

ERROR, ANOMALY, AND VARIATION IN THE ENGLISH OF DEAF INDIVIDUALS

JOSEPH BOCHNER

Rochester Institute of Technology

This paper reports the results of an experiment designed to characterize recursive processes and their impact on constituent structure in the English of deaf individuals. Data gathered in this investigation indicate that subordinate clause markers such as *that*, *which*, *when*, and *because* tend to function as coordinating conjunctions in the English of many deaf individuals. This finding supports Bochner's (1976) contention that many deaf individuals tend to perceive, produce, and learn syntactic structures by arranging lexical items in a linear-sequential fashion without regard to hierarchical order and without specifying relations of subordination and superordination.

Conventional grammatical models of English and its normal development in hearing children have been used to characterize deviant language in deaf children and adults (Quigley, Wilbur, Power, Montanelli, and Steinkamp, 1976). These models, while providing useful conceptual frameworks for describing grammatical structures and their development at both normal and retarded rates, are not appropriate vehicles for describing fully developed linguistic constructions which deviate markedly from normal grammatical paradigms. Conventional grammatical and acquisition models do not, in and of themselves, contain adequate means of describing errors, some of which may belie severe language disorders. In any analysis of deviant language, errors must be described or accounted for in some way; consequently, systems for classifying error types have been devised and applied to bodies of data (Myklebust, 1965; Charrow, 1974). The basic categories contained in these typologies include errors resulting from additions, substitutions, and omissions of lexical items, morphological errors, and word-order errors. Typological analyses of errors necessarily focus a great deal of attention on lexical and morphological forms (i.e., errors involving articles, prepositions, bound morphemes, etc.), but make no mention of the potential for anomalies in constituent structure. Since they concentrate solely on the linear arrangement of words in sentences and take constituent structure for granted, typologies cannot account for errors above the word-level (i.e., errors in phrase or clause structure). Thus, like grammatical and acquisition models of standard English, typologies are not able to adequately characterize error patterns and their structure.

The characterization of ungrammatical language, if it is to avoid erroneous preconceptions, entails thorough error analyses based on adequate principles of linguistic description. Chomsky (1964) has demonstrated that typologies are intrinsically incapable of rendering adequate linguistic descriptions (i.e., pointing to significant generalizations) by illustrating that systems of classification only catalogue observable data and do not have any descriptive or explanatory power. The notion that systems of classification are

not adequate vehicles for describing language is an integral part of modern linguistic theory and methodology. In sum, describing the general principles which organize the grammar and underlie the aberrant linguistic behavior in a prelingually hearing-impaired population (or other population) entails describing the grammatical systems internalized by members of the group on their own terms and not on the basis of error typologies and/or grammatical and acquisition models of standard English.

Patterns of errors observed in the English of deaf and other populations may be construed as either partially acquired grammatical constructions or as entrenched structural anomalies. The former, partially acquired constructions, may be characterized as quasi-grammatical patterns containing slight imperfections which result from abnormalities in the language acquisition process, but which eventually vanish as these patterns metamorphose into fully grammatical structures. The latter, entrenched anomalies, may be characterized as ill-formed patterns which are inextricably bound to fully developed grammatical systems, thereby tending to resist change or extinction. The former differ quantitatively from normal language while the latter differ qualitatively. This paper will present data which suggest that patterns of errors emerging in deaf individuals' comprehension and production of multi-clause (dependent clause) sentences constitute entrenched anomalies in constituent structure and not, as has been previously thought, partially acquired grammatical constructions.

STATEMENT OF THE PROBLEM

The difficulties many deaf children and adults experience in recognizing and producing well-formed dependent clause (embedded) constructions have been attributed to tendencies to add, substitute, and omit lexical items; consequently, errors in perception and production have been taken to indicate the partial acquisition of embedded structures (Quigley, *et al.*, 1976; Quigley, Smith and Wilbur, 1974). Bochner (1976), on the other hand, has hypothesized that many deaf individuals internalize grammatical systems which enumerate linear concatenations of lexical items and do not specify certain features of constituent structure: e.g., relations of subordination and superordination. Bochner's hypothesis has been dubbed "the linear order hypothesis." Validation of this hypothesis would define a specific grammatical anomaly effecting the linguistic performance of many deaf individuals, and could very well open new avenues of basic and applied research in the areas of deafness and language learning. A test designed to assess the validity of the linear order hypothesis was administered to a group of subjects and its results are reported in this paper.

