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A STUDY OF SIGN LANGUAGE IN CHIMPANZEES

Kelli Bacon

One of the hot topics in anthropology concerns the debate over chimpanzee communicative and lingual abilities. This paper will offer evidence gathered from studies by Allen and Beatrice Gardner, Roger Fouts, Maury and Jane Temerlin, Herbert S. Terrace, T.G. Bever, and Sheri Roush who all used American Sign Language (Ameslan) to teach their students Washoe, Lucy, Bruno, Booe, Cindy, Thelma, Nim, Moja, Pili, Tatu, Dar, Loulis, and Ally. Each of the studies was tailored differently, but many of the results were the same. This, in itself, might be evidence for some level of lingual ability, but some scholars such as Noam Chomsky, John Limber, E. Linden, Georges Mounin, and Herbert S. Terrace do not believe that these chimps reached a level of lingual prowess.

The discussion of whether or not chimpanzees possess language abilities has been debated since the first studies in American Sign Language (Ameslan) were undertaken by Allen and Beatrice Gardner in the 1960s with a female named Washoe. Another part of those studies has been the debate over chimpanzee communication. Because of these and other sign language studies between humans and chimpanzees, many scientists believe that chimpanzees do indeed have the capacity for language while others believe that they are simply using sign language as a form of communication without the traditional features of language. Yet another group of scientists believes that the chimpanzees are neither communicating nor do they possess the necessary features of language, but are merely responding to controlled stimuli in a controlled environment. This paper will discuss the primary sign language studies in chimpanzees and determine if the chimpanzees do indeed communicate with humans and if they hold the features of language, the features inherent in all human beings.

Washoe

After arriving at the University of Nevada on June 21, 1966 (Gardner, R. and Gardner,

B. 1989:1), eleven month old Washoe began her first sign language studies under the tutelage of Allen and Beatrice Gardner beginning in June 1966 (Brown 1980; Fouts, R. and Rigby 1980:269; Gardner, R. and Gardner B. 1980:288; Hill 1978; Kellogg 1980; Linden 1974; Mounin 1976:1; Rumbaugh 1980; Terrace 1979:10). These studies were conducted in a home-like, child's environment to allow for comparisons between chimpanzees and children who use sign language (Fouts, R. and Rigby 1980:269; Gardner, R. and Gardner, B. 1989:1; McNeill 1980:146; Mounin 1976:1; Rumbaugh 1980:240). The Gardners' focus on these early studies was to communicate with a chimpanzee using a language of gestures because, "The phonatory apparatus is different in ape and man, and a young ape quickly loses interest in vocalization, but continues to gesture" (Mounin 1976:1).

Method at the University of Nevada

The Gardners' original goal was not to study the "language" abilities in a chimpanzee, but instead to study their communicative abilities (Hill 1978:93). Their methods were tailored to these goals. To teach Washoe American Sign Language, or Ameslan, the Gardners and their assistants did not speak around her, but instead only signed in her

presence (Fouts, R. and Rigby 1980:269; Gardner, R. and Gardner, B. 1989:6; Kellogg 1980:68; Linden 1974:5; McNeill 1980:146; Mounin 1976:1; Rumbaugh 1980:241; Terrace 1979:10). This was for two reasons (Mounin 1976:1). The first was that if a chimpanzee heard humans speak then he could become frustrated because he could not do so himself, which could impede on his ability to learn sign language. Second, chimpanzees spontaneously imitate human actions. There were problems with this technique though. Not all of Washoe's instructors were fluent in Ameslan and were only able to teach her a limited amount of signs before their abilities became inadequate (Brown 1980:90; Gardner, R., Gardner, B. and Nichols 1989:62; Mounin 1976).

