

PRAGMATIC ANALYSIS OF GORILLA UTTERANCES

Early communicative development in the gorilla Koko

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Koko, a lowland gorilla taught a variant of American Sign Language (ASL) in a home-like environment, made use of all pragmatic functions described by Dore (1975) for holophrastic children: labelling, practicing, repeating, requesting action, protesting, answering, requesting an answer, greeting, and calling. This paper documents the infant Koko's holophrastic period from month one (July 1972) to month eleven (June 1973) of a longitudinal project still in progress. During this early period, Koko used sign language primarily for labelling, practicing, repeating, requesting action, and answering. She used vocalizations and some signs for protesting, greeting, and calling. The development of the sign *owt* is detailed in order to demonstrate the infant Koko's use of a variety of different pragmatic functions for one sign.

1. Introduction

John Dore's (1975) keystone article on the holophrastic (one word) stage of child language development advanced several strong arguments for examining the function of the early utterances of children and considering them not as sentences, but as primitive speech acts. Speech acts can be analyzed into two parts - the proposition and the illocutionary force (Searle (1969)). The proposition is the conceptual content of the utterance and the illocutionary force is the function the utterance serves (e.g., question, command, assertion). Pragmatic analysis emphasizes the function of the message rather than its form. It focuses on what the speaker is trying to accomplish by the utterance - for example, moving someone to action ("Get the ball!"), observing ("He is getting the ball.") or questioning ("Is he getting the ball?"). The emphasis, then, in pragmatic analysis is on the intent of the speaker rather than on syntax without regard to meaning. Dore's work on language development in children, which is an extension of the theoretical framework developed by Austin (1962) and Searle (1969) for adults, describes how intentions emerge

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and combine with the acquisition of words (Dore (1975)). Dore defines 'intentions' within a Piagetian framework which emphasizes cognitive structure rather than semantics. Dore states that:

"For Piaget an intention is the deliberate pursuit of a goal by means of instrumental behaviours subordinated to that goal. The linguistic intention in our speech act model is a cognitive-pragmatic structure, distinct from the grammatical categories that serve to express it. Intentions are the speaker's knowledge of how to use the grammar to describe objects, to acquire information, to construct a conversation and so on. Such intentions are not semantic. They are the functions of utterances, as opposed to their meanings or forms. In general, then, a speech act model is more than a semantic model of acquisition." (Dore (1975: 36-37))

Dore describes the primitive speech act in the holophrastic stage of development (i.e., words like 'doggie' and 'bye-bye') as containing a *referent* and an *intention* which relates to the speaker's purpose for the utterance. Intention is conveyed by a "primitive force indicating device (typically an intonation pattern)" (Dore (1975: 31)). Dore also examines contextual cues and nonlinguistic behaviors that accompany referring expressions.

Dore (1975) postulates that the primitive speech act evolves over time into speech acts with rudimentary propositions that contain "predicating expressions" and "referring expressions" as well as "elementary illocutionary forces" and that these are refined developmentally to become sentences.

Research with the great apes has shown that chimpanzees are capable of performing and comprehending certain linguistic operations in a visual rather than an auditory mode (Gardner and Gardner (1971), Premack and Premack (1972), Rumbaugh (1977)). Subsequently it was demonstrated that the lowland gorilla (*Gorilla gorilla gorilla*) possesses abilities in the use of sign language at least comparable to those of the chimpanzee Washoe studied by Gardner and Gardner (Patterson (1978, 1980)).

However, these studies seemed to be inadequate descriptions of the linguistic capabilities of these animals because in general they did not provide qualitative descriptions of how the apes used language. Therefore, the present study employs Dore's pragmatic framework to describe the early utterances of the gorilla Koko.

There are some caveats in this type of study. First, the subject, Koko, was taught a variant of American Sign Language (ASL) whereas Dore's subjects were learning spoken English. Dore relied heavily on intonational inflection as well as contextual clues in categorizing his subjects' utterances. Much syntactic and semantic information in ASL is conveyed through modulation (or inflection) of signs. In ASL this modulation includes accompanying facial expression and body posture, along with the direction, configuration, location, repetition and magnitude of signs. These were the types of clues, along with context, we used in categorizing utterances.

Primitive speech act	Child's utterance	Child's nonlinguistic behaviour	Adult response	Relevant contextual features
Labelling	Word	Attends to object or event; does not address adult; does not wait for response.	Most often none; occasional repetition of child's utterance.	Salient feature focused on by child; no change in situation.
Repeating	Word or prosodic pattern	Attends to adult utterance before his utterance; may not address adult; does not wait for response.	Most often none; occasional repetition of child's utterance.	Utterance focused on; no change in situation.
Answering	Word	Attends to adult utterance before his utterance; addresses adult.	Awaits child's response; after child's utterance, most often acknowledges response; may then perform action.	Utterance focused on; no change in situation, unless child's response prompts adult reaction.
Requesting (action)	Word or marked prosodic pattern	Attends to object or event; addresses adult; awaits response; most often performs signalling gesture.	Performs action.	Salient feature focused on by child and adult; change in condition of object or child.
Requesting (answer)	Word	Addresses adult; awaits response; may make gesture regarding object.	Utters a response.	No change in situation.
Calling	Word (with marked prosodic contour)	Addresses adult by uttering adult's name loudly; awaits response.	Responds by attending to child or answering child.	Before child's utterance adult is some distance away; adult's orientation typically changes.
Greeting	Word	Attends to adult or object.	Returns a greeting utterance.	Speech event is initiated or ended.
Protesting	Word or marked prosodic pattern	Attends to adult; addresses adult; resists or denies adult's action.	Adult initiates speech event by performing an action the child does not like.	Adult's action is completed or child prevents action.
Practising	Word or prosodic pattern	Attends to no specific object or event; does not address adult; does not await response.	No response.	No apparent aspect of context is relevant to utterance.

