THE COMPLEXITY ISSUE:
IS LANGUAGE REALLY THAT COMPLEX?

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Transformational generative grammarians have maintained the belief for some time now that language is so complex that it cannot be learned. This argument, in some cases, is based on incorrect argumentation, in which it is pre-empted by the use of more adequate models of linguistic processing, including Chomsky's own model. As a result, his argument is not valid; it does not prove what he insists that it does. When viewed from a more adequate perspective, language is not as complex as Chomsky says that it is. Besides these arguments, there is also the possibility that the Chomskyan view of language, arising out of the Aristotelian philosophical tradition, makes language appear to be excessively complex. An alternative view of language would accord well with connectionism (Parallel Distributed Processing - - PDP) which offers a model of language or psychology as a mechanism for language learning quite different from the Classical view present in Western societies from the earliest times to the present. Thus, if the transformationalist view of language is incorrect and language is not as complex as it may seem from the transformationalist viewpoint and if the connectionist view of language has a measure of truth in it, then language is, in fact, more simple - - probably simple enough to be learned.

It has been the case for some time now that transformational generative theoreticians have seen language as being so complex that it cannot be learned. Thus Hornstein and Lightfoot (1981: 9) state that "...the child attains the complex system [of language] despite a deficiency of data..." So, too, Moore and Carling (1987: 15) state:

> To explain the knowledge of such a complex property as the binding of reciprocal expressions that children attain, the argument runs, we need to assume that the child's initial state consists of an innate, intricate and highly restrictive schematism of some sort.

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Thus also Kronenfield (1979: 217) writes about "The complexity of the structure of language which Chomsky has described..." This should not be surprising since, as Sampson (1980a: 147) points out, "...Chomsky... is a rationalist in the tradition of Plato and Descartes, who believes that the mind is a thing of highly complex fixed structure which largely determines the form of human mental activity..." The question then arises: Just how complex is language? It is apparent from a survey of the literature that there are no objective measures of the complexity of languages, but, nevertheless, it can be shown that language is not as complex as most transformationalists assert it to be.

Thus, the attempt here will be made to illustrate the belief that Chomskyan argumentation and use of evidence for theory building make natural language appear excessively complex. Commentators such as Slama-Cazacu have intimated as much when they say: "To try to posit differences in syntactic structure for each possible interpretation of every sentence is to introduce into the syntactic description distinctions which are completely foreign to the language in question." (Cited from Uhlenbeck, n.d., p. 12. For an early statement of this concept, see Uhlenbeck, n.d., p. 55). As a result, the first section of this essay will attempt to show that language is not as complex as Chomskyans say that it is while assuming the positions held by Chomsky and his followers. The second section will attempt to do so by showing the essential incorrectness of the Chomskyan position.

One of the arguments that Chomsky adduces for his view that language is extremely complex has to do with the extraction of auxiliaries from sentences with WH-clauses in the formation of yes-no questions. This argument is formulated in Chomsky (1980: 39) in the following terms:

> Consider the process of formation of simple yes-or-no questions in English. We have such declarative - questions pairs as(1):
>
> (1)   The man is here -- Is the man here?
>   The man will leave -- Will the man leave?
>
> Consider the two hypotheses put forth to account for this infinite class of pairs:
>
> H1: process the declarative from beginning to end (left to right), word by word, until reaching the first occurrence of the words *is, will*, etc.; transpose this occurrence to the beginning (left), forming the first noun phrase of the associated interrogative.
>
> H2: same as H1, but select the first occurrence of *is, will*, etc., following the first noun phrase of the declarative.

He then goes on to show how H1 is not correct for pairs such as those at (2):

> (2)   The man who is here is tall. -- Is the man who is here tall?
>   The man who is tall will leave. -- Will the man who is tall leave?