Throughout the course of their study, the Gardners employed several different methods. The first method was the 'babbling hypothesis', which used a random mix of signs and ideas, but this was not a fruitful method (Fouts, R. and Rigby 1980:270; Linden 1974:20; Rumbaugh 1980:241). The second method instituted was by imitation or 'guidance'. Under this method, Washoe began to sign her first signs, but she learned more by 'molding', a method taught by physically manipulating Washoe's hands into the desired sign (Fouts, R. and Rigby 1980:270-271; Linden 1974:20-21; Rumbaugh 1980:241). The fourth method was 'fading' (Linden 1974:22). Up to this point in Washoe's training, she was rewarded for signing correctly, but during this phase, the amount of rewards was decreased, and they began to let Washoe sign more on her own. 'Shaping' was the fifth method used (Fouts, R. and Rigby 1980:271; Linden 1974:22). For this technique, Washoe needed to give the appropriate sign in order to receive a response from her teachers. Washoe also learned new signs by 'observational learning' when she watched her teachers and the natural movements of wild chimpanzees (Fouts, R. and Rigby 1980:271; Linden 1974:22; Rumbaugh 1980:241). Throughout this process, the Gardners

learned that when they touched Washoe, she had an easier time learning new signs, which was also true for chimpanzees in the wild when they communicated with one another (Bronowski and Bellugi 1980:105; Mounin 1976:1).

Progress at the University of Nevada

Washoe's progress seemed remarkable. For the Gardners to consider that Washoe had knowledge of a particular sign, she needed to correctly use that sign at least once a day for fifteen continuous days (Linden 1974:26; McNeill 1980:147; Rumbaugh 1980:242). Her first sign under this rule, "to come", took her seven months to learn (Mounin 1976:1). After sixteen months, she could make nineteen signs (Kellogg 1980:69). She knew thirty-four signs after twenty-two months and ninety-two signs by forty months of study (Mounin 1976:1). By the end of her first training phase, which took fifty months, Washoe understood one hundred and thirty-two signs (Fouts, R. and Rigby 1980:269; Gardner, R. and Gardner, B. 1980:288 1989:6; Hill 1978:91; Terrace 1979:10). During her last six months at the University of Nevada, she regularly used between twenty-four and thirty signs (Goodall 2001:61; Mounin 1976:1). When she left the University of Nevada in 1972, she could make one hundred and sixty signs (Linden 1974:5).

In April 1967, Washoe made her first combination of signs (Linden 1974:27), when she could make eight individual signs (Gardner, R. and Gardner, B. 1980:289). Within three years from the start of her study, Washoe signed in combinations of three and more signs (Linden 1974:26). Washoe's combinations were not arbitrary, but conveyed meaning, like sentences (Brown 1980:86; Goodall 2001:86; Hill 1978:91; Terrace 1979:11). In addition to making combinations, Washoe also showed innovation when she connected individual signs together to make a new single thought or representation for items for which she did not have a sign (Goodall 2001:61; Mounin 1976:1). With objects for which Washoe

had no sign, she would invent her own (Fouts, R., Fouts, D., and Cantfort 1989:281; Fouts, R. and Rigby 1980:280; Gardner, R., Gardner, B., and Nichols 1989:61; Goodall 2001:61-62; Linden 1974:24, 111; Rumbaugh 1980:241).

Moving to the University of Oklahoma

In October 1970, Washoe moved to the University of Oklahoma to be taught by Roger Fouts (Fouts, R., Fouts, D., and Cantfort 1989:280; Fouts, R. and Rigby 1980:274; Gardner, R. and Gardner, B. 1989:9; Mounin 1976:2; Rumbaugh 1980:251). Fouts, who had learned under the Gardners while at the Institute for Primate Studies in Norman, Oklahoma, was now Washoe's instructor (Hill 1978:91-92). Here, Washoe lived in a different environment. At the University of Nevada, she had a mobile home to herself and tailored to her needs, but at the University of Oklahoma, she lived in a cage part of the time, just like at a zoo (Mounin 1972:2). She also had contact with other chimpanzees and some of them already knew Ameslan, something that she did not have at the University of Nevada (Mounin 1976:2). In 1972, her training at the University of Oklahoma began (Gardner, R. and Gardner, B. 1989:9). To maximize the opportunities from this situation, a goal of this research was to see if Washoe would communicate in Ameslan when she was integrated with other chimpanzees (Fouts, R., Fouts, D., and Cantfort 1989:280; Mounin 1976:2). Fouts' primary goal was to show that linguistic behavior could be found in other species, not only *Homo sapiens* (McNeill 1980:145).