Table 1
Dore's primitive speech act criteria.*

Second, it might be argued that early data were influenced by the selection of signs Koko was taught to articulate, but it should be recognized that Koko's environment was quite similar to that of a human child. In order to facilitate early formation of associations between objects, actions, words and signs, Koko's teachers, as those of a human child, directed special attention and instruction toward certain signs in teaching sessions. They also signed throughout the day about the ordinary course of events. Koko also imitated signs spontaneously and used a number of communicative gestures of her own inception. After the first one and one-half years of the project, Koko acquired new signs with increasing rapidity, often through observation or invention and without direct instruction (Patterson (1979)).

Table 1 presents nine primitive speech acts and corresponding contextual conditions that Dore (1975) described for the holophrastic child: labelling, repeating, answering, requesting action, requesting answer, calling, greeting, protesting and practicing. These were the categories used for describing Koko's single-sign utterances and vocalizations.

2. Method

2.1. Subject

The subject, a female lowland gorilla named Koko, was born on July 4th, 1971. Koko's participation in a longitudinal language project began on July 12, 1972 when she was one year old. Additional details of her neonatal history are presented in Patterson (1978, 1979).

During the first 11 months the project was carried out at the San Francisco Children's Zoo nursery in view of the public. Koko was in the presence of project personnel for approximately 5 hours daily during this time. From the twelfth month on, the project was housed in a five-room 3.1 x 15.2-meter house trailer equipped with standard household items and a variety of sturdy toys. The distraction of the public was eliminated and her exposure to signing companions was increased to 8 to 12 hours per day.

Koko was exposed to simultaneous communication (SIMCOM), the use of American Sign Language accompanied by spoken English, in an environment designed to approximate that of a human child. Two techniques were employed to teach sign vocabulary items and to elicit signing: molding and modeling (imitation). Molding requires the teacher to shape the subject's hands into the appropriate configuration and to guide them through the proper motion. Modeling (imitation) requires the subject to form the sign after observing its use by the teacher. During the first 18 months of the project, 13 of Koko's signs met the project's strict acquisition criterion: spontaneous and

appropriate use on half the days of a given month (Patterson (1978)). Koko used 47 different signs in spontaneous and meaningful ways during the period covered by this report.

2.2. Analysis

Data collected on Koko from mid-July 1972 (month 1 of project, age 1;0) through mid-June 1973 (month 11 of project, age 1;11) were examined to determine the development of primitive speech acts in her acquisition of language as well as the proportional frequency of her utilization of Dore's categories. Data were in the form of diary entries and timed samples of Koko's signed output. Videotape was not a common method of data collection in 1972 when this project was initiated, and there were no videotaped records made at this early stage. Videotaped samples were taken later, but the early data are important and merit examination. By the eleventh month of the project, Koko was making so many multiple-sign utterances that she could no longer be considered holophrastic.

3. Results and discussion

Dore (1973) noted that his two subjects varied considerably in their structural and functional styles. Subject M was 'word dominant'. That is, she used words in 98% of her utterances, with 75% of her utterances classified as labelling and repeating. Subject J's utterances, on the other hand, were 'intonation dominant' and centered most often around people and action: request-commanding, protesting, answering, calling, and greeting. Dore relied heavily on context and prosodic features such as variation in pitch, loudness, pause, or duration in determining these functions and styles.

Koko was most similar to Subject J in her use of pragmatic functions. She used all of Dore's categories from the third month of the study, but her earliest utterances functioned to request action, protest, call and answer. She labelled and repeated less frequently.

Unlike those of Dore's subjects, Koko's data demonstrate a subtle but pervasive distinction that might be more similar to language development in deaf children. Koko used signs to label, request action and practice, but primarily used vocalizations and other auditory methods (such as clapping) for calling, greeting and protesting. Signs have a more limited receptive range than sounds and so by their very nature are less effective for serving these three latter functions. For example, it would be difficult and inefficient for a quadrupedal animal to use sign language to issue a greeting. If locomoting, the animal would not have the hands free to sign; also, since greetings are typically issued at a distance, some other mode would often need to be used to gain the attention of the other individual.

Over time, Koko refined or modified ASL signs to include an auditory component when it was useful. For example, in the 10th month of the project, she derived a sign for the word 'out' in which she rotated her hands so that she could slap them together while making the sign if her companion was not facing her. (Throughout the rest of this paper, signs will be denoted in italics; for example, a sign for the word 'come' will be designated *come*.)

