THE EFFECT OF SYNTACTICAL STRUCTURE ON IMMEDIATE MEMORY FOR WORD SEQUENCES IN MIDDLE- AND LOWER-CLASS CHILDREN*1

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A. Introduction

In an earlier study (26) with preschool children aged 3 to 6 years, the authors found differences in immediate memory for reordered four- and six-word sequences. Certain syntactical arrangements of a simple declarative sentence were better recalled than others. The relative order in which the various modifications of syntactical structure reduced recall remained constant between the ages of 3 and 6 years and was similar to that found at college age. The authors suggested at the time that by 3 years of age children have already developed responses to speech that reflect a general linguistic frequency characteristic of English: namely, the relative frequency of occurrence or consistency with which word-class sequences are found as units or sequences in adult English speech.

Since the study was carried out on a very homogeneous group of middle-class children who shared the same speech community, not only among themselves but in many respects with the adult group as well, the question arose as to whether the findings could be generalized to another group of children whose acquisition of English had taken place in a different speech community.

Recent literature is replete with studies describing differences in language between middle- and lower-class children. Cherry (7) found differences in comprehension of middle-class speech by the two groups; Lesser (22) found that lower-class status was correlated with a pervasive lowering of mental ability scales; Deutsch (9) described a language deficit that cumulated from first to fifth grade for children of lower socioeconomic status and that was most pronounced for variables that required the children to categorize. C. Deutsch (8) found that performance on Wepman’s auditory discrimination

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test correlated with tests of verbal ability and reading ability and hypothesized that children raised in noisy environments without much direct speech stimulation might well show deficits in discrimination and recognition of speech sounds. Templin (29) reports significantly poorer performance in about a quarter of her language measures, particularly in the areas of articulation of vowels and final consonants, grammatical complexity of remarks, vocabulary recognition at school age, and length of remarks at younger ages. John and Deutsch (19) also report shorter sentences for school children from lower-class than from middle-class backgrounds.

In view of the mass of evidence testifying to differences between these two groups, the authors felt that, in order for their results to have any validity as a developmental finding, they had to be replicated on a lower-class group. The authors, therefore, selected a group of lower-class urban, negro children for this purpose.

The study presupposes that any group of English speaking children is exposed to a corpus of the language that exhibits certain invariances that are characteristic of general English speech. In addition, it assumes that the linking of words through the discriminative properties that constitute their syntactical structure reduces the number of units that need to be encoded in an immediate memory situation. The authors, therefore, used a recall measure as an index of the salience of the syntactical structure in the material. Specifically, the declarative structure was presented intact and with reversals occurring in less and less likely positions: i.e., subject-predicate, verb-object, noun-modifiers, and complete reversal of word order. If the order in which the children recall the word sequences is consistent with the relative frequency characteristics of English word orders, it can be concluded that the children have made the discriminations necessary for utilizing the structures in encoding. If not, then such children might be assumed to be functioning at an earlier stage, where only gross initial units can be used to improve recall; other subdivisions of these units cannot yet be discriminated by them and, therefore, cannot increase their ability to recall such sequences over word sequences arranged in random order. In the case of older children in a lower-class group, it might be concluded that their language is modeled after different invariances than the same-age children from a middle-class group.

The question, therefore, that the present study attempts to answer is whether there are salient features in syntactical structure that remain intact despite large variations in the speech and language patterns of different communities and that can be utilized by young children to facilitate psychological functioning, such as immediate memory. A further question concerns the
problem of whether the ability to respond in this fashion to the structure of the language varies differentially with the age of the children in different groups.

B. Method

1. Subjects

The Ss consisted of 60 children ranging in age from 3 to 6 years, who were attending a New York City Department of Welfare Day Care Center. The Day Care Center serviced a low-income, predominantly American-born negro, ghetto neighborhood in Harlem. All the children were negro and came from lower-socioeconomic-status homes, more than half of which had no fathers living regularly in the home. The parents worked in domestic or other service occupations or were in the process of looking for work.

