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Recent Use of Signs by Chimpanzees (*Pan Troglodytes*) in Interactions With Humans

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In light of the controversy about the linguistic properties of chimpanzee signing behavior, the recent sign use of 5 chimpanzees (*Pan troglodytes*) with long histories of sign use was analyzed while they interacted with longtime human companions. Four corpora from 1992 to 1999 consisting of 3,448 sign utterances were examined. The chimpanzees predominantly used object and action signs. There was no evidence for semantic or syntactic structure in combinations of signs. Longer combinations showed repetition and stringing of object and action signs. The chimpanzees mostly signed with an acquisitive motivation. Requests for objects and actions were the predominant communicative intentions of the sign utterances, though naming and answering also occurred. This recent sign use shows multiple differences with (early) human language.

The study of the use of human-taught signs by chimpanzees has generated considerable controversy regarding the question of whether chimpanzee signing is comparable to early human child language. This article describes a study in which a comprehensive analysis was made of the recent signing by 5 chimpanzees in order to continue the debate about chimpanzee signing.

Two teams have studied signing chimpanzees. The Gardners and Fouts investigated the sign use of Washoe, the first chimpanzee to learn signs, and several other chimpanzees. Terrace and colleagues studied the signing of the chimpanzee Nim Chimpsky. These teams came to opposite conclusions about the linguistic properties of chimpanzee signing.

The Gardners and Fouts described the signing of their chimpanzee subjects as follows. The chimpanzees had acquired large vocabularies of signs in various semantic categories. Like children, they had learned signs for objects, actions, names, person terms, locations, colors, qualities, request markers, and traits (B. T. Gardner & Gardner, 1974, 1994; B. T. Gardner, Gardner, & Nichols, 1989; R. A. Gardner & Gardner, 1975, 1978; R. A. Gardner, Van Cantfort, & Gardner, 1992). The combinations of signs that the chimpanzees produced showed the expression of semantic relations, meaningful patterns of two related semantic roles, such as *action* + *object* (with examples such as DRINK SODAPOP and BALL CATCH)[1], *agent* + *action* (ROGER TICKLE, YOU DRINK) and *attribute* + *object* (RED ICE-CREAM and HOT DRINK; B. T. Gardner & Gardner, 1971, 1980, 1994). Multiple-sign utterances showed an increase in meaningful information. The motivation of the chimpanzees for using signs did not just consist of uttering requests for food, objects, and play but also of naming objects and pictures, commenting on events, asking questions, and expressing internal states and insults (Fouts, 1975, 1997; B. T. Gardner & Gardner, 1971; B. T. Gardner et al., 1989; R. A. Gardner & Gardner, 1969, 1984). In short, the Gardners and Fouts interpreted chimpanzee signing as being meaningful and spontaneous and showing many similarities with human child language (Fouts, 1997; B. T. Gardner & Gardner, 1994; R. A. Gardner & Gardner, 1978).

Terrace and his team drew different conclusions. They found that Nim had a skewed use of the signs in his vocabulary. Several signs, NIM, ME, YOU, EAT, DRINK, MORE, and GIVE, occurred very frequently, whereas other signs were only made infrequently. Terrace (1980) called these frequent signs *wild card signs,* because they functioned as wild cards in a card game: They were general purpose signs that could be considered "appropriate" in almost every context and were always useful to manipulate the human when the chimpanzee wanted something (Seidenberg, 1986; Seidenberg & Petitto, 1981, 1987; Terrace, Petitto, Sanders, & Bever, 1980). The combinations of signs that the chimpanzees produced were not meaningful expressions but consisted of repetition of signs and strings of object and action signs together with wild card signs. The motivation of the signing chimpanzees was largely *acquisitive,* another term coined by Terrace (1985): Signs

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[1] By convention, signs are printed in capital letters.

were made in order to request and obtain objects, activities, and other things from the humans. Terrace and his colleagues concluded that chimpanzee signing was different from child language. Signing was a nonlinguistic way for the chimpanzees to request things from humans (Seidenberg, 1986; Seidenberg & Petitto, 1979; Terrace, 1979, 1983, 1985; Terrace, Petitto, Sanders, & Bever, 1979; Terrace et al., 1980).

Two methodological criticisms by Terrace and his colleagues Seidenberg and Petitto took central stage in the controversy that ensued. The first was that most published chimpanzee sign use had not been documented in the form of a permanent record, such as film or videotape. Multiple perception and memory errors could therefore have occurred, decreasing the reliability of the data. Furthermore, after video analyses, it was found that Nim sometimes imitated humans for up to 39% to 54% of signs recorded. This discovery showed that unfilmed data could not be relied on as a basis for solid conclusions (Sanders, 1985; Terrace, 1979, 1981, 1983; Terrace et al., 1979, 1980). The second criticism was that the Gardners and Fouts had not made enough use of systematic analyses of large corpora of chimpanzee sign use. Incidental occurrences of seemingly meaningful sign use might therefore be the result of a projection of linguistic patterns by humans. For example, Fouts (1975) reported that Washoe had signed WATER BIRD to describe a swan. However, corpus analyses might have shown that Washoe frequently combined these signs in less apparently meaningful ways, such as WATER BANANA and COOKIE BIRD. The analysis of corpora was therefore necessary to make justifiable interpretations of a sign utterance's meaning or function (Seidenberg, 1986; Seidenberg & Petitto, 1979, 1981; see Van Cantfort & Rimpau, 1982, for a reply to these criticisms).

The Gardners and Fouts had used film and analysis of corpora in their studies of chimpanzee signing. However, most studies published by the Gardners were not based on filmed data but rather on unfilmed observations of trained observers. From the early 1980s onward the Fouts had used filmed corpora as a standard procedure in their studies to analyze specific aspects of chimpanzee signing. However, these corpora had not been used to systematically analyze the individual signs that were used daily by the chimpanzees, the combinations of signs, or the chimpanzees' motivations for using signs. These data were lacking, and the nature of recent chimpanzee signing in these respects had yet to be discovered. The study described in this article was conducted to gather this information in order to continue the debate about chimpanzee signing. Only chimpanzee sign use that had been recorded on videotape was analyzed for the present study, and four large corpora of chimpanzee signing were used to enable systematic analyses, including the corpora of two recently published studies (Bodamer & Gardner, 2002; Jensvold & Gardner, 2000).

An additional focus of this study was to analyze the motivation for signing by determining the communicative intentions of the chimpanzee sign utterances. In child language research, the motivation for language use of children is studied by using the concept of communicative intentions, that is, the reasons for which one communicates. Human children use language for a wide variety of communicative intentions. Early intentions include naming or labeling objects; describing properties, possession, or location of objects; requesting objects, actions, information, or attention; answering; and protesting. Later in their language development, children also express internal states, attribute these to others, make evaluations, and give explanations (Coggins & Carpenter, 1981; Dore, 1975; Nicholas & Geers, 1997; Ninio & Snow, 1996; Roth & Davidge, 1985; Wells, 1985; Wetherby, Cain, Yonclas, & Walker, 1988). The communicative intentions of the signing chimpanzees can be studied because recent work has demonstrated that chimpanzee signing is intentional (Bodamer & Gardner, 2002; Jensvold & Gardner, 2000; Krause & Fouts, 1997; Shaw, 2001). The following behaviors are indicative of intentional sign communication: eye gaze toward the human and visual checking behavior (alternating eye contact between, e.g., a food location and the human) while signing and repeating or changing sign utterances when the humans do not respond.

The context of the four corpora analyzed in this study consisted of unstructured, relaxed, and naturalistic interactions, representative of the daily human–chimpanzee interaction. In studies on children's communicative intentions, it is considered important to study the children's language use in an unstructured, relaxed, and naturalistic setting (Coggins & Carpenter, 1981; Coggins, Olswang, & Guthrie, 1987; Dore, 1974, 1975; Roth & Davidge, 1985). Such a context allows for the expression of a variety of different intentions. Structured settings would only evoke certain specific intentions, such as answering or naming, and would not show the full range of communicative intentions a child is able to encode. In the present study there was some structure only in the 1993 and 1994 corpora in that the human interlocutor was sometimes bound to preset reactions to the chimpanzees' signing, which included the human asking WHAT or another "Wh" question or reacting positively or negatively to a chimpanzee request (see Bodamer & Gardner, 2002, and Jensvold & Gardner, 2000). These prescribed reactions, however, were also representative for the daily human–chimpanzee interaction.

The corpora consisted of interactions from the period 1992 to 1999. The study addressed three questions about this recent signing of 5 chimpanzees with long histories of signing:

1. What are the communicative intentions of the chimpanzees when they use signs?

2. What signs do the chimpanzees use and what possible semantic categories do these signs belong to?

3. What combinations of signs do the chimpanzees make and is there a semantic or grammatical structure in these sequences? Are semantic relations present and do order preferences exist?

