

What Do Signing Chimpanzees Have to Say to Linguists?*

Mark S. Seidenberg
Columbia University

Laura A. Petitto
Deafness Research and Training Center
New York University

0. Introduction

The claims on behalf of the language abilities of non-human primates are by now quite extensive. Penny Patterson, for example, has recently asserted that the performance of her gorilla Koko indicates that "language is no longer the exclusive domain of man." (Patterson, 1978) Beatrice and Allen Gardner have stated that their chimpanzee Washoe's knowledge of "sentence constituents" and her ability to answer questions were superior to those of children at Roger Brown's stage III (Gardner and Gardner, 1975). They have also stated that,

If the standards of experimentation in child psycholinguistics do not improve soon, we will find ourselves in the paradoxical situation of having solid experimental evidence for the syntactic abilities of chimpanzees and a complete lack of acceptable evidence for any syntactic ability in young children. (1974b, p.735)

In addition, Roger Fouts (1977) and others have described the signing of chimpanzees as Ameslan or ASL, the sign language of the North American deaf. These views are widely held, both among the general public (as attested by the popularity and frequency of reports on ape language in the mass media), and among the community of scholars (as seen in the discussions of ape language in the introductory textbooks).

Although linguists and psycholinguists have challenged these radical claims (e.g., Bronowski and Bellugi, 1970; Fodor, Bever and Garret, 1974; Katz, 1976; Limber, 1977), their criticism has been perhaps critically weakened by their lack of access to the relevant data. The usual way to verify an empirical claim--namely, by attempting to replicate the experiment from which it followed--is unavailable when the subjects are apes. This has created a situation in which the persons making the strongest claims are the only ones with access to the data.

Recently, however, additional information bearing on the interpretation of ape signing has emerged from two sources: first, substantive studies of ASL in deaf children and adults now exist (e.g., Friedman, 1977; Schlesinger and Namir, 1978; Bellugi and Klima, in press; Siple, in press; papers in the journal Sign Language Studies). Second, a replication of the Gardners' work was attempted by an independent group of researchers (Terrace, Petitto

and Bever, 1976a and b; Terrace, in press; Terrace, Petitto, Sanders and Tynan, in preparation). Information from these sources, combined with a careful reconsideration of the published data, yields the conclusion that the claims on behalf of ape language abilities are at best unsubstantiated, and quite probably false. We will show that (a) information critical to the interpretation of ape signing has never been provided; (b) the data which do exist are compatible with interpretations which do not require the attribution of linguistic skills to lower primates; and (c) the apes' behavior shows almost no resemblance to signing in ASL. Although these considerations yield the conclusion that there is no evidence for linguistic abilities in apes, they do not place a limit on what lower primates can learn. In fact, it may be the case that the training procedures and other aspects of current ape signing projects underestimate the animals' communicative and general cognitive capacities.

1. Sampling

The fact apes are widely believed to have demonstrated linguistic abilities is difficult to comprehend when the published evidence is considered. This evidence is largely restricted to cumulative vocabulary counts and anecdotes, the latter usually cited as evidence of the apes' abilities to combine signs creatively into novel forms, e.g. Washoe signing "water bird" for duck, or Koko signing "cookie rock" for a stale sweet roll. The published reports do not include fundamental information which is necessary to a full characterization of the apes' behavior. In particular, the absence of a substantial corpus of ape utterances makes it impossible to unambiguously interpret the fragmentary data which are provided. In contrast to the child language literature, where several large corpora exist (e.g. Bloom, 1973; Brown, 1973), permitting comparisons across subjects, ages, languages, and observers, there is no listing of all the ape utterances which occurred during a single period, even an hour. By failing to provide a corpus, the Gardners and others obscure significant aspects of their subjects' behaviors, and make it difficult to independently verify their claims.

This is most clearly seen with respect to the anecdotes which are frequently cited. In the absence of a corpus, one cannot determine whether such sequences were synthesized through the application of linguistic rules, or merely the result of the ape acting as a random sign generator which happened to emit some interesting-looking sequences. The "cookie rock" example loses much of its force if the ape also produced the utterances "cookie tickle", "cookie hat", "toothbrush cookie", and the like in similar contexts. This alternative is not implausible.¹ The chimpanzee studied at Columbia, Nim Chimpsky, combined the sign banana, for example, with drink, hug, tickle, toothbrush, hand-cream, hat, sorry, and other signs (the entire corpus of his combinations and their frequencies of occurrence are provided in Terrace et al., 1976a and b). While his combinations could, of

course, be interpreted metaphorically, the simpler alternative is that he paired each sign with almost every other sign. The correct interpretation requires extensive analyses of the structure and frequency of signs and combinations, and the contexts in which they occurred. Since this has never been provided in the published reports, the claim that the cited examples show evidence for creative language abilities cannot be sustained.