Koko also used vocalizations observed in wild gorillas (Fossey (1983)), such as the annoyance bark to signal protest and the purr or belch vocalization to express contentment or assent. She has consistently used other vocalizations which are apparently not natural sounds in particular situations to signify a certain function. For example, Koko used a kissing sound to obtain the attention of her caretakers.

Some of Koko's signs have been found to be gestures commonly seen in captive gorillas such as the reaching or extended hand for 'gimme' (Ann Southcombe, personal communication, 1979). Others have been observed and reported only rarely: for example, raising both arms to communicate 'up' (Schaller (1963)). In still other cases Koko has generated idiosyncratic signs and used them consistently. For example, in the early months of the study, Koko placed her index fingers together when noticing or commenting on animals or objects out of reach, suspended, or flying.

3.1. Month one of study

Table 2 shows Koko's most common utterances in each of Dore's categories of pragmatic functions at the end of the first month of the study (age 1;1). It should be noted that these were not the only utterances she made; they are selected exemplars of the kinds of utterances she was producing. The table shows that Koko's utterances functioned pragmatically in every category except two: She was not observed to answer questions or to request answers during this period.

On the thirteenth day of the study, the volunteer on duty reported that Koko made gestures resembling the *food* and *drink* signs (practicing) several times during the morning before the principal investigator arrived. Sixteen days later, Koko used the *food* sign several different times when her bottle was in view (labelling or requesting action as determined by contextual cues). During this month, Koko overgeneralized in a manner also observed in children (Clark (1975), Carter (1978)). She used the *food* and *drink* signs as all-purpose requests for such diverse items as shoes, toothbrushes, bells and companion-ship.

Non-verbal repetition and imitation games played a large part in the interaction between Koko and her human companions (Patterson and Tanner (in progress)). From the very beginning of the study, they spent a great deal of time playing games involving turn-taking, a precursor to conversation (Bruner

Table 2
Pragmatic functions performed by Koko during month one of project (Koko's age: 1;0).

Primitive speech act	Koko's communicative act	Non-linguistic behavior & context
Labelling	<i>food</i>	- Watching volunteer cleaning up and removing food; no one is attending to her
Repeating	<i>drink</i>	- Koko signs after companion signs <i>drink</i> and shows bottle on ledge
	<i>food</i>	- Regularly responds to prompting of <i>food</i> and <i>drink</i> by making signs
Answering	- none	- Spontaneously imitates drawing movements, wiping, clapping etc.
Request Action	<i>up</i>	- Moving toward companion, raises both arms
	<i>give-me</i>	- Reaching toward desired object
	<i>mouth-you</i>	- Requests blowing game by putting finger to companion's mouth
	<i>food</i>	- Looking at her baby bottle
	<i>food</i>	- Sees apple pieces
	<i>food</i>	- Overgeneralized all-purpose request for shoe, toothbrush, bell; also request for companion to remain or take Koko along
Request Answer	- none	- On door to room where bottle is being prepared
Calling	- pounds & knocks	- Leaves previous attendant and lies on stomach reaching toward new arrival, who is ignoring her
	• whines	- At sight of face appearing behind screen
Greeting	- claps	- Inspects new person at first meeting by sniffing and touching
	- sniffs	- When left alone at night
Protesting	• screams	- Pushes companion's hand away when she tries to turn clock knob for Koko
	• annoyance barks	- When male human visitor demands response to ape beckoning gesture that he makes
	- hits, bite, pulls hair	- When companion tries to leave
Practicing	- clings	- Zoo volunteers comment that Koko made these signs several times during morning in absence of researchers
	<i>food & drink</i>	

Key: • = vocalization. Words in italics = signs.

(1975)). At times, Koko would imitate not only signs, but also such motions as drawing or wiping a spill. These actions indicated the readiness essential for her to learn ASL with rapidity and without the direct instruction of molding.

During these early months, Koko typically issued signs or vocalizations accompanied by non-linguistic behaviors. Her requests relied on contexts such as looking at the desired object and pushing or pulling a person or the person's

hands toward the object as well as signing. During the first month, Koko also called, greeted and protested vocally.

At their initial meeting, Koko greeted the principal investigator by approaching face-to-face and performing an olfactory and tactile inspection. Over time, this behavior was refined into a greeting in which Koko blew softly into the face of a visitor and waited for the person to blow back. Koko also imitated the sign *hi* during this first meeting.

On day one of the study, Koko pounded and knocked on the door to the room where her bottle was being prepared. Some of Koko's protests during the first month were typical infant behavior: hitting, biting, running away. Like children protesting or demanding attention, she whined, cried and screamed when left alone or ignored. She also used the annoyance bark (an 'uh-uh' sound originating in the diaphragm) when she wanted to do things for herself or to prevent another from doing something. Dore describes a similar vocalization /ʌʔʌʔ/ by child J when he cannot push a peg through a hole. The common human negative 'uh-uh' seems to be a generically similar protest.