After this, he proceeds to argue that H2 is more nearly correct and to picture the child as some sort of linguistic genius for being able to determine this. The argument then is that language is so complex at this point that it cannot be learned from the evidence; it must be determined by neurological structures. Therefore, the child's ability to use and understand language is innate. But even if this is true, as Seidenberg (1994: 392) points out, "...networks can learn to solve problems in the face of inconsistent training." Therefore, irregularity in the thing to be learned does not prove that it is innate. (See also Hacker (1990: 142).)

The curious thing about the Chomskyan argument, however, is that, for its effectiveness, it relies on a left-to-right, linear (serial) processing model by Chomsky's own admission, in his words, "...process... from beginning to end (left to right), word by word..." (1980: 39). The reason that this is such a curiosity is that very few, if any, serious linguists or language theorists (Robertson et al. 1993) in the twentieth century have put forward a linear processing model as capable of describing language. The argument is even more curious since Chomsky himself does not adhere to a linear processing model in his theorizing about language. The transformational generative grammar model is hierarchically organized, utilizing concepts such as the transformational cycle, d-structure and s-structure and the ordering of transformational or movement rules. Further, both he and his followers suggest that his model is psychologically real, that is, it models the human brain and/or neurological processes. (See, for instance, Pritchett (1991: 253).)

Now, if, in fact, hierarchically organized models do best describe language and if, in fact, information is hierarchically organized in the brain, then the difficulty of extracting the correct auxiliary for the production of the yes-no question in (2) is non-existent. In such a model, the auxiliary could quite well be extracted for both the sentences at (1) and at (2) in the same manner. The embedding of the relative clauses at (2) could come after the extraction of the auxiliary in some sense of the word or another. This kind of a model can be illustrated by a diagrammatic schema of the following type.
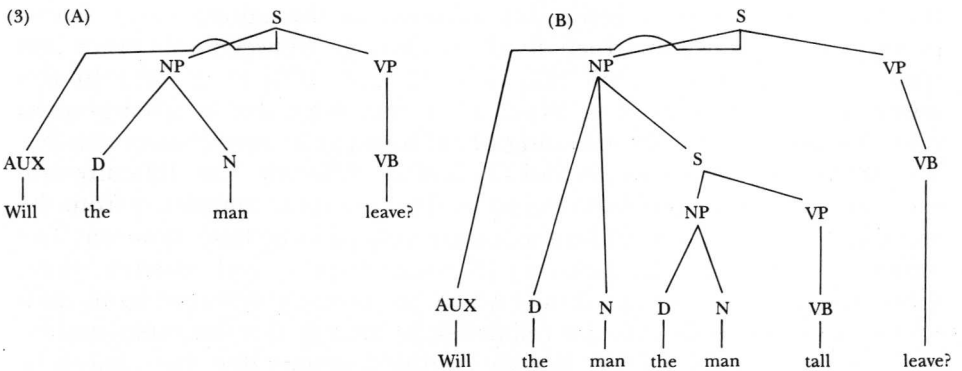
(The above diagrams are similar to those used in a conventional Chomskyan model; however, they are amended to show the extraction of the auxiliary in both instances -- (A) and (B).) It should be apparent that if a top to bottom processing is used in conjunction with a right-to-left processing, extraction of the correct auxiliary is no more difficult in sentence (A) - - Chomsky's(1) --than in sentence (B) -- Chomsky's (2). And Chomsky is in error to say that they are different. He can only make his claim by using a left to right, linear processing model. Since the diagrams, (A) and (B), and the statement which precedes them represent models of neural organization and abstract entities which are manipulated in the brain, they are thus adequate models in the sense that Mendelian law is an adequate model for describing transmission of genetic characteristics from one generation to the next. For this reason, Chomsky's argument is pre-empted by the use of more adequate models of linguistic processing, including his own model. His argument is not valid; it does not prove what he insists that it does. When viewed from an adequate perspective, language is not as complex as Chomsky says that it is.

Similar statements can be made about other arguments from syntax that Chomsky (1980: 40) uses to support his belief that language is excessively complex and cannot be learned. For instance, he looks at the pair of sentences at (4) and (5) and concludes that they are nearly synonymous.

(4)   Each of the men likes the others.

