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# **The Cognitive Animal**

## **Empirical and Theoretical Perspectives on Animal Cognition**

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# 35 Chimpanzee Signing: Darwinian Realities and Cartesian Delusions

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## Darwinian Realities

Truly discontinuous, all-or-none phenomena must be rare in nature. Historically, the great discontinuities have turned out to be conceptual barriers rather than natural phenomena. They have been passed by and abandoned rather than broken through in the course of scientific progress. The sign language studies in chimpanzees have neither sought nor discovered a means of breathing humanity into the soul of a beast. They have assumed instead that there is no discontinuity between verbal behavior and the rest of human behavior or between human behavior and the rest of animal behavior—no barrier to be broken, no chasm to be bridged, only unknown territory to be explored. (R. Gardner et al. 1989, p. xvii)

## Cross-Fostering

While chimpanzees (*Pan troglodytes*) have great difficulty adapting their vocalizations to human speech (Hayes and Hayes 1951; Hayes and Nissen 1971), they can freely move their hands, meaning that a gestural language is well suited to their abilities. R. A. and B. T. Gardner recognized this in their sign language studies with young chimpanzees. In 1966, the Gardners brought 10-month-old Washoe to the University of Nevada-Reno when they began their cross-fostering study. The Gardners described this approach as follows:

Cross-fostering a chimpanzee is very different from keeping one in a home as a pet. Many people keep pets in their homes. They may treat their pets very well, and they may love them dearly, but they do not treat them like children. True cross-fostering—treating the chimpanzee infant like a human child in all respects, in all living arrangements, 24 hours a day every day of the year—requires a rigorous experimental regime that has rarely been attempted. (R. A. Gardner and Gardner 1998, p. 292)

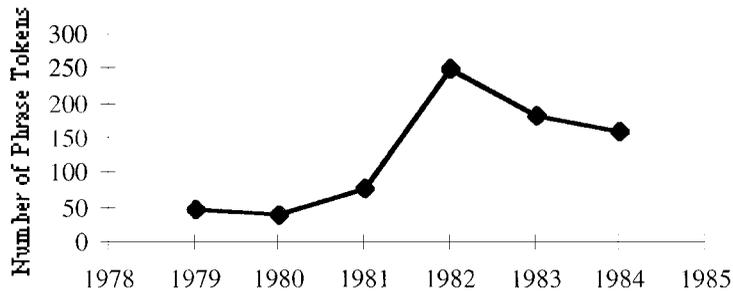
The Gardners and students in the cross-fostering project used only American Sign Language

(ASL) in Washoe's presence (B. T. Gardner and Gardner 1971, 1974, 1989; R. A. Gardner and Gardner 1969).

In teaching sign language to Washoe [and other later cross-fosterlings] we imitated human parents teaching young children in a human home. We called attention to everyday events and objects that might interest the young chimpanzees, for example, THAT CHAIR, SEE PRETTY BIRD, MY HAT. We asked probing questions to check on communication, and we always tried to answer questions and to comply with requests. We expanded on fragmentary utterances using the fragments to teach and to probe. We also followed the parents of deaf children by using an especially simple and repetitious register of ASL and by making signs on the youngsters' bodies to capture their attention. (R. A. Gardner and Gardner 1998, p. 297)

In 1970 Washoe left Reno with companions Roger and Deborah Fouts for the Institute of Primate Studies (IPS) at the University of Oklahoma in Norman. The Gardners began a second cross-fostering project with four other infant chimpanzees. Moja, Pili, Tatu, and Dar were born in American laboratories and each arrived in Reno within a few days of birth. Moja arrived in November 1972 and cross-fostering continued for her until the winter of 1979 when she left for IPS. In 1980, Washoe and Moja moved with the Fouts to the Chimpanzee and Human Communication Institute (CHCI) on the campus of Central Washington University in Ellensburg, Washington. Tatu arrived in Reno in January 1976 and Dar in August 1976. Cross-fostering continued for Tatu and Dar until May 1981, when they left to join Washoe and Moja in Ellensburg. Pili arrived in Reno in November 1973 and died of leukemia in October 1975.