Perhaps the most serious consequence of this sampling problem is that it obscures all aspects of the structure of ape sequences, especially their characteristic redundancy. All of the ape researchers acknowledge that their subjects' utterances included long, repetitive, continuous sequences such as me banana you banana you me me banana. In their paper on Washoe's ability to answer questions, the Gardners deleted one or more repetitions from 46% of her replies. Patterson notes that Koko's strings were as long as 11 including repetitions, and Nim's sometimes exceeded 20. The pervasive occurrence of these repetitions poses a set of questions which bear critically on the hypothesis that apes show linguistic abilities. These utterances have never been fully documented, nor have these questions been explicitly addressed.

First, how do the superficial forms of ape utterances compare with those of deaf and hearing children? While children in the early stages of language acquisition produce utterances which are reduced relative to the corresponding adult forms (or "telegraphic"), apes repetitiously expand (see also Limber, 1977). Although the Gardners conclude that "Transcripts of Washoe's signing show striking similarities to the speech of children" (Gardner and Gardner, 1975), they have never provided the transcripts which would substantiate their claim. Furthermore, the only data which do permit such comparisons, those of Terrace et al., appear to contradict their assertion. In the absence of explicit comparisons of large samples of ape and child utterances, then, the Gardners' statement cannot be taken as fact.

Another obvious question concerns the organization of these repetitious sequences. Do they show internal structure which may be described by simple syntactic rules, or, conversely, are they the result of a random, non-linguistic combinatorial process? The Gardners and Patterson do not address these issues; they perform no structural analyses and do not preserve word order or repetition information. However, statistical analyses of the frequency of individual signs, and of signs in combination with each other, are necessary if only to eliminate certain trivial interpretations of ape signing, e.g., that the signs are combined randomly or that they are combined into a small number of stereotypic patterns. Either outcome would provide strong, although not conclusive, evidence against the hypothesis that the apes were signing linguistically.²

Third, what are the functions of repetition in ape signing? The Gardners eliminate these signs because they believe that they are "redundant and cannot alter the appropriateness or

inappropriateness of Washoe's replies" (Gardner & Gardner, 1975, p. 252). Yet they are so characteristic of ape signing as to demand interpretation. Although their source cannot be established in the absence of a large corpus, some preliminary observations can be made. First, it is clear that these repetitions differ in form and frequency from those which appear as deaf children are acquiring ASL. Some of their repetition is tied to the emergence of the system of grammatical modulations of movement which affect the meanings of utterances (see below). Thus the use of repetition can be placed in a developmental sequence which has not been noted in signing apes.³

Rather than showing similarities to the signing of humans, the apes' repetitions place their behavior squarely in the domain of animal communication systems. As Wilson (1977) has stated,

If a zoologist were required to select just one word that characterizes animal communication systems, he might well settle on "redundancy". Animal displays as they really occur in nature tend to be very repetitious, in extreme cases approaching the point of what seems like inanity to the human observers. (p. 200)

Finally, note that repetitious or perseverative behavior is easily induced in lower animals through the manipulation of reinforcement contingencies. Increased rates of responding will result, for example, when anticipated reinforcement is withheld (as in the early stages of extinction procedures). The extensive repetition in the apes' output would occur if the experimenters attempted to maximize the quantity of signing without regard to meaning or structure by manipulating reinforcement contingencies.

The repetitions in ape signing serve to emphasize other inadequacies of the published reports. The Gardners and Patterson present summary data from which all repetitions were eliminated, a highly questionable methodology. Patterson notes the existence of repetitions in Koko's signing, but does not describe them in detail. In their 1975 test of Washoe's ability to answer questions, the source of many of the strongest claims on her behalf, the Gardners eliminated all signs in her replies that repeated those in a question, signs that appeared more than once in a reply, and signs from a class termed "markers" (i.e., gimme, please, want, hurry, more, can't, enough, and others). Not only is a large proportion of the apes' output simply discounted; the transformed utterances present a substantially different picture than would the originals. Consider this hypothetical exchange between a father and son. The father says, "Where are you going?" The son replies, "you are you are going there you please please where you gimme." By the Gardners' transformation heuristics, the child's utterance would be entered as "there." Furthermore, by eliminating the signs termed "markers", the Gardners are forced to defend certain anomalous interpretations, e.g., that the replies Please gimme Susan, Hurry enough Susan, and More Susan are as appropriate in response to the question Who she? as are You Susan or Susan there.