In 1952 Cathy Hayes wrote that "chimpanzees, alas, do not babble" (Hayes (1952)). She was looking for vocal babbling, which we now know is lacking in apes due to the physical structure of their vocal tracts. In the present study, Koko was frequently observed to babble manually just before settling down for the night and to practice signs at odd moments throughout the day.

Because a table cannot adequately describe the nature of early interactions with Koko, one day of the diary records kept by the principal investigator will be presented so that the reader can sample the language learning in progress. This day, the twenty-ninth day of the study, was the first day on which Koko spontaneously signed *food*. We have inserted Dore's pragmatic categories in parentheses after each instance where appropriate.

Diary excerpt: August 10, 1972 (10:30 a.m.-6:30 p.m.)

A volunteer reported that while she was removing food debris from Koko's room this morning before I arrived, Koko repeatedly made her *food* sign (index finger to mouth) as she watched the cleaning process (Labelling). When I gave Koko her 11:00 bottle, I accepted the *food* sign (two fingers from two hands to the mouth; the ASL form is all fingers of one hand to the mouth) for the first portion (Request Action) and then molded her hand into the *drink* sign (thumb of one fist hand to the mouth) for the second portion. Koko's play with a toy telephone included wrapping the cord around her back and neck - she seemed to be tickling herself with it. Koko signed *food* spontaneously when her food dish was brought in by a volunteer (Request Action or Labelling). From 11:45 to 12:15 I worked on shaping the *food* sign. Koko used the correct form only about one-fourth (or less) of the time. I tried molding her hands again but it didn't seem to alter her index finger form appreciably. I thought of varying the desirability of the reward (watermelon, raisin, apple, egg yolk, egg white, carrot), depending on the form of the sign, but didn't try it out. Sometimes Koko's mouth was open while she signed *food*, sometimes shut, and about one-twentieth of the time she used two hands. I scored over 5 consecutive unprompted trials - she initiated three or

more before I had even positioned the food before her (Repeating). Her form at one point during the day seemed to be improving; she used two or more fingers more often, but later she used her index finger form most often. I tried to teach her the sign for *ball* several times with no real success over about ten trials. She responded to my *come* gesture when I was trying to weigh her today. (She still weighs 20 pounds.)

Her play with the plastic bucket was more varied today. She put it over her head and beat on it, sat on it, pounded on it upside-down like a drum and fingered the places where the handle was inserted. She also carried it in her hand and in her mouth by the handle.

Koko spontaneously signed *food* when she saw her 2:00 bottle (Request Action or Labelling). She unscrewed the top when she was finished, using her index fingers. When I introduced a new plastic squeaky dog toy, she sniffed it (Greeting) and then hit it away on several occasions. Koko also overgeneralized the *food* sign to a situation in which I was demonstrating the use of her toothbrush. She seemed to be asking for it with her *food* sign (Request Action). Koko sneezed several (4 or 5) times today; there is a virus cold/flu going around the zoo. I gave Koko a 100 mg. vitamin C tablet. She chewed it and ate it willingly. Less fuss tonight when I left her - just a few whimpers (Protest) - perhaps she was over-tired or ill. She drank more than usual today - for the first time in about a week she drank from her water dish as well as several times from the squirt gun. (She sucks the water from the gun - I don't even have to use the trigger.)

It is apparent from this early entry that there were many considerations in the education of Koko. It was of primary importance to build a relationship with her that would facilitate language learning and lay the groundwork for conversational turn taking. Another consideration was Koko's manual dexterity. The anatomy of the gorilla hand is different from that of the human hand. Certain signs were difficult for Koko to articulate because of her small thumb. A pervasive goal was to associate signs with objects, actions, and later, states. For these reasons, Koko was provided with as rich and varied an environment as possible so that she could practice these associations both physically and mentally. Her progress through the Piagetian stages of cognitive development was documented along with her language learning.

3.2. Months two and three of the study

Table 3 shows that by the end of the third month of the project, Koko's utterances functioned pragmatically in every category outlined by Dore. The new functions she began to use in the third month were answering and requesting an answer. She labelled many more objects than she had during the first month of the study; her vocabulary was growing rapidly.

Koko continued to overgeneralize signs. During the third month of the study, she was taught the sign *dog* in a game in which a toy dog was made to charge, chase and then tickle Koko. During the next month, Koko signed *dog* when confronted with a variety of charging objects, such as a toy cat, doll, horse, and pen.

companion didn't at first understand what she wanted. When her companion blew on the window, Koko drew in the fog.

Also in the third month of the project, Koko began to use signs as well as vocalizations for greeting and calling. For example, early in the study when Koko was left alone in her room, her most common response was to cry or scream. Toward the end of the second month, as her companion advanced to the door, Koko signed *come* instead. She also signed *hug* when a companion entered the room.

Koko still most frequently protested unpleasant occurrences with crying, hitting and biting. She also consistently used the gorilla annoyance bark, as both a protest (against such things as having her hands molded when she was not interested in signing) and to express her fears and disapprovals. She barked, for example, when her companion petted a monkey on the zoo grounds. Koko feared zoo animals that were larger than she, and emitted her annoyance bark when she was held near a baby elephant. Early in the fourth month, Koko began using the sign *out* as a protest when she wanted to be removed from an uncomfortable situation. Koko developed a variety of uses for this sign over time, which will be discussed later in this paper.

