WHAT ARE CHIMPANZEES TELLING US ABOUT LANGUAGE?

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The divergent views expressed in the literature on the linguistic competence of chimpanzees is due in large part to the lack of a common framework in which to compare human and chimpanzee signing. Working for the most part within a Saussurian semiological framework, several distinct 'tactic' sign types, including: ataxis, lexical parataxis and syntax, are introduced for the purpose of comparison. These types are then illustrated through the ontological development of human signing behavior. Next, the data on the signing behavior of chimpanzees, both wild and captive, are analyzed with the conclusion that, while chimpanzees do show evidence of true semiological communication, their tactic ability does not appear to exceed that of lexical parataxis. This conclusion draws attention to the significance of the difference between syntax and lexical parataxis which in turn tells us something more about the nature of human language.

1. Introduction and purpose

It might be argued that the main purpose of studying the behavior of chimpanzees, our nearest living phylogenetic relatives, concerns a desire to better understand another intelligent species. But it seems more likely that our real concern is to better understand our own. For this reason we are drawn to a comparison of our own communicative behavior with these presumably languageless species, for we are well aware that language, even if we do not know the reasons, is what sets us apart as humans.

This curiosity has led to a number of recent studies of the communicative potential of chimpanzees beginning with the pioneering work of Gardner and Gardner (1969) and including Premack (1970), Rumbaugh et al. (1973), Terrace (1979), Fouts (1977), Patterson (1978) and others. From these studies, two diametrically opposed positions have emerged. The inclusionist view claims little difference between ape and human linguistic ability:

'This difference [between ape and humans] is one of degree and not one of kind, however, and does not weaken the proposition that language is no longer the exclusive domain of man.' (Patterson (1978: 95))

The exclusionist view argues that the communicative ability of these apes has little in common with humans:

'Ape signing shows little resemblance to either the speech of hearing children or the signing of deaf children.' (Petitto and Seidenberg (1979: 162))

The difference in these conclusions is not really a problem of the data involved, but of the interpretation of that data which stems from the lack of agreement on what constitutes human language.

'An agreed-upon definition of language does not presently exist (...) and therefore we do not know the essential characteristics of language.' (Fouts and Mellgren (1976: 324))

Petitto and Seidenberg comment more strongly:

'What is seen [of the] discussion of ape "language" in general is a failure to seriously consider the significant questions of psycholinguistics: what are languages, how do they differ from other communicative systems, how may they be analyzed, how are
they learned and how may we attribute a particular linguistic skill to a child or ape in the process of acquiring a language.' (Petitto and Seidenberg (1979: 181))

These statements are characteristic of a more general problem, namely, that chimpanzee signing behavior has not been placed in a framework where it can be compared with the signing behavior of human beings. In this paper, I pick up on Saussure's (1959: 16) notion of semiology which he defines as 'A science that studies the life of signs within a society'.

Using the Saussurian characterization of the sign, I have chosen to focus on what I have termed levels of tactic signing. These types, labeled here as: 'ataxis', 'lexical parataxis' and (true) 'syntax', are terms which correspond approximately to the more traditional 'one word', 'two word', and 'syntax' as used in the literature on child language acquisition. However, given the semiological framework used here, these terms will require some redefinition.

As suggested, then, this study leads us away from the issue of chimpanzee communication to the question of the nature of human language and explains the choice of the title of this paper: 'What are chimpanzees telling us about language? Not so surprisingly, this approach accords with one of the goals of language put forth by Saussure.

'The task of the linguist is to find out what makes [human] language a special system within the mass of semiological data.' (Saussure (1959: 16))

2. The internal structure of signs

In reading Saussure's Course, one is struck by the lack of reference to a syntactic level of signs. This view has been superseded by more modern accounts of syntax, most notably Chomsky (1957 and elsewhere). For Chomsky, a language consists of a set of sentences, each of which is a pairing of sound and meaning. This characterization coincides with Saussure's notion of the sign, in that it is a pairing of a signifier (sound) with a signified (meaning) within a finite or closed system. Thus, from a semiological point of view, the sentence can also be viewed as a type of linguistic sign.

Having established the sentence as the basic unit of human language, Chomsky then views the task of linguistics as one of characterizing the internal structure of the sentence. It is the view taken here that the sentence consists of three distinct, but interrelated semiological layers: the phonological, the morphological and the syntactic. Each layer represents the domain of a special type of sign with unique properties. From this perspective, it is the task of linguistics to characterize each layer as well as its relationships to other layers.

Briefly, in this regard, I see language as a closed (finite) system of signs within signs. That is, at the phonological level we find the phonemes functioning as signs in their own right. At the morphological level, we find- these phonemes, or rather strings of phonemes serving to 'spell out' the signifiers of word-level signs. And finally, at the syntactic level, we find words, or rather strings of word classes (e.g., Noun, Verb, etc.), spelling out the signifiers of syntactic-level signs. While much needs to be said about the nature of the phonological and morphological levels from this perspective, the remainder of this paper focuses on the syntactic level.

2.1. Syntax

Up until syntax was characterized in terms of (nested) phrase structures, its properties and potentials remained poorly understood and appreciated. Importantly, it is this formulation that enables syntax to be viewed as a type of semiological sign. Thus, in Syntactic structures, Chomsky states that:

'A grammar which generates Phrase-markers includes both formatives (the boy, etc.)