Method

Subjects

The subjects were 5 adult chimpanzees (*Pan troglodytes*) housed at the Chimpanzee and Human Communication Institute (CHCI) at Central Washington University: the 3 females Washoe, Moja, and Tatu, and the 2 males Dar and Loulis. These chimpanzees had been using signs in their daily communications with humans for several decades. Washoe, Moja, Tatu, and Dar had been cross-fostered for several years by Allen and Beatrix Gardner at the University of Nevada in Reno. They were raised as closely as possible to a human child and were taught signs that were mostly based on signs from American Sign Language (Fouts, 1997; B. T. Gardner & Gardner, 1971, 1985; R. A. Gardner & Gardner, 1969, 1978, 1989). After cross-fostering, the Fouts took care of the chimpanzees, first at the University of Oklahoma and from 1980 at Central Washington University. Loulis was not cross-fostered but was introduced to be adopted by Washoe. He grew up with and acquired signs from the other chimpanzees (Fouts,

1997; Fouts, Fouts, & Van Cantfort, 1989; Fouts, Hirsch, & Fouts, 1982). Table 1 presents the birthdate and the period of cross-fostering for each chimpanzee.

In Nevada the humans mostly interacted with the chimpanzees by using American Sign Language (ASL) and rarely by spoken English. In Oklahoma the humans mostly spoke English and sometimes used ASL. From Loulis's arrival in March 1979 until June 1984 the humans seldom signed and mostly spoke to communicate with the chimpanzees. This restriction on human signing was introduced to see if Loulis would learn signs from the other chimpanzees. From July 1984 onward the humans returned to using mostly ASL and seldom spoken English in their interactions with the chimpanzees (Bodamer & Gardner, 2002).

Housing Conditions

The corpora were filmed in two different buildings. In the 1992 and 1993 corpora the five chimpanzees were housed in a complex on the third floor of the Psychology building of Central Washington University. In May 1993 the chimpanzees were moved to the new CHCI building, where the 1994 and 1999 corpora were collected.

Psychology Building

The complex in the Psychology building consisted of four enclosed rooms connected by three passageways, through which the chimpanzees had access to the entire compound. The interactions of the 1992 and 1993 corpora took place while the chimpanzee was in a passageway (measuring 5.5 m × 1.1 m × 0.9 m) that passed through a room while the human was sitting or standing next to this passageway. Objects such as clothes, toys, and magazines were stored on shelves in the room, visible to the chimpanzees. A further description of the enclosure can be found in Bodamer and Gardner (2002).

CHCI Building

The CHCI building had two larger indoor enclosures (56 m^2 each, 10 m high) and an outdoor enclosure of 465 m^2, with a 10-m high wire-fenced dome. The enclosures included numerous structures the chimpanzees could climb on and use as enrichment (see Fouts, 1997). The chimpanzees generally had access to the enclosures in mornings and afternoons. During mealtimes and at night, the chimpanzees stayed in the night enclosure area, consisting of four woven-wire enclosures connected by one floor tunnel and two elevated passageways. Each night enclosure measured 2.4 m × 2.2 m × 2.5 m. There was a small area in between the outdoor area and the indoor rooms, called the *human cage,* from which humans could interact with the chimpanzees. Another place for interaction was the area encircling the outdoor enclosure, called the *berm,* consisting of a small yard where fruits and vegetables grew and a footpath for humans.

The 5 chimpanzees were always housed together and familiar humans were around them during their waking hours. Humans who had received training were allowed to interact and sign with the chimpanzees. The humans were never in the same enclosure as the chimpanzees but interacted with them from the outside. The chimpanzees often had access to toys, clothes, magazines, and other objects in their enclosures.

Corpora

There were four corpora, which together consisted of 22 hr of videotape. The interactions in these corpora were generally filmed between 9 and 12 a.m. and between 1 and 4 p.m.

The 1992 Corpus

The 1992 corpus consisted of 24 interaction sessions (2 hr of videotape) that were filmed in July 1992. Washoe participated in five of these sessions, Tatu participated in seven sessions, and Moja, Dar, and Loulis took part in four sessions each. The sessions were taken from a study by Vicki Kennerud (1993), who analyzed the chimpanzees' sign use in "drills" and "conversations." The drill sessions were not used in the present study because they consisted of structured interactions in which the human repeatedly asked the chimpanzees to identify pictures and objects. During the conversation sessions the interaction was more relaxed and unstructured.

The 1993 Corpus

The 1993 corpus consisted of 128 interaction sessions (5 hr of tape) between the chimpanzees and Mark Bodamer, filmed from April 1992 to April 1993. Bodamer interacted with Washoe in 32 sessions, with Moja and Tatu in 30 sessions each, and with Dar in 36 sessions. The sessions came from a study by Bodamer on the initiation and maintenance of conversations by the chimpanzees (Bodamer & Gardner, 2002). Those sessions that were used for analysis were mainly the longest interactions, which had been transcribed by Heidi Shaw for her dissertation study (Shaw, 2001).

The 1994 Corpus

The 1994 corpus consisted of 355 sessions (about 8.5 hr of tape) between the chimpanzees and Mary Lee Jensvold, filmed from October 1993 to September 1994 in various places of the new CHCI building. Jensvold interacted with Washoe in 84 sessions, with Moja in 90 sessions, with Tatu in 104 sessions, and with Dar in 77 sessions. She used this material for her study on the responses of chimpanzees to different types of questions (Jensvold & Gardner, 2000). Loulis was not included in the studies by Bodamer and Jensvold. Bodamer did not indicate why Loulis was not included (Bodamer, 1998; Bodamer & Gardner, 2002). Jensvold (1996), however, mentioned that she did not include Loulis because he did not participate in the pilot trials for her study. She mentioned that Loulis "initiated signed interactions with humans less often than" the other chimpanzees (Jensvold, 1996, p. 14).

The 1999 Corpus

The 1999 corpus consisted of 114 human–chimpanzee interactions (taken from 6.5 hr of tape) filmed in various places in the CHCI building from May to October 1999. The human interlocutors interacted with Washoe in 30 sessions, with Moja and Tatu in 31 sessions each, with Dar in 15 sessions, and with Loulis in 13 sessions. The interactions took place

Table 1
Birthdate and Period of Cross-Fostering of Chimpanzee Subjects

Chimpanzee	Washoe	Moja	Tatu	Dar	Loulis
Birthdate	9/65 (estimated)	11/18/72	12/30/75	8/2/76	5/10/78
Cross-fostered	6/66–9/70	11/72–11/79	1/76–5/81	8/76–5/81	Not

in the night enclosure area during breakfast (8 to 9 a.m.), lunch (12 noon to 1 p.m.) and dinner (from about 4 to 5 p.m.); while the human was in the berm area aligning the chimpanzees' outdoor area; while the human was in the "human cage" area; and during "chimp care" shifts, in which one human took care of the chimpanzees in their night enclosures on Saturday afternoons or Sunday mornings. With these latter three types of interactions, filming did not take place during meals or during the hour before a meal.

Sessions and utterances in these corpora with bad visibility were excluded from analysis. When the chimpanzee utterances in a session only consisted of signs that could have been imitated from the human (according to the definition used, see below), the whole session was not included for analysis. No further selection of sessions was used.

Interlocutors

The human interlocutors only used ASL in the interactions. They had worked with the chimpanzees for 1 year or more and had long-term experience with ASL. In the 1992 corpus, there were two human interlocutors, one who had worked with the chimpanzees for 3 years, another for 1 year. The human interlocutors in the 1993 and the 1994 corpora had worked with the chimpanzees for 8 years. In the 1999 corpus there were 13 human interlocutors, who had all been working with the chimpanzees for at least 1.5 year, some up to 15 years. The chimpanzees thus communicated with humans that they had known for a long time. The importance of using interactions with well-known and familiar individuals has been stressed in the study of communicative intentions in children (Coggins & Carpenter, 1981; Coggins, Olswang & Guthrie, 1987; Dore, 1974, 1975; Roth & Davidge, 1985). It is in this set-up that one can expect the best representative sample of intentions.

Chimpanzee Signs and Utterances

The term *chimpanzee signs* in this article refers to the communicative hand behaviors that the chimpanzees had learned. Each sign consists of a particular configuration or shape and orientation of the hand(s), a specific movement of the hand(s), and a particular location where the sign is made. (For a description of most of the chimpanzee signs mentioned in this article, see Table 3.2. in B. T. Gardner, Gardner, and Nichols, 1989). The use of the term *chimpanzee sign* does not imply an equivalence with a sign as it is used by humans nor with signs from official sign languages such as ASL. The term *chimpanzee utterance* similarly does not imply a linguistic utterance. It is a convenient way in which to refer to the chimpanzee's communication of one or more signs.

Analysis and Observer Agreement

Sign Transcription

The signs of both humans and chimpanzees in the interactions were transcribed by experienced transcribers of the CHCI. In the 1992 corpus the observer agreement was 87% on the presence or absence of a chimpanzee sign and 96% on the particular form of a chimpanzee sign. The reliability of the human signs in the 1992 corpus had been determined by the use of these transcriptions as part of standard sign reliability tests at the CHCI. Table 2 shows the percentages of agreement for the 1993 corpus.

For the 1994 corpus there was an agreement of 93% on the gloss of the human signs, and an agreement on the gloss of the chimpanzee signs of 87% for both Washoe and Moja, 95% for Tatu, and 92% for Dar (agreement on the presence or absence of a sign was not calculated by Jensvold). Table 3 presents the agreement among the four transcribers of the 1999 corpus.

Imitation

A conservative definition of imitation was used. A sign was considered imitated by the chimpanzee if a human had made the same sign in the previous five seconds.

