

8. The Infant Loulis Learns Signs from Cross-Fostered Chimpanzees

Roger S. Fouts, Deborah H. Fouts
and Thomas E. Van Cantfort

In October 1970, Roger Fouts brought Washoe to the Institute for Primate Studies (IPS), University of Oklahoma, where he had been appointed as Research Associate. The University of Oklahoma maintained a colony of 18 chimpanzees at IPS, and Fouts planned to continue the research with Washoe there, with new objectives and new questions. Would Washoe sign to the other chimpanzees? If Washoe signed to them, what would she sign? Would the other chimpanzees learn signs, either from human caregivers or from Washoe herself? The long range goal of the continuation of Project Washoe was to explore the cultural transmission of ASL: Would Washoe pass on her signing skills to an offspring?

Washoe at Oklahoma

At IPS, Washoe was housed with other chimpanzees of the colony, inside a laboratory building, in a complex of interconnected enclosures. As part of her introduction to the colony, she also spent considerable time with other juveniles, on a one-third acre island in a lake, several hundred feet from the laboratory building. The Oklahoma students who were members of Roger Fouts' research team used both ASL and spoken English when interacting with Washoe. Although none of the students were native or fluent signers, they all attended class in ASL throughout their participation in the research.

Washoe was observed to sign to the other IPS chimpanzees shortly after her arrival. At that time, the other chimpanzees had no experience with ASL, and did not appear to understand what she was signing, nor to answer her. Washoe often signed COME HUG to other juvenile chimpanzees when they became upset. Once, when she was with three juveniles on the island, she signed this phrase in a somewhat different context. While Washoe was grooming a young colony-born male in the middle of the island, two female chimpanzees discovered something that frightened them at the east end of the island (most probably a snake) and began giving alarm calls. Washoe stood up bipedally and watched the two females move toward the other end of the island, while they

continued to give occasional alarm calls. Washoe started in that direction also, 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 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 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.

Booee, Bruno, Cindy, and Thelma were the first of the IPS chimpanzees to learn signs from their human caregivers (Fouts, 1973). Booee and Bruno, and later , Lucy and Ally (a.k.a. Ali), went on to acquire sizable vocabularies and sophisticated signing skills (Fouts, 1975; Fouts, Chown & Goodin, 1976; Fouts, Shapiro & O'Neil, 1978). At least one of the young chimpanzees, Manny, learned COME HUG from Washoe, and used it in appropriate contexts, such as when greeting or when comforting another chimpanzee (Fouts & Rigby, 1977). Washoe, herself, continued to learn new signs, adding items such as MONKEY and ROCK to her vocabulary. She participated in a study comparing the effectiveness of two specific procedures, modelling and molding, for introducing new signs (Fouts & Goodin, 1974). In this follow up of Fouts' dissertation research (1972), modelling and molding were equally effective procedures for nine-year-old Washoe (and eight-year-old Lucy). Washoe also continued to produce phrases, and some of her phrases were novel combinations of signs describing objects that were not represented by a sign in her vocabulary, such as WATER BIRD for the swans on the lake, and ROCK BERRY for Brazil nuts (Fouts & Rigby, 1977).

Washoe's Babies

In August, 1976, Washoe gave birth to her first infant, a baby with a congenital heart defect who lived for four hours only. In January, 1979, she gave birth to her second infant, Sequoyah, fathered by Ally. Unfortunately, this infant was sickly also, and died of pneumonia when he was two months old. Throughout Sequoyah's short life, Washoe displayed excellent maternal behavior (for details see Fouts, Hirsch & Fouts, 1982).

Several primate facilities around the country were contacted in hopes of finding an infant that could replace Washoe's dead baby. The Yerkes Regional Primate Research Center kindly agreed to provide the project with a ten-month-old male, and on March 24, 1979, 15 days after the death of Sequoyah, Loulis arrived at IPS. Fouts went to see Washoe first, and signed to her, I HAVE BABY FOR YOU. Washoe became very excited. Every hair on her body stood on end.

She began to hoot and swagger bipedally while signing, *BABY MY BABY* repeatedly. Fouts then went out to fetch Loulis. When he returned carrying Loulis and entered Washoe's enclosure her high excitement disappeared immediately. Fouts had expected Washoe to take and hold Loulis, but instead she only looked at him and signed a very calm, *BABY*. Loulis, meanwhile, clung tightly to Fouts while watching Washoe. When Fouts left the two in their enclosure, they were sitting next to each other, looking out, and, in Washoe's case, interacting with the human observers.

After an hour, Washoe began to approach Loulis playfully, touching him gently and then moving away, in an attempt to start tickle or chase play. Loulis did not respond. He continued to sit on the floor and look at the humans. When night came, Washoe tried to get Loulis to sleep in her arms, as her own infant had done. Loulis refused, and slept alone, on the same bench as Washoe. 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 signed. This commotion woke Loulis, and no doubt frightened him. He jumped into Washoe's arms and they both went back to sleep, and 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 to Washoe, and the present study was initiated.