Comparisons will be made with another population of 45 nursery-school children reported on extensively in a previous study (26). The children of that study can be described as an all-white Jewish middle-class population of approximately the same age and schooling as the children in the present study.

2. Apparatus

A thorough description of the apparatus can be found in Salzinger et al. (26). Briefly, the apparatus consisted of a papier-maché clown's head with a red light-bulb nose, which could be turned on and off by E to supply reinforcements; a trinket dispenser for the same purpose; a wooden toy mallet; two tape recorders; and a burlap screen which, when placed on the table, separated the child and the stimulus display from E and the tape recorders.

3. Procedure

Before testing the Ss individually, the two Es visited them in their classrooms and read them an illustrated story about the adventures of "Happy the Clown." The story not only served the purpose of introducing the clown, but also elicited from the Ss, in a familiar group setting, the types of responses later required during individual testing.

Each S was then brought individually into the experimental room. He was seated in front of the papier-maché clown at the table and the microphone was hung around his neck. He was shown the clown, the trinket dispenser, and the mallet, and told that the clown would speak to him and play games with him. The clown then partly sang, partly spoke the following tape-recorded instructions (S° indicates reinforcement):

2 Mt. Morris Day Care Center. The authors would like to acknowledge the wonderful cooperation they received from Miss Berry, the director, and the staff of the Center.
[whistling.] I’m so happy \( S_r^1 \) = clown’s nose lighting up], I’m so happy \( S_r^1 \), I’m so ha-pa-pa-ha-pa-ha-pa happy \( S_r^1 \). Whoops, well hi there. My name is Happy. What’s yours? [S’s response] \( S_r^1 \). That’s a nice name. Say, how do you like that? Whenever I’m happy my nose lights up. You know what? I like you. If you say “hello” to me I’ll give you a present. [S’s response] \( S_r^1 \) \( S_r^2 \ = delivery of trinket.] Do you remember how we said “boo” to the lion? Well, if you say “boo” for me now, I’ll give you another present [S’s response] \( S_r^1 \) \( S_r^2 \).

The clown then had S imitate two identical series of taped auditory stimuli, one of rhythmic “boo’s” and one of rhythmic mallet taps. Each series consisted of nine items: one boo or tap; three equally spaced; four equally spaced; four, the first two and the last two equally spaced but separated by a longer interval in between (i.e., two—two); five; three—three; six; seven; three—four. Every response by the child was followed by \( S_r^1 \) and \( S_r^2 \): i.e., children were reinforced for attempted imitations, not necessarily correct ones. The following instructions were then given by the clown for the verbal response task:

Great! You’re just great. You’re just wonderful. Say, do you know my favorite game? [S’s response] \( S_r^1 \). Well, I call it silly mixed-up words. The silly mixed-up words I say are so silly and so ridiculous that even ferocious lions laugh at me. Say, I’ll bet that you can say some of my favorite mixed-up words. O.K.? [S’s response] \( S_r^2 \). Now listen carefully, and after you hear me say my silly thing, then you say it right after me. O.K.? [S’s response] \( S_r^1 \).

Twelve sequences of single syllable words were then presented, one at a time, for S to imitate. All attempts at imitation were reinforced by \( S_r^1 \) and \( S_r^2 \). Five different types of word sequences were used: (a) simple declarative sentence, (b) reversal of subject and predicate, (c) reversal of verb and object, (d) reversal of noun and modifier, and (e) complete reversal of declarative sentence.\(^3\) Two sequence lengths, one of four words and the other of six words, were used to sample each of the five types of reordered sequences. Two practice items were given to all the children initially. (See Salzinger et al. (26) for a sample list of stimuli and the orders of presentation.)