Utterance Boundaries

The chimpanzee signing was segmented into utterances by using the following criteria. The beginning of an utterance started differently depending on the first sign that the chimpanzee made. When the first sign was a contact sign such as TATU, the utterance started when the hand configuration tapped the specified place on the body for the first time. With a noncontact sign such as COLD, an utterance started when the first movement of the hand configuration took place. Lastly, with a contact and movement sign such as TOOTHBRUSH the utterance started at the first movement after the hand configuration made contact with the body. The end of an utterance took place when one of two behaviors occurred: either the chimpanzee's hand(s) dropped from the place of the sign and the hand(s) relaxed out of the configuration of the sign, or the chimpanzee's hand(s) was held in place and in the configuration but without further movement. These segmentation criteria were based on those applied by the Gardners (B. T. Gardner & Gardner, 1994; B. T. Gardner, Gardner, & Nichols, 1989) and Terrace (see Terrace et al., 1979). In order to avoid projection of linguistic patterns by the human coders, a further external criterion was added, which stated that an utterance had not ended when the chimpanzee's hands were continuing to move (human interruptions, which could influence the chimpanzee's continuing movement, were written down). The author of the present article determined the utterance boundaries for the 1992, 1993, and 1994 corpora. A second observer used the same criteria for 20% of these corpora. The interobserver agreement was 93% for the 1992 corpus, 88% for the 1993 corpus, and 92% for the 1994 corpus. For the 1999 corpus, the sign transcribers determined the chimpanzee utterance boundaries while they identified the signs. The author of the present article then functioned as a second observer by analyzing 20% of this corpus. Interobserver agreement was 95%.

Length of Sign Utterances

Only utterances without an imitated, unclear, or unidentifiable sign were used to analyze the lengths of the chimpanzee utterances. Including utterances with imitated signs would not show the spontaneous length of the utterances that the chimpanzees made and could result in erroneously attributing linguistic patterns to such utterances (see Sanders, 1985).

Table 2
Percentages of Agreement Between Transcribers of the 1993 Sessions

Agreement	Washoe	Moja	Tatu	Dar	Human
Presence sign	88	90	90	93	94
Gloss sign	95	95	97	96	95

Table 3
Percentages of Agreement Between Transcribers of the 1999 Sessions

Agreement	Tr1–Tr4	Tr2–Tr4	Tr3–Tr4
Presence chimpanzee sign	91	84	88
Gloss chimpanzee sign	92	93	95
Presence human sign	93	88	95
Gloss human sign	97	98	95

Note. Tr = Transcriber.

Semantic Relations

The Gardners' category system was used as an initial division of the recent two-sign combinations into candidates for the different types of relations. In Table 4 of their 1994 publication, the Gardners had specified several combination types for each semantic relation on the basis of the semantic categories of the signs within the combination (B. T. Gardner & Gardner, 1994). For example, the *action + object* relation was represented by the three combination types object sign + action sign (e.g., BALL CATCH), object/action sign + object sign (EAT APPLE), and demonstrative sign + action sign (THAT OPEN). The recent two-sign combinations were then tried as candidates by taking into account the context, the utterance's communicative intention code, and other information, such as the previous and subsequent contingent utterances and the separate use of the individual signs within the combination in one-sign utterances. Alternative explanations that were not in need of an interpretation in terms of a semantic relation were then first considered. It was also taken into account that for a semantic relation to be present, the two semantic roles within the relation should be represented by a variety of signs rather than consisting of stereotypic patterns with one particular sign only (Bowerman, 1973; Terrace et al., 1980).

Communicative Intentions

Each chimpanzee utterance was coded for communicative intention by using the methodology of child studies on this subject. The following five aspects of an utterance were used together as indicators of specific intentions:

1. The semantic content of the utterance: For example, an utterance with GIMME suggested a request while an utterance with HURT could be an internal report;

2. The grammatical and inflectional aspects of the utterance: For example, inflecting signs into the question form could suggest a request for information;

3. The accompanying nonverbal behavior of the chimpanzee: For example, awaiting a response from the human by prolonged looking indicated that the chimpanzee was requesting something while looking at an object or picture without prolonged looking at the human suggested naming;

4. The context: The presence of picture books could indicate naming intentions while a play context and a chimpanzee "play face" could suggest requests for actions; and

5. The behavior of the human: A human signing CAN′T or SORRY in response to the chimpanzee utterance could indicate refusal of a request for an object or action while the human pointing to a picture and asking WHAT? before the chimpanzee utterance could indicate naming.

Coders made use of a table with the categories of communicative intentions and their operational definitions, consisting of the five appropriate aspects for each intention. Not every utterance in the recent corpora was accompanied by substantial information from all of these aspects, so sometimes the coders had to decide on the intention by basing themselves largely on the semantic content (the signs) of the utterance and on the human behavior. The author of the present study coded all utterances and had an experience of 21.5 months with the chimpanzees. A second coder, who had worked with the chimpanzees for about 10 years provided interobserver agreement on the category of communicative intention for 20% of the chimpanzee utterances. Agreement ranged from 84% to 92% for the four corpora, with a mean of 89%.

Unprompted Utterances

To determine the communicative intentions of the chimpanzee sign utterances when the chimpanzees were not prompted by the humans, unprompted utterances were set apart. Using a conservative criterion, a chimpanzee utterance was considered prompted by the human when in the previous five seconds the human had asked a question, signed a nonquestion utterance, pointed to or held up a picture or object, or manipulated an object. Note that not all of the chimpanzee utterances that were thus defined as prompted may actually have been prompted by the human. For example, when a human takes an object out of a bag, the chimpanzee may sign about that object out of a spontaneous motivation rather than because of being prompted by the human. This analysis was therefore not done to determine the prompted versus unprompted nature of chimpanzee utterances but to separate those utterances that were unprompted with great certainty in order to compare the communicative intentions of these utterances with those of all utterances.

Results

The chimpanzees predominantly signed to request objects and actions. They mostly used object and action signs and signs that were used as wild cards. Combinations of signs showed no semantic or syntactic structure. These results are described in separate sections.

Total Utterances

The chimpanzees made a total of 3,448 analyzable utterances in the four corpora. Excluding utterances that only consisted of imitated signs, the total was 2,839. Table 4 presents the totals for each corpus and for each chimpanzee.

Communicative Intentions

The predominant communicative intention of the chimpanzees in each of the four corpora was to make requests: 2,454 utterances or 86% of all utterances were requests for objects and actions (with a range for the corpora of 63–96%). Table 5 lists the number of chimpanzee sign utterances for each communicative intention category.

Requests for objects were more frequent (65% of the total) than requests for actions (18%). The most frequent object signs in requests for objects were DRINK (used 327 times), FLOWER (241 times, mostly for edible plants), FOOD/EAT (189 times), GUM (187 times), TOOTHBRUSH (158 times, for toothbrushes with edible toothpaste), COFFEE (113 times), BRUSH (111 times, for brush as an object), CLOTHES (101 times), CHEESE (64 times), HOT (55 times, probably for a drink), NUT (52 times), SHOE (41 times), and WATER (41 times). Action signs that were most frequent in requests for actions were SMELL (176 times, used mostly to ask humans to blow their breath through the bars to the chimpanzee, so the chimpanzee could smell it), CHASE (42

Table 4
Number of Utterances per Chimpanzee per Corpus

Corpus	Washoe	Moja	Tatu	Dar	Loulis	All chimps
1992	59	44	37	8	65	213
1993	249	286	379	283		1,197
1994	232	267	337	188		1,024
1999	72	134	146	28	25	405
All corpora	612	731	899	507	90	2,839

times), BRUSH (35 times, for the action of brushing), and PEEKABOO (34 times). Other frequent signs in requests for objects and actions were GIMME (420 times), THAT (284), YOU (205), HURRY (173), and THERE (136).

Naming or labeling of objects and pictures occurred in 53 utterances, or 2% of all utterances. Naming occurred most often in the 1992 corpus, where a picture book was often part of the context of the interaction. Object signs were used in the general naming category, whereas in the naming properties category the color signs BLACK and RED occurred. There was not enough information available, however, to determine the correctness of the chimpanzees' naming utterances.

The remaining communicative intention found was answering. There were 109 utterances (4%), consisting of simple responses to human questions. In many of these replies the chimpanzees signed their own name sign after a human "Wh" question such as WHO?

Finally, there were 215 unclear utterances, for which the communicative intention was not evident, constituting 8%. More than half of these (118) consisted of Tatu using the sign BLACK. Tatu often repeated BLACK many times. She drew her extended index over her brow to the side (the way BLACK is signed) sometimes up to five times in a row. A further finding was that Tatu signed 21 of her unclear BLACK utterances at about the time she was regurgitating food. In these instances she got up from a sitting position, bent forward to regurgitate while signing BLACK, after which she sat down again and chewed on the regurgitated food now back in her mouth, sometimes repeating the sign BLACK.

Unprompted Utterances

There were 522 unprompted utterances. This represented 18% of the total, with a range for the corpora from 5 to 30%. There were 409 unprompted request for object utterances (78% of the total), 69 request for action utterances (13%), and 11 with a double code of both. In total, there were 489 unprompted request utterances, forming 94% of the total (with a range for the corpora of 80% to 100%). The percentage of requests thus increases when the unprompted utterances are compared with the total of utterances (unprompted and prompted). Next, there were 31 unprompted utterances (6%) that were unclear for intention. The majority of these were again utterances by Tatu with the sign BLACK. Lastly, on two occasions Tatu was coded to be naming properties when she signed THAT BLACK, pointing to a black object. These two utterances cannot count as evidence for this intention, however, because BLACK was not always clearly used to describe the color black.