3.3. Month eleven of the study

As noted above, Koko issued utterances which functioned in all of Dore's pragmatic categories by the end of the third month. Table 4, which includes

Table 4
Pragmatic functions performed by Koko during month eleven of project (Koko's age: 1;10).

Primitive speech act	Koko's communicative act	Non-linguistic behavior & context
Labelling	<i>out</i> <i>clean</i> <i>listen</i> <i>sleep</i> <i>home</i> <i>blow</i> <i>hat</i> <i>mine</i> <i>comb</i> <i>bear</i> <i>stupid</i>	- Before jumping off picnic table, chair - As Koko sponges window, and as companion washes nursery floor - After watch is put to Koko's ear and taken away - After lying down on nest at night - In car on the way to nursery - When wind blows outside - Takes hat off then puts back on her head and signs - As companion puts sunglasses back into case - While playing with comb - As companion takes bear out of toybox; again as she makes bear charge Koko - Repeatedly after stepping into a bucket of water - After companion signs, Koko pats her head with both hands in a configuration similar to the sign
Repeating	<i>attention</i>	

Primitive speech act	Koko's communicative act	Non-linguistic behavior & context
Answering	* huffs <i>key</i> <i>open</i>	- Companion huffs onto clear plastic ball; Koko imitates immediately and again later - Companion asks about key Koko holds, signing <i>what's this?</i> - Koko fails to undo zipper latch, pulls companion's hand to zipper; companion asks <i>what?</i> - Uses as request to open bottles or pour liquids - Requests to be tickled with pen - Near closed door; also in car waiting for companion to drive to nursery - In response to a closed can - Restlessly signs; companion puts Koko onto potty which she immediately uses - After Koko tries to open door to outside - For companion to open a can - Puts palm up to companion's lips when companion puckers - When companion ignores sign, Koko pulls companion's hand to Koko's underarm - Walks over to companion and signs - Points to her stomach when companion stops brushing it - For candy, raisin, film can, pineapple - As companion opens can containing candy; as companion takes her time getting lock off Koko's door and opening it - Signs on companion's leg while glancing up toward turkey outside window - After Koko finishes on potty, companion signs <i>finished</i> , Koko signs <i>out</i> and puts hands out for molding; companion molds <i>finished</i>
Requesting Action	<i>out</i> <i>pen</i> <i>home</i> <i>hurry</i> <i>out</i> <i>sweater</i> <i>open</i> <i>blow-you</i> <i>tickle</i> <i>scratch</i> <i>there</i> <i>candy</i> <i>hurry</i>	- When companion talks to keeper outside before entering nursery - When confined to room, along with screams and whimpers; on another occasion as companion comes to door of room where she was confined as punishment for biting - On window when zookeepers appear - Whenever zoo train, which frightens her, comes by new living quarters - To protest diapering, and mouths companion's arm; also used in other situations involving restraint - Repeatedly while falling asleep in companion's lap in new living quarters - To self while lying down
Requesting Answer	<i>bird</i> requests molding	
Calling	* cries <i>out</i>	
Greeting	pounds	
Protesting	<i>out</i> <i>sorry-please</i>	
Practicing	<i>home</i> <i>Koko</i>	

Key: * = vocalization. Words in italics = signs.

data from the eleventh month of the project, demonstrates that the quality of Koko's utterances and the concepts underlying them changed over time. The eleventh month was the last considered in this study as it was near the end of the holophrastic phase for Koko. During the twelfth month she began to use multiple-sign utterances with far greater frequency.

Koko no longer only labelled concrete objects that were in view: She signed *blow* upon hearing the wind blow outside her dwelling. Moreover, she had begun to label intended action. She signed *out* before jumping off a piece of furniture and *sleep* before lying down in her nest at night. She made fewer inappropriate overgeneralizations during this period, but appropriately extended labels such as *listen* to a variety of sounds like the ticking of a watch or a bird outside, rather than limiting the sign to the bell used as a teaching device. She also demonstrated that she associated signs with conditions and objects removed in time and distance (displacement). For example, she signed *home* when she was riding in a car back to her residence.

One of Koko's answers to questions during the tenth month demonstrates her memory and her pragmatic use of the multi-word utterances which were increasing in frequency around this time. Koko climbed up on a cabinet ledge and her companion signed *help up?*. Koko replied *candy more eat* (answering). A few minutes before, her companion had given her candy from one of the cabinets.

When asked questions like *want food?*, Koko responded with specific statements such as *more milk*. When she was playing wildly and was asked by her companion *want go room?*, she responded by playing more quietly, giving evidence that she interpreted this as a threat and indirect command, not as a question. When Koko was asked *want out?*, she signed *hat* and *sweater* which she associated with going outdoors.