The size of the chimpanzees' vocabulary, their responses to *Wh*- questions (where, why, when etc.), number of utterances, proportion of phrases, variety of phrases, length of phrases, complexity of phrases, and inflection all grew



**Figure 35.1**  
Number of phrase tokens.

throughout 5 years of cross-fostering (R. A. Gardner et al. 1992; B. T. Gardner and Gardner 1974, 1989, 1998). “Washoe, Moja, Pili, Tatu, and Dar signed to friends and strangers. They signed to each other and to themselves, to dogs and to cats, toys, tools, even to trees” (R. A. Gardner and Gardner 1989, p. 24). Signing was a robust behavior in the chimpanzees.

### Cultural Transmission

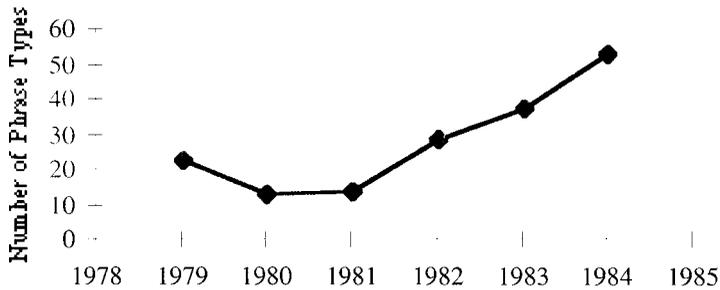
At CHCI we continued to explore how the chimpanzees acquired signs and used them to communicate with humans and each other. The first of these studies began in 1978. In 1979, Washoe adopted a 10-month-old son, Loulis. To show that Loulis would learn signs from Washoe and other signing chimpanzees without human intervention, we restricted human signing when Loulis was present except for seven specific signs, WHO, WHAT, WHERE, WHICH, WANT, SIGN, and NAME. Humans used vocal English to communicate in his presence. Loulis began to sign in 7 days; at 15 months of age he combined signs; and at 73 months of age his vocabulary consisted of 51 signs (R. S. Fouts 1994; R. S. Fouts et al. 1982, 1989).

Human observers maintained written records of Loulis’s signing and behavioral development. We used all of the records from his tenth month (the first month of the project) to his seventy-

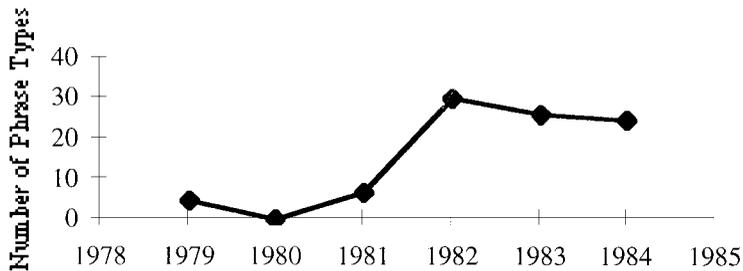
second month. From this record we plotted the growth of Loulis’s phrases. A phrase is two or more different signs within two utterance boundaries. Utterance boundaries are defined by a pause marked by a relaxation of the hands within the signing area, or dropping the hands from the signing area altogether. The observer indicated utterance boundaries in the field records with a slash. Reiteration, where a sign is repeated for emphasis, did not meet the requirement for a phrase in that it did not contain two different signs.

Phrase tokens provide information on the frequency of all phrases that appeared in a year. YOU CHASE and CHASE YES are examples of two different phrase tokens. When Loulis signed ME ME GOOD GOOD once on March 1, 1984 and ME ME GOOD GOOD once on May 28, 1984, this was counted as two tokens. Figure 35.1 shows the total number of phrase tokens recorded for Loulis each year. Loulis’s pattern is similar to that of Moja in figure 2 of B. T. Gardner and Gardner (1998).

We grouped phrase tokens into types according to the signs that they contained regardless of the order of the signs in the utterance. For example, all phrases that contained the signs THAT HURRY, HURRY THAT, and THAT THAT HURRY HURRY THAT THAT were the same phrase type containing the two signs HURRY and THAT. This provides information on the



**Figure 35.2**  
Number of phrase types: two sign phrases.



**Figure 35.3**  
Number of phrase types: three or more sign phrases.

variety of phrases that Loulis produced. Figure 35.2 shows the total number of phrase types recorded for Loulis each year. After the third year of the project, Loulis showed a steady increase in the variety of his phrases. This pattern was similar to that of Moja, Tatu, Pili, and Dar in figure 3 of B. T. Gardner and Gardner (1998). Figure 35.3 shows the development of phrase types with three or more signs for Loulis. An example is HURRY YOU TICKLE. After the fourth year of the project, there was a sharp increase in the variety of Loulis's three or more sign phrases.