Signs

The 3,448 utterances consisted of 5,982 signs. Of this number, 4,776 signs were not imitated from the human. Further analysis of these nonimitated sign productions led to the following information. The five chimpanzees combined used 88 different signs in total. Table 6 gives the number of signs used and the most frequent signs for each chimpanzee.

Table 5
Number of Utterances per Corpus for Each Communicative Intention

	Number of utterances (all chimpanzees)				
Communicative intention	1992	1993	1994	1999	All
Requests					
Request for object	43	1,064	491	245	1,843
Request for action	81	60	260	111	512
Request object request action	11	30	45	13	98
Total requests	135	1,154	796	369	2,454
Naming and properties					
Naming	39	0	4	2	45
Properties	4	0	4	0	8
Total naming	43	0	8	2	53
Naming/request	6	0	1	1	8
Answering	2	36	68	3	109
Unclear	27	7	151	30	215
Total utterances	213	1,197	1,024	405	2,839

Table 6
Number of Signs and Percentage of Four Most Frequent Signs per Chimpanzee

Chimpanzee	Number of signs	Percentage of four most frequent signs
Washoe	43	COME/GIMME (26) FLOWER (12) GUM (11) DRINK (9)
Moja	55	THAT/THERE/YOU(21) BRUSH (9) CLOTHES (8) DRINK (7)
Tatu	55	THAT/THERE/YOU (19) BLACK (10) DRINK (9) SMELL (8)
Dar	38	THAT/THERE/YOU (15) DAR (13) TOOTHBRUSH (7) BRUSH (6)
Loulis	4	THAT/THERE/YOU (58) GIMME (26) CHASE (13) HURRY (4)

The pointing sign THAT/THERE/YOU was the most frequent sign for 4 chimpanzees (the Gardners glossed this sign differently according to the place where the chimpanzee pointed to: Pointing to an object or picture was glossed as THAT, pointing to a location was glossed as THERE, and pointing to a person was glossed as YOU). Note that for each chimpanzee several signs accounted for large percentages of the chimpanzee's total sign use. Loulis only used four signs. For the 5 chimpanzees combined 10 signs, THAT/THERE/YOU, COME/GIMME, DRINK, FLOWER, FOOD/EAT, SMELL, GUM, TOOTHBRUSH, BRUSH, and HURRY, constituted 60% of the total times a sign was produced.

Semantic Categories

The Gardners had classified the chimpanzees' signs into semantic categories on the basis of their use by the chimpanzees (B. T. Gardner & Gardner, 1994; B. T. Gardner, Gardner, & Nichols, 1989). This categorization was applied to the recently used signs as a preliminary division. Table 7 shows the number of times a sign was used in the recent corpora for each semantic category, the percentage of the category, the number of signs used in each category, and its most frequently used signs.

The sign use was mostly restricted to object and action signs (signs for edibles being the biggest category), request markers (GIMME, HURRY), the sign THAT/THERE/YOU, and the chimpanzee's own name sign. Note that Loulis did not produce an object sign or his own name sign.

Use of Specific Signs

THAT had been classified by the Gardners as a demonstrative sign only, used to refer to an entity by pointing. In the recent corpora, however, THAT could not always be interpreted as a

Table 7
Semantic Categories of Recent Sign Use, Ranked According to Frequency

Semantic categories	No. of times a sign was made in this category						Percentage of total	No. of signs	Most frequent signs (in order of frequency)
	W	M	T	D	L	All chimps			
Objects: All categories	464	367	407	224	0	1,462	31	47	
Objects: Edibles	343	155	371	146	0	1,015	21	30	FLOWER, GUM, COFFEE
Objects: Inanimates	97	199	36	71	0	403	8	13	TOOTHBRUSH,[a] CLOTHES, SHOE
Objects: Animates	24	13	0	7	0	44	1	4	BIRD
Objects/actions	172	298	260	57	0	787	17	10	DRINK, FOOD/EAT, BRUSH
Requests	454	90	110	34	32	710	15	5	COME/GIMME, HURRY
Person: All categories	43	156	201	121	1	522	11	9	
Person: YOU + ME	17	109	112	20	1	259	5	2	YOU
Person: Names chimp	26	47	88	86	0	247	5	4	TATU, DAR, MOJA
Person: Generic names	0	0	0	12	0	12	<1	1	BOY
Person: Names humans	0	0	1	3	0	4	<1	2	HEIDI
Actions	37	148	120	42	14	361	8	9	SMELL, CHASE, PEEKABOO
Demonstrative	37	105	100	58	61	361	8	1	THAT
Attributes: All	57	87	145	5	0	294	6	4	
Attributes: Colors	3	71	143	0	0	217	5	2	BLACK, RED
Attributes: Sensory qualities	54	16	2	5	0	77	2	2	HOT
Locatives	15	78	46	56	1	196	4	3	THERE
Traits	3	27	7	23	0	60	1	1	GOOD
Negatives	0	4	0	0	0	4		1	NO
Unclassified	12	7	2	0	0	21		1	PERSON
Total times/chimpanzee	1,295	1,363	1,348	661	109	4,776			

Note. W = Washoe; M = Moja; T = Tatu; D = Dar; L = Loulis.
[a] TOOTHBRUSH was categorized by the Gardners (B. T. Gardner, Gardner, & Nichols, 1989) as an object/action sign, referring to toothbrushes as well as the act of brushing teeth. In the recent corpora the context indicated that TOOTHBRUSH referred to the object only, usually with some toothpaste on it for the chimpanzees to eat (which suggests that TOOTHBRUSH should actually be categorized as an edible object). No utterance warranted a reference to the action of brushing teeth.

demonstrative, because the pointing was most often part of request utterances, drawing attention or exhorting the human toward the requested object or action. THAT was therefore used more imperatively than declaratively (see Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979). YOU was frequently part of action requests in the recent corpora. There was no evidence for the use of YOU and ME as actual pronouns. The chimpanzees only produced their own name sign and never the name sign of another chimpanzee. The four times a human name sign was made consisted of the following. Three times Dar signed HEIDI. This sign is close in place, configuration, and movement to BOY, which is also used to refer to himself and functions similarly to his own name sign. Dar's instances of HEIDI may therefore have been sloppy versions of BOY. The fourth instance of a human name sign occurred in the utterance ROGER CHEESE, signed by Tatu after she had first requested ICE/COLD, CHEESE, MEAT, NUT, and BANANA. It was unclear what she meant here, and the utterance was coded as unclear for intention. BLACK and RED may not always have referred to colors. For Moja, RED may have changed into an object sign for clothes (see the discussion of RED in the Attributive subsection of Two-sign combinations). As was already mentioned, it was unclear what BLACK referred to when Tatu (the only chimpanzee using the sign) signed it. HOT was only signed by Washoe. None of her 54 utterances with HOT could be determined as describing the hot quality of an object. Moreover, combinations with HOT included HOT GUM and HOT TOOTHBRUSH GIMME TOOTHBRUSH. Moja was the only one using NO, by shaking her head sideways. In her four utterances with NO it was not clear that she was using it as a negative. This behavior may not have been a sign but rather some nervous shaking of the head.

Wild Card Signs

Terrace and colleagues had introduced the term *wild card sign* for signs that can be considered "appropriate" in almost every context. In the recent corpora, the chimpanzee's own name sign and the signs THAT/THERE/YOU, HUG, and GOOD could often be interpreted to function as wild card signs. The use of the chimpanzee's own name sign serves to clarify how a sign can function as a wild card: When a chimpanzee produced his or her own name sign, most of the times the chimpanzee had already uttered several unfulfilled requests, and the name sign followed a human "Wh" question, usually WHO? but also WHERE? or WHAT? Answering the question with the chimpanzee's own name sign would often be interpreted as correct by the human, after which the human would generally fulfill the chimpanzee's request. Throwing in the name sign when there were no human questions but when an earlier request had not led to human fulfillment of the request could similarly function to speed up such fulfillment. This function of name signs can further be seen from the combinations with name signs, with examples such as GUM WASHOE GIMME, DRINK MILK DRINK TATU, and COFFEE TATU YOU WATER DRINK TATU YOU COFFEE.

Imitation

The chimpanzees imitated a human sign 1,206 times, which accounted for 20% of the total times a sign was made. In terms of utterances, 18% were full or partial imitations. These were utterances that consisted only of imitated signs, either by imitating all of the signs (full imitation) or some of the signs (partial imitation) that the human had just made.

Combinations

Of the total of 2,839 utterances, there were 2,366 utterances that did not contain an imitated, unclear or unidentifiable sign. These utterances were used for analysis. They consisted of 1,589 single-sign utterances (67% of the total), 474 two-sign utterances, 169 three-sign utterances, 53 four-sign utterances, 31 five-sign utterances, 19 six-sign utterances, 11 seven-sign utterances, 9 eight-sign utterances, 4 nine-sign utterances, 3 10-sign utterances, 2 11-sign utterances, 1 13-sign utterance, 1 15-sign utterance, 1 17-sign utterance, and 1 22-sign utterance.