(5)   The men like each other.

He then looks at the sentences at (6) and (7) and is surprised that the condition of near synonymity does not hold for them.

(6)   Each of the men expects John to like the others.

(7)   The men expect John to like the others.

Again, Chomsky's argumentation is curious. The curiosity stems from the fact that Chomsky ostensibly adheres to the autonomous syntax position - -a hypothesis which forces a cleavage between semantics and syntax. (See Chomsky 1965: 226, note 15 and 1975: 41-42, 82.) In this argumentation, he is arguing largely from semantics, that is, his argument relies on the fact that the meaning of (4) and (5) is somewhat similar but the meaning of sentences (6) and (7) is quite different. The difficulty with the argumentation from these examples does not stem completely from the fact that Chomsky is not faithful to his presuppositional base, however. The difficulty stems from the fact that Chomsky tries to find patterns where there are none; he groups things which are entirely different from each other and then finds that the relationships among the dissimilar entities are very complex. And since they are complex, he says that they cannot be

learned. They must be innate. This can be seen by the fact that, in the first place, sentences (4) and (5) are not all that similar in meaning. In (4) the plural of *other* has a collective meaning; each of the men like the other men as a group. In (5) the meaning of plurality associated with *other* is distributive; each of the men like the other men as individuals. In the second place, sentences (4) and (5) are syntactically quite different and should not be treated as though they are similar. In (4), *each* is in construction with *of* and signals what at one time was known as a partitive construction. In (5), *each* functions as a determiner with the noun, *men*. In the third place, verbs like *expect* are not transparent in the sense that the meaning of the subject 'sees through' to the predicate. *Happen* and *seems* are verbs like this: *It seems that John likes Mary / John seems to like Mary*. But *expect* is not a verb of this type. Chomsky's attempt to force it into this category produces the complexity that he finds. In short, there is no reason at all to compare sentences (4) and (5) with sentences (6) and (7) or to compare sentences such as (6) and (7) with sentences such as (8) *The men heard stories about each other*. They are completely different and their comparison throws no light on the structure of English whatsoever. For these reasons, Chomsky's argumentation is simply incorrect and language is not as complex as he would maintain. The complexity is caused by the fact that Chomsky tries to find patterns where there are none; he groups things which are entirely different from each other and then finds that the relationships among the dissimilar entities are very complex.

In another of his works, Chomsky (1975:101) pursues the same kind of argumentation. He finds it surprising that sentence (8) (Chomsky's 29) is ungrammatical but that sentence (8') (Chomsky's 29') is grammatical.

(8)   *it seems to us that Bill likes each other.
(8')   it seems to each of us that Bill likes the others.

He says that there is "...no semantic reason..." why the sentence at (8) "...should not have the same meaning..." as the sentence at (8'). This may be so. But there is a syntactic reason why they do not have the same meaning. The embedded sentence at (8) is ungrammatical: *Bill likes each other* and it also makes no sense whatsoever; that is, it cannot satisfy pragmatic rules for any situation in the knowable world. But the embedded sentence at (8') is grammatical and it makes good sense: *Bill likes the others*. Why Chomsky should compare groups of words that simply have the same lexical tokens: *each* and *other*; *Bill* and *like*; and expect them to have semantic and syntactic similarities is simply curious. It is not only curious; it is incorrect argumentation since he ostensibly holds to the autonomous syntax position but looks at the meaning of individual words, lumped together in odd orders, and expects to come out with sensible conclusions. It is no wonder, then, that English syntax to him seems to be mysteriously complex and requires that he formulate the innateness hypothesis to explain how it is learned.

This leads to the kind of evidence that Chomsky uses to support his theory building. For example, he uses the following sentence as a grammatical sentence:

(9)   Here is the student that my attempt to talk to scared to death.
        (Chomsky 1982: 44).