By the eleventh month of the project, Koko's requests for action were much broader than in the third month. Although she still focused on food a great deal, she made many other kinds of requests. She requested help in opening cans, jars and even zippers by signing *open* or *out*. Even though she knew the sign for *tickle* and used it often by this time, she signed *pen* when she wanted to be tickled with a pen rather than a hand. In order to urge her companion to open the door to her dwelling so she could go inside, Koko signed *home*. In a similar vein, when she wished to go outside and tried to open the door, she signed *sweater* or *out* or even *hurry*.

Beginning in the ninth month of the project, a new category which Dore does not denote for the holophrastic period surfaced for Koko. It was a category which we have called 'appeasement'. Appeasements were apologies after wrongdoing on the part of Koko. The most common example was after Koko had misbehaved and punishment was imminent or already in force. Koko signed *sorry* or *sorry-please* in order to be forgiven or released from confinement in her room. Many times she also offered something as appease-

ment such as a kiss, flowers, or leaves. Usually, however, the items offered were not things that she wanted very badly for herself.

By the eleventh month of the project, Koko used *sorry-please* to protest actions she didn't like such as diapering. Often these signs were accompanied with physical displays of displeasure. Eventually signs substituted for the physical displays in many, but not all, instances of protest.

In the early months, Koko participated in turn-taking games and actions involving imitation with her companions. By the ninth month of the project, she interacted in turn-taking routines with strangers (zoogoers) in sequential activities. In one instance during the ninth month, a little boy alternately drew on and kissed the window to her room. Koko drew on her side of the window when he did, and licked it when he kissed it. In another instance, she sparred back and forth with a child who stood outside her glass enclosure.

The following entry from a day in the ninth month of the project is typical of the end of Koko's holophrastic period.

Diary excerpt: April 23, 1973 (1:30 a.m.-6:40 p.m.)

General: Koko's deaf sign language teacher didn't come as scheduled this morning and Koko was alone, quiet, and easy to work with. The zoo was also empty and quiet. Perhaps Koko is boisterous on those days that she has a large audience. Koko played a game of pushing a pea pod back and forth under the door with me before I let her out (Repeating).

Gestures: Koko spontaneously signed *out* to get out of her room when I arrived (Request Action). Soon after I let her out she hugged herself and then hit out at a small child at the window (Greeting, Noticing). She did this two times. On the way to the trailer, Koko leaned to the extreme left and signed *drink* (Labelling). I couldn't figure out what in the world she was doing until I looked over and saw a sprinkler shooting water in a jet about a hundred yards away behind a fence and some trees.

Koko's *give-me* (Request Action) sign is still a lot like reaching and is directional - she swipes at the object she wants or in its general direction. She did this when I was carrying some sourgrass and her on the way back to the nursery from the trailer.

At the trailer she put her palm up to my face (in front of my mouth). I responded by blowing into her face (she used this gesture in that context before). However, it may have been Koko's way of getting my attention (Calling?). She wanted to leave the trailer and got her sweater when I had finished blowing. While Koko sat on the counter in the nursery, she signed *out* repeatedly as I sorted her toys (Request Action). When I stopped she turned me around and got on my back only to get off again when I headed in the direction of the sink. Then she picked up her sweater and handed it to me (Request Action). I put it on her, and when I asked her what she wanted, she signed *out*, and then pounded her wrist with her fist (Answering, Request Action).

Outside, as I sat on my car, Koko came over and sat several feet away and signed *out* (Labelling) before starting to take off her sweater. When we came inside I tried to interest Koko in some of her toys. She threw all the toys off the box and took from me the ones I picked up, throwing them overboard as well, until they were all gone and my hands were free. Then she tried to turn me around and signed *out* (Request Action) when I tried to mold her into the sign for *around*.

Table 5
Pragmatic functions performed by Koko with the sign *out*.

Month of project	Primitive speech act	Context
Months 3-4	Repeating Practicing Request Action Request Action	- Copies companion's signs spontaneously - Repeatedly signs <i>out</i> to herself - First spontaneous use of sign. Use of sign is attempt to get to companion who is outside - To get off potty
Months 6-9	Protesting Request Answer Answering Practicing Calling	- When companion handles bear cubs in nursery, protest barks, pulls her away, signs <i>out</i> - While riding in car - To leave outside area, climbs into companion's lap, raises companion's hands, signs <i>out</i> - Companion asks Koko, <i>what want?</i> Koko comes over and sits on companion's lap and signs <i>out</i> ; in other response to same question, pulls companion, then signs <i>out</i> - Sits on box after play, seems near sleep; babbles signs (<i>hat, out, clean, more, and baby</i>) and several sign fragments - Koko is put into her room after misbehaving; companion who left her there is walking outside
Months 10-11	Labelling Request Action Request Action Answering Answering	- Before jumping off picnic table, cage top and chair - As request for opening or pouring liquids - Restlessly signs; companion puts Koko on potty, which she immediately uses - Companion asks Koko, who is on potty, <i>finished?</i> - Companion asks, <i>what's this?</i> , of rainhat

Table 5 shows the general pattern of Koko's progression in learning a sign - repetition and practice came first. On the first day of the third month of training, she spontaneously repeated the sign *out* after a companion made it in her presence. On the same day, she also practiced making the sign on her own. There was no 'training' of this sign until later in the study. Koko imitated it the first day it was shown to her: She had attempted to use the sign *more* to get out and her companion (a native signer) showed her the sign *out*.