Method at the University of Oklahoma

At the University of Oklahoma, the method used to teach the chimpanzees was markedly different from at the University of Nevada. For example, at the University of Oklahoma, Fouts had several chimpanzees that he was studying. Some of them were raised in a more home-like setting while others were

from semi-caged surroundings (Hill 1978:91).

Progress at the University of Oklahoma

The change in environments and teaching methods did not reverse any of Washoe's previous knowledge (Mounin 1976:2). By 1973, though, Washoe had yet to have the opportunity to communicate in Ameslan with other chimpanzees (Mounin 1976:2). Then, within the first few days of being on the chimpanzee island where the chimpanzees played and spent time outside, Washoe began to sign with other chimpanzees (Fouts, R., Fouts, D., and Cantfort 1989:280; Linden 1974:130). Washoe was given a chimpanzee, Loulis, to adopt after her baby died and through another study, taught him Ameslan (Gardner, R. and Gardner, B. 1989:25; Goodall 2001:61). The methods that she used to teach Loulis were much like the methods that the Gardners first used to teach Washoe. She used modeling, molding, and signing on Loulis' body in order to teach him (Fouts, R., Fouts, D., and Cantfort 1989:286). Washoe, herself, also learned from other chimpanzees. She learned signs from Moja, Tatu, and Dar, three chimpanzees also instructed at the University of Oklahoma (Fouts, R., Fouts, D., and Cantfort 1989:291; Gardner, R. and Gardner, B. 1989:25). After communicating with the other chimpanzees on a regular basis, Washoe began to use Ameslan as her preferred mode of communication, placing her wild instincts aside (Fouts, R. and Rigby 1980:278).

Results from Studies at the University of Nevada and the University of Oklahoma

To determine that Washoe understood her signs, the Gardners ensured that each of her signs stood for a group of objects and not just that specific one (Gardner, R. and Gardner, B. 1980:288; Linden 1974:23; Mounin 1976:1). Even after all of the results, the Gardners will not admit if Washoe did indeed have language

capabilities (Mounin 1976:2). They have pronounced that Washoe demonstrated communication skills, but they are unsure of the type of communication because she did not usually spontaneously begin conversations (Mounin 1976:3).

Washoe did accomplish many things despite the disagreement about her language abilities. Her studies proved three things (Gardner, B. and Gardner, R. 1989:182-183). First, Washoe proved that chimpanzees and humans could communicate when the only mode of communication was through sign language. Second, independent observers were able to agree on names for objects, which allowed for an easier time in training. Third, chimpanzees used their signs to refer to groups of objects that humans put into natural categories. Bronowski and Bellugi (1980:105) believe that Washoe was able to prove that a chimpanzee could learn the names for objects. Washoe also did many other things that indicate language abilities. She was able to swear by using the sign for 'dirty' in a derogatory sense (Linden 1974:8). While reading a magazine, Washoe "thinks aloud" by signing to herself the words for the different pictures that she saw (Bronowski and Bellugi 1980:108; Gardner, R. and Gardner, B. 1989:23; Linden 1974:99). Although the Gardners believed that Washoe used consistent word order and asked questions, these two accomplishments were debated by some (Gardner, R. and Gardner, B. 1980, 1989; Linden 1974). Washoe was also able to show that she understood more signs that she could make herself (Kellogg 1980:69).