Now, it is possible to create such a 'sentence' and even to understand it. But it is the contention here that such a sentence would never occur in natural conversation and hence when it is used as evidence, the evidence is spurious. Similarly, sets of sentences such as the following exist only in various writings of transformational grammarians:

(10)   a. I forget who filed every article without reading it.
          b. I forget who filed which article without reading it.
          (Chomsky 1982: 44)

(11)   a. Not to seem happy is a prerequisite for Writing Novels.
          b. *To seem not happy is a prerequisite for Writing Novels.
          Pollock's (22a) (1989: 376).

Requiring the grammar to distinguish between sets of sentences such as these, which are probably not a part of natural language use in any case in that they probably have never occurred in English, makes the grammar unnecessarily complex. It also creates the view that language is excessively complex. Similarly, the grammatical judgements in the sentences at (11) seem incorrect; the two sentences are equally grammatical or ungrammatical.

(11)   a. Not to seem happy is a prerequisite for Writing Novels.
          b. *To seem not happy is a prerequisite for Writing Novels.
          Pollock's (22a) (1989: 376).

Attempting to have the grammar of English discriminate between sentences such as (11a) and (11b) makes the grammar excessively complex.

Besides these arguments, there is also the possibility that the Chomskyan view of language, arising out of the Aristotelian philosophical tradition, makes language appear to be excessively complex. In particular, it is possible to look at a phrase from natural language such as *The shooting of the hunters* and to parse the sentence so that in one reading the noun, *hunters,* is subject and in another reading the noun, *hunters,* is object. (The example is from Chomsky (1957: 88).) But the question is this: Do native speakers when they encounter the language in its natural state, that is, within the context of situation or within the context of a written or spoken discourse, parse the sentence prior to uttering or understanding it? The

answer to the question is: Probably not. Antal has commented on this stating:

> 'Disambiguation' almost never occurs in the everyday practise of the native speaker and hearer. The speaker generally 'knows' what he wants to say and formulates his speech according to his intended message. While speaking he doesn't 'select' one interpretation from among several, but he uses the most obvious one in order to achieve his goal, usually without the faintest idea of other possible interpretations of the sentence which he happens to use momentaneously (1989: 349). (See also Tabossi and Zardon 1993.)

Similarly, experimentation by psychologists during the 60's and early 70's could not demonstrate the existence of transformational processes or the fact that native speakers, in some sense or other, parsed sentences in their attempt to process the meaning in them. As Wilks (1987: 198) has stated "...psychological experiment has consistently failed to confirm the reality of the structures Chomsky has predicted. ..."

In support of this, consider the following: What if the Aristotelian tradition has simply led generations of grammarians and linguists to look at language in an incorrect fashion? Although it is possible to analyze the phrase *The shooting of the hunters* so that in one reading the noun, *hunters,* is subject and in another reading the noun, *hunters,* is object, is it necessary to do so? In any natural environment, the speaker/hearers know intuitively who is doing the shooting and who is being shot. Perhaps, language simply provides rather inexact symbols to which language users attach meaning which they infer from the context of situation or from the context of a written or spoken discourse and the meanings 'subject of', 'object of', etc. are not to be found in the concatenations of the verbal symbols at all. Uhlenbeck (n.d. p. 28) is very close to formulating such a concept when he discusses the very topic and points out that *The shooting of the soldiers* is ambiguous in a 'reciprocal' reading versus a non-reciprocal reading, whereas *The shooting of the soldier* is not. He also points out that the ambiguity of the reading cannot be attributed to the plural because the *The shooting of the gang* is ambiguous in the same way that *The shooting of the soldiers* is. He goes even further to suggest that *The broiling of the duck* would not normally be read with *duck* as the subject of *broil* but it could be read this way if the duck under discussion was a mythical hero in a fairy tale. Thus the meaning inherent in any collocation of language items would be attributable to the meaning derived from the context of situation or from the context of a written or spoken discourse and not from notions of 'subject', 'object', 'agent', 'instrument', 'noun', and 'verb' inherently attached to collocations of lexical items. In this sense also, the meanings of 'subject', 'object', 'agent', 'instrument', 'noun', and 'verb' would be derived indirectly from the context also.