Two rules which enumerate clauses in a linear, non-embedded fashion have been formulated on the basis of this hypothesis. These rules generate deviant strings like those which frequently appear in the written English of deaf students. The first rule generates coordinate structures and places a function word between every two conjuncts. The output of this rule is a multi-clause string of the form: S_1 - FUNCTION WORD - S_2 . As can be seen in the following examples, which resemble strings appearing in the written English of deaf students, the function word appearing in such an environment acts as a

kind of coordinate conjunction:

The girl screamed who the boy ran.

John passed the test which the college accepted him.

The second rule deletes the second of two identical NP's in strings of the form S_1 – FUNCTION WORD – S_2 when the final constituent in S_1 is an NP which is identical to an NP, either subject or object, in S_2 . The output of this rule is a truncated version of an S_1 – FUNCTION WORD – S_2 string, which resembles strings appearing in the written English of deaf students. In this context, the word *truncated* refers to strings which have been shortened by the deletion of an identical NP as depicted in the examples below (the deleted NP appears in parentheses in these examples):

Japan makes small cars because (small cars) use less gas.

The wind broke the umbrella and I can't use (the umbrella).

These two rules are able to generate non-embedded strings which resemble subordinate clause constructions; i.e., relative clauses. If the empirical validity of these rules can be demonstrated with reference to relative and other subordinate clause constructions, then it will be reasonable to conclude that some deaf individuals have merely learned rules governing the distribution of function words in multi-clause constructions, but have not learned how to generate subordinate clauses.¹

The major linguistic structures used in this test of the linear order hypothesis are listed below:

- S_1 – FUNCTION WORD – S_2 strings containing identical NP's
- S_1 – FUNCTION WORD – S_2 strings not containing identical NP's;
- S_1 – FUNCTION WORD – S_2 strings which have been truncated
(ungrammatical)
- Relative clause sentences (grammatical)

These structures can, of course, be described by the rules discussed above. The slots labeled FUNCTION WORD in these constructions were filled by the following words: *and*, *that*, *which*, *who*, *when*, *because*, *or*, and *so*. According to the hypothesis under consideration, these lexical items, when inserted into the syntactic structures enumerated above, function as coordinating conjunctions.

METHOD

Test design

The test used in this investigation required subjects to make judgments of grammati-

¹ *Bochner (1976) has argued that, as a consequence of utilizing a grammatical model of standard English to describe syntactic structures in the English of deaf individuals, Quigley, et al. (1976) were impelled to describe certain deviant strings in terms of either coordination or subordination when, in fact, little or no empirical justification existed for choosing one description over the other.*

cality and synonymy. The format consisted of the presentation of pairs of stimulus items. Although a few pairs consisted of two grammatical items, most pairs consisted of one grammatical and one ungrammatical stimulus – the grammatical stimulus being two well-formed clauses, some of which were independent clauses, and the ungrammatical stimulus being an ill-formed string which deviated from the grammatical member of the pair in a specific way (e.g., an ungrammatical string of the form: S_1 -- FUNCTION WORD – S_2). Subjects had to decide whether or not each stimulus was presented in correct English and then decide whether or not the two stimulus items comprising each pair were synonymous. A sample of the test is depicted below:

- | | | |
|----|--|-------------|
| A. | a. John was angry. The team lost the game. | 1. CORRECT? |
| | b. Jchn was angry which the team lost the game. | 2. CORRECT? |
| | | 3. a = b? |
| B. | a. A car hit the girl. The girl broke her leg. | 4. CORRECT? |
| | b. A car hit the girl who the girl broke her leg. | 5. CORRECT? |
| | | 6. a = b? |
| C. | a. John that ate the fish which so the fish tasted good. | 7. CORRECT? |
| | b. John ate the fish. The fish tasted good. | 8. CORRECT? |
| | | 9. a = b? |

The test instrument consisted of 120 pairs of items. Therefore, subjects had to make a total of 360 responses (i.e., three responses to each pair of items). The format was designed in a symmetrical fashion with all items presented in pairs so that grammatical and ungrammatical items could be juxtaposed in a systematic manner. Such a format, it was felt, would encourage subjects to respond automatically, without a great deal of conscious introspection, thereby giving a more accurate characterization of their linguistic competence and the strategies underlying their linguistic performance.²

