ABSTRACT
        To the question of whether Chomsky's hypothesized
Language Acquisition Device (LAD) in young children is an adequate
and feasible model of language acquisition, this paper answers that
LAD should be reformulated so as to include semantics; that
"informant presentation" rather than "text presentation" is
responsible for language acquisition; and that nonlinguistic
knowledge may be crucial in syntax acquisition. The first argument is
supported by experiments which show that learning strategies differ
according to whether or not the learner has semantic information. The
second argument is supported by experiments which show that parents
present semantic-specific and phonology-specific feedback to the
learner, and, indirectly, syntactic feedback. Finally, situations are
discussed in which nonlinguistic knowledge may be the basis for
linguistic hypotheses. The paper's conclusion is that this approach
may lead to insight into the link between cognitive development and
language acquisition. (AM)

WHAT SHOULD LAD LOOK LIKE?

SOME COMMENTS ON LEVELT[*]

Eve V. Clark
Stanford University

1.0   The previous paper by W.J.M. Levelt, "Grammatical inference
and theories of language acquisition," has raised some important
points about the validity of the Language Acquisition Device (LAD)
that has been posited as an explanation of how the child learns lan-
guage. Levelt has brought up two issues: first, whether LAD is
adequate in principle, which he argues has not been shown, and sec-
ondly, whether LAD is a feasible model of language acquisition. (As
a model, it has virtually been ignored within current language acqui-
sition research.) Levelt's paper constitutes a much-needed airing
of the issues related to a model like LAD; he makes a strong case
against LAD in its present form, and appears to be suggesting that
an empirical, rather than a rational, approach might be a more prof-
itable one to pursue. I shall argue, however, that, first, there is
evidence from work on the learning of artificial languages that should
lead us to reformulate LAD so as to include mechanisms pertinent
to semantics as well as to syntax. Once this change is effected, it
becomes possible to argue that the child actually acquired language
on the basis of <u>informant presentation</u> rather than <u>text presentation</u>.
Furthermore, the restricted nature of the input to the child raises
questions about the validity of using learnability criteria from com-
puter science. Thirdly, I shall discuss a little of the recent work
on the cognitive basis for language acquisition, and suggest that the
child's non-linguistic knowledge may also play a crucial role in the
acquisition of syntax.

2.0 <u>LAD: Syntax and Semantics</u>

In Chomsky's early discussions of the form taken by LAD, he
minimized the role of semantics, and suggested that it was unrelated
to the mechanism of language learning although it might provide the
motivation for learning (e.g. Chomsky, 1962). Later, Chomsky took
a somewhat stronger position which appears to have been based on
an experiment by Miller and Norman (1964). In this experiment,
subjects had to discover the rules for producing admissible strings
of letters in a miniature language. The subject began by typing on
a computer what he thought might be a grammatical string; if it
was, the computer went through various operations corresponding to
the letters used (this acted as the semantic reference system for the
language); if the string was not admissible, the computer simply
typed the word <u>wrong.</u> Miller and Norman (1964) found that subjects
learning the language with semantic reference appeared to learn in
exactly the same way as subjects not given any semantic information.
This led Chomsky to claim:

"Thus it has been found that semantic reference ... does
not, apparently affect the manner in which the acquisition
of syntax proceeds; that is, it plays no role in determin-
ing which hypotheses are selected by the learner [Chomsky,
1965, p. 33]."

However, as Moeser and Bregman (1972) have pointed out, semantic
reference in the Miller and Norman study is only incorporated after
the subject had produced a syntactically correct sequence of letters.
Since the semantic input was not available at the time when subjects
were making their hypotheses about syntactic structure, it is hardly
surprising that it did not affect these hypotheses. More important,
though, is the fact that this kind of experiment cannot be said to tell
us anything about the possible role of semantics in the formation of
hypotheses about syntax.

Moeser and Bregman (1972) have recently explored the effects
of knowledge of a small 'referent world' on the acquisition of syn-
tactic rules in several miniature languages, of differing complexity,
used to describe that world. The miniature linguistic systems were
presented under four different conditions: (i) words-only where the
subject received no semantic information at all; (ii) arbitrary word-
figure relations between the language and the referents; (iii) word-
figure correlation where visual design features in the referent figures
indicated the class-membership of words; and (iv) syntax-correlation,
where words referred to figures that incorporated both visual design
features that defined class-membership and visual reasons for selec-
tion restrictions at the syntactic level.