1Here, I take syntax in the traditional sense (though to be defined more precisely below) to refer to constructions between the level of word and that of the sentence. Saussure's way of dealing with syntax was in terms of associative (syntagmatic) and paradigmatic relationships of the word.
and category symbols (S, NP, V, etc.). The formatives can be, furthermore, subdivided into lexical items (sincerity, boy) and grammatical items (Perfect, Possessive, etc.).' (Chomsky (1957: 65))

Phrase markers are generated by means of rewrite rules (1) which in semiological terms spell out, using category symbols, a syntactic sign in much the same way that a string of phonemes spells out a lexical formative.

1. S ——> NP + Aux + NP
   NP ———> Det + NP

As such, each rewrite rule defines the signifier of a syntactic sign. However, to meet the requirements of a semiological sign, these signifiers have to be paired with a value, or in Saussurian terms, with a concept or mental image. In the case of phrase structure, Chomsky paired the syntactic signifiers with a 'grammatical function' such as Subject, Predicate, etc., that designates the semantic role each syntactic sign plays in the phrase structure.

2.2. Syntactic nestings

While each of the three layers of signs found in natural human language are semiologic, each has distinctive properties which set it apart from the others. In the case of syntax, this is due to the nature of the categorical symbols that allow for nesting or embeddings. This is because categorical symbols can function at one level as the signifiers of higher order signs, and at another level as signs in their own right. The symbol VP when concatenated with NP and Aux serve to form the signifier of S, and, at the same time, VP itself is a sign with a signifier of V + NP and a signified of 'predicate-object'.

Currently there are numerous versions of syntactic theory put forth by Chomsky and others to capture more explicitly the intricacies of modern syntax, but fundamentally all of them can be interpreted as having in their essence a notion of the linguistic sign that can be understood in semiological terms.

2.3. Unnested syntax

A much more limited syntax can be constructed by requiring that all categorical symbols except the initial starting symbol S be terminating. This, I believe, is the intent behind the 'pivot + x-word' (Brame (1963)) or 'functor and contentive' (Miller and Ervin (1964)) grammars found in the early literature on child language acquisition. These proposals involved the positing of two terminating categorical symbols; e.g. P(ivot), X(-word), a functional relationship (as suggested by the terms 'functor' and 'contentive'), and a set of rewrite rules (2):

2. S ———> P + X
   S ———> X + P
   S ———> X + X

2.4. Lexical parataxis

Bloomfield defines a paratactic construction as one:

'(... in which two forms united by no other construction are united by the use of only one sentence pitch.' (Bloomfield (1933: 171))

2 Chomsky argues that these functional notions (like categorical symbols) are part of a universal human grammar and do not need to be specified in the phrase structure rules of a given human language.
 Implicit in this definition is the functional notion that the two sentences are to be taken together but that no further functional notion such as 'subject of is specified. Using this notion of parataxis, I propose to define lexical parataxis as consisting of two categorical symbols S (sentence) and W (ord), one tactic sign (3):

\[
(3) \quad S \rightarrow W; W
\]

and one functional notion: that the sign W; W is to be taken as combining some aspect of the (lexical) meaning of each constituent word.\(^3\)

Semantically, the paratactic relationship is not unlike that of an English compound word such as 'buttercup' in that the meaning has something to do with 'butter' (it is yellow) and 'cup' (it is cup-shaped). In English, buttercup has by convention come to be the sign for a yellow, cup-shaped flower, though in lexical parataxis, other readings that conform to the functional notion of lexical parataxis such as 'cup used for butter' would be included as possible meanings.

2.5 Ataxis

The final type of taxis\(^4\) presented here is termed 'ataxis'. Two categorical symbols are involved: S and W, and one atactic sign (4):

\[
(4) \quad S \rightarrow W(\text{ord})
\]

The functional notion is minimal being, essentially: 'take the word as a message'.

2.6. Iterations

In this framework, iteration refers to the stringing together of sentences, whether atactic, paratactic or syntactic. Because iterations result in utterances of considerable length, iterated ataxis or parataxis could be taken at first glance to indicate the presence of syntax. For this reason, it is important to glean from the above tactic types a set of criteria that will allow us to determine from actual use what type of taxis is involved.

2.7. Nested parataxis

At this point, the questions of the possibility of nested parataxis arise. Such a grammar would be characterized by the two categorical symbols: S and W, and two paratactic signs defined by (5):

\[
(5) \quad S \rightarrow W ; W ; W
\]

\(^3\) The use of the semicolon /;/ as a concatenator as opposed to /+/ should be read to mean that the word order is not fixed. Also, by this time, the reader may have detected a shift in terminology from 'rule' to 'sign' in describing the relationship in examples (3), (4) and (5). What is interesting here is that while modern usage prefers the term rule, what is being described is a relationship between signified and signifier. This relationship can most clearly be discerned when this current terminology refers to a lexical entry as a 'type of rule'.

\(^4\) Because I have posited a number of sign types operating at this level: nested syntax, unnested syntax, lexical parataxis and ataxis, I have chosen to label the level at which these occur as 'the tactic level', and the various sign types as 'tactic sign types'.
Nested parataxis poses a problem of ambiguity. Given that by definition, word order is not fixed, a string such as (6a): could be parsed as either (6b) or (6c).