While the Gardners believe that "this scheme of simplification cannot do justice to the richness of meaning that can be found in Washoe's replies" (1975, p. 252), its effect is to alter her utterances radically, before they have been documented. In the context of a paper containing a corpus of actual replies, these reduction procedures might possess some legitimate value. In the absence of a corpus, they simply obscure what the ape actually did.

2. Attributions of meaning and grammatical function

In the reports of ape signing there is an apparent failure to confront the single most difficult methodological issue in language acquisition research, namely, what evidence justifies the attributions of meanings and grammatical functions to a child or chimp's utterances? Clearly, the assumption underlying the anecdotes, vocabulary counts, and other fragmentary data in these papers is that the signs have for the apes the meanings which they have for the experimenters. However, this cannot be established by simply enumerating the different hand configurations which they learned. Since there is no single test which could establish that the signs were used meaningfully, information concerning the structure, frequency, and contexts of signs is required. Again, however, it is this information which has never been reported. As a result, it is impossible to eliminate many other trivial interpretations of ape signing. To cite just one, the apes could in general produce contextually appropriate signs by simply imitating their teachers' inputs. That this was in fact true of a large proportion of Nim's signing is suggested by analyses which will appear in Terrace (in press), Sanders (in preparation), and Terrace et al. (in preparation).

The published examples call into question the validity of the very specific meanings attributed to Washoe's and Koko's signs. These examples make it clear that the referents for particular signs were very general. Patterson cites the example of tree, which Koko learned "with reference to acacia branches and celery and overgeneralized to asparagus, green onions, and other tall, thick objects presented vertically," (Patterson, 1978). While this may provide evidence for the ape's ability to learn the concept "tall green object", it leaves the meaning of the sign obscure. In English or ASL, "tree" does not mean "asparagus" or "green onion". The putative importance of Patterson's example is that such overgeneralizations occur in the speech of children. However, the significance of her example is lost because we cannot determine whether Koko's overgeneralizations were systematic, occasional errors, or in fact random, general errors. This description, while potentially interesting, is utterly ambiguous in the absence of other data.

It is, however, quite typical of the methodology of ape language studies. The apes learn hand configurations which the experimenters gloss as having specific meanings on the basis of their own knowledge of ASL. Then it is observed that the apes' use of a sign "generalized" to other referents and contexts.

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This is taken to indicate creative use of the sign. Except for anecdotal accounts, no attempt is made to characterize the use of the sign, i.e. in terms of frequency, combination with other signs, contexts of occurrence, etc. In the absence of such information, one is simply left with the experimenter's initial attribution. By assigning specific meanings to the apes' hand shapes, close similarities to human languages are implied where none may in fact exist.

Other examples confirm this disturbing pattern. Both the Gardners and Patterson attribute knowledge of the sign please to their respective subjects. The grammar of please has of course interested linguists for some time. We know from Sadock (1974) and others that its use follows some very subtle constraints. Although Koko and Washoe formed hand configurations which their trainers glossed as please, no comparison of their use of these signs with the use of please in English or ASL is provided. Thus there is no evidence of even the remotest resemblance. Yet by glossing a response as please, such a correspondence is implied.

The sign sorry is also attributed to Washoe and Koko without any description of its use. Nim also used a hand configuration glossed as sorry. This gesture was largely under the control of his teachers' threats. If they appeared ready to punish him, he would sign sorry. This sign appeared almost exclusively in contexts where such threat was imminent. We do not mean to suggest that this example is uninteresting; it may be that Nim learned to mediate threatening interactions in a manner unavailable to apes in the wild. However, the inclusion of this sign on lists of the apes' vocabularies--without documentation of its use--leaves the possibly disingenuous implication of a deep isomorphism with the use of sorry in English or ASL.