There were some indicators of language in Washoe's use of Ameslan. She seemed to tell others of her emotional state when she made the sign for 'sorry', but it may have been more of a sign for reassurance than true regret (Terrace and Bever 1980:181). Washoe also used Ameslan to give others new information (Gardner, B. and Gardner, R. 1989:181). The errors that Washoe made while signing were also much like young children who are learning language grammar

and make mistakes by over-extension (Bronowski and Bellugi 1980:105).

Lucy

Lucy was born on October 18, 1966, and was trained by Maury and Jane Temerlin at the Institute for Primate Studies (Goodall 2001; Linden 1974:90). There are many similarities between her methods and those of Washoe. For example, she was not a baby when she began to learn Ameslan, but was four years old (Linden 1974:117). The Temerlins also trained Lucy in home-like species isolation, akin to Washoe (Fouts, R. and Rigby 1980:275; Goodall 2001:58; Linden 1974:90). Although they were not concerned with the numbers of signs that Lucy learned, but instead studied the ways that Lucy used the words that she had learned (Linden 1974:91), Lucy had a vocabulary of seventy-five signs after two years of study (Fouts, R. and Rigby 1980:275), and in 1974 had a vocabulary of approximately eighty signs (Linden 1974:91).

The results of the Temerlins' studies with Lucy were much the same as the results from Washoe's studies. As with Washoe, Lucy seemed to grasp word order, had a concept of symbols, grouped together similar objects for which she did not have a sign based upon their characteristics, knew the difference between specific objects and general categories, expressed emotional states, was able to swear, negated statements and asked questions, signed to herself while reading, and invented her own signs (Fouts, R. and Rigby 1980; Goodall 2001; Linden 1974). When Lucy invented her own sign for leash, the Temerlins believed that she, "Abstracted and reified the properties of the leash into a symbolic representation and, in so doing, was demonstrating how she analyzed the world" (Linden 1974:109). From these results, the Temerlins believed that Lucy was using Ameslan as a form of communication (Linden 1974:94).

Bruno, Booe, Cindy, and Thelma

Bruno, a male born at the Institute for Primate Studies in February 1968, and home raised by Stephanie LaFarge and family for the first fourteen months, Booe, a male whose brain was split before entering the Institute, and Cindy and Thelma who were both born in the wild in 1967, were trained in Ameslan together at the Institute for Primate Studies (Linden 1974:126-7; Terrace 1979:23, 25-26). All of the chimpanzees were over two years old when their studies began and spent most of their time together (Linden 1974:125, 127). Fouts' original intent for the study was to compare the differences in sign acquisition among chimpanzees (Linden 1974:126). Fouts also experimented with Bruno and Booe when he let them sign with each other to observe any communication between the two (Fouts, R. and Rigby 1980:277). They spontaneously signed with each other for a significant portion of their time, but preferred their natural form of communication (Fouts, R. and Rigby 1980:278; Linden 1974:128, 131). Other than Bruno and Booe's communication with one another, the studies showed that there were similarities and differences between Ameslan acquisition in chimpanzees. He found that all four had different personalities that caused them to have different learning experiences (Linden 1974:128). Fouts also found that the four chimpanzees were consistent with each other in the errors that they made during testing situations, but they were not consistent in their correctness (Linden 1974:128).

Nim

Nim Chimpsky was born in Norman, OK, on November 11, 1973 (Terrace 1979:23, 28). Nim's studies were markedly different from those of Washoe, Lucy, and the others for several reasons. First, Nim began learning Ameslan very soon after his birth while living with one of his teachers, Stephanie LaFarge, and her family (Terrace 1974:5, 38; Terrace and Bever 1980:187). Another difference was the number of

instructors that Nim had. Over four years, he had sixty instructors, including Herbert S. Terrace (Terrace 1974:ix, 23). Mostly of these instructors were volunteers while forty more people were involved in analysis (Terrace 1974:ix). A third difference was the trouble that Terrace had in obtaining enough money to continue his studies with Nim (Terrace 1974).