Loulis's phrase development paralleled that of the cross-fostered chimpanzees. Like human children, the development of phrases grew gradually in Loulis and the cross-fostered chimpanzees (B. T. Gardner and Gardner 1998). Loulis's

acquisition of phrases is particularly impressive since it occurred in the absence of human signing and his only models were other signing chimpanzees.

### Remote Videotaping

In June 1984, the restriction on signing around Loulis ended and we turned our attention to recording Loulis's use of signs by remote videotaping, a technique that allowed the behavior of the chimpanzees to be recorded with no humans present. In the original method, three cameras were mounted in a chimpanzee enclosure, with each focused on part of the enclosure. Later a fourth camera was added. The cameras were attached to television monitors and to a video-

cassette recorder (VCR) in another room away from the chimpanzees. Only one camera recorded at a time and the VCR operator could control which camera recorded.

D. H. Fouts (1994) made 45 hours of remote videotape recordings to examine Loulis's interactions with Washoe, Moja, Tatu, and Dar. Loulis initiated 451 interactions, both signed and nonsigned, with the other chimpanzees. Forty percent (181) of those interactions were directed to his male peer, Dar. Loulis used 206 signs in his interactions and 114 of those were directed toward Dar. D. H. Fouts (1994) also reported 115 private signs that Loulis made when his face and body were not oriented toward another chimpanzee.

Loulis signed to the other chimpanzees and they signed to each other as well. A later study by Cianelli and Fouts (1998) found that the chimpanzees often used emphatically signed ASL signs during high-arousal interactions such as fights and active play. For example, after separating Dar and Loulis during a fight and with all the chimpanzees still screaming, Washoe signed COME HUG to Loulis. Loulis signed NO and continued to move away from Washoe. These results indicate that the chimpanzees' signing is very robust indeed and is a regular part of their interactions.

Bodamer (1987) looked for instances of private signing by the other chimpanzees in the videotapes recorded by D. H. Fouts (1994). He found 90 instances of private signing. These were signs made in the absence of interactive behaviors, such as looking toward another individual. He classified these into categories of private speech that humans use (Furrow 1984). We later recorded 56 more hours of remote videotape and found 368 instances of private signing (Bodamer et al. 1994). In both samples, one of the most common categories of signing was referential (59 percent in the 56-hour sample). In this category the chimpanzee signed about something present in the room, for example, naming the pictures in a magazine. The informative category, an utter-

ance that refers to an object or event that is not present, accounted for 12 percent in the 56-hour sample and 14 percent in the 45-hour sample. An example of an utterance in this category was when Washoe signed DEBBI to herself when Debbi was not present.

One category of private signing was imaginative and accounted for 17 instances in the 56 hours of remote videotaping. We later recorded 15 hours of remote videotape while the chimpanzees' enclosure was filled with toys. We found six instances of imaginary play. We classified these into categories of imaginary play that human children use (Matthews 1977). There were four instances of animation in which the chimpanzee treated an object as if it was alive. For example, Dar signed PEEKABOO to a stuffed bear. There were four instances of substitution in which the chimpanzee treated one object as if it were another. For example, Moja wore a shoe and signed SHOE. She then removed the shoe, put a purse on her foot, and zipped it up (Jensvold and Fouts 1993).

Williams (1995) used remote videotaping to examine the five chimpanzees' nighttime behavior. The chimpanzees were more active at night than we previously had assumed. There were even a few instances of signing in their sleep.

### Conversational Context

While remote videotaping provides a way to discover what the chimpanzees do in the absence of humans, at other times we are interested in controlling variables and measuring the chimpanzees' responses within the context of their typical daily signed interactions with their human caregivers. This is the legacy of the Gardner cross-fostering project; they used rigorous methodology within the usual routine of the cross-fostering environment. In the Gardner experiments and in our own, the chimpanzees were free to leave the testing situation and to respond to their world with their full repertoire of behaviors. Typically in comparative psychology

the experimenter tests the participant in an artificial environment in order to control all variables. However, this so greatly removes the participant from his or her natural environment that we often discover more about the intelligence of the experimenter than that of the participant. The following studies were all conducted during naturally occurring signing interactions between the chimpanzees and their human caregivers without compromising methodological controls.