Two-Sign Combinations: Semantic Relations

Using contextual information, analysis showed no clear evidence for the presence of semantic relations in two-sign combinations. The candidate utterances for the most important relations are briefly discussed here.

Action + object. The Gardners (B. T. Gardner & Gardner, 1994; R. A. Gardner & Gardner, 1978) had reported chimpanzee examples of this relation, such as EAT APPLE and OPEN BLANKET. In the recent corpora, most candidates for this relation type (49) consisted of combinations of object signs with DRINK and FOOD/EAT. There were 22 candidates that looked like instances of the action + object relation, such as DRINK COFFEE and FOOD/EAT CHEESE. However, the remaining 27 were apparently unrelated combinations such as DRINK GUM and CLOTHES FOOD/EAT, which seemed more like asking two things at the same time. Other examples of unrelated combinations of the action + object type were CHASE TOOTHBRUSH, SODAPOP BRUSH, and FLOWER PEEKABOO.

Agent + action. Chimpanzee examples of this relation reported by B. T. Gardner and Gardner (1994) were SUSAN CHASE, ME OPEN, YOU WRITE. Candidates from the recent corpora were limited to action signs combined with YOU (most often SMELL YOU, requesting the blowing breath routine) or the chimpanzee's own name sign (such as DRINK TATU and DAR BRUSH). Nim had similar patterns of limited types of combinations. He only used NIM or ME in 99% of object + beneficiary combinations, and only YOU in 76% of agent + object sequences. These patterns made Terrace doubtful about an interpretation as a semantic relation, and led him to conclude that NIM, ME, and YOU were used as wild cards. In the recent corpora, YOU and the chimpanzee's own name sign similarly functioned as wild cards.

Locative action and object + locative. Gardner & Gardner (1994) published chimpanzee examples of this relation, such as TICKLE THERE, ME UP, IN KEY. Almost all recent candidates were combinations of object or action signs with THERE, such as FLOWER THERE, DRINK THERE, and THERE LIPSTICK. In these instances the chimpanzees were pointing toward the location where a requested item could be found rather than giving a mere description of the location of an object. Again this is a limited pattern, because there is no variety of signs. And again there is a strong similarity with Nim. In 90% of his location combinations,

Nim only used POINT. There were only three recent combinations with another locative sign: YOU IN, IN DAR, and IN BANANA. YOU IN, signed by Tatu, could be better interpreted as requesting the human to be let in than as a description of the location of the human. Dar's IN DAR followed a one-sign IN request utterance, so adding DAR could be an instance of throwing in a wild card sign. IN BANANA, also signed by Dar, similarly followed one-sign IN requests and could be interpreted as requesting two different things.

Attributive. Chimpanzee examples of the attributive semantic relation published by B. T. Gardner and Gardner (1994) were BLACK HAT, RED TOOTHBRUSH, GLASS MIRROR, GOOD BOY. In the recent corpora, Moja made seven combinations of an object or object/action sign with RED: 4× RED CLOTHES, 1× RED SHOE, 1× RED NUT, and 1× BRUSH RED, all coded as requests for objects. The context, however, did not include red objects. They might have laid on the shelves of the observation room (as these utterances were made in the 1993 corpus), but this was impossible to determine from the videotapes. As Moja did not use other color signs, it is also not possible to conclude that RED referred to a color. Moja did, however, make one-sign request-for-object utterances with RED. Maybe RED had shifted to an object sign, possibly referring to clothes. This may have been stimulated by the humans' perception that RED was Moja's favorite color. The humans may have waited for Moja to sign RED before they gave her clothes or other objects, causing a similar pattern to that of the name signs: When Moja wanted something, throwing in RED could cause the humans to deliver an item more quickly. Further doubt on RED as a color sign arises from some of Moja's longer combinations with RED, such as RED MOJA RED, THERE RED GIMME and BRUSH RED BRUSH RED YOU RED. Tatu had four combinations of an object or object/action sign with BLACK: 2× BLACK TOOTHBRUSH, 1× CHEESE BLACK, and 1× SMELL BLACK. Again, no such black objects were visible. Washoe had three combinations of an object with HOT. Two of these were COFFEE HOT and HOT DRINK. However, Washoe also produced HOT as a single-sign utterance, possibly to request a drink. COFFEE HOT and HOT DRINK could therefore involve asking for the same thing twice rather than connecting *hot* with *coffee* or *drink*. The other combination, HOT GUM, is a good example of combining two request items that Washoe regularly asked for in one-sign utterances. Dar had two combinations of a person sign with GOOD: DAR GOOD and YOU GOOD. YOU GOOD was coded as a request for an object and followed requests for IN and EAT. The context did not suggest that the human was being assigned the trait *good* but rather that Dar was pointing to the human as the one to initiate action while stimulating the human by adding the human-pleasing sign GOOD.

Nomination. The Gardners reported chimpanzee examples of this relation such as THAT CAT, THAT SHOE, and THAT NAOMI (B. T. Gardner & Gardner, 1994; B. T. Gardner et al., 1989). Of the recent combinations with THAT, only two were coded as naming. These were two instances of THAT ICE-CREAM made by Tatu while she was looking at a picture book. There were 82 two-sign combinations with THAT that were coded as requests for objects or actions. Above I already pointed out that THAT was used more as an attention getter of the human toward a requested item than as a demonstrative communication.

Experience/notice. B. T. Gardner and Gardner (1994) published chimpanzee examples of the experience/notice relation such as FLOWER SMELL, SEE SUSAN, and TATU HEAR. There were only combinations with SMELL in the recent corpora. Rather than suggesting a description of experiencing or noticing things, these were all requests for the human breath-blowing routine.

Negative. Chimpanzee examples of this relation as reported by B. T. Gardner and Gardner (1994) were NO CHASE, POTTY CAN′T, and FINISH OUT. There was only one recent candidate for this relation: Moja's PEEKABOO NO. However, it was coded as a request for action after she had already made five unfulfilled requests. As was said above, Moja's headshaking does not seem to be an actual sign.

Requests. The Gardners reported chimpanzee examples of this relation, such as MORE COOKIE, GIMME DRINK, and HUG PLEASE (B. T. Gardner & Gardner, 1994; B. T. Gardner et al., 1989). In the recent corpora there were 97 combinations of a request marker with another sign such as GIMME FLOWER and HURRY DRINK. These combinations showed a variety of request markers and request items, so here the criterion of a variety of exemplars for the semantic roles within a semantic relation is fulfilled. However, one can conclude that these combinations also are unrelated, because request markers can also be interpreted to act as wild card signs.

Combinations of Three Signs and More

Longer combinations did not provide more information but showed a great deal of repetition. Repetition of a sign occurred in 41% of three-sign combinations and 60% of four-sign combinations, as in FLOWER GIMME FLOWER and GUM FLOWER GUM TOOTHBRUSH. The remaining three- and four-sign combinations consisted of strings of multiple object and action signs together with request markers and the wild card signs THAT/THERE/YOU, GOOD, and the chimpanzee's own name sign. Examples were NUT BRUSH TOOTHBRUSH, FLOWER DRINK GUM TOOTHBRUSH, BANANA TOOTHBRUSH THAT, DRINK THERE BRUSH CLOTHES, GOOD BRUSH CLOTHES, FLOWER SODA YOU GOOD, CHEESE DRINK TATU, and FOOD/EAT WASHOE GIMME CORN. As can be seen from these examples, there was considerable overlap in content between utterances of different lengths. More informative utterances, such as YOU ME IN and SUSAN CHASE DAR, reported earlier, were not found. Instead, the longer combinations were very similar to Nim's repetitive and string-like multiple-sign sequences.

The remaining utterances, of 5 to 22 signs, showed the same patterns as three- and four-sign combinations. Especially Washoe and Moja made long concatenations of signs. Two examples are illustrative: Moja made the 11-sign combination BRUSH CLOTHES THERE BRUSH THERE TOOTHBRUSH THERE BRUSH GIMME BRUSH THERE. Washoe produced the 16-sign combination FLOWER HURRY FLOWER HUG GO FLOWER BOOK FLOWER GIMME FLOWER GIMME FLOWER HUG HURRY DRINK GIMME. Note the striking similarity with Nim's longest utterance: GIVE ORANGE ME GIVE EAT ORANGE ME EAT ORANGE GIVE ME EAT ORANGE GIVE ME YOU. Some longer combinations (not these two examples) were interrupted by the human, possibly causing an unclear length of the utterance.

Sign Order

A clear order pattern was found in two- and three-sign combinations: Object and action signs were more frequent in the initial position, whereas request markers and the signs THAT/THERE/YOU and GOOD appeared more frequently in final position. This order preference did not modify the meaning of an utterance and was therefore not syntactic. The pattern can instead be interpreted as the expression of an acquisitive motivation. The object and action signs are produced first because these are the more important or salient signs of the (usually request) utterances, specifying what is requested. The request markers, THAT/THERE/YOU, and GOOD are produced last because they are less important (not specifying what is requested) and function to add emphasis or to spur the human into action. Because these latter signs often function as wild cards, one could also represent the order pattern as *object/action sign + wild card sign.* The order preferences found in the recent signing thus fuel the interpretation of the chimpanzees' motivation as acquisitive.