Such a view of language would accord well with more recent views of language such as that of the connectionists (Parallel Distributed Processing

-- PDP). The reason for this is that connectionism provides for computer simulation of learning, including language learning, through the scanning of input and the adjustment of 'weights' in 'networks' until the desired output is achieved. In the words of Fodor and Pylyshyn (1988: 6) connectionist "...networks can be made to learn; this is achieved by modifying the weights on the connections as a function of certain kinds of feedback..." To accomplish this simulation of learning connectionists start with ill-defined units which are modified in the networks. As a result, connectionism (PDP) does not utilize the notion of rules governing specific units; it rather changes the notion of "rule" to "lawful" or a generalization of series of connections or associations over a number of connections. In terms of Rumelhart and McClelland, two of the principal proponents of associationism, language is not a "rule-governed" phenomenon. They state (1987: 196):

> In our network models, the mechanisms that process language are constructed in such a way that there are no rules anywhere in them. Acquisition occurs by a simple process of adjusting connections between units. The behavior of the models is lawful (as lawful, we would argue, as the human behavior it simulates), but it is not based on the formulation or consultation of rules.

Thus, according to them, although language is not "rule-governed", it is "lawful" like other forms of human behavior.

Gasser expands this notion in a series of rhetorical questions:

> What if the adult 'grammar' is not a neat one after all? What if the best characterization of adult 'performance' is one quite unlike the idealized picture that generative theory would have us believe in? Once we are willing to accept the possibility of an adult system in which redundancy is rampant, concepts are fluid, metaphor is a fundamental process, and exceptions are the rule, our picture of the learner and our research strategy change dramatically. Rather than focusing on innate constraints, our work seeks powerful ways of extracting regularities from the input. Using these techniques, learners are free to examine the input and decide for themselves whether and where lines are to be drawn. (1990: 196)

In any case, because of the nature of connectionism, language is not viewed as composed of units with properties inhering in them, a view which results in the view of language as rule-governed; rather, language is composed of units which change given the nature of the input.

At this point, it might be interesting to speculate on recent debates about whether meanings are precisely fixed onto linguistic items. These debates usually take an all-or-none form with commentators such as Harris (1981: 155) and Sampson (1980b: 48, 68) insisting that they are not and those such as Pateman (1987), that they are. The point here would be that they are precisely fixed for certain contexts, but they are not for others. Thus, in the context of a cattle ranch the phonological form of *The sons*

raise meat would mean one thing; in the context of a sunrise, *The sun's rays meet,* would mean quite another thing. And the phonological form/reyz/ would function at one time as a noun and another time as a verb. Their behavior is lawful but neither 'noun-ness" nor 'verb-ness' inhere in the lexical item/reyz/and cannot be predicated by rule in the Chomskyan sense. The same could be said of 'Time flies', which in a discussion of how time passes means one thing and, in a discussion of the speed of racing insects in a mythical story, would mean quite another - -the response to the first would be, 'It does, doesn't it' and to the second, would be 'I can't; they go too fast.' In the first, *time* is a noun, an abstract entity; in the second, it is a verb, used to express action. In the first, *flies* is a verb, used to express a kind of motion; in the second, it is a noun, in the plural, used as a name for an insect. Form, function and meaning in language come together only in the context of situation or the context of discourse. When the context changes, the form, function and meaning all change together. Only a system such as the one postulated by connectionists can easily accommodate this fact. Pulling language out of context and trying to puzzle through descriptions of it out of context is a useless endeavor which changes the study of language into the study of abstract tokens bearing little or no resemblance to the thing studied. It also makes language appear more complex than it really is.

Thus it is that, in the context of situation, none of the participants who understand that context need a theory of government and binding or traces that index pronouns or similar mechanisms to comprehend the sentence:

(12) John knows who gave it to him.

The tokens in the utterance are sufficiently vague to allow meaning to be attached to the lexical items which then allow the function and the form to follow along. If a participant were to come late to a conversation in which such a sentence were used and not understand the situation, then that individual would have to ask:

(13) Who gave what to whom?

