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ABSTRACT

The techniques of transformational grammar can be used effectively to identify and describe significant differences in the language competencies of children at several grade levels. The oral language responses of 150 elementary school children and 30 kindergartners (selected at random) to two silent, animated films of Aesop's "Fables" were transcribed and segmented into syntatic units for linguistic analysis. Among the findings of the analysis are (1) that the length of compositions, the length of minimal terminable syntactic units (T-units), and the number of sentence-combining transformations per T-unit increase with advance in grade, particularly during grades 1 and 5, signifying important stages in the development of language complexity, (2) that nominal constructions containing adjectives, participles, and prepositional phrases show significant increments in the rate of occurence at each advance in grade level, and (3) that boys surpass girls, except in grade 5, in length of compositions and of T-units, and in the use of nominal and coordinate constructions. (Included are nine tables to indicate such data as mean number of words used per T-unit and compostion, and structural patterns of main clauses and of grammatically incomplete constructions in boys' and girls' speech at six grade levels.) (See also ED 017 508.) (JB)

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GRAMMATICAL STRUCTURES IN THE SPEECH OF CHILDREN: A TRANSFORMATIONAL ANALYSIS

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RECENT ADVANCES in the study of linguistics have made it possible to analyze and describe language with a high degree of accuracy and efficiency (2, 3, 6), and investigations have been made to determine the grammatical characteristics of language used by children in the various stages of development (1, 4, 5, 8, 9, 11). Not a great deal has been done, however, to apply to children's language the techniques of analysis of generative and transformational grammar. In the present study an attempt is made to apply some of the techniques of transformational grammar to analysis of grammatical structures of kindergarten and elementary-school children.

THE PROBLEM

This study is designed to investigate grammatical structures in the speech of children in kindergarten and in grades one, two, three, five, and seven; and attention is focused on the rate of occurrence of the various syntactic structures that can be identified and described by techniques of transformational grammar. The following items are of primary concern: 1) structural pattern of main clauses; 2) average length of minimal terminable syntactic units; 3) types of sentence-combining transformations; and 4) average number of sentence-combining transformations per minimal terminable unit. Information on additional items observed in the investigation is reported, but no attempt has been made to evaluate usage and effectiveness of expression.

Although the study is concerned with speech, it does not include phonological analysis. Phenomena of pitch, stress, and juncture are valuable, and sometimes necessary, structural signals in language; but a great deal can be observed about the structure of an utterance on the basis of other signals of syntactic structure. This study reports observations that can be made on the basis of other structural clues, including word order, function words, and inflectional and derivational affixes.

The objectives of the study are stated as follows: 1) to collect from samples of children's language data concerning (a) the structural patterns of main clauses, (b) the average length of minimal terminable syntactic units, (c) the types of sentence combining transformations, and (d) the average number of sentence-combining transformations per minimal terminable syntactic unit; 2) to compare these data for statistically significant differences in respect to (a) grade level and (b) sex of subjects.

DEFINITIONS OF TERMS

"Minimal terminable syntactic units" (T-units) are defined as single independent predications with their complements (if any) and whatever modifiers (including clauses) may be grammatically attached to them. Hunt (4) describes them as "...the shortest segments which it would be grammatically allowable to write with a capital letter at one end and a period at the other, leaving no fragment as residue." Thus, When John laughed, Mary cried (.) is one terminable unit; but John laughed and Mary cried (.) contains two terminable units. A coordinating conjunction that joins two independent predications is regarded as belonging to the second terminable unit.

"Sentence-combining transformations" are components of a syntactic construction regarded as converting a pair of sentences into a single sentence by embedding one in the other. Thus, for example,

The man was rich.
The man rode a bicycle.

may be combined as The rich man rode a bicycle (.) or The man who was rich rode a bicycle (.) or Though the man was rich, he rode a bicycle. Such transformations obviously increase the information load of the syntactic units they produce. Hence, the child's demonstrated ability to use them freely may be supposed to reflect an important aspect of development toward maturity in language behavior.