This pattern is seen throughout the reports on ape signing. The apes are credited with the knowledge of signs whose meanings are quite abstract, e.g., happy, sad, good, bad, silly, funny, please, sorry, clean, dirty, quiet, pound, etc. These attributions entail strong claims about the apes' cognitive capacities--i.e., their perception of the world, ability to make comparative judgments, awareness of self and others, ability to consciously monitor their own behaviors, etc.--which are vastly underdetermined with respect to the evidence provided. The Gardners' and Patterson's extensive overattributions in the case of signs whose meanings are not exemplified by simple actions or objects call into general question the methodology by which all their attributions were made.

The logic underlying these attributions appears to be this: when deaf children use signs, we attribute meanings and grammatical functions to them. The apes learn hand configurations which resemble these signs. Thus, on pain of anthropocentric bias, we must attribute similar meanings and functions to their behaviors. Leaving aside for a moment questions concerning the form of the apes' signs, this syllogism entails the incorrect assumption that the mere form of certain behaviors qualifies them as meaningful or "linguistic". It is remarkable that extensive (and indeed, profound) implications have been drawn from the fact that the apes formed certain hand shapes.⁴

A somewhat different, but equally acute, problem of over-attribution is seen in the case of a class of ape signs which we will term gestural. We know that in ASL, signs vary in the degree of abstraction between form and meaning (Bellugi and Klima, 1976; in press). In the ape studies, there are no rigorous attempts to differentiate among signs in this way. However, the descriptions of the apes' signs indicate that many are in fact extremely concrete gestures which require no special knowledge of ASL to comprehend. In the terminology of Bellugi and Klima (1976), they are transparent. The vocabularies of Nim, Washoe and Koko include signs such as pick, (signed by picking a part of their anatomy), scratch (signed by scratching), tickle (signed by tickling), come, hug, kiss, give, me, you, go, up, down, groom, brush, etc. The apes' pointing is variously glossed as the signs this, that, and there. Many of these "signs" are in fact gestures which have been observed by Van Lawick-Goodall (1968) in chimps in the wild. In the sign language projects, however, they are glossed as lexical items, with attendant linguistic implications. The apes' natural communicative systems are, of course, extremely interesting, and detailed comparisons to human languages would be revealing. Nonetheless, although certain of these behaviors (e.g., the apes' use of pointing) show a degree of abstraction, flexibility, and intelligence beyond those seen in lower animals, they do not show some of the critical features of words and signs in human languages, e.g., arbitrariness and displacement (Hockett, 1960; Hockett and Altmann, 1968). Thus there is no need to invoke ASL or any other language in describing them.⁵

Since the relevant data have not been reported, we cannot precisely determine the extent to which the apes relied upon these concrete gestures. However, all of Nim's five most frequent signs (hug, eat, drink, give, and play) were of this form. These five alone account for 41% of the tokens of the 25 most frequently-used signs reported in Terrace et al. (1976 b).

Given the apes' apparent reliance upon gestures, it would perhaps be a powerful test of what they had learned to attempt to teach them abstract (i.e., arbitrary) signs for messages which can be gestured. We predict that the apes could learn such signs, but would quickly abandon them in favor of concrete gestures unless intensive maintenance procedures were utilized. This would suggest that the apes had not learned a fundamental fact about language, that words and signs symbolically represent their meanings. The apes' preference for a gestural mode of communication is not shared by signers of ASL; in both the acquisition of new signs by deaf children (Bellugi and Klima, 1976), and in the historical evolution of individual signs (Frishberg, 1975), one moves from relatively concrete representations to increasingly stylized forms which obscure their origins. Furthermore, the proportion of transparent signs in ASL is extremely small.

3. Tests of Meaning and Grammatical Function

Although the attributions in these papers are largely (and in the case of Patterson, 1978, entirely) ad hoc, the Gardners did

attempt to test Washoe's linguistic abilities. Most widely cited are the "double blind" vocabulary tests (Gardner & Gardner, 1971, 1974a), which required Washoe to sign the names of pictures which the experimenters could not see. Washoe's ability to form particular hand shapes in the presence of particular pictures has been taken as crucial evidence for chimpanzee language abilities. However, this characterization of the naming process is quite sterile. It suggests that any animal which could be trained to execute a specific behavior in the presence of pictures of certain objects would possess the naming ability. It is clear that even pigeons possess this ability. Herrnstein, Loveland and Cable (1976) have shown that pigeons can give the appearance of having learned simple concepts such as tree or water. They learned to discriminate pictures of trees, for example, from pictures of other objects. It would be trivial to teach these birds to pair the pecking of a single colored light with the presentation of a picture of a tree. They would then be said to "name" the picture under the above characterization. Furthermore, the ability of Herrnstein's pigeons to discriminate trees (and other classes of objects) generalized to literally thousands of exemplars without specific training. Given the limitations on the birds' discriminative capacities, it is likely that they would overgeneralize to pictures of asparagus and celery as Koko did.