Subjects

Subjects were 58 post-secondary students enrolled in elementary and intermediate level English courses at the National Technical Institute for the Deaf (NTID). The criteria for placing students in these courses are based on scores obtained on the NTID English Placement Battery (Johnson, 1976). Scores obtained on this battery indicate levels of English skill. Since subjects were drawn from elementary and intermediate level English classes, all had deficiencies in English serious enough to prevent them from handling a

² *Although subjects were required to make three responses to each pair of items, their grammaticality judgments of deviant strings and certain key synonymy judgments were, in most cases, the only responses analysed as yielding relevant data. Since many grammatical items merely consisted of two contiguous simple sentences of the form $S_1 - S_2$ (e.g., "John found the book. Mary lost the book."), subjects' responses would not offer any insight into the way embedded structures are perceived. Thus, data derived from responses to these items have not been analysed.*

TABLE I

Number of subjects taking each part of the test in relation to participation on other parts

	No. of Subjects Taking Part 1	No. of Subjects Taking Part 2	No. of Subjects Taking Part 3	Total
No. of subjects taking all three parts	37	37	37	37*
No. of subjects taking two parts	10	12	12	17*
No. of subjects taking one part	2	1	1	4*
Total	49	50	50	

*Obtained by calculating the sum across Parts 1, 2, and 3 and dividing by the number of parts designated in the row heading.

full-time academic load in college; the reading achievement of students enrolled in these courses averages between the seventh and ninth grade levels (Walter, 1976).

Procedure

The test instrument was administered in three separate parts on three separate days. Each part consisted of 40 representative pairs of items and was administered separately in order to minimize subjects' fatigue and the chance of receiving random responses. As a consequence of this procedure, a number of subjects did not complete the entire test. Only 37 of the 58 individuals participating in this study actually completed all three parts of the test. The others completed either one or two parts. Table I depicts the number of subjects taking each part in relation to participation on other parts. Although each part of the test was administered to either 49 or 50 individuals, it will be assumed, for the sake of expediency, that 50 subjects took each part. This figure ($N = 50$), and the number of subjects completing all parts of the test ($N = 37$), will be used in analysing the results of this experiment.

Analysis of data

Since the linear order hypothesis purports to characterize specific variations and

anomalies in the English of deaf individuals, data gathered from this experiment must be analysed in such a manner as to indicate the way in which individual subjects perform. The rates at which the entire group of subjects accept and reject specific linguistic structures will be determined in order to specify whether the group's responses were strongly affirmative, strongly negative, or somewhere in between. Strongly affirmative responses will be defined as responses yielding an acceptance rate of 70% or greater for any group of items, and strongly negative responses will be defined as responses yielding a rejection rate of 70% or greater. Strongly affirmative or negative responses will be taken to indicate that at least a distinct minority of individuals in the group were responding relatively consistently.

When the 70% criterion is not met, another type of analysis will be used to discern the extent to which variation occurred in the performance of individuals. This type of analysis involves calculating each individual's rates of acceptance and rejection separately and organizing the data into a frequency distribution. An analysis of this sort provides information regarding the reliability of individuals' responses.

The technique of determining a group's rates of acceptance and rejection, along with a similar criterion reference, has been utilized by Schachter, Tyson, and Diffley (1975) in examining the grammaticality intuitions of groups of adult foreigners learning English as a second language. The analytical procedures used in other studies utilizing a test instrument to control subjects' responses (Carrow, 1968; Miller and Yoder, 1973) are not applicable in the present context since previous research has not sought to obtain specific information about variations and anomalies existing in a given group's performance. Most previous studies have utilized criteria based on a percentage of subjects, not a percentage of responses; e.g., both Carrow (1968) and Miller and Yoder (1973) define their criteria in terms of a percentage (60%) of subjects responding in a given manner. Given the design and purpose of the present study, a 70% criterion seems to be a reasonable standard for judging the significance of responses since it insures that some individuals, at least, are responding in a relatively consistent manner. At the same time, this technique provides data on the performance of the group as a whole.