The results suggest very strongly that the strategies employed
in learning the miniature linguistic systems differed depending on
whether the subjects were given semantic information or not. If
they had the semantic referents (the figures) present during learn-
ing, their strategy appeared to consist of (a) associating each word
with its referent; (b) learning the specific rules of the reference
field (the ways in which the referent figures were organized); and
(c) learning to map words referring to the relevant aspects of the
visual field onto the sentence positions. Thus, subjects in the syn-
tax-correlation condition reliably learnt significantly more about
the syntactic rules than those in the words-only condition. In the
latter (words-only), subjects tended to try to learn the relative posi-
tions of words (cf. Braine, 1966, 1971), and failed to learn most of
the syntactic rules. Some subjects in the second condition (arbitrary
word-figure relations) also tried to learn word positions, although
more of them attempted to use the semantic strategy of learning the
association between words and figures. This semantic strategy was
also used in the word-figure correlation condition.

These results led Moeser and Bregman to conclude that:

"It is only when the elements in the reference field mirror
the syntactic constraints of the language that complex gram-
matical relations are easily acquired. As the only major
difference among the three semantic reference conditions
was the way in which the referent field was organized, it
appears that the information obtained from this perceptual
organization plays an important role in the learning of
grammatical relations [1972, p. 769]. "

These data strongly suggest that semantic information does affect the
manner in which the subject (or child) approaches the learning of syn-
tactic rules, contrary to Chomsky's (1965) assumption. Without any
semantic information, subjects simply tried to learn the relative
positions of words. In contrast, when they were given semantic in-
formation, they used very different strategies, first associating word
and referent, then learning how the referent field was organized, and
finally mapping that knowledge onto the relative positions of words.

One important conclusion that could be drawn from this is that
the notion of LAD, the Language Acquisition Device, should be modi-
fied so as to include semantics. This is particularly important if it
is indeed the child's organization of non-linguistic knowledge about
the properties of objects and their relations in the world that provides
the basis for his first linguistic hypotheses about the structure of his
first language. This approach suggests that more attention should
be paid to the non-linguistic knowledge that the child relies on in work-
ing out the semantics and the syntax of his first language. Some pre-
liminary steps have already been taken in this direction by a number
of researchers in the field of language acquisition. These will be
discussed further in Section 4 below.

3.0 The nature of the input

One assumption that seems to be implicit in the discussions of
learnability is that the input consists of the utterances possible in
English, and not a simplified subset of such utterances. A number
of early discussions have made fairly strong claims on the basis of
impressionistic analyses of adult-to-adult speech when considering
the input data available to the child. Beve , Fodor and Weksel (1965),
for example, characterized adult speech as being full of performance
errors (false starts, lapses of memory, changes in construction,
pauses, hesitations, etc.) and implied that this was all the child re-
ceived by way of language data. Other investigators have assumed
that most of the input comes from adult-to-adult speech overheard

by the child. From this, it has been concluded that the child could
not possibly learn the syntax of his language unless he was endowed
with some innate, language-specific, mechanism for just that purpose.

Many of these claims have since been modified. Labov (1970)
has contested the view that most adult-to-adult speech is ungrammat-
ical and full of errors, and has shown that it is actually almost error-
free. Furthermore, other investigators have found that adult-to-child
speech actually differs markedly from adult-to-adult speech. For
example, adults generally use short, simple, completely grammatical
utterances to young children (Brown and Bellugi, 1964). In several stud-
ies that included adult-to-adult and adult-to-child comparisons, it was
found that adults use much shorter, simpler sentences, with less em-
bedding and fewer inflections the younger the children being addressed
(e.g. Sachs, Salerno and Brown, 1972; Snow, 1972a). Adults also
tend to pause exclusively at sentence boundaries with very young chil-
dren, though not with older children where pauses occur equally often
within the sentence (e.g. Broen, 1972). Syntactically, adults appear
to use more and more complex structures as the child gets older; it
is not clear how closely this is matched to the child's own development
but there is some evidence that the child's level of comprehension may
play a role in which structures are selected by the adult (Ervin-Tripp,
1971; Shipley, Smith and Gleitman, 1969; Snow, 1972b). Adults speak-
ing to children tend to use many fewer negative sentences, but many
more questions. Ervin-Tripp (1970) has suggested that this is because
the adult is continually checking to find out whether the child has under-
stood or not. Speech to young children is characterized by exaggerated-
sounding intonation patterns, and high pitched, fairly slow delivery.
It also contains a high incidence of repetitions, and an even higher one
of paraphrases (Snow, 1972a).