The Gardners' interpretation of their vocabulary tests reflects a failure to recognize the traditional distinction between name and concept. As Nelson (1977) states,

The basic developmental task [of the child] is to elaborate the cognitive structure and to learn how to match it to the encountered linguistic structure. In other words, the child's task is to develop conceptions and acquire semantics to match. (p.119)

Discussions in the ape signing literature focus exclusively on their ability to learn the "semantics", or hand configurations. Unless there is evidence that concepts are mapped onto these behaviors, however, their status is simply that of any other arbitrary operant.

Note that if these behaviors are merely operants, other comparisons to the behavior of standard laboratory animals such as rats and pigeons should be fruitful. The Gardners, Fouts, Patterson, and others compare the behavior of their subjects solely to the language behaviors of humans. The comparisons to lower animals which would provide a necessary baseline are entirely lacking, however. Studies such as Herrnstein's suggest that pigeons could learn to discriminate some of the lexigrams used in the Yerkes "language" taught to the chimpanzee Lana (Rumbaugh, 1977)⁷ A study at Columbia by Straub, Seidenberg, Terrace, and Bever (1978) suggests that pigeons are able to learn chains of responses whose structure and function may be similar to those of "linguistic" apes. For other discussions of the similarities between the behaviors of pigeons and these apes, see Terrace (1978). While Patterson, in common with many others, claims that the difference between language behaviors in apes and humans is "one of degree and not of kind", the same could be argued for the difference between the

behaviors of apes and pigeons, given the existing data.

Although it is generally claimed that Washoe was able to form appropriate signs in the presence of particular objects or pictures, it is unclear whether her skill extended beyond the rather impoverished milieu of the "double blind" vocabulary tests. In a somewhat different context, their 1975 test of Washoe's ability to answer questions, the Gardners abandoned this simple requirement. Washoe's response to a question was scored as correct if it contained a sign from a pre-designated target category. For example, the question What's that? took a noun response; the question Where's that? took a locative, etc. Washoe's vocabulary signs were grouped into grammatical categories for this test; for example, the sign glossed as listen was categorized as a noun. The presumed meanings of her signs were ignored. Thus, if the Gardners held a ball in front of Washoe and asked her, What's that?, the response listen come would be scored as correct because it contains listen, a member of the target category noun. Given their liberal scoring procedure, it is not surprising that the Gardners could conclude that Washoe's responses were superior to those of children at stage III.

Note also that the validity of this test rests upon two points which are not discussed. First, the judgment that Washoe answered questions with signs drawn from appropriate target categories depends entirely on the manner in which her signs were classified. The assertion, for example, that she correctly answered the question "What's that?" with signs from the category noun is uninteresting if signs were arbitrarily placed in this class. The Gardners state that in performing these classifications, they relied upon intuitions concerning "good usage" in adult Ameslan. This enterprise is of dubious validity. First, one doubts the intuitions of non-native, non-linguist signers of ASL. Second, it is unacceptable methodology in child language studies to classify a child's words solely on the basis of their presumed functions in adult language (cf. Bloom, 1970). Third, the grammatical functions of signs in ASL are signalled by the system of modulations and inflections (see below). Since the Gardners invoke ASL in their analyses, it should be possible to classify Washoe's signs on the basis of these structural features, rather than intuitions.

The other important consideration is that we cannot determine from the given information whether Washoe's responses were rote associations to particular questions and/or objects which were learned through intensive and specific training. Her preparation for this test is not described in detail, and her actual responses are not appended. As a result, we cannot evaluate the degree of flexibility and heterogeneity seen in her replies. Given the Gardners' description of their procedure, Washoe could have "correctly" answered the questions in this test by simply emitting signs from her vocabulary in random order until she produced one from the target category.

In summary then, meanings and grammatical functions are attributed to the apes' utterances without sufficient evidence. The tests of Washoe's vocabulary and question-answering abilities

are subject to non-linguistic interpretations. In addition, they are orthogonal to a critical question: can the apes use their signs to refer to objects which are not in the immediate environment, or actions which are not concurrent? Even if these tests were not subject to the reductio ad absurdum suggested by the pigeon research, their design is such that they could never provide evidence that the apes had learned to use signs in this manner. In fact, there has been no test, and thus there is no evidence, of the ape's ability to use signs which are displaced relative to their referents. In the absence of such evidence, their behavior cannot be equated with that of humans using languages.