RESULTS

S_1 - FUNCTION WORD - S_2 strings

Fifty-five items on the test instrument elicited grammaticality judgments on multi-clause strings of the form S_1 - FUNCTION WORD - S_2 . In each of these items the slot labeled FUNCTION WORD was filled by *and*, *that*, *which*, or *who*. Strings in which the function-word slot was filled by *and* were always grammatical; but, strings which contained one of the other function words in this slot were never grammatical. In 33 of these items, S_1 contained an object NP which was identical to an NP, either subject or object, in S_2 . The following examples depict such strings:

The library had the book which Mary wanted the book.

The police arrested the student that the student killed the teacher.

In the remaining 22 items, S_1 and S_2 did not contain any identical elements. In some of these items, the final constituent in S_1 was a verb or an adjective, but in most it was an NP.³ Such strings are illustrated by the following examples:

The Republicans were happy which Ford became President.
John failed the course that the teacher became angry.

The data depicted in Tables 2 and 3 indicate that subjects accepted S_1 – FUNCTION WORD – S_2 strings containing identical NP's slightly less readily than strings which did not contain identical elements. The rate of acceptance for strings containing *and*, *that*, and *which* was consistently lower when identical NP's appeared, but was higher for strings containing *who* in the identical NP environment. In terms of performance according to each different function word, data indicate that strings containing *that* and *which* were accepted almost as readily as those containing *and*. However, strings containing *who* were not accepted nearly as frequently. The lower rate of acceptance for strings containing *who* suggests that subjects were slightly more adept at recognizing these strings as being ungrammatical. This lower rate of acceptance may be accounted for by hypothesizing that subjects have learned that *who* may not appear in certain environments; i.e., they know slightly more about the distribution of *who* in multi-clause sentences than they know about the distribution of *that* and *which*; thus, they are better able to recognize environments where *who* is used inappropriately.

Strings of the form S_1 – FUNCTION WORD – S_2 containing *that*, *which*, or *who* and identical NP's (Table 2) clearly resemble relative clause constructions. However, strings without identical NP's (Table 3) bear absolutely no resemblance to relative clause sentences and little, if any, resemblance to other kinds of subordinate clause constructions. Since strings without identical NP's hardly resemble complex sentences, the data depicted in Table 3 may provide some insight into the way many deaf individuals perceive the structure of all dependent clause (embedded) constructions; i.e., multi-clause strings both with and without identical NP's. These data illustrate that subjects accepted ungrammatical strings containing *that* and *which* at high rates even though these strings do not resemble embedded constructions. Data on synonymy judgments indicate that subjects equated the meaning of strings containing *that* and *which* (e.g., "John smokes cigars which Mary drinks beer.") to that of contiguous independent clauses of the form S_1 – S_2 (e.g., "John smokes cigars. Mary drinks beer.") at a rate of 80.1%. Since many subjects find S_1 – FUNCTION WORD – S_2 strings without identical NP's acceptable and since these strings do not resemble embedded constructions, it is reasonable to infer that many deaf individuals perceive the structure of all multi-clause strings, including those with identical NP's, in an analogous fashion: i.e., they perceive them as coordinate constructions.

The data depicted in Table 4 serve as an adjunct to Tables 2 and 3. These data indicate that subjects accepted most S_1 – FUNCTION WORD – S_2 strings quite readily regardless

³ The last element in S_1 in only five of the strings containing *that*, *which*, or *who* was either a verb or an adjective (*that* – two strings; *which* – two strings; *who* – one string).

TABLE 2

Subjects' grammaticality judgments of S_1 – FUNCTION WORD – S_2
strings containing identical NP's (N = 50)

Function Word	Number of Items	% Accepted	% Rejected
<i>and</i>	9	80.5*	19.5
<i>that</i>	8	77.3	22.7*
<i>which</i>	8	70.8	29.2*
<i>who</i>	8	54.8	45.2*

*correct response

TABLE 3

Subjects' grammaticality judgments of S_1 – FUNCTION WORD – S_2
strings not containing identical NP's (N = 50)

Function Word	Number of Items	% Accepted	% Rejected
<i>and</i>	5	90.2*	9.8
<i>that</i>	5	87.1	12.9*
<i>which</i>	7	76.5	23.5*
<i>who</i>	5	46.7	53.3*

*correct response

of whether or not an identical NP appeared. The rate of acceptance for strings containing *that* was extremely high and nearly coincides with the rate at which grammatical compound sentences were accepted. The rate of acceptance for strings containing *which* was also quite high. However, strings containing *who* were not accepted at a high rate. Thus, the gross rates of acceptance for strings containing *and*, *that*, and *which* is considered