C. Results

In order to test for the relative effects of syntactical structure on recall as a function of age, the total group of 60 children was rank ordered by age and

\(^3\) The intonation and rhythmic patterns adopted for each stimulus were based on standard English intonation for the intact parts of each stimulus sequence, with pauses between the intact portions of about the duration of the pauses that ordinarily separate phrases.
then subdivided into five successive groups each comprised of 12 children. The mean ages and age ranges for each group can be found in Table 1.

Each child’s recall of a given stimulus word sequence was scored in two ways. The first was the largest number of correct words recalled in the order presented—the longest sequence of words recalled. The second was the longest sequence of lexemes recalled—a lexeme being defined as a child’s rendition of the stimulus word, which, although inaccurately inflected, indicated that he had perceived the meaning of the word. This procedure permitted the child changes in the inflection of any word, such as dropping of word endings indicating tense and number.

### TABLE 1

**Mean Age and Age Range in Years for Each of Five Age Groups**

<table>
<thead>
<tr>
<th>Age group</th>
<th>Lower class</th>
<th>Middle class*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M Age range</td>
<td>M Age range</td>
</tr>
<tr>
<td>I</td>
<td>3.7</td>
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<tr>
<td></td>
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<td>3.0-3.3</td>
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<tr>
<td>II</td>
<td>4.3</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>4.0-4.5</td>
<td>3.4-3.7</td>
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<td>III</td>
<td>5.0</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
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<td>3.8-4.4</td>
</tr>
<tr>
<td>IV</td>
<td>5.4</td>
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<td>5.8</td>
<td>5.0</td>
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<tr>
<td></td>
<td>5.6-6.0</td>
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</tr>
<tr>
<td></td>
<td>3.4-6.0</td>
<td>3.0-5.8</td>
</tr>
</tbody>
</table>

* The ages of these children are inserted here for ease of comparison. A detailed analysis of this group was presented in a prior study (Salzinger et al., 1966).

Analyses of variance using a three-way layout in a mixed model (27) were applied separately to the word and lexeme scores for both the four- and six-word sequences in order to determine the effect of age and structure of sequences on recall. Figure 1 presents the means of the longest sequence recalled as a function of age with the syntactical structure of the sequences represented as a parameter.

Significant differences (φ < .005) among the age groups were found for all the conditions, four- and six-word sequences scored for either words or lexemes. Inspection of Figure 1 shows that the increase in age is positively related to an increase in recall scores. The decrease in recall of words for the older children appears to be more a function of inaccurate word inflection (e.g., dropping word endings) rather than an inability to recall the sequential or syntactical organization of the word sequences, as can be seen when comparison is made of the sustained trend of the lexeme curves with the dip in the word curves for the oldest group.

The mean longest sequence recalled differed significantly (φ < .005) with respect to the five types of word sequences (see Figures 1 and 2) for both the
four- and six-word sequences scored for both words and lemmes. The differences, as in the former study, were more pronounced for the six- than the four-word sequences.

**FIGURE 1**  
Recall of stimulus sequences as a function of age with structure varied as a parameter.
None of the conditions produced a significant interaction between age and recall of types of word sequences ($\phi > .05$), indicating that there is no systematic effect of age on the order in which the various types of word sequences are recalled. The means graphed in Figure 2 show that immediate memory decreases with reorderings of constituent sequences of words in a simple declarative sentence in such a way that best recall is found for the intact declarative sentence [1], next best for the subject and predicate reversal [2], next for the reversal of verb and object [3], next for the reversal of nouns and their modifiers [4], and poorest for the complete sentence reversal [5].

These results are completely in accord with prior results obtained on a group of middle-class children (26). However, further inspection of Figure 2, which represents data from both groups, shows some interesting differences. Although the relative order in which reorderings of a declarative sentence produce decreases in recall is the same for both groups, the middle-class group shows better absolute recall of all the types of word sequences except for the six-word completely reversed sequences. This last may be an interference effect

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4 The numbers refer to the corresponding numbers on the abscissa in Figure 2.
of the lack of syntactical structure in longer sequences for the middle-class group (26). The difference in absolute recall scores for the middle- and lower-class group is probably more pronounced than appears when one considers the fact that the middle-class group is, on the average, nine months younger than the lower-class group.