With this ambiguity, little is gained in terms of expressibility from this type of parataxis. In fact, iterated parataxis (7) can be more effective than nested parataxis especially when the same lexical sign is present in both sentences: even though iterated parataxis is far inferior to syntax in this regard.

(7) Boy; bite. Apple; bite.

2.8. Criteria

In contrasting the four tactic types presented here, I propose the following four criteria: categorical symbols, functional notions, sentence length, and significant word order.

2.8.1. Categorical symbols

Excluding the initial categorical symbol S(entence), the above discussion has shown that ataxis and lexical parataxis have only one such symbol: W(ord), while unnested syntax, such as the pivot grammar, has two: P(ivot) and X(-word). Nested syntax has a finite number greater than two.

2.8.2. Functional notions

As defined, both ataxis and lexical parataxis have only one sign type and hence only one associated functional notion. Syntax, both nested and unnested, has more. Therefore, evidence for more than one functional notion constitutes evidence for syntax.

2.8.3. Sentence length

In the types of taxis discussed so far, ataxis has a word length of one, lexical parataxis and pivot grammars have two and owing to the embedding powers of nested syntax its word length is potentially infinite.

2.8.4. Significant word order

Word order becomes significant at the syntactic stage (nested and unnested) where different
sequences of categorical symbols serve to signify different syntactic signs for which different functional notions have been associated. Because lexical parataxis and ataxis have only one signifying categorical symbol, word order can not be of relevance.

2.9. Summary

This discussion can be summed up as shown in table 1.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Ataxis</th>
<th>Parataxis</th>
<th>Pivot</th>
<th>Nested syntax</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Categorical symbols excluding S</td>
<td>One</td>
<td>One</td>
<td>Two</td>
<td>Greater than 2</td>
</tr>
<tr>
<td>2. Functional notions</td>
<td>One</td>
<td>One</td>
<td>Two</td>
<td>Greater than 2</td>
</tr>
<tr>
<td>3. Sentence length</td>
<td>One</td>
<td>Two</td>
<td>Two</td>
<td>Infinite</td>
</tr>
<tr>
<td>4. Significant word order</td>
<td>N.a.</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

3. Illustration of tactic types in humans

The stages of language development through which all humans pass illustrate the types of taxis described in the preceding section.

3.1. The atactic period

More commonly referred to as the 'one word stage', ataxis is found in humans roughly between the ages of one and two years. This stage usually persists until the vocabulary inventory rises to somewhere around 50 to 60 items (Bloom (1970)). Structurally, these atactic signs consist of a simple sign message (word) and an increasingly complex sign vehicle composed of phoneme strings.

The atactic stage has been termed 'holophrastic' thereby implying that more complicated tactic structures underlie these one word messages. Indeed, this level can convey complex meanings as the following episode (8) illustrates (from Moscowitz (1978:125)):

(8) Child: Car, car. (pronounced ka)
    Adult: What?
    Child: Go, go.
    Adult: (undecipherable)
    Child: Bus, bus, bus, bus, bus. (pronounced baish)
    Adult: What? Oh, bicycle? Is that what you said?
    Child: Not. (pronounced na)
    Adult: No?
    Child: Not.
    Adult: No, I got it wrong.

---

I note briefly that there are devices other than word order, such as inflection for case, that can serve to signify a syntactic sign, avoiding the requirement of fixed word order. While these devices can be shown to be semiologic, further discussion is beyond the scope of this paper.
According to Moskowitz, the child was trying to express something like the following: 'hearing that car reminds me that we went on the bus yesterday. 'No, not in a bicycle'.

But instead of attributing the richness of this kind of meaning to any underlying complexity of structure of the atactic message, I prefer to consider this richness to derive from the interpretation of such messages as acts of parole, using, not only the structural value of the sign, but also the context in which they appear. By claiming that the richness of meaning attributed to such signs occurs outside the atactic sign system, I claim that the term 'holophrastic' is misleading and hence unwarranted.

There have also been some attempts to posit word classes (i.e., categorical symbols) for atactic grammars. Such claims, however, run counter to the discussion in section 2, where I argue that categorical symbols only have relevance at the syntactic level. In this regard, Bloom cautions against the use of 'parts of speech' terminology at the one word (atactic) stage of children:

'叙 conclude, it is inappropriate to think of children learning adult 'parts of speech' in the course of their development before the use of syntax. Rather it is the case that children develop certain conceptual representations of regularly recurring experiences and then learn whatever words conveniently code or linguistically represent such conceptual notions.'

(Bloom (1975: 112))

3.2. The paratactic stage

As mentioned earlier, Brame (1963) and Miller and Ervin (1964) regard this stage as a type of unnested) syntax with both grammatical classes (P-ivot and X-word) and functional notions. In contrast, I argue here that pivot grammars do not characterize accurately the linguistic ability of humans at this level for several reasons.

First, there is no evidence of grammatical classes as Bloom points out.

'叙evertheless, the distributional analyses used to obtain 'pivot' grammars ignored the linguistic function of utterances - notions of linguistic contrast, interpretation, 'meaning' or reference were not considered.'

(Bloom (1970: 5))

In other words, these grammatical classes are not inherent in the sign system, but have been imposed by investigators by comparing these messages to adult grammars. They have not been established on the basis of any independent criteria.

Second, these purported grammatical classes and functional notions serve no purpose in explaining semantic ambiguities (as in (9)) on structural grounds.