TABLE 4

Subjects' grammaticality judgments of all S_1 – FUNCTION WORD – S_2 strings (N = 50)

Function Word	Number of Items	% Accepted	% Rejected
<i>and</i>	14	83.9*	16.1
<i>that</i>	13	81.1	18.9*
<i>which</i>	15	73.5	26.5*
<i>who</i>	13	51.7	48.3*

* correct response

significant (acceptance rate above the 70% criterion), but the rate at which *who* was accepted is not. An analysis of individuals' performance with respect to this lexical item was not undertaken since data on synonymy judgments of truncated strings, which will be presented shortly, lend support to the previously mentioned contention that subjects' performance on strings containing *who* should be attributed to their knowledge of the distribution of *who* and not their knowledge of syntactic structure. It is felt that, for some subjects at least, an identical NP appearing in S_2 must be obligatorily deleted when *who* appears in the function word slot in S_1 – FUNCTION WORD – S_2 constructions.⁴

Truncated strings and relative clauses

Ten items on the test elicited grammaticality judgments on truncated S_1 – FUNCTION WORD – S_2 strings such as:

⁴ Quigley et al. (1974) refer to the appearance of identical NP's as "copying." They reported that 10- and 11-year olds in their study accepted strings with "copied" or identical NP's at a rate of over 60%. However, this rate decreased steadily with age and 18-year olds only accepted such strings at a rate of 24%. These data differ substantially from the data enumerated in Tables 2, 3, and 4. This discrepancy may be due to the fact that the procedures used to gather and analyse data differed in each study. For example, the test items used by Quigley and his associates included nested constructions (e.g., "The girl who the girl found the ball played in the park."); however, such constructions were not included in the present study. In addition, data in the Quigley study were not analysed in terms of the specific function words which appeared in the test items (i.e., separate data were not reported for that, which, and who); the present study, however, reports data on each specific function word.

TABLE 5

Subjects grammaticality judgments of relative clause sentences
and ungrammatical truncated S₁ – FUNCTION WORD – S₂
strings (N = 50)

Stimulus	Number of Items	% Accepted	%Rejected
grammatical relative clause sentence	6	69.0	31.0
ungrammatical truncated S ₁ – FUNCTION WORD – S ₂ string	10	61.9	38.1

Many people want nuclear energy and some electric companies already produce.

The elephant crossed the road when a truck blocked.

The above sentences are truncated versions of the following:

Many people want *nuclear energy* and some electric companies already produce *nuclear energy*.

The elephant crossed *the road* when a truck blocked *the road*.

All of these items were ungrammatical since the function word slots were filled by *and*, *when*, *because*, *or*, and *so* (two items each). In contrast, six items on the test were grammatical relative clause sentences containing *that*, *which*, and *who* (two items each) and two items were grammatical reduced compound sentences containing *and* (e.g., "John smoked the cigarette and burned the table."), which were derived in the same manner as the examples depicted above (i.e., an identical NP was *incorrectly* deleted – "John smoked *the* cigarette and *the* cigarette burned the table."). Table 5 depicts data on subjects' grammaticality judgments of grammatical relative clause sentences and ungrammatical truncated strings (data on the two grammatical reduced compound sentences have not been included since these sentences, by virtue of being grammatical, cannot be grouped with the ungrammatical truncated strings).

These data seem to indicate that subjects did not accept grammatical relative clause sentences at a high rate. However, the rate of acceptance for relative clauses introduced by *who* and *which* (two items each) was approximately 78%, while the rate of acceptance for similar structures introduced by *that* (two items) was only about 50%. These results are surprising since one would expect grammatical sentences (i.e., relative clause sentences)

to be accepted far more readily than ungrammatical strings which resemble them (Table 2). As it stands, relative clauses introduced by *who* and *which* were accepted more readily than ungrammatical S_1 – FUNCTION WORD – S_2 strings (with identical NP's) which resemble them; but, relative clauses introduced by *that* were accepted at a much lower rate. These data indicate that the ability of subjects to recognize grammatical relative clauses introduced by *that* is extremely poor.⁵ It should also be noted that relative clauses introduced by *which* were only accepted at a rate slightly higher than the rate of acceptance for ungrammatical strings which resemble them (Table 2). Thus, subjects approved of the use of *which* in both grammatical and ungrammatical contexts.