The PCM system (B. T. Gardner et al. 1989) describes how a sign is formed, using place where the sign is made, configuration of the hand, and movement of the hand. During everyday activities such as cleaning, meals, and playtime, Davis (1995) introduced a distortion in some of her signs to measure the chimpanzees' response to the mispronunciations. The distortions always occurred on the place of the sign. Low distortions were made 1 to 4 inches from the standard form of the sign. Medium distortions were made 5 to 8 inches from the standard form of the sign. High distortions were made 9 to 12 inches from the standard form of the sign. For example, the standard form of the sign CRACKER is a fist hitting the elbow. In low distortion the fist hit the forearm; in medium distortion the fist hit the wrist; and in high distortion the fist hit the forehead. In response to low distortion messages, the chimpanzees restored the sign to its original form. When the distortion was high or medium, they typically did not respond. Like humans, the chimpanzees are tolerant of slight mispronunciations of signs. When the mispronunciation increased, the chimpanzees' responding decreased. This study used naturally occurring interactions with a human interlocutor to test the chimpanzees' perception of semantics. Other experiments tested pragmatic aspects of the chimpanzees' signed interactions with humans.

At the original CHCI facility, the chimpanzees had access to a suite of enclosures. One of the enclosures was across the hall from a human workroom. When a caregiver was in the workroom, the chimpanzees often came to the nearby

enclosure to request objects or activities. They often made noises if the human was not looking at them. Bodamer and Gardner (2002) systematically studied these initiations. The interlocutor sat in the workroom with his back toward the chimpanzees' enclosure. When the chimpanzee made a noise, he turned and faced the chimpanzee immediately or after a 30-second delay. When the interlocutor was not facing the chimpanzees, they made noises, such as Bronx cheers, and rarely signed. The few times the chimpanzees signed, they used signs that made noise, such as DIRTY, in which the back of the hand hits the bottom of the jaw. Closed with force, this sign is noisy. In the delayed-response condition, the noises became louder and faster. Once the interlocutor faced the chimpanzees, they stopped making sounds and signed. Using a naturally occurring situation, this experiment showed that the chimpanzees initiate interactions and sign spontaneously.

In another test of conversational skill, the interlocutor used one of four types of probe: general questions, on-topic questions, off-topic questions, or negative statements (Jensvold and Gardner 2000). When the interlocutor asked a general question, the chimpanzees frequently expanded across turns, showing a persistence in their original topic and giving the interlocutor more information. When the interlocutor asked a relevant on-topic question, the chimpanzees responded with many incorporations and expansions. These responses are indicators of topic maintenance. When the interlocutor asked an off-topic question, the chimpanzees often failed to respond and when they did respond, they used few incorporations and expansions. When the interlocutor made a negative statement, Washoe and Dar often did not respond. The chimpanzees' responses were contingent and appropriate to the interlocutor's questions or statements and resembled patterns of conversation found in similar studies of human children.

By using rigorous methods that allow the chimpanzees to demonstrate their behaviors in

a context-appropriate situation, sign language studies of chimpanzees show remarkable similarities between human and chimpanzee behaviors. These similarities support the biological reality that species differ by degree.

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### Future Research

We plan to continue to explore the rules governing the chimpanzees' conversations with each other and with humans. A recent new direction has been to examine the non-ASL gestures that the CHCI chimpanzees use to communicate with each other. We have already found evidence that they are using non-ASL gestures in the fashion of a dialect. At present we are expanding this research to the study of gestural dialects among free-living chimpanzee communities in Africa.

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### Cartesian Delusions

*Nature, Mr. Allnut, is what we were put in this world to rise above.*

—Huston and Agee, *The African Queen*

The Darwinian view is very different from the Greek Platonic view and the more recent Cartesian view that holds that man is superior to all other beings, including women. Descartes held that a definite gap or difference in kind existed between man and the defective automata below him. Some scientists today continue to uphold the existence of such gaps in nature and accept the absence of evidence as evidence of absence. If a chimpanzee fails to perform like a human in a particular experiment, these scientists maintain that there are differences in kind between species and that there is a chasm between humans and the rest of nature.

Chimpanzees acquired the signs of ASL from humans and other chimpanzees. The chimpanzees used signs when conversing with each other, even when no humans were present. They used the signs to sign to themselves and in imaginary

play about things that were present as well as not present. They initiated interactions with humans and appropriately adjusted their answers to variations in the interlocutor's signs and questions. Sign language studies fill some of the gaps between humans and the rest of nature that were created in the minds of philosophers and are maintained by human arrogance.

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