"Deletion rules" are rules for producing trans-

TABLE 1

AGE RANGE AND MEAN AGE IN YEARS AND MONTHS FOR BOYS AND GIRLS AT SIX GRADE LEVELS

	Kindergarten	Grade 1	Grade 2	Grade 3	Grade 5	Grade 7
Oldest						
Boys	6 - 4	7 - 4	9 - 3	10 - 2	11 - 8	14 - 6
Girls	6 - 2	7 - 2	8 - 4	9 - 9	11 - 2	13 - 2
Youngest						
Boys	5 - 4	6 - 3	7 - 5	7 - 8	10 - 2	12 - 5
Girls	5 - 3	6 - 3	7 - 2	7 - 4	10 - 5	12 - 2
Mean Age						
Boys	5 - 10	6 - 7	7 - 11	8 - 9	10 - 10	13 - 3
Girls	5 - 10	6 - 9	7 - 10	8 - 8	10 - 10	12 - 8

formations involving the reduction of certain elements in the base sentence that is embedded in another sentence.

DESCRIPTION OF SAMPLE

Language samples were taken in March, 1965, from 150 children enrolled in Mitchell-Neilson School, Murfreesboro, Tennessee, and from 30 kindergarten children who would enter Mitchell-Neilson School in the fall of 1965. Thirty children were selected at random from each of the following grades: One, two, three, five, and seven. The sexes were distributed as follows: kindergarten, 15 boys and 15 girls; grade one, 15 boys and 15 girls; grade two, 14 boys and 16 girls; grade three, 14 boys and 16 girls; grade five, 16 boys and 14 girls; grade seven, 17 boys and 13 girls. The age ranges and means are reported in Table 1. All subjects participating in the study were from middle class white families residing in Murfreesboro, Tennessee.

DESCRIPTION OF PROCEDURE

The language samples used in this study consist of children's oral responses to two short films selected from the Coronet Language Arts series. The two films present animated versions of two of Aesop's Fables, The Ant and the Dove, and The North Wind and the Sun. Each film is eight minutes in length. The films were shown, with the sound turned off, to children in groups ranging in size from three to six. The films were shown without narration in order to avoid influencing the vocabulary and structural patterns used by the children in telling the stories. After viewing each film, each child was asked to tell the story of the film privately to an interviewer and to answer questions related to the story. Each child's response was recorded on tape. No specific time limits were imposed on individual interviews.

A typescript was made of each child's recording, and the typescripts were segmented into syntactic units for linguistic analysis. Single-word responses to questions were omitted, since they are not suitable for syntactic analysis.

The syntactic unit chosen for this study is the minimal terminable unit (T-unit) employed by Hunt (4) in his study of written grammatical structures. Preliminary analysis showed that these units could be identified in typescripts of oral language samples without reliance on clues of pitch, stress, and juncture. Working independently, the investigators found that they were in complete agreement on the boundaries of terminable units in grammatically complete utterances. Since the content of the stories was known to the investigators, semantic clues could be used to reinforce structural clues where structural ambiguity existed. In view of Strickland's (11) conclusion that the phonological unit was unsatisfactory as a measure of maturity of language and the fact that there was a high degree of interscorer agreement in identifying terminable units without phonological signals of structure, the investigators thought it unnecessary to segment the language samples into phonological units.

After the material had been segmented into minimal terminable units, each unit was typed on an analysis sheet and analyzed by techniques of transformational grammar. All sentence-combining transformations were classified under three headings: 1) transformations producing nominal constructions, 2) transformations producing adverbial constructions, and 3) transformations producing coordinate constructions. It was recognized that coordinate constructions could also be nominal or adverbial in func-

TABLE 2

MEAN NUMBER OF WORDS PER COMPOSITION FOR BOYS AND GIRLS AT SIX GRADE LEVELS

	Kindergarten	Grade 1	Grade 2	Grade 3	Grade 5	Grade 7
Boys	230.5	248.8	370.9	556.9	643.6	870.2
Girls	188.3	241.5	334.3	469.6	670.1	655.1
Both	209.4	245.1	352.6	510.3	656.0	748.0

TABLE 3

MEAN NUMBER OF WORDS PER T-UNIT FOR BOYS AND GIRLS AT SIX GRADE LEVELS

	Kindergarten	Grade 1	Grade 2	Grade 3	Grade 5	Grade 7
Boys	7.47	7.98	8.52	8.79	8.85	10.21
Girls	6.66	7.96	8.15	8.67	8.95	9.39
Both	7.07	7.97[a]	8.33	8.73	8.90	9.80[a]

[a]Increment over preceding grade significant at .05 level

tion, and provision was made to count the sentence-combining operations accurately. Subdivisions of these three categories were identified and each sentence-combining operation was tabulated in the appropriate subcategory. In a few instances constructions formed by combining kernel sentences could not be identified by reference to published descriptions of transformational grammar. Since most of them were movable elements not closely related to a single constituent, they were classified as sentence adverbials. The investigators followed Roberts (10) in classifying determiners, and no attempt was made to analyze these structures. Each compound noun was counted as two separate words and treated as a structure produced by transformation. Contractions were also counted as two separate words.