Method

The first goal of Nim's studies with Ameslan was to make him understand signs that were important to him and not to the instructors (Terrace 1974:38). The methods used to teach him were much the same as with the previous chimpanzees' studies with Ameslan. None of Nim's teachers was fluent in Ameslan, and he was exposed to more English than was Washoe, but he did not show much interest in learning Ameslan (Terrace 1974:38). When Nim was two months old, Terrace and LaFarge began teaching him by molding (Terrace 1974:38-39). On February 4, 1974, Nim made his first spontaneous sign (Terrace 1974:39). He convincingly knew his first sign on March 4, 1974 (Terrace 1974:39).

Columbia University

On November 26, 1974, Nim also began sign language studies at Columbia University under the instruction of Carol Stewart (Terrace 1974:49, 51). Stewart used strict methods in three stages to teach Nim how to make signs (Terrace 1974:51-52). The first stage was reception, or when Nim began to understand the sign he made. Second, was production of the sign by molding. Third was expression of the sign when Nim made the sign in the correct context. While Nim learned many signs under Stewart, Terrace believed that Nim might have learned more if Stewart had not been as strict with her technique (Terrace 1974).

Laura Petitto became Nim's next full-time teacher while at Columbia University. In the summer of 1975, Terrace acquired a

house, Delafield, in which Terrace, Petitto, two other teachers, and Nim could live full-time while conducting the studies (Terrace 1974:66, 68). While studying with Laura, Nim's acquisition of signs was the highest at any time throughout his studies evidenced by learning two new signs a week (Terrace 1974:83). When he was twenty-two months old, Nim had a vocabulary of thirty signs and had a passive vocabulary of between fifty and sixty signs (Hill 1978:92; Terrace and Bever 1980:187). During the first summer at Delafield, Nim could make two word combinations, and by the next summer, he made three word combinations (Terrace 1974:83). After that summer, though, all of his original teachers at Delafield left the project to pursue other interests (Terrace 1974:104).

Results

On September 25, 1977, after financial difficulty at Columbia University, Terrace returned Nim to the Institute for Primate Studies in Norman, OK, where Terrace and T.G. Bever began teaching him (Hill 1978:92; Terrace 1974:194; Terrace and Bever 1980:181). By the time that Nim left Columbia University, he had correctly learned one hundred and twenty-five signs (Terrace 1974:137). During the studies at the Institute for Primate Studies, Terrace and Bever had three goals for Nim (Rumbaugh 1980:251-252). First, they wanted Nim to combine words to show that he knew syntactic rules, which would be evidence of language. Second, they wanted him to show that he had an active memory. Third, they wanted Nim to tell others of his mood. Terrace believed that Nim's studies at Columbia University made great progress. First, by the time that he was eighteen months old Nim was social and his use of sign language was developing in different ways (Terrace 1974:68). Second, Nim's acquisition of Ameslan demonstrated that a chimpanzee's acquisition of signs was much like the manner that children acquire new words (Terrace 1974:209). Third, as with children, Nim had a harder time learning

signs that were made away from his body (Terrace 1974:159). Like Washoe, Nim understood more signs than he could make and invented signs (Terrace 1974:, 164). Nim sought reassurance for his actions, but probably did not describe his emotions. Had he done so, it would indicate that he had language abilities (Terrace and Bever 1980:181). As evidence of language, Nim made combinations of signs and could substitute words while using the same structure (Terrace 1974:171). From these studies and specifically watching Nim and Petitto, Terrace learned that a strong bond must be formed with the instructor and student to provide for the most fruitful environment for signing (Terrace 1974:54).