4. Comparisons to ASL

It is frequently asserted that the signing apes are learning ASL. This conclusion would appear to require evidence concerning the structures and/or expressive devices which are common to the apes' behavior and to signing in ASL; however, no such evidence exists. The discussions of ASL in these reports are uniformly superficial. For example, in a recent paper by Fouts (1977), there is no discussion of ASL beyond the title, "Ameslan in Pan (Troglo-dytes)". That the apes use ASL is merely assumed, rather than adduced from behavioral data.

Perhaps the single correspondence between signing in ASL and ape signing, is the use of hand configurations.⁶ However, the ape researchers described their subjects' behaviors exclusively in terms of hand configurations, whereas the structure of signs in ASL is more complex (Stokoe, et al.; Bellugi and Klima, in press). Briefly, the root or citation form of a sign in ASL is defined along four parameters: location, orientation, and movement in addition to hand configuration. A change within any one of these parameters signals a change in meaning. In addition, an extensive system of modulations and inflections on signs exists in ASL; this system is used to signal syntactic information, tensing, subtle variations in meaning, and other aspects of the message. This is effected through the systematic use of movement and visual information provided by facial expression, eye gaze, head and body orientation, the structured use of the signing space, etc. A sign in ASL, then, is defined not by a unique hand configuration, but along several dimensions simultaneously. We take the fact that apes show no ability to use these expressive devices as immediate refutation of the claim that they are using ASL. Their failure to learn to use them, despite years of intensive training, purportedly in ASL, contrasts strongly with the fact that deaf children rapidly learn to use them in the course of natural, non-intrusive interactions. Many of these expressive devices are seen in nascent or primitive form in the earliest utterances of deaf children. For example, signers use the space around them in highly structured ways, one of which is termed "establishing loci". In a conversation, a signer can place a noun, e.g., the name of a person, at a particular location in the signing space by pointing and other means. Multiple locations can be used for multiple referents. Among other functions, this permits pronominal reference to be accomplished by merely repointing to the

location in space. The use of loci is governed by syntactic rules; for example, it is ungrammatical in some cases to sign the name of an object rather than point to its locus in space, much as it is sometimes ungrammatical in English to fail to pronominalize. Deaf children acquire use of the locus system progressively (Petitto, 1977). At early stages, they will sign on or toward an actual object or location, moving around a room if necessary, rather than placing it at a metaphoric location in the proximal signing space. Over time, they learn to stay within the signing space and establish loci through pointing, eye gaze and body shifts. There is no evidence that any signing ape ever showed this progression, distinguishing their behavior from the deaf child's.

Another primary communicative device in ASL is the use of eye gaze and facial expressions in conjunction with signs. It is interesting that while lower primates use facial expressions and eye gaze as part of their natural communicative system, they do not use them to modulate the meanings of the hand shapes they learn, in contrast to the child learning ASL. This suggests certain constraints on the malleability of the ape's natural communicative system which should be investigated further.

A third example is provided by the deaf child's use of the signing space in denoting time reference. This is accomplished through use of the time line, an imaginary vertical plane which passes through the signer's body just behind his ears. A forward thrust of the signer's hand, relative to this plane, at ear level denotes reference to the future. A backward thrust at the same level indicates reference to the past. The present is represented in front of the signer's body, centered around the chest-stomach area. It would be important, of course, to determine whether lower primates can sign about past or future activities, or learn to use this system; at present, there is no evidence that they can, again distinguishing them from deaf children and adults using ASL.

These examples are only illustrative. They serve to indicate some fundamental ways in which chimpanzee signing differs from signing in ASL. In their failure to even mention the basic structures and devices which characterize the language, the existing comparisons of ASL and ape signing behavior are exceedingly shallow.