But traces, theta-roles and empty categories do not help in the understanding of the utterance; the context does that either in the form of the situation or the discourse. Traces, theta-roles and empty categories only serve to make language appear unnecessarily complex. As Love (1989: 273) has pointed out: "The point is that speaking and understanding are activities that are carried on in a real world which is quite unlike the artificially simplified world of the experimental laboratory." And it might be added, speaking and hearing do not go on in the artificial laboratory of the linguist whose every sentence is the creation of an active brain in the laboratory situation, not in the real world, "...an ideal speaker hearer in a

completely homogeneous speech community" (Chomsky 1965: 6).
Language is a social fact, "...rules, constituting conventions to which
existing speakers are party..." (Love 1989: 278. See also Itkonen 1978).

The great innovation of connectionist devices is that PDP permits
digital devices to function as analog devices and thus makes them more
adaptable to the assignment of meanings in context and, consequently, to
the fuzziness of sets which are so characteristic of language (Love
1989: 280-281). As Eikmeyer and Rieser have shown: "... meanings are
not fixed objects of any sort, they are fuzzy, flexible and open to ad-
justment. ..." (See also Rieger (1981: 195).) And as a result, the form and
function of linguistic items change depending upon their meaning and
use. It is no wonder then that "...natural language categories, such as noun
phrase, clause, etc. ... are fuzzy and that rules of grammar do not simply
apply or fail to apply, but apply with more or less 'strength'..." (Ross as
quoted in Lakoff 1982: 154). Thus it is that connectionist (PDP) systems
are more adept at modeling natural language. As Clark (1989: 110) points
out:

> The power of PDP systems to shade meanings across a whole continuum of cases
> enables them to model a number of effects. Most straightforwardly, it enables
> them to disambiguate words according to the context built up by the rest of the
> sentence.

Such a system, since it can accommodate the notion of 'context',
makes language appear more simple than other competing language
models.

Furthermore, since PDP models generate or produce both the irregu-
lar and regular forms of language from a single type of model, the view that
they give of language appears less complex from that of competing views.
Seidenberg (1993: 234) says that connectionism (PDP) changes the way we
think. Connectionism encodes "...both rule-governed cases and exceptions
to the rules." Similarly, as Pinker and Prince (1988:73) admit:

> Rumelhart and McClelland have described a connectionist (parallel distributed
> processing) model of the acquisition of the past tense in English which
> successfully maps many stems onto their past tense forms, both regular (*walk/
> walked*) and irregular (*go/went*), and which mimics some of the errors and
> sequences of development of children.

Certainly, such a system produces a view of language which is less
complex than a system which must have rules to describe the regularities of
language and a lexicon for the listing of irregularities. It turns out that the
PDP models not only give a more adequate view of how a single mechanism
can account for both regular and irregular forms, but it also accounts for
errors that children make in learning the language and errors made by
aphasics. Clark (1989: 169) argues the latter point in the following fashion:

...imagine a kind of damage that decrements *all* the connectivity strengths by 10 per cent. This could move all the irregular words below the threshold while leaving the originally strong regular pattern functional.

Certainly, a view of language produced through a single mechanism that can account for errors of children increasing their use of language and aphasics involved with decrements of language usage, to say nothing of a system which can account for 'shades of meaning' or the construction of ambiguities, on the one hand, and metaphors, on the other, sees language as not being extraordinarily complex.

So it is, then, that language viewed through the eyes of a transformationalist is excessively complex, too complex to be learned in any meaningful sense of the word. But it can be shown that the transformationalist's view of the complexity of language is marred by incorrect argumentation and it is also marred by incorrect use of evidence. Further, the transformationalist view of language may be incorrect. If this is so and if the connectionist view of language has a measure of truth, then language is, in fact, more simple -- probably simple enough to be learned. And since this is so, then, "...it is possible to bring back more emphasis on teaching/ learning in second language acquisition theory since connectionism focuses on learning... (Shirai and Yap 1993: 127)."

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