Moja, Pili, Tatu, and Dar

The Gardners' second experiment of chimpanzee sign language was with Moja, Pili, Tatu, and Dar. All of the chimpanzees studied at the University of Nevada, arrived a few days after their respective births, and were allowed to interact with one another (Gardner, R. and Gardner, B. 1980:294-295, 1989:9). Moja, a female, arrived in November 1972, Pili arrived in September 1973, Tatu arrived in January 1976, and Dar arrived in August 1976 (Gardner, R. and Gardner, B. 1980:294-295, 1989:9). These chimpanzees' study of Ameslan began when they were newborns and employed native Ameslan signers because Washoe's study did not fully explore a chimpanzee's capability to learn (Fouts, R. and Fouts, D. 1989:293; Gardner, R., Gardner, B., and Nichols 1989:62; Hill 1978:91). The Gardners believed that it was important for the instructors to understand the differences between Ameslan use when the chimpanzees were young compared to when they matured so they began studies when the chimpanzees were young (Linden 1974:115). The chimpanzees began the project at one to two year intervals so they would be at different ages and different levels of study and so the younger students could learn from the older ones (Gardner, R. and Gardner, B. 1980:296-297, 1989:14).

The experiments were arranged so they would mimic those experiences of a human child over many years (Hill 1978:91). By the time that the chimpanzees were four to five months old, the Gardners found that the chimpanzees' acquisition of Ameslan was much like human children of the same age (Hill 1978:91). As the chimpanzees matured, they began to use 'negative incorporation' such as negating sentences (Hill 1978:91). Throughout the studies, all of the chimpanzees started conversations even when no human was present (Gardner, R. and Gardner, B. 1989:23-24). They also signed to almost anything with which they came into contact (Fouts, R. and Fouts, D. 1989:293; Gardner, R. and Gardner, B. 1989:24).

Loulis

Loulis, a male, was born on May 10, 1978, at Yerkes Regional Primate Research Center in Georgia (Fouts, R., Fouts, D., and Cantfort 1989:281). Washoe adopted Loulis when she was fourteen, and he was ten months old (Gardner, R. and Gardner, B. 1989:24). No signing by humans was permitted around Loulis (Fouts, R., Fouts, D., and Cantfort 1989:282; Gardner, R. and Gardner, B. 1989:24-25; Goodall 2001:61). Instead, the goal of this project was to determine if a chimpanzee could learn Ameslan by being around other chimpanzees who already knew the language. Loulis learned by imitating Washoe, Dar, Moja, and Tatu (Goodall 2001). He made his first sign eight days after meeting Washoe (Fouts, R., Fouts, D., and Cantfort 1989:285). By the time that he was fifteen months old, Loulis used combinations of two signs (Fouts, R., Fouts, D., and Cantfort 1989:285). When he was twenty-nine months old, Loulis knew more than seventeen signs, and by the time that he was sixty-three months old, he knew forty-seven signs (Fouts, R., Fouts, D., and Cantfort 1989:285). In the first five years of the study, Loulis acquired fifty signs that he learned only by watching the other chimpanzees (Gardner, R. and Gardner, B.

1989:24-25). On June 24, 1984, five years and three months into the study, the restriction over human signing was retracted because it was denying Loulis of signs that he could learn from human instructors and not other chimpanzees (Fouts, R., Fouts, D., and Cantfort 1989:285). When Loulis was six years and one month old, he had learned fifty-one signs (Fouts, R., Fouts, D., and Cantfort 1989:285). By the time that he was eight years old, Loulis knew fifty-eight signs (Goodall 2001:81).