It is difficult to convey through such examples the degree to which the signing of deaf children differs from that of signing apes. These differences cannot be overestimated. Deaf children use sign language to converse, ask questions, generate ideas, learn, comment about the world around them and relate to other people. Their signing is spontaneous, interactive and inquisitive. All available information--including our own experiences with a signing chimpanzee--indicates that the apes' signing is reactive, manipulated, coerced. Perhaps the most striking feature of their signing is that it is never integrated into their behavior. Signing must be imposed on these animals, and maintained through the use of intensive, intrusive training procedures. The apes appear to learn not the importance of signing as a linguistic medium, but rather the importance of signing to their teachers. Further studies of the pragmatics of the apes' behavior will demonstrate this

more clearly (cf. Marshall and Wales, 1974).

5. Conclusions

We have demonstrated that the conclusion that apes show linguistic abilities is vitiated by the absence of the appropriate data and analyses. The omission of information which is routinely included in psycholinguistic studies of child language obscures the essentially non-linguistic character of the apes' behavior; the fragmentary data which are provided are consistently overinterpreted. Thus the widespread claims on the apes' behalf are at best premature. We conclude with three observations.

First, we await longitudinal studies of the apes' signing. There are as yet no indications that they can retain large sign vocabularies beyond puberty. The claim that they possess the capacity to learn languages rests on demonstrating that their signing does not disappear when their intensive training is relaxed, and that they can in fact internalize rules of the sort which underlie human language capacities.

Second, the source of many of the problems in the existing literature may be traced to the Gardners' statement that "Our analyses do not depend on any special theory of linguistics or psycholinguistics," (1975, p. 256). Their analyses depend upon a special theory that is created de facto by their acceptance of a simplistic set of assumptions about language structure and language learning. The Gardners simply fail to acknowledge their grammar. Their antipathy to current linguistics (1974b) has led them to embrace a theory of language so impoverished that demonstrating that Washoe's signing can be described by it defeats the claim that she had attained linguistic skills.

Finally, we should note that the existing studies do not examine genuinely interesting aspects of ape behavior. It is clear that the apes are extremely intelligent. Further study of their cognitive capacities and natural communicative abilities ultimately may be more revealing about the behaviors of both apes and humans than attempts to impose languages upon them.

Footnotes

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The authors alone are responsible for the views expressed herein.

1. Introducing this example, Patterson (1978) states, "Although Koko produced uninterpretable strings (as do some children), most of her utterances are appropriate to the situation and some are str'kingly apt." (p. 88) Only by presenting a large corpus of both "interpretable" and uninterpret-

able strings can this be established, however.

2. Note, however, that it is likely that the actual data show deviations from these simple patterns. It is possible to imagine more complex patterns which, nonetheless, are irrelevant to questions of language. For example, ape signing could be "quasi-random", i.e., the result of a random selection and repetition process utilized in conjunction with certain stereotypical combinations such as More + X, where X is any vocabulary sign. Furthermore, such distributional analyses are interesting only insofar as (a) the signs have particular meanings for the apes, and (b) the rules describing any distributional asymmetries underlie the combination of classes of signs (e.g., noun + verb), not merely individual signs (e.g., give + more). The assignment of meanings to signs, and of signs to grammatical classes cannot be justified by mere distributional analyses, but, rather, depends on analyses of the contexts in which the utterances occurred. Thus, while statistical analyses of sign combinations are a necessary part of the characterization of ape signing, they are informative only when taken in conjunction with other types of data.

3. This issue is beyond the scope of this paper. In adult ASL, certain classes of signs (e.g., verbs) may be repeated; however, the repetitions carry inflections which express other information (concerning, e.g., aspect). The deaf child will sometimes repeat the correct sign, but without the proper inflection. Thus, repetition occurs in their signing, but it isn't random or redundant. See Bellugi and Klima (in press), and Petitto (forthcoming).

4. Note that the problem of attribution is somewhat different in the case of child utterances than it is in the case of ape utterances. Our interpretation of the child's behavior is based on the knowledge that in the absence of pathology, he or she will learn to speak (or sign) a language, and retain this ability beyond puberty. However, this is not true of apes. While we may be certain that the fragmentary utterances of a child are evidence for an emerging linguistic skill, we cannot assume the same of ape utterances.

5. The degree to which signs in ASL have a representational¹ basis is controversial. Essentially, the question is whether the iconic aspects of signs are perceptually salient, or merely the vestiges of diachronic processes. However, these considerations are orthogonal to our point, which is that while a very small fraction of the signs in ASL can be comprehended by naive observers, a very large proportion of the apes' signs can be comprehended without special training.

6. We should note that the apes were taught many hand configurations which are not standard in ASL. Their teachers modified ASL signs or created novel forms because of the apes' lack of manual dexterity and other limitations (see, e.g., Patteron, 1978, p. 80). The number of signs modified in this manner is not known.