Frequency distribution analyses

The data depicted in Table 5 concerning subjects' grammaticality judgments of truncated strings is not significant (the 70% criterion was not met). However, the group accepted such strings nearly as readily as they accepted sentences with relative clauses. The group's synonymy judgments were not significant either. Since these analyses did not yield significant results, each individual's rates of acceptance were calculated apart from that of the group so that the reliability of individuals' responses could be determined via a frequency-distribution analysis. As noted earlier, this form of analysis yields data about the extent to which variation occurred in the performance of individuals. Synonymy judgments on two sets of truncated strings and their full (untruncated) counterparts were analysed in this manner. The first set consisted of four pairs of stimulus strings. Each pair in this set contained one full S_1 – FUNCTION WORD – S_2 string in which the function word slot was filled by *and*; the other member of the pair was the truncated counterpart of this string. Two truncated strings were grammatical (rate of acceptance = 78%) and two were not (rate of acceptance = 73%). Although the items in each pair were not synonymous, more than 60% of the subjects tended to equate their meanings. Table 6 presents these data. It should be noted that the first column in this table enumerates the possible number of affirmative responses per four test items: i.e., an individual may make either four, three, two, one, or zero affirmative responses.

These data clearly indicate that many subjects (more than 60%) incorrectly equated the meaning of truncated strings containing *and* to that of their full counterparts with a reasonable amount of consistency (i.e., more than 60% of the subjects were consistent in that they judged *either* three *or* four pairs of these items to be synonymous). Individuals

⁵ *Grammatical unmarked relative clauses (e.g., "John found the book Mary lost.") were hardly ever recognized by subjects; four such items were judged to be grammatical at a rate of only 30%. In a related finding, two ungrammatical strings of the form SUBJECT – VERB₁ – NP – VERB₂ – OBJECT (e.g., "Harry bought the car had a flat tire.") were judged to be grammatical at a rate of 38%. Quigley et al. (1974) reported that subjects in their study accepted strings of this form at a slightly higher rate. When viewed within the context of the present study, these meagre data may indicate that the rejection of unmarked relative clauses and strings of the form SUBJECT – VERB₁ – NP – VERB₂ – OBJECT is, in some way, conditioned by the fact that a function word does not appear at some point between the two verbs in such strings (i.e., immediately after the first object NP in such strings).*

TABLE 6

Consistency of individuals in equating the meaning of S_1 – FUNCTION WORD – S_2 strings containing *and* with that of their truncated counterparts (N = 37)

Total Number of Affirmative Synonymy Judgments (4 test items)	Number of Individuals Responding	% of Individuals
*4	*11	*29.7
*3	*12	*32.4
2	5	13.5
1	3	8.1
0	6	16.2

*Strongly affirmative and relatively consistent.

who equated the meaning of either three or four pairs of items responded in a “strongly affirmative” manner since their responses, by virtue of being consistent a minimum of three out of four times, meet the 70% criterion; i.e., three out of four responses yields an affirmative response rate of 75% while four out of four yields a rate of 100%.

The second set of items consisted of two sentences with *when* and their truncated counterparts and two sentences with *because* and their truncated counterparts. The four truncated strings in this set were all ungrammatical and were accepted at a rate of 54%. Their full counterparts were, of course, grammatical. Although the items comprising each pair were not synonymous, more than 33% of the subjects tended to respond as though they were.⁶ Table 7 presents these data.

The data depicted in Table 7 indicate that many subjects (more than 33%) incorrectly equated the meaning of truncated strings containing *when* and *because* to that of their full counterparts with a reasonable amount of consistency (i.e., approximately 33% of the subjects judged *either* three *or* four pairs of these items to be synonymous). As noted earlier, responses of this sort may be considered “strongly affirmative.” Of the 13 individuals who tended to respond affirmatively to this set of items, 11 also tended to respond affirmatively to the first set (Table 6). Thus, 11 individuals were reasonably consistent in incorrectly equating the meaning of various truncated strings to that of their

⁶ Subjects judged grammatical complex sentences with *when* (two items) and *because* (two items) to be synonymous with two contiguous independent clauses (i.e., corresponding S_1 – S_2 configurations) at a rate of 84%. In addition, two grammatical complex sentences with that were judged to be synonymous with contiguous independent clauses at a rate of 84%.