Nine days after copying and practicing *out*, Koko used it as a request for action. In this case, the zoo manager was in her dwelling, smoking a cigar which Koko seemed to find fascinating. When he left the nursery to work in the yard, Koko repeatedly dragged her companion to the door and put her hands up for molding. Koko was helped with the sign, and she later twice

Koko handed over a pen she had stolen from my purse when I signed *give-me* (Comprehension) and obeyed the *down* command when swinging on cupboard doors (Comprehension). As I signed *hurt* and pointed to my chin which was bleeding, Koko looked, licked it and then looked at the cut on her wrist (Comprehension).

While Koko was lying down at bedtime, I looked over to see her poking repeatedly and rather purposefully in an uncoordinated way at her forehead and once or twice on her nose (Practicing). I imitated her and she signed *tickle* on her underarm and then poked at it as well (Request Action). Then she returned to poking at her head and finally knocked on her head. She also babbled in a strange position. With one hand extended at an angle above her head she patted her palm which was close to her face (her arm was in the wrist-to-palm *out* position) (Practicing).

Perceptual-motor. Outside Koko pulled off a handful of vegetation from thick bushes. Koko, in her nestmaking activities before bed, placed parts of her towels on me as I sat to the side. Then she took them off and rearranged her nest. She also put a towel to the window and tried to put one on the ledge above her bed, but it wouldn't stay.

Social. Koko persistently charges Dale, a volunteer, whenever she comes into the nursery. We can't always tell if she is playing or in earnest. Once after a charge, Dale charged Koko back in a serious-looking way. Koko cowered at my feet and a minute later had a bowel movement. I think Koko really was intimidated for once.

Koko offered me leaves from which she had taken a bite outside as I carried her. Yet, when I was feeding her peas and ate a few, Koko put her lips to my mouth and annoyance barked ("Uh-Uh") when I tried to eat the last one (Protesting). As I was sitting on Koko's large train and tooting the whistle, Koko took it literally out from under me and hurled it across the room (Protesting). She evidently didn't want me on it. Koko willingly cleans her puddles upon request again.

This diary entry described a fairly typical day in the education of Koko at this time. She loved playing reciprocal games. She was also able to recognize the similarity of a sprinkler hose to a water faucet or water fountain and to make an association with the sign *drink*. This is further evidence of her ability to categorize and generalize appropriately.

Her comprehension of commands to stop disruptive behavior like swinging on cabinet doors was documented as was her comprehension of questions relating to activities and states (Patterson (in progress)).

Koko often practiced signing at bedtime, just as Weir (1962) has described for the babbling of human infants. At times Koko executed well-formed signs while at other times she moved her hands idiosyncratically.

4. The acquisition and development of the sign 'out'

Table 5 traces Koko's use of one sign, *out*, over the first year of the study. This sign was chosen because it illustrates the multiple uses Koko developed for signs over a 12-month period. It is indicative of her intentions and suggestive of her cognitive development during the first year of the project.

signed *out* with correct form and motion. Her companion took her out as requested.

Eleven days later, Koko used the sign *out* in a similar but new situation. She used it to signal that she wanted to get off the potty. She had generalized from going outside through the door to leaving a place when she had finished an activity.

The next new aspect of her use of *out* occurred in the sixth month of the project. She began to use it to mean 'away from' and she used it consistently to protest and to get away from situations that were undesirable or made her uncomfortable, as well as for going outside. Use of this sign was sometimes accompanied by protest barks. Koko used it when a companion came after her for biting a sponge, and when a doll was taken away. She used it to signal her desire to get away from objects she feared (such as large animals) or activities she disliked such as diapering. In the eighth month, when she wanted to leave a field adjacent to the zoo nursery, she climbed into her companion's lap, raised her companion's hands and signed *out*.

In the tenth month of the project, Koko made a major cognitive advance - she began to announce her intentions using a sign. Before she would leave her dwelling, jump off furniture, or remove her sweater, Koko would sign *out*, indicating she was planning her activity, labelling it, and eventually following through with the action.

Somewhat later, she used the sign to obtain desired but unseen objects that were inside containers. The word/concept *out* was no longer associated only with herself, humans, or with walking or moving away.

Finally, Koko used *out* as a generalized sign to convey discomfort. When she needed to go to the potty, she signed *out* (perhaps signalling that she wanted to be relieved of her discomfort or possibly associating the sign with the voiding of the bladder). She also signed *out* when she was ill and vomiting.

The development of this sign illustrates that Koko's use of language was not limited to practice lessons in which a sign was associated with an object or action. Rather, Koko used language to communicate her intentions, desires, and needs as well as her physical and emotional condition. From the first year of the project, Koko was capable of generalizing a sign appropriately from the concrete condition in which it was initially learned to similar conditions concerning herself, others and inanimate objects.