(9) Mommy sock
   (a) Kathryn picked up her mother's sock.
       (this is mother's sock)
   (b) Mommy putting Kathryn's sock on Kathryn.
       (Mommy is putting the sock [on me])

Third, the power of a pivot grammar is not necessary for distinguishing grammatical sequences from ungrammatical ones nor does it aid in accounting for the variety of possible two word sentences.

From a paratactic perspective, these facts fall into place. First, a paratactic grammar predicts no significant word classes. Second, a paratactic grammar predicts that ambiguities such as (9) will occur, but not because of structural ambiguities, but rather from the interpretation of these paratactic messages as acts of parole in a
specific context. This richness is fully brought out in (10) where even though Brenda is limited to a paratactic stage of structure, she can through iterating and through interacting with Scollon (both aspects of the context) express a meaning something like 'I would like to speak into tape recorder' (from Moskowitz (1978: 127)):

(10) Brenda: Tape corder. Use it. Use it.
    Scollon: Use it for what?

Third, whatever distributional restrictions that are found at this level can be traced to the semantic content of the individual lexical items and not to their grammatical classes. For these reasons then, I reject the claim that the properties of the two word stage in children can be explained by a grammar based on unnested syntax.

3.3. Syntax

In noting the development of syntax, Moskowitz comments:

"There is no three-word stage in child language. For a few years after the end of the two-word stage children do produce rather short sentences, but the almost inviolable length constraints that characterized the first two stages have disappeared. The absence of a three-word stage has not been satisfactorily explained yet." (Moskowitz (1978: 125))

Within the framework presented here, the explanation for the lack of a length constraint at the syntactic stage derives from the use of nesting made possible by the properties of syntax. Since there is no inherent condition restricting the number of times nesting may be applied to a sentence, there can be no restriction on the number of words within a sentence.

3.4. Transitions

The transitions from atactic to paratactic and paratactic to syntactic stages are not marked by an abrupt change of word string length from one to two and from two to three words. Rather, through time, there is a trend toward increased word string length and at any given point in a child's development the strings produced may represent a variety of tactic types. Table 2 illustrates the range of utterances of Eric's speech based on data from Bloom (1975) sampled at different time periods.

<table>
<thead>
<tr>
<th>Age (mo.)</th>
<th>MLU</th>
<th>Shortest</th>
<th>Typical</th>
<th>Longest</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1</td>
<td>1.1</td>
<td>Truck</td>
<td>Turn</td>
<td>See window</td>
</tr>
<tr>
<td>20.2</td>
<td>1.2</td>
<td>Out Hand</td>
<td>Eating cereal</td>
<td>Here the clown</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>No the toy</td>
<td>Here comes (ma)chine</td>
</tr>
<tr>
<td>22.0</td>
<td>1.4</td>
<td>Boy</td>
<td>Want more apple</td>
<td>I get horsie (ma)chine</td>
</tr>
</tbody>
</table>
Tactic development has been reported in terms of Mean Length of Utterance (MLU). The MLU is simply the average sentence length in words calculated over a given period of time. As can be seen from the above data, an MLU does not indicate tactic stages directly because of the averaging in longer and shorter word strings. Nevertheless, an MLU greater than 1.0 correlates with a stage higher than ataxis and an MLU greater than 1.4 or 1.5 correlates with true syntax (see Eric's productions at the 1.4 stage above).

Table 3 shows the growth of MLUs in two hearing children, two deaf children and a chimpanzee, Nim between 24 and 48 months.

Table 3
Graph of MLU and age.

<table>
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<tr>
<th>Months</th>
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<th>38</th>
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<th>42</th>
<th>44</th>
<th>46</th>
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</table>

Hearing: x = Eve (Brown (1973))    # = Sarah (Brown (1973))
Deaf:   o = Ruth (Schlesinger (n.d.)) + = Alice (Hoffmeister (1972))
Chimp:  * = 'Nim' (Terrace (1979))

3.4.1. The emergence of atactic signs

Volterra (1981) provides an account of how atactic signs develop using a type of sign she terms a 'deictic gesture'.

We call deictic such gestures as SHOWING, GIVING, and POINTING. These deictic gestures appear when the child is about ten months of age, and at the very beginning they are produced one at a time and often simultaneously with vocal signals... the referential meaning communicated is given entirely by the context in which the communication takes place'. (Volterra 1981: 353)

Referential signs differ from deictic signs in that referential signs have a fixed referent. Volterra describes the evolution the true sign through a process termed

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6 While Volterra (1981) carried out her research on deaf children, the decontextualization process appears to obtain for hearing children at this stage as well.
'decontextualization': a developmental sequence moving from showing to giving and then to pointing, with pointing marking the stage when the object and the gesture are for the first time physically separated.

The result is a fully decontextualized atactic sign. But once fully atactic signs are established they can, as acts of parole, be reembedded into a given context, and as a result be further enriched through interpretation as illustrated in (11).

3.4.2. From ataxis to parataxis

Volterra notes that in hearing children as early as one year, deictic gestures glossed as 'that', 'here', 'you', etc. appear in combination with referential decontextualized signs. I take these combinations to be an incipient form of parataxis which subsequently evolves into true parataxis through the same process of decontextualization of these deictic gestures.