TABLE 7

Consistency of individuals in equating the meaning of S_1 – FUNCTION WORD – S_2 strings containing *when* (2 items) and *because* (2 items) with that of their truncated counterparts (N = 37)

Total Number of Affirmative Synonymy Judgments (4 test items)	Number of Individuals Responding	% of Individuals
*4	*6	*16.2
*3	*7	*18.9
2	10	27.0
1	9	24.3
0	5	13.5

*Strongly affirmative and relatively consistent.

full counterparts.

Reliability of responses

In order to check the reliability of the group's responses and also to get an indication of subjects' ability to identify ungrammatical strings, a number of recognizably deviant strings were randomly scattered throughout the test instrument. Six of these strings contained errors in word order and usage which resulted in severe violations of selectional restrictions, and 33 strings contained one or two arbitrarily placed and misused function words. Examples of such strings are depicted below:

The dinner fell asleep which the cat ate the dog.

The students visited the zoo who when the zoo closed early.

The newspaper that reported in the election because Ford who won the election.

Table 8 presents data on subjects' grammaticality judgments of these deviant strings.

These data indicate that subjects tended to reject these deviant strings. The fact that subjects could identify such strings as being ungrammatical demonstrates that, as a group, they did not perform in a random fashion and that they tended to reject strings which they knew were ungrammatical.⁷

⁷ Subjects equated the meaning of the six strings with errors in word order and usage to the meaning of two contiguous independent clauses, which were grammatical (i.e., grammatical S_1 – S_2 configurations), at a rate of 20.1%.

TABLE 8
 Subjects' grammaticality judgments of recognizably deviant
 strings (N = 50)

Error in Stimulus	Number of Items	% Accepted	% Rejected
Violations of selectional restrictions or normal English word order	6	23.1	76.9*
Arbitrary placement of function word(s)	33	29.7	70.3*

*correct response

DISCUSSION

The results of this study indicate that many deaf individuals incorrectly accept ungrammatical S_1 - FUNCTION WORD - S_2 strings, both with and without identical NP's, and also incorrectly equate the meaning of truncated strings to that of their full (untruncated) counterparts. These data tend to substantiate the tenets of the linear order hypothesis (Bochner, 1976) and, in addition, illustrate that the aberrant linguistic behaviours characterized by this hypothesis are systematic and governed by rules such as those proposed earlier in this paper. In other words, these data indicate that many deaf individuals do not have an adequate knowledge of grammatical relationships which may occur among clauses; consequently, these individuals tend to arrange clauses in a linear-sequential fashion without specifying relationships of subordination and superordination.

As noted earlier, the linear order hypothesis claims to characterize aspects of the linguistic performance of many deaf individuals, but does not make sweeping claims about the English of deaf people in general. Data reported in this paper suggest that the behaviour of approximately one-third of the subjects in this study may be characterized by this hypothesis. The performance of these individuals on certain key sets of test items was reasonably consistent with the tenets of the hypothesis. A smaller group of subjects (probably less than one-third of the total sample) performed in a manner which seemed inconsistent with the principles of the hypothesis. Since 75-80% of all responses to certain sets of ungrammatical strings were affirmative, it is reasonable to assume that this group is smaller than the first and that variations, which may be characterized by the

linear order hypothesis, existed in the performance of some individuals in this group. The performance of all other subjects (probably more than one-third of the total sample) seemed to be characterized by significant variation. That is, their responses were neither consistently affirmative nor consistently negative. This lack of consistency seems to be indicative of latent tendencies or behaviours which may be characterized by the linear order hypothesis. Although it is reasonable to assume, based on the data depicted in Tables 6, 7, and 8, that a few individuals in this group exhibited random or idiosyncratic behaviours, the same data suggest that most of the individuals in this group have acquired variable rules which cause inconsistencies in their performance. In any event, there is ample justification for employing the notion of linguistic variation, and it appears that the linear order hypothesis accounts for much of the inconsistency noted in the linguistic performance of deaf individuals. Although it is tempting to speculate about the causes of this aberrant linguistic behaviour, there would be little substance to such speculation at this time. A variety of factors including social, psychological, biological, environmental, and epistemological conditions set the prelingually hearing-impaired individual linguistically apart from his normal hearing counterparts and any one or more of these factors may condition the emergence of linguistic anomalies.