Discussion

This study has found three major differences between the chimpanzee signing in the recent corpora and (early) human language:

1. The used vocabulary of the chimpanzees consists mostly of object and action signs and wild card signs, whereas humans have vocabularies with a large variety of semantic categories of words or signs. Human children quickly acquire this variety as they learn words or signs (Bonvillian, 1999; Dromi, 1999; Nelson, 1973).

2. The chimpanzees' combinations of signs show no internal structure, whereas humans combine words or signs in a semantically and grammatically structured way. Human children soon express semantic relations when they start combining words or signs into combinations and sentences. They also quickly learn specific grammatical rules for order in combinations of words or signs (Bloom, Lightbown & Hood, 1975; Bonvillian, 1999; Bowerman, 1973; Braine, 1976; Brown, 1973; de Villiers & de Villiers, 1986; Neidle, Kegl, MacLaughlin, Bahan, & Lee, 2000; Tomasello & Brooks, 1999). None of these linguistic patterns were found in the recent chimpanzee utterances.

3. The chimpanzees' communicative intentions for using signs are mostly limited to uttering requests, whereas humans from early onward have a wide range of different intentions underlying their use of language.

These differences between chimpanzee signing and child language show that these are different forms of behavior. It is for this reason that chimpanzee signing should not be labeled linguistic.

In terms of individual signs, there was a skewed use of the signs in the chimpanzees' vocabulary in that some signs were made very frequently, whereas other signs were made infrequently or not at all. These findings are similar to those reported for Nim's production of individual signs. His signing also showed a predominance of object and action signs, and request markers, and a skewed use of the signs in his vocabulary.

The chimpanzee's own name sign, and the signs THAT/THERE/YOU, HUG, and GOOD often appeared to function like Nim's wild card signs. In the recent corpora the use of a chimpanzee's own name sign most often followed human "Wh" questions, mostly WHO. For decades such human questions have frequently been part of the human–chimpanzee interactions. The chimpanzee responding with a name sign to such questions would generally be interpreted as appropriate by the human. It was therefore a fruitful strategy for the chimpanzee to make their name sign often, especially at moments when the human delayed fulfillment of a request by signing such questions instead of fetching the requested item. Obligatorily producing the name sign could then satisfy the human's request for more signing and stop the signing interaction. Thus the human was manipulated into retrieving the requested item as quickly as possible to ensure the least delay of gratification. The chimpanzees thus learned that the name sign was an effective strategy to speed up fulfillment of requests and therefore made the sign even without a human "Wh" question preceding it. Terrace and colleagues reported that Nim used his name sign in this same manner (Seidenberg, 1986; Seidenberg & Pettito, 1981; Terrace, 1980). In 1971 the Gardners themselves interpreted Washoe's use of her name sign, the name signs of her human companions, and YOU and ME as routine signs useful to add to please and manipulate the humans (B. T. Gardner & Gardner, 1971). Savage-Rumbaugh (1981) mentioned a similar instrumental use of name lexigrams of humans by the chimpanzees Sherman and Austin (*lexigrams* are geometric designs constructed by humans). It is important to realize that when signs are used as wild cards, the chimpanzee does not necessarily communicate the symbolic meaning of these signs but produces them in a performative, instrumental way to produce a cooperative effect in the humans.

A further intriguing finding has been that Loulis only produced four signs. According to earlier reports, Loulis had acquired at least 51 signs from the other chimpanzees, which was interpreted as a cultural transmission of a human language (Fouts, 1997; Fouts & Fouts, 1993; Fouts, Hirsch, & Fouts, 1982; Fouts, Jensvold, & Fouts, 2002). It is remarkable that, by comparison, he used such a small number of the signs in his presumed vocabulary in the two recent corpora. Further, two of his signs, GIMME and HURRY, are similar or close to natural chimpanzee behaviors (B. T. Gardner & Gardner, 1971, R. A. Gardner & Gardner, 1989; Seidenberg & Petitto, 1979). In fact, only the pointing sign THAT/THERE/YOU and the sign CHASE appear to be wholly new behaviors. The fact that only 90 utterances by Loulis were analyzed in this study may mean that there are too little data on which to base final conclusions about his signing behavior. However, the patterns of his sign use were the same in both the 1992 and 1999 corpus.

It may be worthwhile to refrain from giving some of the sign behaviors a sign gloss and to introduce non-sign descriptions of the behaviors. THAT/THERE/YOU could be described as pointing, GIMME as beckoning or begging. Another example is the sign CHASE. In many cases this hitting of the wrist by a fist or open hand was an initiation to a game of chase. No instances were found in which CHASE was used as a description of the act of chasing. CHASE could be renamed 'wrist-hit' as an initiation to play. Tomasello found a similarly functioning, spontaneously occurring wrist-hit in captive chimpanzees that had not been taught signs (Tomasello, 1990; Tomasello, Gust, & Frost, 1989). The bonobo Kanzi spontaneously used hand-clapping to initiate play (Savage-Rumbaugh, Shanker, & Taylor, 1998). Such changes in the description of the chimpanzee behaviors could avoid unfounded interpretation of some of these behaviors as actual symbols and could relate these to the chimpanzees' nonverbal communicative behaviors in the wild and in captivity.

The level of imitation in the recent corpora was much lower than that reported for Nim. The percentage of fully and partially imitated utterances was 18, whereas percentages of 39 to 54 were reported for Nim. Bloom, Rocissano, and Hood (1976) also reported a mean of 18% of imitated utterances for children with a mean length of utterances of less than 2 morphemes, whereas this was 2% for children with a mean length of utterance between 3.5 and 4 morphemes. Terrace's characterization of chimpanzee signing as predominantly imitative and nonspontaneous thus applies more to Nim than to all signing chimpanzees. The fact that the chimpanzees in this study imitated to a low degree could imply that the recent signing is therefore more similar to children's early speech and signing and, consequently, more linguistic in nature. However, the nonimitative nature of the signing can also mean that these chimpanzees have simply found the use of signs to be something valuable and useful in their interaction with humans.

The combinations of signs that the chimpanzees produced in the recent corpora had no apparent semantic or syntactic structure. Longer combinations showed much repetition and stringing of object and action signs together with wild card signs. Again, these findings are in strong agreement with Nim's combining of signs and different from the combinations reported of these same chimpanzees in earlier days.

With regard to motivation, the data about the communicative intentions of the recent utterances support Terrace's (1985) description of chimpanzee signing as being predominantly acquisitive in nature. The vast majority of recent utterances consist of requests for objects and actions. The use of signs as wild cards, the structureless strings of signs in multiple-sign combinations, and the sign order pattern found in two- and three-sign combinations further indicate the acquisitive nature of the chimpanzee signing. The Gardners and Fouts have often rejected the characterization of chimpanzee signing as being mostly request oriented (Fouts, 1987, 1997; B. T. Gardner et al., 1989; R. A. Gardner & Gardner, 1978, 1984, 1988). The current data, however, do not support their position.

The captive situation of the chimpanzees will have played a part in the predominance of requests. The fact that the chimpanzees are in captivity and are fully dependent on the humans to bring them foods, objects, and activities to which they have no access causes them to utter requests whenever they want something. Human children make few requests when objects are easily accessible (Coggins, Olswang, & Guthrie, 1987). The fact remains, however, that the chimpanzees had few other communicative intentions in the thousands of utterances that were analyzed. Moreover, the chimpanzees were not forced to request and were free to express any communicative intention. The context of all interaction sessions was an unstructured and relaxed interaction, so the communicative intentions of the chimpanzees were not restricted by the human interlocutor. Nor did the interactions consist of drills or routine question–answer patterns in which the human continuously asked questions that the chimpanzee had to answer. Also, the humans themselves expressed a great variety of communicative intentions in their utterances. They named objects and pictures, described the properties, possession, and location of objects, requested objects and actions, requested information by asking questions, reported internal states, attributed internal states to the chimpanzees, and expressed evaluations of the chimpanzees. The context of the interactions should therefore have given the chimpanzees ample opportunity to express a large variety of communicative intentions. The fact that the chimpanzees nevertheless mostly restricted themselves to uttering requests therefore suggests that the chimpanzees were not motivated to communicate further intentions. Furthermore, many similarities of the recent signing of the 5 chimpanzees with the signing of Nim have been found. This suggests a similar type of behavior in all of these chimpanzees. Until new data are presented that show another distribution of communicative intentions, I conclude with Seidenberg (1986) that "the fact that [the chimpanzees] use [signs] instrumentally across a wide range of conditions may reflect a powerful generalization about their behavior" (p. 44).

It is interesting that data from another ape language project, the study of the bonobo Kanzi's use of lexigrams, corroborate these findings. Greenfield and Savage-Rumbaugh (1990) mention that a high percentage of 96 of Kanzi's lexigram utterances were interpreted as requests, whereas 4% were considered to be "indicatives or statements." Though they argue that captivity will have had an influence on this distribution, they also mention that this finding might be related to a possible "lesser proclivity for symbolization per se" (Greenfield & Savage-Rumbaugh, 1990, p. 567).

