Palms	Both curved hands, palms facing palms	Palms of opposite hands grasp
BRUSH	Arm or part of body to be brushed	Open hand or compact hand, palm to body	Rubs to and fro
CATCH	Palm of curved hand	Fist	Fist contacts with palm of curved hand
CHASE	Wrist of curved hand, forearm extended	Fist	Knuckles contact repeatedly
CLEAN	Palm, open hand, palm up	Fist	Knuckles rub repeatedly in circles
COMB	Temple	Open hand or claw hand palm to signer	Rubs down
COME/ GIMME*	Space in front of signer	Curved hand, pincer hand palm down or palm to side	Arm extended toward addressee or object, then wrist or fingers beckon

DAR	Ear	Index extended from loose fist	Tip of index contacts or rubs forward	HUG*
DIANA	Nose	Thumb extended from open hand palm to side	Thumb contacts	HURRY
DIRTY	Underside of chin	Open hand or fist, palm down	Back of wrist contacts repeatedly, often with force so that teeth click together audibly (the audible component is characteristic of Washoe also)	IN
				ME/ MINE*
				MILK
DRINK*	Lips or mouth	Thumb extended from fist	Tip of thumb contacts or inserts	MORE
FLOWER/ DEB	Nose	Curved hand, palm to signer	Fingertips contact	NO
FOOD/ EAT	Lips	Curved or pincer hand, palm to signer	Fingers contact	NUT*
FRIEND	Indexes	Both hooked indexes extended from fists, one palm up and other palm down	Indexes of opposite hand interlock	OUT
GO*	Space in front of signer	Index extended from fist or from open hand	Arm extends away from signer, wrist rotates to point index toward location	PAINT
GOOD*	Lips	Open hand, palm to lips	Palm contacts repeatedly	PEEK-A-BOO/ MASK
GUM	Cheek	Index extended from fist	Tip of index contacts then bends and straightens	PLEASE
HAT/ PERSON*	Top of head	Open hand, palm down	Palm contacts repeatedly	ROGER
HOSE	Space in front of signer	Index extended from fist	Index or hand wiggles up and down	SANDWICH
HOT/ COFFEE	Space in front of signer	Open hand, palm to signer	Approaches then turns palm down while extending arm away from signer	SHOE*

HUG*	Upper arms	One or both curved hand(s), forearms crossed	Palms contact
HURRY	Space in front of signer	Spread hand bent at wrist	Shakes
IN	Curved hand, index edge up	Open hand, palm to signer and fingers point down	Fingers insert
ME/ MINE*	Chest	Open hand, palm to signer	Palm contacts repeatedly
MILK	Space in front of signer	Fist, index edge up	Squeezes repeatedly
MORE	Fingertips	Both pincer hands	Fingertips of opposite hands contact repeatedly
NO	Head	N/A	Shakes side to side
NUT*	Teeth	Thumb extended from fist, palm down	Tip of thumb rubs away from signer
OUT	Palm of curved hand, palm to signer, index edges up	Open hand, fingers point down	Back of hand contacts then moves up out of grasp
PAINT	Palm of hand	Open hand, palm to signer	Fingertips contact then fingers bend and straighten
PEEK-A-BOO/ MASK	Both eyes	Open hand or hands, palm to signer	Palm or palms contact
PLEASE	Chest	Open hand, palm to signer	Palm contacts and draws across
ROGER	Ear	Pincer	Index and thumb grasp
SANDWICH	Back of open hand, palm to signer	Curved hand, palm to signer and crossing signer	Palm contacts and hand grasps
SHOE*	On object or space in front of signer	One fist or both fists, side by side and palms to signer	Knuckles contact object or ground

SORRY	Chest	Open hand, palm to signer	Rubs down
SWALLOW	Throat	Index extended from fist or from open hand	Tip of index rubs down
THAT/ THERE	On object or space in front of signer	Index extended from fist	Tip of index contacts object or points toward object or location
TICKLE*	Back of hand, or place on body to be tickled	Hooked index extended from fist	Tip of index rubs to side
TIME	Back of wrist	Hooked index extended from fist	Tip of index contacts sometime repeatedly
TOOTHBRUSH	Lips or teeth	Index extended from fist	Index edge rubs side to side
WANT	Chest	Curved hand, palm to signer	Contacts and rubs down
WASHOE	Contralateral ear	Curved hand	Fingertips rub
YOU	Addressee	Index extended from fist	Index points toward addressee

*Loulis' first ten signs

6. Conclusion

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6. Conclusion

The findings presented here show that Loulis acquired signing and other skills from Washoe and the younger chimpanzees in his community. As in human language acquisition (Moerk, 1976), the chimpanzee mother actively taught her offspring, and the infant actively learned. The laboratory environment provided interesting events and an enriched social atmosphere, "interesting things to talk about ... and good friends to talk to" (R. Gardner & Gardner, 1974). Data collection by trained observers was a matter of course -- as much a part of the routine as serving meals and cleaning. Because of this we have been able to examine the development of social behavior, communication, and other skills in Loulis without disrupting them, and in this way, obtained a comprehensive record of cultural transmission.

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