Adult-to-child speech also seems to contain, on the adult's side,
a number of explicit training situations. New lexical items are pre-
sented in familiar frames, e.g. Here's a _____, Look at the _____.
The child's own utterances are expanded to the adult form, or else
the adult does what has been called 'modelling,' i.e. taking the child's
utterance and saying other things about the same situation, e.g.
Child: This rabbit, Adult: Yes, rabbits have very soft fur and long
ears, don't they?. Adults also present the child with question-answer
sequences that could be regarded as models for conversational inter-
change as well as a source of information about word classes, e.g.
Adult: Where's the ball? Here's the ball. The adult speaks more
slowly, uses routines, and through the 'training sequences' provides
the child with a good deal of explicit information about the segmen-
tation of utterances, word class membership and syntactic relations
(cf. Clark, in press).

The modifications made in adult-to-child speech are similar in some respects to the kinds of modifications commonly made to foreigners who do not speak your language (Ferguson, 1971). Furthermore, they are early learnt by the child who is still trying to master the adult language. Shatz and Gelman (1973), for example, found that even four-year-olds systematically modified their speech in addressing two-year-olds (cf. also Berko Gleason, 1973).

These modifications on the part of adults and older children in addressing younger children suggest that the input that the child has to work on in constructing a grammar for his language is specifically simplified so as to make certain structural properties easier to learn. Clearly, this issue requires further investigation, but it does raise the question of whether the learnability criteria applied to different language types in computer science can be applied directly to natural language. The actual input data changes in complexity as the child's knowledge of the language structure increases.

I would like next to turn to the two learning situations discussed by Levelt: text presentation versus informant presentation. With text presentation, one simply gets language input, and receives no further information. The child has to assume that the input sequences are all correct sequences. With informant presentation, on the other hand, one should receive corrections and explicit information about impossible as well as possible sequences. Many investigators have been struck by the fact that parents do not correct their children's sentence structure (e.g. Brown, 1973; Brown and Hanlon, 1970), and, because of this, Braine (1971) concluded that the child receives the equivalent of text presentation only, whereas informant presentation seems to be necessary for learning. Since children do learn language, we will have to re-examine this question of text presentation vs. informant presentation from a slightly different viewpoint.

If LAD is reformulated to include those mechanisms necessary for the acquisition of semantic structure as well as of syntax, then it could be argued that the child actually receives informant presentation about his first language. Parents first of all convey to the child very directly whether or not they have understood him. Non-comprehension presumably pushes the child to try other forms to express his meaning. Secondly, parents do make explicit semantic corrections, and approve or disapprove the child's utterance on the basis of its truth value. In other words, parents give the child feedback about whether his utterances constitute a good 'match' for the situation they are apparently meant to describe, e.g.

Child: There's the animal farmhouse.
Parent: No, that's the lighthouse.

As Brown and Hanlon (1970) pointed out:

> "Approval and disapproval are not primarily linked with
> the truth value of the proposition, which the adult fits to
> the child's generally incomplete and often deformed
> sentence. And so, though Eve makes a grammatical
> error when she expresses the proposition that her mo-
> ther is a girl with the utterance He a girl, the prop-
> osition itself is true and since it is the proposition rather
> than the grammar that governs response, the response
> is approving.
>
>   ...While there are several bases for approval and
> disapproval, they are nearly always semantic or phono-
> logical. Explicit approval or disapproval of either syn-
> tax or morphology is extremely rare in our records,
> and so seems not to be the force propelling the child from
> immature to mature forms [pp. 47-48]."

Truth value, therefore, seems to be more important than syntactic
form; and truth value is fairly directly tied to the semantics used
by the child, as in the correction of the child's naming cited above.
This form of correction is found in the early diary studies, and would
obviously provide the child with direct information about category
names, category boundaries and appropriate descriptions for rela-
tions and events.

The lack of parental feedback specific to syntax may not matter
if, as Moeser and Fregman's (1972) data suggest, semantics itself
is integral to the acquisition of syntactic structure. We could sup-
pose that the child too starts by trying to match up words with the
objects around him, on the basis of knowledge he already has (e. g.
Clark, 1973a, 1974). At the sam : time, he begins to look for corre-
lations between his non-linguistic knowledge of how objects and events
are structured, and the sequences of words used by the adult to de-
scribe particular situations.

4. 0 A cognitive basis for language

The child spends the first year or two of his life taking in his
surroundings and organizing his knowledge about them. He learns
a good deal about the properties of different objects (their shape,
size, ability to move or make a noise, etc.) and about possible re-
lations between objects (e. g. that object x can move, and can move
y, but not vice-versa; that object z has a certain orientation, etc.).
It is this kind of non-linguistic knowledge that often appears to be
the basis for the child's first hypotheses about what words mean.