One other interesting difference emerges upon inspection of Figure 2: namely, the effect of scoring the responses in terms of words or lexemes. The lower-class group shows a more marked improvement in recall of lexemes over that of words than the middle-class group. In an additional tabulation, the authors found that the proportion of the recall scores that could be attributed to imitation remained invariant with age. This indicates that the lower-class group is processing less information about the stimulus sequences than the middle-class group, whose imitation is much closer to the original stimulus.

A final comparison was made between the two groups of their performance on imitation of the two sets of nonverbal sequences—the tapping which required a nonvocal motor response and the booing which required a vocal motor response. Table 2 presents the proportion of children in each of the two groups who imitated each stimulus sequence correctly. There is a slight trend indicating better performance for the lower-class group, but chi square tests showed this pattern to be significant in only two instances. The difference in age between the two groups may well account for the slightly better motor performance in the lower-class group, and the result might be better interpreted as showing that the performance of both groups was the same.

**TABLE 2**

<table>
<thead>
<tr>
<th>Stimulus sequences</th>
<th>LC N = 60</th>
<th>MC N = 45</th>
<th>LC N = 60</th>
<th>MC N = 45</th>
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<td>.56</td>
<td>.62</td>
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<td>.36</td>
<td>.40</td>
<td>.40*</td>
</tr>
<tr>
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<td>.50</td>
<td>.38</td>
<td>.28</td>
<td>.33</td>
</tr>
<tr>
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<td>.60</td>
<td>.42</td>
<td>.40</td>
<td>.29</td>
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</tr>
<tr>
<td>3-4</td>
<td>.20</td>
<td>.04*</td>
<td>.12</td>
<td>.13</td>
</tr>
</tbody>
</table>

* .04 < p < .05 tested by chi square.
D. Discussion

Having replicated the results of their former study, the authors are led to conclude that preschool children from diverse speech communities (i.e., lower- and middle-class) make use of the same aspects of syntactical structure in facilitating such psychological functioning as immediate memory for verbal sequences. The order in which various syntactical arrangements of the words in a declarative sentence help the children to process information may well correspond to the relative frequency of distributional regularities in adult English. Furthermore, the fact that responses to modifications in the structure of the word sequences was not shown to change significantly with age (i.e., no significant interaction was found) indicates that children's ability to respond to some basic syntactical characteristics of the language is established quite early. There is, however, some graphic indication (see Figure 1) among the youngest children in the present study that the order of the various syntactical arrangements is not as clear as for the older children, although this was not statistically significant.

Since the speech communities of lower- and middle-class children differ, the corpus of English speech to which they are exposed should also differ. If, then, the children utilize the forms of adult speech as a model stimulus for imitation, discrepancies in the children's utilization of structural characteristics should emerge. The fact that such syntactical discrepancies were not found suggests that there are invariances of the relative frequency characteristics of word order common to very different speech communities, which have enough salience to act as effective stimuli. Studies describing these invariances and detailing the differences for adult speech (1, 12, 14, 15), particularly speech used when addressing children, are scarce. Furthermore, they have generally been performed on written material, which, conceivably, may turn out to show some differences in structure although there is some evidence to the contrary. Often the studies are carried out on single words or pairs of words rather than on the syntactically structured units, which have been described by many linguists, but whose distribution in actual speech has never been computed.

There is evidence from a number of sources in the literature that there is a "psychological unity" (23) for certain word orders, which is difficult to break down (18). The authors would choose to consider these response units (25). Those which emerge most often and earliest in studies of children's speech appear to be a function of the acquisition of predication (4, 5, 11, 20), in the early stages being called pivot and x-class words, and were found in the present
study, as well, where the reversed subject and predicate sequence served the children almost as well as the intact declarative sentence. That this response is so strong at such an early stage is not surprising when one considers that practically all adult spoken sequences exemplify it.