The naming behavior of the chimpanzees remains an interesting area for future research. There is some indication that especially Tatu spontaneously names things, which might suggest a motivation beyond an acquisitive one. She produced most of the naming utterances in the four corpora and was the most cooperative chimpanzee in naming sessions. Terrace (1979) argued, however, that Nim's cooperation during naming sessions need not mean that he was intrinsically motivated to name. Nim could have cooperated in the expectation that he would then more likely obtain some sort of reward, or because he enjoyed the social attention and interaction that a naming session involved. With Tatu this may also be the underlying motivation. However, such an explanation may not be fully applicable, because another form of signing behavior exists that could not result in a reward. This is the private signing that has been filmed and documented by Bodamer (Bodamer, Fouts, Fouts, & Jensvold, 1994) and was reported earlier by both the Gardners (B. T. Gardner & Gardner, 1971; R. A. Gardner & Gardner, 1972) and Terrace (1979). In this type of signing behavior, the chimpanzees sign when they are alone, sometimes while looking at pictures in magazines. Though its function is unclear, this form of signing is not directed at others and can therefore not be regarded as request oriented. It can still be the case, then, that the chimpanzees have some sort of fascination for the signs that is intrinsic. The overall conclusion may be that the use of signs by chimpanzees largely consists of uttering requests, but an acquisitive motivation may not underlie all of the signing behavior. Future research should focus more on motivationally spontaneous naming behavior and other sign use that does not seem to be request oriented. Additional studies could also provide knowledge on the correctness of the naming, which was not possible to determine in the current study.

Tatu's use of BLACK also deserves further investigation as it was found to be a recurrent phenomenon in several corpora. According to the Gardners (Gardner, Van Cantfort, & Gardner, 1992) and Fouts (1997), black used to be Tatu's favorite color. Fouts (1997) later interpreted the sign BLACK to be comparable to the English adjective *cool,* because Tatu expressed liking or positive affect with the sign when she was enjoying something.

However, in the instances from the recent corpora, there was no clear reference to a color description or to an expression of positive affect. A different explanation than Tatu saying *cool* when signing BLACK could be that in most instances the sign carries no referential meaning but is some sort of habit or stereotypical behavior. Perhaps the sign provides Tatu with a reinforcing tactile stimulation when she repeatedly presses her index along her prominent brow ridge, a facial feature characteristic of chimpanzees.

The chimpanzee sign utterances in the recent corpora are obviously only a small portion of what the chimpanzees have signed in recent years. It is therefore recommended that similar studies be carried out, for example, on an annual basis, to increase our knowledge of chimpanzee signing behavior. Similarly, a study such as the current one could also be set up to further analyze the signing behavior of the signing gorilla Koko and the signing orangutan Chantek and to further examine the use of lexigrams by the bonobo Kanzi.

Surprisingly, the recent signing is considerably different from the chimpanzees' reported earlier sign use. As was mentioned before, most studies of the early sign use suffered from several important methodological problems (Ristau & Robbins, 1982; Rivas, 2003; Seidenberg, 1986; Seidenberg & Petitto, 1979, 1981; Terrace, 1983; Terrace, et al., 1979; Umiker-Sebeok & Sebeok, 1980; Wallman, 1992). The question therefore arises as to whether the earlier signing may actually have been similar to the recent signing in these corpora. It may also be that the increased captivity of the chimpanzees as they have grown older has caused a decrease of linguistic signing. However, no reports exist of a similar decline of language in captive humans. The reduction in human signing during the time in Oklahoma and the seldom use of signs by humans during the first 5 years that Loulis was part of the group will probably have had an effect on the chimpanzees' signing. Filmed corpora of sign use from these earlier periods should be analyzed and published to understand the longitudinal development of the chimpanzees' signing.

This study has shown that many similarities exist between the recent sign use of these chimpanzees and Nim's use of signs. I therefore propose the hypothesis that the signing of chimpanzees in interactions with humans is usually acquisitive in motivation, mostly limited to object signs, action signs, and wild card signs, and lacking a semantic or syntactic structure in sequences of signs. Perhaps more complex and linguistic sign use exists, but for now the burden of proof lies with a linguistic interpretation. Until filmed data are presented that show more similarities with human language, the conclusion for now on chimpanzee signing is that the chimpanzees do not use signs in the way human children use language but have mostly found signs to be useful instruments to get what they want when interacting with a human.

References

Bates, E., Benigni, L., Bretherton, I., Camaioni, L., & Volterra V. (1979). *The emergence of symbols: Cognition and communication in infancy.* New York: Academic Press.

Bloom, L., Lightbown, P., & Hood, L. (1975). Structure and variation in child language. *Monographs of the Society for Research in Child Development, 40*(2, Serial No. 160), 1–79.

Bloom, L. M., Rocissano, L., & Hood, L. (1976). Adult–child discourse: Developmental interaction between information processing and linguistic knowledge. *Cognitive Psychology, 8,* 521–522.

Bodamer, M. D. (1998). *Cross-fostered chimpanzee initiated sign interactions.* Unpublished doctoral dissertation, University of Nevada, Reno.

Bodamer, M. D., Fouts, D. H., Fouts, R. S., & Jensvold, M. L. A. (1994). Functional analysis of chimpanzee (*Pan troglodytes*) private signing. *Human Evolution, 9,* 281–296.

Bodamer, M. D., & Gardner, R. A. (2002). How cross-fostered chimpanzees (*Pan troglodytes*) initiate and maintain conversations. *Journal of Comparative Psychology, 116,* 12–26.

Bonvillian, J. D. (1999). Sign language development. In M. Barrett (Ed.), *The development of language* (pp. 277–310). Hove: Psychology Press.

Bowerman, M. (1973). *Early syntactic development: A cross-linguistic study with special reference to Finnish.* Cambridge, England: Cambridge University Press.

Braine, M. D. S. (1976). Children's first word combinations. *Monographs of the Society for Research in Child Development, 41*(1, Serial No. 164), 1–97.

Brown, R. (1973). *A first language: The early stages.* London: George Allen & Unwin.

Coggins, T. E., & Carpenter, R. L. (1981). The Communicative Intention Inventory: A system for observing and coding children's early intentional communication. *Applied Psycholinguistics, 2,* 235–251.

Coggins, T. E., Olswang, L. B., & Guthrie, J. (1987). Assessing communicative intents in young children: Low structured observation or elicitation tasks? *Journal of Speech and Hearing Disorders, 52,* 44–49.

de Villiers, J., & de Villiers, P. A. (1986). The acquisition of English. In D. Slobin (Ed.), *The cross-linguistic study of language acquisition* (Vol. 1, pp. 27–139). Hillsdale, NJ: Erlbaum.

Dore, J. (1974). A pragmatic description of early language development. *Journal of Psycholinguistic Research, 3,* 343–350.

Dore, J. (1975). Children's illocutionary acts. In R. O. Freedle (Ed.), *Discourse production and comprehension* (pp. 227–244). Hillsdale: Erlbaum.

Dromi, E. (1999). Early lexical development. In M. Barrett (Ed.), *The development of language* (pp. 99–131). Hove: Psychology Press.

Fouts, R. S. (1975). Capacities for language in great apes. In R. H. Tuttle (Ed.), *Socioecology and psychology of primates* (pp. 371–390). The Hague, Netherlands: Mouton.

Fouts, R. S. (1987). Chimpanzee signing and emergent levels. In G. Greenberg & E. Tobach (Eds.), *Cognition, language and consciousness: Integrative levels* (Vol. 2, pp. 57–84). Hillsdale: Erlbaum.

Fouts, R. S. (with Mills, S. T.). (1997). *Next of kin: What chimpanzees have taught me about who we are.* New York: Morrow.

Fouts, R. S., & Fouts, D. H. (1993). Chimpanzees' use of sign language. In P. Cavalieri & P. Singer (Eds.), *The great ape project: Equality beyond humanity* (pp. 28–41). London: Fourth Estate.

Fouts, R. S., Fouts, D. H., & Van Cantfort, Th. E. (1989). The infant Loulis learns signs from cross-fostered chimpanzees. In R. A. Gardner, B. T. Gardner, & T. E. Van Cantfort (Eds.), *Teaching sign language to chimpanzees* (pp. 280–292). Albany: State University of New York Press.

Fouts, R. S., Hirsch, A. D., & Fouts, D. H. (1982). Cultural transmission of a human language in a chimpanzee mother–infant relationship. In H. E. Fitzgerald, J. A.Mullins, & P. Gage (Eds.), *Psychobiological perspectives* (Vol. 3, pp. 159–193). New York: Plenum Press.

Fouts, R. S., Jensvold, M. L. A., & Fouts, D. H. (2002). Chimpanzee signing: Darwinian realities and Cartesian delusions. In M. Beckoff, C. Allen, & G. M. Burghardt (Eds.), *The cognitive animal: Empirical and theoretical perspectives on animal cognition* (pp. 285–291). Cambridge, MA: MIT Press.

Gardner, B. T., & Gardner, R. A. (1971). Two-way communication with an infant chimpanzee. In A. Schrier & F. Stollnitz (Eds.), *Behavior of nonhuman primates* (Vol. 4, pp. 117–184). New York: Academic Press.

Gardner, B. T., & Gardner, R. A. (1974). Comparing the early utterances of child and chimpanzee. In A. Pick (Ed.), *Minnesota Symposium on*

Child Psychology (Vol. 8, pp. 3–23). Minneapolis: University of Minnesota Press.

Gardner, B. T., & Gardner, R. A. (1980). Two comparative psychologists look at language acquisition. In K. E. Nelson (Ed.), *Children's language* (Vol. 2, pp. 331–369). New York: Gardner Press.