7. Tom Bever has suggested that a pigeon which had learned to discriminate these lexigrams could be said to have learned "pigeon Yerkish".

-i.e., non-arbitrary-

References

- Bellugi and Klima (1976). Two faces of sign: iconic and abstract. In Harnad, Steklis, and Lancaster.
- Bellugi and Klima (in press). The signs of language. Harvard U. Press.
- Bloom (1970). Child language, adult model. Review of Paula Menyuk, Sentences children use. Contemporary Psy., 15, 182-184.
- Bloom (1973). One word at a time. The Hague: Mouton.
- Bronowski and Bellugi (1970). Language, name, and concept. Science, 168, 669-673.
- Brown (1973). A first language. Harvard U. Press.
- Fodor, Bever, and Garrett (1974). The psychology of language. McGraw-Hill.
- Fouts (1977). Ameslan in Pan. In Bourne (ed.), Progress in ape research. Academic Press.
- Friedman (1977). On the other hand. Academic Press.
- Frishberg (1975). Arbitrariness and iconicity: Historical change in American Sign Language. Language, 51, 696-719.
- Gardner and Gardner (1971). Two-way communication with an infant chimpanzee. In Schrier and Stollnitz (eds.), Behavior of non-human primates, vol. 4. Academic Press.
- Gardner and Gardner (1974a). Comparing the early utterances of child and chimpanzee. In Pick (ed.), Minnesota symposium on child psychology, vol. 8. University of Minnesota Press.
- Gardner and Gardner (1974b). Review of R. Brown's A first language. American J. of Psy., 87, 729-736.
- Gardner and Gardner (1975). Evidence for sentence constituents in the early utterances of child and chimpanzee. J. Exp. Psy.: General, 104, 244-267.
- Harnad, Steklis, and Lancaster (1976). Origins and evolution of language and speech. Annals of the NY Academy of Sciences. vol. 280.
- Herrnstein, Loveland, and Cable (1976). Natural concepts in pigeons. J. Exp. Psy.: Animal Behavior Processes, 2, 285-302.
- Hockett (1960). Logical considerations in the study of animal communication. In Lanyon and Tavolga (eds.), Animal sounds and communication. Publication no. 7, American Institute of Biological Sciences.
- Hockett and Altmann (1968). A note on design features. In Sebeok (ed.), Animal communication: Techniques of study and results of research. Indiana University Press.

Katz (1976). A hypothesis about the uniqueness of language. In Harnad et al.

Limber (1977). Language in child and chimp? American Psychologist, 32, 280-295.

Marshall and Wales (1974). Pragmatics as biology or culture. In Cherry (ed.), Pragmatic aspects of human communication. Reidel.

Nelson (1977). The conceptual basis for naming. In McNamara (ed.), Language, learning, and thought. Academic Press.

Patterson (1978). The gestures of a gorilla: Language acquisition in another Pongid. Brain and Language, 12, 72-98.

Petitto (1977). Transcripts of a deaf child, J. The Salk Institute for Biological Studies.

Petitto (forthcoming). Acquisition of the system of modulations by deaf children.

Rumbaugh (1977). Language learning by a chimpanzee. Academic Press.

Sadock (1974). Toward a linguistic theory of speech acts. Academic Press.

Sanders (forthcoming). Conversations with a chimpanzee. PhD dissertation, Columbia University.

Schlesinger and Namir (1978). Sign language of the deaf. Academic Press.

Stokoe, Casterline, and Croneberg (1976). A dictionary of American Sign Language on linguistic principles. Linstok Press.

Straub, Seidenberg, Terrace, and Bever (1978). Representation of a sequence in pigeons. Manuscript.

Terrence (1978). Is problem solving language? Manuscript.

Terrence (in press). Untitled book on Nim. Alfred Knopf.

Terrence, Petitto, and Bever (1976a and b). Project Nim: Progress Reports I and II. Distributed by Columbia University Psychology Department.

Terrence, Petitto, Sanders, and Tynan (forthcoming). Can a chimpanzee create a sentence?

Van Lawick-Goodall (1968). A preliminary report on expressive movements and communication in the Gombe Stream chimpanzees. In Jay (ed.), Primates: studies in adaptation and variability. Holt, Rinehart and Winston.

Wilson (1975). Sociobiology. Harvard University Press.