Granted that there is an underlying physiological appropriateness for the acquisition of speech in humans, the present authors do not see the need to fall back upon some inborn knowledge of the rules for basic structures, such as is postulated by McNeill and Fodor (13, 23), to explain why children of different speech communities in a language group grow up speaking essentially the same grammar. Rather, the authors prefer to consider the fact that living organisms can tolerate quite a lot of variability, or noise, in stimuli during the acquisition of response classes, and that, in fact, such variability often strengthens the response classes rather than changes them (17).

In some respects, however, we have found that the lower-class children differed from the middle-class children. One of these was the fact that requiring the children to imitate not only sequence but also inflection produced poorer performance among the lower-class children, whereas this requirement had no effect on the middle-class children's performance. Since the proportion of the recall scores attributable to inflection does not change with age for either group, it is our interpretation that the difference between the two groups reflects an inflectional difference in the corpus of speech to which the children of each speech community are exposed. In this area, too, there is a need for distributional descriptions of the structure of adult speech in different groups.

The present study also found an overall depressed level of performance in the lower-class children's recall of all types of verbal sequences, which was already in evidence at the youngest age level and which is more pronounced than might appear at first, in view of the fact that the lower-class group is somewhat older than the middle-class group. Both Deutsch et al. (10) and Lesser et al. (22) have claimed that an overall verbal deficit appears to be a function of class rather than racial or ethnic characteristics. That this is a verbal deficit only is supported by the fact that the lower-class children performed either at the same level or better on a similar nonverbal task, even when they were required to make a vocal response. What we seem to be dealing with here is not a generalized lack of attention or an inability to adapt to the testing situation, but the specific problem of depressed functioning in the verbal area.

There is a growing literature, some of it admittedly speculative (16), that attempts to explain why lower-class children should perform poorly in the verbal area. In general, the argument is as follows: Lower-class children live
in smaller, more crowded and noisy circumstances than middle-class children (3). Much of the adult speech heard around him by the child is not relevant to his functioning, with the result that he may, therefore, learn to tune it out (8). When it is relevant, it refers more often to less abstract topics and more concrete everyday functioning (e.g., commands) than speech directed at the middle-class child. Furthermore, many of the adult-child verbal interactions that are found in middle-class homes may not be found in lower-class homes due to the fact that there are fewer ritualized formal occasions for conversation, such as mealtimes (2, 9, 21). And finally, child care is not exclusively an adult task in lower-class homes, much of it being undertaken by older siblings. Cazden (6), who believes that the amount and richness of language stimulation available in the context of face-to-face interaction is important for speech acquisition, claims that differential exposure to the adult model accounts for the differences found among different subcultural groups.

It is the feeling of the present authors that the argument outlined above, although in some respects attractive and plausible, must be taken as hypothetical because the descriptions of the verbal environment in lower-class homes (and, for that matter, in middle-class homes) are based on indirect information-gathering techniques rather than on direct experimental or observational evidence taken in the homes themselves. A beginning, along observational lines, has been made by Vivian Horner, who recorded spontaneous speech in lower-class homes for long periods of time (28), and by Rheingold (24), who observed maternal care. Although Rheingold, herself, notes difficulties with her techniques, they are encouraging and could be extended so as to deal with language observation in homes. In addition, it would be fruitful to adapt some of the observational techniques utilized in anthropology for studying unfamiliar cultures.

E. Summary

A group of 60 urban, negro lower-class children aged 3 to 6 years were tested on their immediate memory for various reorderings of a declarative sentence. Recall increased with age and similarity to standard frequency characteristics of English.

These results replicated similar findings on a white middle-class group of approximately the same age. However, a difference was found between the groups with respect to the absolute recall of all the verbal sequences, although not for similar nonverbal sequences. The implications of the findings were discussed with reference to problems in acquisition of language and the effects of socioeconomic variables on children's language.
References


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