Gardner, B. T., & Gardner, R. A. (1985). Signs of intelligence in cross-fostered chimpanzees. *Philosophical Transactions of the Royal Society, 308B,* 159–176.

Gardner, B. T., & Gardner, R. A. (1994). Development of phrases in the utterances of children and cross-fostered chimpanzees. In R. A. Gardner, B. T. Gardner, B. Chiarelli, & F. X. Plooij (Eds.), *The ethological roots of culture* (pp. 223–255). Dordrecht, Netherlands: Kluwer Academic.

Gardner, B. T., & Gardner, R. A., & Nichols, S. G. (1989). The shapes and uses of signs in a cross-fostering laboratory. In R. A. Gardner, B. T. Gardner, & T. E. Van Cantfort (Eds.), *Teaching sign language to chimpanzees* (pp. 55–180). Albany: State University of New York Press.

Gardner, R. A., & Gardner, B. T. (1969). Teaching sign language to a chimpanzee. *Science, 165,* 664–672.

Gardner, R. A., & Gardner, B. T. (1972). Communication with a young chimpanzee: Washoe's vocabulary. In R. Chauvin (Ed.), *Modèles animaux du comportement humain* (pp. 241–260). Paris: CNRS.

Gardner, R. A., & Gardner, B. T. (1975). Early signs of language in child and chimpanzee. *Science, 187,* 752–753.

Gardner, R. A., & Gardner, B. T. (1978). Comparative psychology and language acquisition. *Annals of the New York Academy of Sciences, 309,* 37–76.

Gardner, R. A., & Gardner, B. T. (1984). A vocabulary test for chimpanzees (*Pan troglodytes*). *Journal of Comparative Psychology, 98,* 381–404.

Gardner, R. A., & Gardner, B. T. (1988). Feedforward versus feedbackward: An ethological alternative to the law of effect. *Behavioral and Brain Sciences, 11,* 429–447.

Gardner, R. A., & Gardner, B. T. (1989). A cross-fostering laboratory. In R. A. Gardner, B. T. Gardner, & T. E. Van Cantfort (Eds.), *Teaching sign language to chimpanzees* (pp. 1–28). Albany: State University of New York Press.

Gardner, R. A., Van Cantfort, T. E., & Gardner, B. T. (1992). Categorical replies to categorical questions by cross-fostered chimpanzees. *American Journal of Psychology, 105,* 27–57.

Greenfield, P. M., & Savage-Rumbaugh, E. S. (1990). Grammatical combination in *Pan paniscus*: Processes of learning and invention in the evolution and development of language. In S. T. Parker & K. R. Gibson (Eds.), *"Language" and intelligence in monkeys and apes: Comparative developmental perspectives* (pp. 540–578). Cambridge, England: Cambridge University Press.

Jensvold, M. L. A. (1996). *Cross-fostered chimpanzee responses to questions.* Unpublished doctoral dissertation, University of Nevada, Reno.

Jensvold, M. L. A., & Gardner, R. A. (2000). Interactive use of sign language by cross-fostered chimpanzees (*Pan troglodytes*). *Journal of Comparative Psychology, 114,* 335–346.

Kennerud, V. M. (1993). *The effect of social context on the use of American Sign Language by five chimpanzees (Pan troglodytes*). Unpublished master's thesis, Central Washington University, Ellensburg.

Krause, M. A., & Fouts, R. S. (1997). Chimpanzee (*Pan troglodytes*) pointing: Hand shapes, accuracy, and the role of eye gaze. *Journal of Comparative Psychology, 111,* 330–336.

Neidle, C., Kegl, J., MacLaughlin, D., Bahan, B., & Lee, R. G. (2000). *The syntax of American Sign Language.* Cambridge, MA: MIT Press.

Nelson, K. (1973). Structure and strategy in learning to talk. *Monographs of the Society for Research in Child Development, 38*(1–2, Serial No. 149), 1–137.

Nicholas, J. G., & Geers, A. E. (1997). Communication of oral deaf and normally hearing children at 36 months of age. *Journal of Speech, Language, and Hearing Research, 40,* 1314–1327.

Ninio, A., & Snow, C. E. (1996). *Pragmatic development.* Boulder, CO: Westview Press.

Ristau, C. A., & Robbins, D. (1982). Language in the great apes: A critical review. *Advances in the Study of Behavior, 12,* 141–255.

Rivas, E. (2003). *GIMME GIMME GIMME: The recent signing behaviour of chimpanzees (Pan troglodytes) in interaction with longtime human companions.* Unpublished doctoral dissertation. Nijmegen, the Netherlands: Katholieke Universiteit Nijmegen.

Roth, F. P., & Davidge, N. S. (1985). Are early verbal communicative intentions universal? A preliminary investigation. *Journal of Psycholinguistic Research, 14,* 351–363.

Sanders, R. J. (1985). Teaching apes to ape language: Explaining the imitative and nonimitative signing of a chimpanzee (*Pan troglodytes*). *Journal of Comparative Psychology, 99,* 197–210.

Savage-Rumbaugh, E. S. (1981). Can apes use symbols to represent their world? In T. A. Sebeok & R. Rosenthal (Eds.), *The clever Hans phenomenon: Communication with horses, whales, apes, and people. Annals of the New York Academy of Sciences, 364,* 35–59.

Savage-Rumbaugh, E. S., Shanker, S. G., & Taylor, T. J. (1998). *Apes, language and the human mind.* Oxford: Oxford University Press.

Seidenberg, M. S. (1986). Evidence from great apes concerning the biological bases of language. In W. Demopoulos & A. Marras (Eds.), *Language learning and concept acquisition: Foundational issues* (pp. 29–53). Norwood, MA: Ablex.

Seidenberg, M. S., & Petitto, L. A. (1979). Signing behavior in apes: A critical review. *Cognition, 7,* 177–215.

Seidenberg, M. S., & Petitto, L. A. (1981). Ape signing: Problems of method and interpretation. In T. A. Sebeok & R. Rosenthal (Eds.), *The clever Hans phenomenon: Communication with horses, whales, apes, and people. Annals of the New York Academy of Sciences, 364,* 115–129.

Seidenberg, M. S., & Petitto, L. A. (1987). Communication, symbolic communication, and language: Comment on Savage-Rumbaugh, McDonald, Sevcik, Hopkins, and Rupert (1986). *Journal of Experimental Psychology: General, 116,* 279–287.

Shaw, H. L. (2001). *Gaze direction in conversational interactions of chimpanzees.* Unpublished doctoral dissertation. Reno: University of Nevada.

Terrace, H. S. (1979). *Nim.* New York: Knopf.

Terrace, H. S. (1980, December 4). More on monkey talk. Response to Patterson's rejoinder to Martin Gardner's review of *Nim* and *Speaking of Apes. New York Review of Books,* p. 59.

Terrace, H. S. (1981). A report to an academy, 1980. In T. A. Sebeok & R. Rosenthal (Eds.), *The clever Hans phenomenon: Communication with horses, whales, apes, and people. Annals of the New York Academy of Sciences, 364,* 94–114.

Terrace, H. S. (1983). Apes who "talk": Language or projection of language by their teachers? In J. de Luce & H. T. Wilder (Eds.), *Language in primates: Perspectives and implications* (pp. 19–42). New York: Springer-Verlag.

Terrace, H. S. (1985). In the beginning was the "name." *American Psychologist, 40,* 1011–1028.

Terrace, H. S., Petitto, L. A., Sanders, R. J., & Bever, T. G. (1979). Can an ape create a sentence? *Science, 206,* 891–902.

Terrace, H. S., Petitto, L. A., Sanders, R. J., & Bever, T. G. (1980). On the grammatical capacity of apes. In K. Nelson (Ed.), *Children's language* (Vol. 2, pp. 371–495) New York: Gardner Press.

Tomasello, M. (1990). Cultural transmission in the tool use and communicatory signaling of chimpanzees? In S. T. Parker & K. R. Gibson. (Eds.), *"Language" and intelligence in monkeys and apes: Comparative developmental perspectives* (pp. 274–311). Cambridge: Cambridge University Press.

Tomasello, M., & Brooks, P. J. (1999). Early syntactic development: A construction grammar approach. In M. Barrett (Ed.), *The development of language* (pp. 161–190). Hove: Psychology Press.

Tomasello, M., Gust, D., & Frost, G. T. (1989). A longitudinal investigation of gestural communication in young chimpanzees. *Primates, 30,* 35–50.

Umiker-Sebeok, J., & Sebeok, T. A. (1980). Introduction: Questioning apes. In T. A. Sebeok & J. Umiker-Sebeok (Eds.), *Speaking of apes: A critical anthology of two-way communication with man* (pp. 1–59). New York: Plenum Press.

Van Cantfort, T. E., & Rimpau, J. B. (1982). Sign language studies with children and chimpanzees. *Sign Language Studies, 34,* 15–72.

Wallman, J. (1992). *Aping language.* Cambridge, England: Cambridge University Press.

Wells, G. (1985). *Language development in the pre-school years.* Cambridge, England: Cambridge University Press.

Wetherby, A. M., Cain, D. H., Yonclas, D. G., & Walker, V. G. (1988). Analysis of intentional communication of normal children from the prelinguistic to the multiword stage. *Journal of Speech and Hearing Research, 31,* 240–252.

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