5. Conclusion

The preceding analysis of data collected early in the project indicates that Koko made use of a range of pragmatic functions - labelling, practicing, repeating, requesting action, protesting, answering, questioning, greeting, and calling. By the end of the first month of the project when Koko's age was 1;1,

her utterances functioned pragmatically in all of Dore's categories except requesting an answer and answering questions. At the close of the third month of the study, when Koko's age was 1;3, her utterances functioned pragmatically in all nine categories outlined by Dore, and she made use of a more extensive vocabulary. By the end of the eleventh month of the project (age 1;11), Koko's vocabulary was much more varied and she expressed abstract concepts. At this point many multiple sign utterances and several more sophisticated types of utterances not included in Dore's primitive categories had appeared, thus making the eleventh month of the project a logical termination point for this study.

Research with the great apes has stimulated much discussion among psycholinguists in the already controversial study of the origins and development of child language. Psycholinguists disagree as to how children progress from babbling sounds to syntactical utterances over the course of a few years. Some believe, as Chomsky (1965) argues, that knowledge of basic syntactic relations is innate. Others, such as Greenfield and Smith (1976), have developed a theory arising from semantics in which they argue that "non-verbal events - the child's actions and perceptions - are being structured in terms of semantic functions of Agent, Action, Object, Location, etc., and that words are being inserted into such a cognitive-perceptual-action framework from the outset" (Greenfield and Smith (1976: 30)).

The pragmatic functions observed in Koko are similar to those expressed by human children in the early stages of language acquisition. This is what would be expected if the fabric of language unfolds within a cognitive-perceptual-action framework as the child matures (Greenfield and Smith (1976)), rather than being strictly innately specified (Chomsky (1965)).

The physical, intellectual and emotional characteristics shared by the human infant and the non-human primate infant raised in a human home environment are considerable. Analysis of Koko's early linguistic and behavioral development suggests that these shared characteristics of function and intentionality are basic to language development.

References

- Austin, John L., 1962. How to do things with words. New York: Oxford University Press.
 Bruner, Jerome S., 1975. The ontogenesis of speech acts. *Journal of Child Language* 2: 1-9.
 Carter, Anne L., 1978. 'From sensori-motor vocalizations to words: A case study of the evolution of attention-directing communication in the second year'. In: A. Lock, ed., *Action, gesture and symbol: The emergence of language*. London: Academic Press. pp. 309-349.
 Chomsky, Noam, 1965. *Aspects of the theory of syntax*. Cambridge, MA: MIT Press.
 Clark, Eve V., 1973. 'What's in a word? On the child's acquisition of semantics in his first language'. In: T. E. Moore, ed., *Cognitive development and the acquisition of language*. New York: Academic Press. pp. 65-110.

- Dore, John, 1973. The development of speech acts. Doctoral Thesis, City University of New York.
- Dore, John, 1974. A pragmatic description of early language development. *Journal of Psycholinguistic Research* 3(4): 343-351.
- Dore, John, 1975. Holophrases, speech acts, and language universals. *Journal of Child Language* 2: 21-40.
- Fossey, Dian, 1983. *Gorillas in the mist*. New York: Houghton-Mifflin.
- Gardner, Beatrice T. and Allen R. Gardner, 1971. 'Two way communication with an infant chimpanzee'. In: A.M. Schrier and F. Stollnitz eds., *Behavior of nonhuman primates*, Vol. 4. New York: Academic Press. pp. 117-184.
- Greenfield, Patricia, and Joshua Smith, 1976. The structure of communication in early language development. New York: Academic Press.
- Hayes, Catherine, 1952. The ape in our house. New York: Harper and Brothers.
- Patterson, Francine G., 1978. The gestures of a gorilla: Language acquisition in another pongid. *Brain and Language* 5: 72-97.
- Patterson, Francine G., 1979. Linguistic capabilities of a lowland gorilla. Doctoral thesis, Stanford University.
- Patterson, Francine G., 1980. 'Creative and innovative uses of language by a gorilla: A case study'. In: Keith E. Nelson, ed., *Children's language*, Vol. 2. New York: Gardner Press. pp. 497-561.
- Patterson, Francine, in progress. Verbal and nonverbal comprehension of language in a lowland gorilla. (Cf. 'Comprehension' in Patterson (1979).)
- Patterson, Francine and Joanne Tanner, in progress. Imitation games and cooperative play as precursors of language learning in a lowland gorilla.
- Premack, Anne J. and David Premack, 1972. Teaching language to an ape. *Scientific American* 227: 92-99.
- Rumbaugh, Duane M., ed., 1977. Language learning by a chimpanzee: The Lana project. New York: Academic Press.
- Searle, John R., 1969. *Speech acts - An essay in the philosophy of language*. Cambridge, MA: Cambridge University Press.
- Shaller, George, 1963. *The mountain gorilla: Ecology and behavior*. Chicago, IL: University of Chicago Press.
- Terrace, Herbert S., Laura A. Pettito, D.J. Sanders and T.G. Bever, 1979. Can an ape create a sentence? *Science* 206: 891-901.
- Weir, Ruth H., 1962. *Language in the crib*. The Hague: Mouton.