Since hearing-impaired individuals perceive distorted and/or incomplete linguistic signals through the visual and auditory channels and since there is also a delay in deaf childrens' acquisition of linguistic behaviours relative to their normal development of cognitive and neurological functions, the findings reported in this paper could have implications for language-acquisition models. For example, the manual and written forms of English visually perceived by prelingually hearing-impaired children do not encode suprasegmental features such as stress and intonation, which are present in the auditory signals perceived by hearing children. Additionally, orthographic representations are discrete in that words and letters of the alphabet appear as distinct entities, whereas the speech signal is continuous. Such factors may very well inhibit the normal acquisition of phrase and clause structures. The potential for acquiring universal syntactic notions (e.g., the notion that words are arranged hierarchically to form phrase, clause, and sentence units) clearly exists in the deaf child. However, this potential seems to remain dormant in many deaf individuals, suggesting that the nature of the linguistic input to which the child is exposed and the age at which the child is exposed to this input play a vital role in the development of so-called "innate" linguistic notions. If such factors can be shown to have an impact on the normal acquisition of language, then existing acquisition models will have to be modified accordingly.

The major effect the anomalies discussed in this paper have on language use is in one's ability to process (read) unfamiliar information: i.e., information out of the realm of one's own personal experience and knowledge of the world. As long as one is relatively conversant with the context and/or subject matter (content) of a given discourse, it is reasonable to assume that he will, in many instances, be able to make appropriate inferences about the logical relationships obtaining among clauses. However, if one is not familiar with the context of a discourse or its subject matter, he must rely completely on linguistic cues and be able to perceive the logical relationships which obtain among clauses via such cues. In sum, it is likely that deaf individuals who perceive complex

sentences in a linear-sequential fashion will have difficulty processing unfamiliar information accurately since logical relationships obtaining among clauses will not be readily accessible to them.

The results of this investigation suggest directions for future research in the areas of deafness and language learning; e.g., research into the causes of these anomalies and their pedagogical implications. Such research can provide insight into the social, psychological, biological, environmental, and epistemological factors involved in the use and acquisition of both normal and deviant language. However, before such research is undertaken, data corroborating the findings of this investigation should be gathered. Plans are currently being made to progress along all of these lines.

REFERENCES

- BOCHNER, J. (1975). English in the deaf population: the linear order hypothesis. Unpublished paper, National Technical Institute for the Deaf.
- CARROW, S.M.A. (1968). The development of auditory comprehension of language structure in children. *J. Speech Hear. Dis.* **33**, 99-111.
- CHARROW, V.R. (1974). *Deaf English - An Investigation of the Written English Competence of Deaf Adolescents*. Institute for Mathematical Studies in the Social Sciences, Stanford University.
- CHOMSKY, N. (1964). Current issues in linguistic theory. In J.A. Fodor and J.J. Katz (eds.), *The Structure of Language: Readings in the Philosophy of Language* (Englewood Cliffs, N.J.).
- JOHNSON, D.D. (1976). Communication characteristics of a young deaf adult population: techniques for evaluating their communication skills. *American Annals of the Deaf*, **121**, 409-24.
- MILLER, J.F. and YODER, D.E. (1973). Assessing the comprehension of grammatical form in mentally retarded children. Paper presented to the Third Congress of the International Association for Scientific Study of Mental Deficiency, The Hague, The Netherlands.
- MYKLEBUST, H.R. (1965). *Development and Disorders of Written Language*. Vol. 1 (New York).
- QUIGLEY, S.P., WILBUR, R.B., POWER, D.J., MONTANELLI, D.S. and STEINKAMP, N.W. (1976). *Syntactic Structures in the Language of Deaf Children*. Institute for Child Behavior and Development, University of Illinois.
- QUIGLEY, S.P., SMITH, N.L. and WILBUR, R.B. (1974). Comprehension of relativized sentences by deaf children. *J. Speech Hear. Res.*, **17**, 325-41.
- SCHACHTER, J., TYSON, A. and DIFFLEY, F. (1975). Learner intuitions of grammaticality. Paper presented at the Queens College Summer Conference on Language Learning.
- WALTER, G.G. (1976). English skills assessment and program planning for NTID students. *Proc. 47th Meeting of the Convention of Amer. Instructors of the Deaf* (Washington, D.C.).