His dependence on such knowledge is clearly shown by his over-extensions of words where his first hypotheses about word meanings seem to be of the form: "A word refers to some identifiable [perceptual] attribute of the object pointed to." This leads the child to assume that the feature (or set of features) he has picked out is the meaning of that particular word, so that any other objects that 'match' on the feature(s) in question can be named by the same word (Clark, 1973a, 1974). As a result the word dog may, for a while, be used to refer to horses, cats and sheep as well as to dogs.

The non-linguistic basis for the linguistic hypothesis is fairly clear in the case of the over-extension data. It is less clear, however, when we come to the child's hypotheses about relational terms such as prepositions or verbs. What kind of non-linguistic basis does the child have for his hypotheses about linguistic structures such as The rabbit is under the bush, The man threw the rock, or The boy picked up the rabbit after he shut the door? Although there has been an increasing interest in the kinds of strategies that children bring to the task of learning language (e.g. Bever, 1970; Slobin, 1973), as Levelt points out, there has been very little research on whether these strategies are specifically derived from the linguistic input provided to the child, or whether they might have some more general cognitive source. If the child is relying on non-linguistic knowledge in analyzing and interpreting his linguistic input, the same (non-linguistic) strategies should show up in tasks where there is no linguistic input. It could then be argued more plausibly that these cognitive strategies provide a basis for hypotheses about the meaning of language structures.

In a recent study of the acquisition of locatives like in, on and under, I found that very young children (aged 1;6 - 2;6) depend on certain non-linguistic strategies prior to comprehension of the prepositions. The strategies were used both in the comprehension tasks they were given and in other tasks where the child simply had to copy some array. I argued from this that the child's first hypotheses about the meanings of prepositions like in and on are based on his non-linguistic strategies. Because of this, some meanings could be regarded as cognitively simpler than others. The child should then find it much easier to learn the meanings of those words where his non-linguistic strategies happen to coincide with the actual meaning (Clark, 1973c).

There are a number of other studies that could be interpreted in a similar way. In the acquisition of more and less, for example, it could be a non-linguistic strategy ("Choose the greater amount") that provides the basis for child's linguistic hypothesis about the

feature [+Polar]. The word more should be easier to learn than less because responses based on the strategy coincide with the real meaning of more. This argument could also be extended to the positive members of many dimensional adjective pairs. The non-linguistic strategy of choosing the more extended object coincides with the meaning of the positive adjectives (Donaldson and Wales, 1970; Klatzky, Clark and Macken, 1973; Clark, 1973c).

Both Schlesinger (1971) and Bowerman (1973) have suggested that the child relies on semantic and cognitive information about classes of objects in coming to understand grammatical relations such as Subject-of and Object-of. In this instance, the non-linguistic know-ledge on which the child could be relying might be the following: The child knows that certain objects (or classes of objects) are able to perform particular actions, and that these actions result in a change in a further class of objects at a subsequent time. This could lead the child to make the linguistic hypothesis that Agents are always talked about before Actions or the Objects they affect, and hence to rely on a consistent parsing hypothesis that Noun-Verb-Noun se-quences are to be interpreted as Agent-Action-Object (e.g. Bever, 1970). On the other hand, it could be that the child has simply formed his linguistic hypothesis from the typical (adult) use of active sen-tences in English. At the moment, we have no way of deciding which of these accounts is the more viable.

Another situation in which the child may be relying on non-linguistic knowledge for his linguistic hypotheses is that in which the child uses order of mention in reconstructing the actual order of a series of events. When asked to act out sequences like The girl picked up the rock after she jumped the fence, young children treat the first clause as a description of the first event, and the second as a description of the second event (Clark, 1971; Ferreiro, 1971). They also tend to describe a series of events in the order in which they occurred (Clark, 1973b). The children could be using a non-linguistic strategy of acting-out and talking about events in the order in which they remember them, with the assumption that the events happened in that order. This strategy then leads them to make the linguistic hypothesis that the order of mention always reflects actual order. Here again, there is another possibility: Children may realize that adults normally talk about events in the order in which they occur, and it is this that could underlie their order of mention strategy.

While these present only a few situations in which the child's non-linguistic knowledge might plausibly be argued to underlie his first linguistic hypotheses about the meaning of new linguistic structures, I think it is clear that this approach may eventually provide us with some iঃ sight into the processing that links cognitive develop-ment and language acquisition. At the same time, this approach in no-way constitutes a rejection of rationalism. The child's non-linguistic knowledge gives every appearence of being highly structured according to certain built-in principles. These principles are what allow him to categorize and organize his interpretations of his per-cepts in such a way that he has a coherent body of non-linguistic knowledge onto which he can then map his first language (cf., e.g. H. Clark, 1973). If we are to find out what LAD really looks like, then we must clearly find out more about the child's own knowledge at the point when he begins to acquire language.

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