Project Loulis

Signing to Loulis

To show that Loulis could learn signs from chimpanzees, 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, Fouts and his associates used vocal English and the rich repertoire of human and chimpanzee nonverbal gestures, postures, and calls to interact with Washoe and Loulis. When Washoe signed to them, they responded appropriately: for example, if she signed *DRINK*, she was given a drink, or told, 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. Over the five years of the experiment, there were fewer than 40 such instances.

While humans refrained from signing to Loulis, chimpanzees were not bound by this rule. In addition to his adoptive mother Washoe, three other signing chimpanzees interacted with Loulis, in the course of the five-year-three-month experiment. In December 1979, seven-year-old Moja, who had been reared in the Gardners' cross-fostering laboratory (see Chapter 1 this volume) joined Washoe and Loulis at IPS. The following year, Washoe, Loulis, and Moja, along with the Fouts, moved to Central Washington University. The three



Fig. 8.1 Washoe (15.5 years) with her adopted son Louie (3 years).

chimpanzees were housed in a new 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.

Criteria of 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 place, configuration, and movement. 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 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 pilo-erected. 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 sign TICKLE, DRINK, and HUG, there was an initial period during which Loulis used the correct form in a variety of context 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 caging so that the person could tickle her. Initially, Loulis imitated Washoe by pressing his body to the caging, without making the sign, and usually the caregiver would tickle him when he did this. Later, Loulis began to make TICKLE signs, but did not press his body to the caging. 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 caging 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).

Signs in Loulis' 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 originally made by moving the open hand down the back of the head, indicating the long hair, fashionable for men in the 1970s. 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. So Washoe made his name and made 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 age 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, the restriction on human signing in Loulis' presence was ended, 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 8.1. 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.

Table 8.1 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 (see Table 3.2), 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 chimpanzees¹, and vocal speech was used only outside the chimpanzee living area. As of October 1987, the vocabulary of Loulis had increased to 70 signs.

Washoe as Teacher

When she was an infant in Reno, Washoe's human foster family taught her signs by modelling, molding, and signing on her body the way human parents teach deaf infants (Maestas y Moores, 1980; Schlesinger & Meadow, 1972; Chapter 1 this volume). She used all of these methods with her own infant, Loulis.

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 the first 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 a sign (Maestas y Moores, 1980, pp. 5-6; Chapter 1 this volume). Washoe also molded Loulis' hands. For example, while waiting for a candy bar that a human friend was bringing to 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 (see Table 3.2 this volume). In a similar context,

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With the exception of occasional tests, to demonstrate that the chimpanzees continued to understand spoken English.

Table 8.1
Form of Signs in Loulis' Vocabulary

<p>ALAN P: Temple C: Fist M: Index edge contacts</p>	<p>BOOK P: Palms C: Both curved hands, palms facing M: Palms of opposite hands grasp</p>
<p>APPLE/FRUIT P: Cheek C: Curved hand, palm to P M: Knuckles rub down</p>	<p>BRUSH P: Arm or other place on body to be brush C: Open hand or fist, palm to Signer M: Rubs to and fro</p>
<p>BALL P: Fingertips C: Both curved hands, palms facing M: Fingertips of opposite hands contact</p>	<p>CATCH P: Palm, of curved hand C: Fist M: Back of fist contacts</p>
<p>BANANA P: Tip of index, extended from fist C: Hooked index extended from fist M: Index grasps then pulls toward signer</p>	<p>CHASE P: Inside of wrist, of open hand, forearm extended C: Fist M: Knuckles contact repeatedly</p>
<p>BIB P: Chest C: Both open hands, palm to Signer M: Fingertips rub down</p>	<p>CLEAN P: Palm, of open hand, palm up C: Fist M: Knuckles rub repeatedly in circle</p>
<p>BIRD P: Lips C: Pincer hand, palm to Signer M: Index and thumb grasp repeatedly</p>	<p>COMB P: Temple C: Open hand or claw hand, palm to P M: Rubs down</p>
<p>BLANKET P: Underside of chin C: Both fists, palms to Signer and forearm vertical M: Knuckles contact</p>	<p>COME/GIMME* P: Space in front of Signer C: Curved hand or pincer hand, palm down or palm to side M: Arm extends toward Addressee or object, then wrist or finger beckon</p>

Table 8.1 (continued)