The greater part of the computation involved in the study was performed by means of an IBM 7072 electronic data processing system. Statistical analysis of variance was executed to test for significance at the .05 level the mean differences in frequency of uses of grammatical structures by boys and girls at various grade levels. The procedure used for testing statistical significance is that described by Lindquist (7). Appropriate subanalyses were conducted where necessary to clarify the nature of the more complex relationships.

SUMMARY OF FINDINGS

Significant findings are summarized by grade level and sex. Items of particular interest are presented in Tables 2-9.

Differences by Grade Level

1. Length of compositions consistently increases with advance in grade (Table 2).

2. Length of minimal terminable syntactic units increases with advance in grade; the increments from kindergarten to grade one and from grade five to grade seven are significant (Table 3).

3. Number of sentence-combining transformations per terminable unit increases with advance in grade; the increments from kindergarten to grade one and from grade five to grade seven are significant (Table 4).

4. Sentence-combining transformations forming nominal constructions, adverbial constructions and coordinate constructions show an overall increment by grade. Nominal and adverbial constructions show significant increments from kindergarten to grade one and from grade five to grade seven. Coordinate constructions show a significant increment from grade five to grade seven (Table 5).

TABLE 4

MEAN NUMBER OF SENTENCE-COMBINING TRANSFORMATIONS PER T-UNIT AT SIX GRADE LEVELS

	Kindergarten	Grade 1	Grade 2	Grade 3	Grade 5	Grade 7
Boys	.81	.97	1.01	1.03	1.03	1.47
Girls	.62	.92	.94	1.00	1.07	1.21
Both	.71	.95[a]	.97	1.01	1.05	1.34[a]

[a]Increment over preceding grade significant at .05 level

TABLE 5

TYPES OF CONSTRUCTIONS FORMED BY SENTENCE-COMBINING TRANSFORMATIONS FOR BOYS AND GIRLS AT SIX GRADE LEVELS: RATE OF OCCURRENCE PER 100 T-UNITS

	Kindergarten	Grade 1	Grade 2	Grade 3	Grade 5	Grade 7
Nominal Constructions						
Boys	56.93	66.47	61.50	63.71	59.19	80.76
Girls	41.87	59.33	58.06	59.88	65.36	69.62
Both	49.40	62.90[a]	59.78	61.79	62.27	74.69[a]
Adverbial Constructions						
Boys	7.93	10.67	13.29	14.79	13.50	19.88
Girls	7.07	12.67	10.25	15.88	16.29	19.31
Both	7.50	11.67[a]	11.77	15.33	14.89	19.59[a]
Coordinate Constructions						
Boys	16.20	20.20	26.50	24.29	30.56	46.41
Girls	13.13	19.67	24.25	21.88	25.50	31.00
Both	14.67	19.93	25.37	23.09	28.03	38.71[a]

[a]Increment over preceding grade significant at .05 level

5. Of the subtypes of nominal constructions, adjective + noun, noun + prepositional phrase, and participle + noun show an overall increase by grade (Table 6). Nominal constructions containing adjectives and those containing prepositional phrases increase significantly between grades five and seven. Other nominal constructions show no consistent and significant differences by grade.

6. Adjectival, nominal and adverbial clauses show no consistent and significant increases from grade to adjacent grade (Table 7).

7. Rate of occurrence of the various structural patterns of main clauses differs only slightly by grade, and these differences appear to be inconsequential (Table 8). Although most main clauses are of the subject-verb and subject-verb-object pattern, practically all of the normal structural patterns occur at all grade levels.

8. There is an overall decrease in rate of occurrence of grammatically incomplete patterns with advance in grade level (Table 9).