3.4.3. From parataxis to syntax

An adequate account of the evolution of syntax must also provide an explanation of the emergence of the categorical symbols that enable nesting. During the paratactic stage, the child has the opportunity to increase word length through two devices: iterated parataxis and embedded parataxis. There is ample evidence that both are used. Brenda's: Tapecorder. Use it. Use it typifies iterated parataxis, while (11) typifies nested parataxis.

(11) (wear ; mitten) ; no
   no ; (play ; that)

But as pointed out in section 2.7, without the existence of categorical symbols nestings are of little value because of their high degree of ambiguity. Thus embedded parataxis poses a dilemma, for while it offers the opportunity for more complex (potentially infinite) messages, the limitations of ambiguity of paratactic structures render it relatively useless. We can suppose that if pressure to produce more complex structures is continued (children do encounter such sentences used by adults around them) then, in all likelihood, the dilemma will be resolved through the development of categorical symbols.

Nested paratactic sentences involving negatives are of interest here, because they present little ambiguity, as the following data in (12) from Kathryn illustrates.

(12) Sentence Situation
   No fit    K was unable to put a toy lamb into a small block.
   No dirty soap  K pushing away a piece of worn soap in a bathtub, wanting to be washed with new pink soap.
   No pocket    K unable to find a pocket in Mommy's skirt.
   No Mommy    K pulling away from someone else, not Mommy, who had offered to comb her hair.

I suggest here that these sentences may actually represent unnested syntax. That is, the negative represents an incipient categorical symbol. This, I argue, is due to the singular properties of this formative. That is, because it is in a class all by itself, it automatically carries a negating function, and with this, the formative is placed in a position to be interpreted as a categorical symbol. Further,
it may well be that this development paves the way for the creation of other categorical symbols which have more than one formative as members.

### 4.1. Wild chimpanzees

In examining the communicative behavior of wild chimpanzees, we note that most of the messages have to do with social relationships such as male-male dominance, male-female associations and parent-child interactions.

Also, many of these messages can be interpreted as emotions held by the sending chimpanzee and as such appear to be involuntary transmissions and not representative of communication as defined here. However, Menzel (1973) reports several instances of seemingly intended communication, one in which a chimpanzee deliberately misled his companions in order not to be beaten to the food supply.

I consider these messages to consist of simple, atactic signs. They are atactic because there appears to be no evidence of syntax or even parataxis. Even when two such signs appear in association, such as a hoot shifting to a bark or a cry, there is nothing to suggest that this is anything other than one atactic statement after another. They are termed 'simple' because there is no evidence for any internal complexity of the signifier (unlike that of a word being represented by a string of phonemes). A hoot has no common substructure with a 'bark', 'cry', 'a baring of the teeth' or 'a pat on the behind'.

It is important to emphasize, however, that the limitations of simple taxis should not be taken as an indication of the conceptual limitations of the chimpanzee, but only as a limitation of the code. As we will see below, captive chimpanzees are capable of both more complex codes and conceptualizations. Furthermore, even in the wild, chimpanzees take advantage of context to enrich the content of the sign message as the following passage illustrates.

> 'What then (...) was the leader to do? The most parsimonious way to describe his behavior is to say that he did almost anything he could and performed almost any signal [i.e. atactic sign] in his repertoire that would achieve the molar, objective end state of getting others to accompany him IN THE DIRECTION HE CHOSE TO GO.' (Menzel (1976: 99))

### Captive Chimpanzees: the data

Before confronting the question of tactic ability in chimpanzees and other apes, I wish to address the problem of data. There have been three classes of experiments with these animals. Those carried out by Premack (1970) using symbolic plastic chips focus primarily on the chimpanzee's ability to decode symbolic messages. Those carried out by Rumbaugh et al. (1973) have worked with the chimpanzee's ability to work with the artificial language known as Yerkish. Finally, there are the experiments involving teaching the sign gestures of American Sign Language. These later experiments, quite possibly because they involve human-chimpanzee interaction have shown themselves to be both the most interesting and the most controversial. It is for this reason that this paper focuses on these studies. And because, as Petitto and Seidenberg (1979) point out, 'The largest corpus of utterances from any signing ape [is] that of Terrace, Petitto, and Bever (1976a, b)', this paper draws its data primarily from those sources.

### 4.3. The question of intent

Reversing the trend toward acceptance of captive chimpanzee signing as equivalent to natural human language, Terrace (1979) and Terrace et al. (1979) raise the question 'Can a chimpanzee
create a sentence?' Terrace's query brings out two important issues concerning chimpanzee communication. The first is, how spontaneous is chimpanzee communication? This question really asks whether the chimpanzee can communicate at all, for intent to convey information is an essential aspect of parole which, as Ricoeur (1978) indicates, is for someone to intend to say something to someone about something. And without intend, the chimpanzee would be regarded as nothing more than a clever mimic. This question arose when Terrace, upon reviewing the data gathered from his work with the chimpanzee named Nim, noted that frequently Nim's signs could be interpreted as conditioned responses to the stimuli of Nim's teachers, often in fact being repetitions of the teacher's signs. Although Terrace offers no indication of intent on behalf of the chimpanzee, he does report Nim sitting by himself looking at a picture book signing to himself. While this does not constitute intent, it does show an ability to sign in the absence of human prompting. However other studies reveal evidence to support intent. Fouts and Mellgren (1976) cite several cases of novel productions by chimpanzees which in addition to being sensible message also are hard to explain as conditioned responses. And finally, the use of prevarication would clearly mark the presence of intent and as pointed out above, wild chimpanzees have clearly demonstrated this ability. Furthermore, Fouts and Mellgren remark that captive chimpanzees are also capable of prevarication.