<p>DAR P: Ear C: Index extended from fist M: Tip of index contacts or rubs forward</p>	<p>GO* P: Space in front of Signer C: Index extended from fist or from open hand M: Arm extends away from Signer then wrist rotates to point of index toward location</p>
<p>DIANA P: Nose C: Thumb extended from open hand, palm to side M: Thumb contacts</p>	<p>GOOD* P: Lips C: Open hand M: Palm contacts repeatedly</p>
<p>DIRTY P: Underside of chin C: Open hand or fist, palm down M: Back of wrist contacts repeatedly, often forcefully so that teeth click together audibly (the audible component is characteristic of Washoe also)</p>	<p>GUM P: Cheek C: Index extended from fist or from open hand M: Tip of index contacts then bends and straightens</p>
<p>DRINK* P: Lips or mouth C: Thumb extended from list M: Tip of thumb contacts or inserts</p>	<p>HAT/PERSON* P: Top of head C: Open hand M: Palm contacts repeatedly</p>
<p>FLOWER/DEB P: Nose C: Curved hand, palm to Signer M: Fingertips contact</p>	<p>HORSE P: Space in front of Signer C: Index extended from fist M: Index or hand wiggles up and down</p>
<p>FOOD/EAT P: Lips C: Curved hand or pincer hand, palm to Signer M: Fingertips contact</p>	<p>HOT/COFFEE P: Space in front of lips C: Open hand M: Approaches then turns to palm down while extending arm away from Signer</p>
<p>FRIEND P: Indexes C: Both hooked indexes extended from fists, one palm up and other palm down M: Index of opposite hand interlock</p>	<p>HUG* P: Upper arms C: One curved hand or both curved hands, forearms crossed M: Palms contact</p>

Table 8.1 (continued)

<p>HURRY P: Space in front of Signer C: Spread hand, bent at wrist M: Shakes</p>	<p>PAINT P: Palm of hand C: Open hand, palm to Signer M: Fingertips contact then fingers bend and straighten</p>
<p>IN P: Palm, of curved hand, index edge up C: Open hand or curved hand, palm to Signer and fingers point down M: Finger insert</p>	<p>PEEKABOO/MASK P: Both eyes C: Open hand M: Palm contacts</p>
<p>ME/MINE* P: Chest C: Open hand M: Palm contacts repeatedly</p>	<p>PLEASE P: Chest C: Open hand, palm to P M: Rubs to side</p>
<p>MILK P: Space in front of Signer C: Fist, index edge up M: Squeezes repeatedly</p>	<p>ROGER P: Ear C: Pincer hand M: Index and thumb grasp</p>
<p>MORE P: Fingertips C: Both pincer hands M: Fingertips of opposite hands contact repeatedly</p>	<p>SANDWICH P: Back, of open hand, palm to Signer C: Curved hand, palm to P and crossing P M: Palm contacts and hand grasps</p>
<p>NO P: Head C: N/A M: Shakes side to side</p>	<p>SHOE* P: On object or space below Signer C: One fist, or both fist, side by side and palms to Signer M: Knuckles contact object or ground</p>
<p>NUT* P: Teeth C: Thumb extended from fist, palm down M: Tip of thumb rubs away from Signer</p>	<p>SORRY P: Chest C: Open hand, palm to Signer M: Rubs down</p>
<p>OUT P: Palm, of curved hand, palm to Signer C: Open hand, fingers point down M: Back of hand contacts then moves up out of grasp</p>	<p>SWALLOW P: Throat C: Index extended from fist or from open hand M: Tip of index rubs down</p>
	<p>THAT/THERE P: On object or in space in front of Signer C: Index extended M: Tip of index contacts or points toward object or location</p>

Table 8.1 (continued)

TICKLE* P: Back of hand or place on body to be tickled C: Hooked index extended M: Tip of index rubs to side	WANT P: Chest C: Curved hand, palm to Signer M: Rubs down
TIME P: Back of wrist C: Hooked index extended M: Tip of index contacts sometimes repeated	WASHOE P: Contralateral ear C: Curved hand M: Fingertips rub
TOOTHBRUSH P: Lips or teeth C: Index extended from fist or from open hand, finger points to side M: Edge of index rubs side to side	YOU P: Addressee C: Index extended M: Index points

P = Place, C = Configuration, and M = Movement

*Indicates first ten signs acquired by Loulis

Washoe formed the sign GUM, but with her hand on Loulis' cheek (see Table 3.2 this volume). 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 (Maestas y Moores, 1980, p. 5; Schlesinger & Meadow, 1972, pp. 67-68; see also Chapter 1 and 6 this volume).

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).

Nonverbal 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.

Washoe Learns From the Younger 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 (see Chapter 3 this volume, pp. 60-61). Later in Reno, Moja, Tatu and Dar, were taught BLANKET, which differs in place, configuration, and movement from COVER (see Table 3.2). 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 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).

CONCLUSION

The findings presented in this chapter 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, obtain a comprehensive record of cultural transmission.

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