Ally

A male, Ally, was born at the Institute for Primate Studies, and unlike some of the previous studies, was raised in species isolation (Fouts, R. and Rigby 1980:276; Linden 1974:117). Sheri Roush, who trained Ally from birth, taught him Ameslan based upon him knowing the spoken English equivalent for the sign (Fouts, R. and Rigby 1980:277; Linden 1974:117, 121-122; Rumbaugh 1980:251). This method is called cross-modal transfer and is considered language acquisition (Fouts, R. and Rigby 1980:277; Linden 1974:121-122; Rumbaugh 1980:251). Results from Ally's experiments with Ameslan were much the same as other chimpanzees. His vocabulary reached ninety words when he was three years old, and each day he learned new signs and made them with clear gestures (Linden 1974:117-118). As an indicator of language, Ally negated statements, asked questions, and learned to understand spoken English (Linden 1974:118-119). Another indicator of language was that Ally favored Ameslan when communicating with other chimpanzees (Fouts, R. and Rigby 1980:278).

Use of Ameslan as Communication and Language

Despite advances from these experiments, some researchers do not believe that the results from the Ameslan experiments were evidence for language in chimpanzees.

Mounin (1976:2) did not believe that Washoe reached a level of language for several reasons. First, Washoe's Ameslan use did not comprise double articulation, as her gestures were single units of communication that were unable to be broken down into smaller units. Second, she did not lie, but she did play tricks. Although Mounin stated this, he also wrote that, "The criteria for human language can not be thought of just by present features, but must be compared with all systems, including human" (Mounin 1976:2). Other critiques of the studies said that Ameslan cannot be compared to spoken English because the syntactical and grammatical rules are different in the two (Linden 1974:103). Terrace (1979:18) believed that the chimpanzees only gave signs in certain situations to receive rewards instead of showing innovation or initiation, which would be significant of language.

Limber (1980:198-199) also believed that there were problems with the studies. He believed that the chimpanzees employed an extensive symbolic communication and that a traditional language environment for humans was not sufficient for a chimpanzee to learn a human language such as Ameslan (Limber 1980:198-199). Limber did agree that chimpanzees were better adapted to learn a visual-manual form of communication such as Ameslan than an auditory-vocal one such as spoken English (Limber 1980:198). Noam Chomsky, also a part of the debate, stated that, "If syntax, that is, the transformation of deep structures into surface structures, is a language universal, then because language is specifically human, it seems quite unlikely that Washoe could acquire and express the rudiments of syntax, and the series of signs should not be considered syntactic" (Bronowski and Bellugi 1970, in Mounin 1976:2). He also said that, "If negative transformation is a universal, if wh-questions are a universal, if imbedded phrases are also a universal, then, because communication with Washoe does not present these characteristic (descriptive) features, there can be no language" (Mounin

1976:2). As is evident by these statements, it seems like many were against the notion of language in chimpanzees.

Conclusion

From these studies of chimpanzee use and manipulation of Ameslan, there seem to be good evidence that points towards chimpanzee communicative or lingual ability. Many of the results were the same in several chimpanzees. This may or may not have been due to random errors or a small sample size. Even though different techniques were used for the studies, some instructors led several studies, and this may have lead to the similarity in results. On the other hand, with the number of chimpanzee studies, the results may have truly shown that chimpanzees are able to communicate with a human language. Some scientists argue about the level of communication reached in these studies. They do not deny that something happened during the studies. They are simply unsure of what happened and to what degree it happened. Washoe might have demonstrated the most convincing evidence for chimpanzee language because of the way that she manipulated and invented the signs and because she was able to teach her adopted son, Loulis, how to communicate with Ameslan. Moja, Pili, Tatu, and Dar had similar results with learning and teaching one another how to sign and deserve credit for attempting to prove that chimpanzees are capable of some form of communication or language. This debate is far from over, but the results seem to show that chimpanzees are indeed capable of some form of communication and language. It simply remains to be seen how much is possible for the chimpanzees.

Acknowledgements. I wish to thank my husband, Joel, for his continued patience and support and for helping me to realize and reach my goals. I would also like to thank all of my friends and family for supporting my education and helping me put things in perspective. Credit is also due to the

University of Nebraska, Lincoln,
Department of Anthropology and
Geography and the Nebraska State
Historical Society, Archeology Division for
supporting my education.

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