'We have recently observed a number of cases in which a chimpanzee has lied or has shown that it could recognize a lie, or at least has displayed a behavior that would be interpreted as a lie in humans.' (Fouts and Mellgren (1976: 337))

Thus despite Terrace's claims to the contrary, there appears to be considerable evidence to suggest that captive and wild chimpanzees do produce messages that are more than involuntary gestures and constitute willful communication of some sort.

4.4. The issue of sign type

Terrace's second question concerns the nature of the linguistic messages used by these chimpanzees. It is tempting to say that because chimpanzees use the signs of American Sign Language (ASL) and because ASL is a natural and syntactic human language, chimpanzees use syntax. As Volterra (1981) and other studies on the acquisition of language by the deaf have shown, children using ASL go through the same tactic types found in the acquisition of vocal language by hearing children. Thus the question whether chimpanzees produce syntactic sentences is one that can only be answered by examining the types of signs actually produced by chimpanzees.

4.5. Evidence for a complex sign vehicle

Before addressing the question of tactic type, I want to point out that although the structure of ASL signifiers is not identical to the phonemic structure of vocal human language, this structure is nevertheless complex. Each ASL word consists of a set of one or more component gestures, like phonemes, but with the possibility of being either simultaneous or sequential. For example, a closed fist, depending on the orientation of the thumb and the back of the hand, represents a variety of meanings including 'help' and 'Bill'. Thus chimpanzees, even though they do not have the physical ability to produce articulate phonemic speech do have the ability to issue complex signifiers.

4.6. Evidence for ataxis
But the real question is not one of the structure of the signifier at this level, but rather the
degree of complexity at the tactic level. Ample evidence from all the classic studies: Premack and
Premack (1972), Gardner and Gardner (1969), Savage-Rumbaugh (1980) and Terrace (1979), is
available to show that chimpanzees have the capacity to generate atactic signs. Perhaps the clearest
documentation for this ability is Nim's signing while looking at a picture book (Terrace (1979)) and
Washoe's responses in the double-blind picture experiments (Gardner and Gardner (1969)). Both
Terrace and Gardner and Gardner cite a set of stringent conditions which must be met for a gesture
to be considered a sign. For Terrace, this includes the identification of the gesture as meaningful and
appropriate on at least three different occasions. For Gardner and Gardner, this involves a double
blind test in which neither of the evaluators judging Washoe's signed responses could see the
original stimulus.

Furthermore, in all of these experiments, the responses given by the chimpanzee represented
true signs in the sense that the relationship between the signifier and the signified was arbitrary.
Although many of the ASL signs are iconic such as the cradling motion for 'baby' and a hand to the
scalp for 'comb', many signs are not (e.g., the touching of the fingers of both hands together to
signify 'more').

Importantly, this means that the chimpanzee has the ability to issue signs other than those
directly linked to the emotional states of the animal (hooting, barking, etc.). It is worth noting in this
regard that some of the signs learned by chimpanzees did represent emotional states (e.g., 'bite').
Terrace (1979) reports that the signing of 'bite' had much the same effect as a growling gesture in
that once issued, Nim's aggressive level diminished.

4.7. Evidence for tactic types other than ataxis

In section 3.4, the MLU was shown to be a rough indicator of tactic type with an MLU greater than
1.0 suggesting at least parataxis and an MLU
greater than 1.5 suggesting the threshold of syntax. Nim's MLU for the last two years of the
project varied between 1.1 and 1.6 (Terrace (1979)) placing his signing ability in the paratactic
range. In part, it was the lack of an increase of the MLU beyond 1.6 which lead Terrace to question
the existence of a syntactic capacity in chimpanzees and subsequently to question whether
chimpanzees communicated at all. Although I have taken issue with Terrace on the matter of
whether chimpanzees can communicate (section 4.3) I agree with Terrace that chimpanzees show no
convincing evidence of using syntactic signs. I suspect that much of the confusion on this matter in
the literature has arisen because a lack of a clear understanding of properties of syntax and how it
differs from the properties of parataxis as defined here, for without this distinction, evidence for
parataxis could easily be mistaken for evidence of syntax.

4.7.1. Parataxis versus syntax

The discussion of the properties of syntax and parataxis revealed four categories in which
syntax and parataxis differ. These are given in table 4. This section examines Nim's sign message
structure with respect to each of these paired contrasts between syntax and parataxis.

<table>
<thead>
<tr>
<th>Category</th>
<th>Parataxis</th>
<th>Syntax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant Word Order</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Functional Notions</td>
<td>One</td>
<td>&gt; 2</td>
</tr>
</tbody>
</table>
Word Classes | No | Yes
---|---|---
Word Length | Two words | Unlimited

4.7.2. Significant word order

Terrace gives ample evidence (see table 5) of sequences consisting of the same words but appearing in different orders.