Differences by Sex

1. Compositions of boys are longer than those of girls at all levels except grade five (Table 2).

2. Minimal terminable syntactic units of boys are longer than those of girls at all levels except grade five (Table 3).

TABLE 6

CLAUSE CONSTITUENTS RESULTING FROM DELETION TRANFORMATION IN THE SPEECH OF BOYS AND GIRLS AT SIX GRADE LEVELS: RATE OF OCCURRENCE PER 100 T-UNITS

	Kindergarten	Grade 1	Grade 2	Grade 3	Grade 5	Grade 7
Adjectives						
Boys	5.53	11.07	9.14	6.43	7.63	10.82
Girls	7.40	6.93	10.69	6.63	8.86	13.21
Both	6.47	9.00	9.91	6.53	8.25	12.07[a]
Participles						
Boys	1.27	1.80	1.71	1.93	2.00	3.35
Girls	.33	.40	.06	1.13	1.71	1.62
Both	.80	1.10	.89	1.53	1.85	2.49
Adjectival Prepositional Phrases						
Boys	4.47	3.27	3.36	3.14	6.00	9.71
Girls	3.33	2.67	5.31	4.00	4.50	4.92
Both	3.90	2.97	4.33	3.57	5.25	7.31[a]

[a]Increment over preceding grade significant at .05 level

TABLE 7

TYPES OF SUBORDINATE CLAUSES IN THE SPEECH OF BOYS AND GIRLS AT SIX GRADE LEVELS: RATE OF OCCURRENCE PER 100 T-UNITS

	Kindergarten	Grade 1	Grade 2	Grade 3	Grade 5	Grade 7
Adjectival Clauses						
Boys	4.20	2.67	2.50	4.14	3.38	4.65
Girls	5.33	3.33	3.81	1.13	3.14	3.15
Both	4.77	3.00	3.15	2.63	3.26	3.90
Nominal Clauses						
Boys	8.80	7.13	6.50	8.71	4.56	9.92
Girls	2.33	7.40	7.50	8.13	7.07	7.92
Both	5.57	7.27	7.00	8.42	5.81	8.87
Adverbial Clauses						
Boys	6.27	8.53	10.36	9.86	8.25	12.59
Girls	5.87	9.80	5.38	10.38	11.86	13.08
Both	6.07	9.17	7.87	10.12	10.05	12.83

3. Average number of sentence-combining transformations per terminable unit is greater for boys than for girls at kindergarten level and at grade seven, but there is no overall significant difference by sex (Table 4).

4. Nominal constructions and coordinate constructions occur at a higher rate in the language of boys than in the language of girls. Rate of occurrence of adverbial constructions does not differ significantly between sexes (Table 5).

5. The subject-verb pattern is used in main clauses more by girls than by boys at all levels except grade five, while the subject-verb-predicate nominal pattern is used more by boys than by girls at all levels except grade five (Table 8).

TABLE 8

STRUCTURAL PATTERNS OF MAIN CLAUSES IN SPEECH OF BOYS AND GIRLS AT SIX GRADE LEVELS: RATE OF OCCURRENCE PER 100 T-UNITS

	Kindergarten	Grade 1	Grade 2	Grade 3	Grade 5	Grade 7
Subject-Verb						
Boys	34.07	31.87	34.07	40.93	46.63	43.12
Girls	38.27	34.13	43.56	44.69	45.14	46.23
Both	36.17	33.00	38.81	42.81	45.89	44.67
Subject-Verb-Object						
Boys	41.93	46.40	47.86	44.51	42.19	40.94
Girls	38.93	46.53	40.75	43.88	42.21	42.23
Both	40.43	46.47	44.31	44.29	42.20	41.59
Subject-Verb-Predicate Nominal						
Boys	6.13	4.07	3.14	2.79	1.88	3.29
Girls	4.00	2.93	1.25	1.69	1.93	1.54
Both	5.06	3.50	2.19	2.24	1.91	2.41

TABLE 9

GRAMMATICALLY INCOMPLETE STRUCTURAL PATTERNS IN SPEECH OF BOYS AND GIRLS AT SIX GRADE LEVELS: RATE OF OCCURRENCE PER 100 T-UNITS

	Kindergarten	Grade 1	Grade 2	Grade 3	Grade 5	Grade 7
Boys	9.33	9.87	7.36	4.00	1.81	1.59
Girls	10.47	6.40	4.94	3.19	2.64	1.54
Both	9.90	8.13	6.15	3.59	2.23	1.57

6. Grammatically incomplete structural patterns occur more frequently in the language of boys than in that of girls at grades one, two, and three, but the overall difference by sex is not significant (Table 9).