Table 5

<table>
<thead>
<tr>
<th>Example</th>
<th>Frequency</th>
<th>Example</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>More apple</td>
<td>(12)</td>
<td>Apple more</td>
<td>(5)</td>
</tr>
<tr>
<td>More banana</td>
<td>(62)</td>
<td>Banana more</td>
<td>(5)</td>
</tr>
<tr>
<td>Give apple</td>
<td>(9)</td>
<td>Apple give</td>
<td>(3)</td>
</tr>
<tr>
<td>Give gum</td>
<td>(4)</td>
<td>Gum give</td>
<td>(3)</td>
</tr>
<tr>
<td>Brush me</td>
<td>(35)</td>
<td>Me brush</td>
<td>(9)</td>
</tr>
<tr>
<td>Brush Nim</td>
<td>(13)</td>
<td>Nim brush</td>
<td>(4)</td>
</tr>
</tbody>
</table>


Although these examples show a favoring of one sequence over another, there is no indication that this difference is at all significant. On the basis of word order, Nim's signing is paratactic.

4.7.3. Word classes

Evidence for syntactic classes would come from observations of restricted occurrence of individual words and of sets of individual words patterning alike. There is evidence in Nim's signs for the existence of word restrictions, but the basis of these restrictions appears to rest with the referential meaning of the word rather than with syntactic classes. The lack of clearly identifiable word classes is coherent with a paratactic mode of signing.

4.7.4. Vagueness of semantic relationship

When Nim's word pairs were compared with the meanings assigned to them, on the basis of context, the semantic relationships between one word and another showed considerable variability (see table 6).

Table 6

<table>
<thead>
<tr>
<th>Example</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eat Nim</td>
<td>Action-agent</td>
</tr>
<tr>
<td>Eat grape</td>
<td>Action-object</td>
</tr>
<tr>
<td>Eat tickle</td>
<td>Two propositions</td>
</tr>
<tr>
<td>Food Nim</td>
<td>Object-beneficiary</td>
</tr>
<tr>
<td>Food there</td>
<td>Action P14^</td>
</tr>
<tr>
<td>Nim out</td>
<td>Agent-action</td>
</tr>
<tr>
<td>Out shoe</td>
<td>Action-object</td>
</tr>
<tr>
<td>Out pants</td>
<td>Routine</td>
</tr>
</tbody>
</table>

Source: Terrace (1979: 286).
Whatever semantic specificity that could be obtained from these pairs was done so on the basis of the referential meaning of the individual words and context. This evidence too reflects parataxis as opposed to syntactic signing.

4.7.5. Binary pairing

From a period beginning June 1, 1975 and terminating February 13, 1977 Nim produced a total of 19,203 instances of sequences of more than one sign. This represents 5,235 different sign sequences (Terrace (1979: 270)). Of this amount two word sequences comprised almost 65%, three word sequences, about 23% and four and five word sequences, roughly 5% each.

Furthermore, as can be seen in table 7, a listing of Nim’s most frequent two word and three word combinations, most of the three word combinations involved a repetition of one of the other two signs in the sequence.

Table 7

<table>
<thead>
<tr>
<th>Two word combinations</th>
<th>Three word combinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>Frequency</td>
</tr>
<tr>
<td>Play me</td>
<td>375</td>
</tr>
<tr>
<td>Me Nim</td>
<td>328</td>
</tr>
<tr>
<td>Tickle me</td>
<td>316</td>
</tr>
<tr>
<td>Eat Nim</td>
<td>302</td>
</tr>
<tr>
<td>More eat</td>
<td>287</td>
</tr>
<tr>
<td>Me eat</td>
<td>237</td>
</tr>
<tr>
<td>Nim eat</td>
<td>209</td>
</tr>
<tr>
<td>Finish hug</td>
<td>187</td>
</tr>
<tr>
<td>Drink Nim</td>
<td>143</td>
</tr>
<tr>
<td>More tickle</td>
<td>136</td>
</tr>
</tbody>
</table>


At this point it is not clear whether these strings represent an iteration of a paratactic and an atactic message or nested parataxis. The remaining three word sequences (that do not involve a repetition) might well represent nested parataxis. They are not seen to be syntactic because of the lack of a significant word order (cf. Banana Nim eat and Banana eat Nim).

Four word combinations, as can be seen from the ten most frequent combinations (see table 8) appear to be paired paratactic statements.

Table 8

<table>
<thead>
<tr>
<th>Example</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eat drink eat drink</td>
<td>15</td>
</tr>
<tr>
<td>Eat Nim eat Nim</td>
<td>7</td>
</tr>
<tr>
<td>Banana Nim banana Nim</td>
<td>5</td>
</tr>
<tr>
<td>Drink Nim drink Nim</td>
<td>5</td>
</tr>
<tr>
<td>Banana eat me Nim</td>
<td>4</td>
</tr>
<tr>
<td>Banana me eat banana</td>
<td>4</td>
</tr>
<tr>
<td>Banana me Nim me</td>
<td>4</td>
</tr>
<tr>
<td>Grape eat Nim eat</td>
<td>4</td>
</tr>
</tbody>
</table>
Nim eat Nim eat
Play me play me


Many of these can be seen as repetitions of the same paratactic pair, others can also be seen as related pairings of paratactic sets. The combination Grape eat Nim eat, analyzed here as the iterated paratactic sentences (13):


It appears to represent the meaning expressed syntactically as Nim eats grapes.

One of the longest sequences produced by Nim (14), despite its initial appearance of nonsense may well be an example of iterated parataxis representing the meaning expressed syntactically as "You give me (the) orange (to) eat."

(14) Give orange me give eat orange me eat orange, give me eat orange give me you.

The paratactic sentence breaks down into the following pairs (15):

(15) (1) give; orange
(2) me; give
(3) eat; orange
(4) me; eat
(5) orange; give (same as (1)
(6) me; eat (same as 4)
(7) orange; give (same as (1) and 5)
(8) me; you

What is remarkable about this sentence is that Nim has commented on most of the semantic relationships expressed so much more succinctly by the syntactic version as shown in (16).

Given this interpretation, we begin to have an image of Nim, attempting to express a relatively complex concept through a highly limited code. Such an approach involves expressing each relationship separately using a paratactic statement. The order of presentation Nim chooses is also interesting. First the transaction is expressed: (1) give; orange + (2) give; me, followed by the purpose: (3) eat; orange + (4) me; eat. Then the command is repeated: (5) give; orange, with the purpose: (6) me; eat. Presumably Nim's wish has not been fulfilled at this point so he returns to the main point: (7) give; orange and finally underscores the direction of the transaction: (8) me; you.

4.8. Possible indications of syntax
This evidence can be viewed as either a case of 'rich interpretation' or of 'over interpretation'. Whatever the position taken on the issue of whether Nim's 16 word sign is meaningful, it can in no way be taken to support a syntactic capacity in chimpanzees. Furthermore, this evidence when joined with the evidence on word order, word classes and semantic relationships between words leads to the conclusion that Nim has shown the ability to use parataxis, probably iterated parataxis and possibly embedded parataxis, but not syntax. We are aware, however, that there is some evidence of syntax-like expressions which have appeared in the signing of other chimpanzees, but these in almost every instance are suspect. For example, Washoe is credited with the sentence Baby in my cup, though the recording actually shows something like, 'Baby in...baby in...cup, my cup...baby in my cup'. Although the last four word sequence was fairly fluent, the episode does suggest a struggle with the syntactic barrier which may or may not have been crossed in this particular instance.

A second argument for syntax that has been offered comes from the experiments with Lana in which the two Yerkish (a computer language for chimpanzees) sentences: Tim groom Lana and Lana groom Tim appear to have been understood correctly by a chimpanzee named Lana. This evidence only suggests that Lana is capable of discerning the difference between two messages containing the same signs; it does not say that Lana is capable of producing such messages. Therefore, it is possible to attribute the disambiguation of the two messages to the interpretation of them in the context in which the signs were issued rather than to the operation of syntactic principles, and as a result the evidence from Lana is not clearly in support of a syntactic capability.

A third argument for syntax comes from Premack (1972) with the chimpanzee named Sarah. Premack reports that Sarah was able to correctly read and interpret the sentences in (17):

(17) Sarah insert apple dish.
    Sarah insert banana dish.
    Sarah insert apple pail banana dish.

This evidence raises the question: is Sarah parsing these sentences syntactically or paratactically? While the sentences in (16) are syntactic, the experiment does not contain sufficient information to rule out a paratactic analysis. A paratactic analysis would allow competing interpretations of the sentences in (16) such as Sarah put the dish in the apple. These bizarre meanings would of course have been ruled out as unlikely. To test for true syntax we need to observe what Sarah would do were we to give her the sentences in (18).

(18) Sarah insert dish apple.
    Sarah insert dish banana.
    Sarah insert apple dish pail banana.

Were Sarah to read these sentences paratactically, she would respond in the same way as she did to those sentences in (17). Confusion, or an attempt to put the dish in the apple, would support a syntactic hypothesis.

Because of the inconclusiveness of all these purported instances of syntax, and the overwhelming evidence in support of a parataxis, we are led to the conclusion that to date, chimpanzees only clearly show an ability for paratactic signing.

5. Conclusion
Thus, we are left with the conclusion that although captive chimpanzees have the need to send messages of a complexity that strains the capacity of lexical parataxis they have shown little evidence of being able to produce syntactic messages. They appear to be on the threshold of syntax but, as yet, unable to cross it. In this regard, some evidence points to an ability to nest signs, as in some of the three word constructions (e.g., Grape eat Nim), but there is no evidence to support the use of syntactic classes. As has been argued earlier, without syntactic classes, tactic nestings are extremely difficult to decode. Thus it would seem that the chief barrier to syntax in chimpanzees such as Nim is the lack of the development of syntactic categories. The existence of this barrier may explain why Nim chose to continue to use parataxis and to develop iterative parataxis to a greater degree than do children, who find it less difficult to develop syntactic classes and hence, syntax. This raises the interesting question of whether it is possible to teach chimpanzees some level of syntactic categorization, and if so whether it would follow that this would enable chimpanzees to enter the world of syntax. Until such time as experiments are carried out along these lines, this will remain an open question.

In closing, I wish to reemphasize the distinction between the ability to generate various types of tactic messages and another ability to fill them with meaning and to interpret them. This is the distinction between Saussure’s langue and parole. In the domain of parole, we cannot but be amazed by the chimpanzee’s interest and ability to express and grasp concepts that transcend the complexities of paratactic code. In fact, it is this ability that I see driving Nim, at least, to expand his signing powers through the use of iterative parataxis, given that the syntactic code is beyond reach.

This distinction between langue and parole is but one of the concepts drawn from Saussurian structuralism which has made it possible to place human and chimpanzee communication in a common framework that has enabled us to better understand language. And from this framework, what we see chimpanzees telling us is that there is an important distinction between lexical parataxis and (true) syntax and that a crucial element in this distinction is the development of categorical symbols.

References