CONCLUSIONS

The data gathered in this investigation provide the basis for the following conclusions:

1. Length of nimimal terminable syntactic unit and number of sentence-combining transformations per unit increase with advance in grade and are useful indications of growth in language. Since an increase in number of transformations usually results in a longer terminable unit, these two measures of language development are closely related. Of the two, length of minimal terminable unit is easier to observe and is probably the best single index of structural complexity of language.

2. Significant increments in length of terminable units and in number of sentence-combining transformations per unit between kindergarten and grade one and between grades five and seven indicate that these levels are important stages in the development of language structure. The absence of comparable increments at other grade levels indicates that the language of children undergoes relatively little development in complexity of structure from grade one to grade five.

3. Since noun clauses, adjective clauses, and adverb clauses do not increase significantly with advance in grade but nominal constructions containing adjectives, participles, and prepositional phrases do show significant increments in rate of occurrence, the latter constructions are useful indications of growth in structural complexity of language. The fact that these constructions result from deletion transformations suggests that transformations requiring application of deletion rules contribute more to complexity of syntactic structures than do transformations forming subordinate clauses.

4. Structural patterns of main clauses show little change from kindergarten to grade seven; therefore, they are not an efficient measure of language development at the elementary school level.

5. The fact that boys excel girls in length of terminable unit and in use of nominal and coordinate constructions suggests that the language of boys may be somewhat more complex in structure than the language of girls. This evidence combined with findings of other studies (4, 8, 11) conducted in recent years makes it difficult to maintain the widely accepted belief that girls are superior to boys in language development.

IMPLICATIONS

The findings of this investigation of children's language have several implications for the teaching of English. As Loban (8) has pointed out, prior research has not resulted in identification of clearly determined stages of development in the language of children. The techniques of analysis employed in the present study enable us to see some patterns of development not clearly indicated in earlier studies. For example, in these language samples, the number of sentence-combining transformations and the number of words per terminable unit increase significantly from preschool to grade one and from grade five to grade seven. Several of the more specific measures show this same pattern.

The preschool years constitute a period of rapid and extensive development in language structure; then from grade one to grade five, if these samples are representative, it appears that growth proceeds at a much slower rate. Approaching adolescence, children apparently experience an increase in rate of language growth, and their increasing physical maturity is accompanied by a corresponding increase in maturity of language structure.

The findings of this study indicate that by the time the child reaches first grade he has mastered the basic sentence patterns that he will be using most frequently throughout his elementary-school career, and indeed throughout his life. He is capable of performing a great many sentence-combining transformations, but he prefers to communicate largely by means of kernel and near-kernel sentences. He uses noun clauses, adjective clauses, and adverb clauses nearly as frequently as the child in fifth grade does, but his ability to manipulate transformations of deletion, transposition, and expansion is rather limited. By the time he reaches grade seven, he can more easily reduce clauses to phrases and single words, and he often combines these deleted constituents into coordinate constructions.

This information has possible implications for the teaching of English in the grades. It seems that the upper elementary grades and the junior high school grades should provide opportunity for directed growth in language ability. During this period of accelerated development in language, it seems likely that teaching materials and techniques designed to heighten awareness of the structural resources of the language would be particularly effective.

Of course there are many questions that must be answered in the light of further research. Some of the more pressing ones seem to be these: Is the period between grade one and grade five necessarily one in which little structural development takes place, or would more efficient instruction result in more rapid growth? Does deliberate instruction at any level contribute a great deal to mastery of language, or does the child just absorb a functional knowledge of language structure from his environment? If deliberate instruction does result in increased facility with language, what materials and methods of instruction are most effective and efficient? These questions are not new, and the answers may continue to be elusive. However, it does not seem unreasonable to hope that recent advances in linguistic science can contribute to the solution of many of our problems in language teaching.

The investigators have been impressed by the efficiency of the techniques of analysis provided by transformational grammar. These techniques provide insights into the structure of language which are not easily accessible by other means. Possibly, they may be equally useful in teaching children the structure of their language.

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