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ABSTRACT

The purpose of the study was to apply various quantitative and qualitative indices of grammatical complexity proposed by Hunt (1965) to written language samples of hearing impaired students. Hunt studied grammatical structures of normal students at three grade levels, and found that the minimal terminal syntactic unit, or T-Unit, more reliably measured increasing syntactic complexity than the Subordination Ratio commonly used. Part I of the investigation studied the T-Unit as a measure of syntactic complexity in the written language of 23 males and 23 females at nine selected age levels (10-18 years). The Subordination Ratio appeared to be more useful and reliable than the T-Unit, which, however, did prove to be a useful measure. Part II of the study examined the types of grammatical structures which were chief contributors to increasing syntactic complexity in the written language samples. It was found that certain types of verbs and verbals possessed a great deal of sensitivity to growth across the whole 9-year age span sampled, while other constructions tended to be sensitive only at the younger or only at the older ages. (Author/KW)

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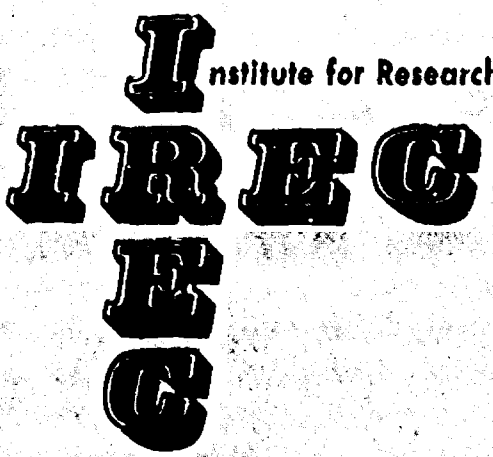

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1970

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Department of Health, Education, and Welfare

U. S. Office of Education
Bureau of Education for the Handicapped

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ABSTRACT

The purpose of the present study was to apply to written language samples of hearing impaired students various quantitative and qualitative indices of grammatical complexity proposed by Hunt (1965). Hunt studied grammatical structures written at three grade levels by students with normal hearing, and found that the "minimal terminable syntactic unit", or T-Unit, was a more reliable measure of increasing syntactic complexity than commonly used measures such as the Subordination Ratio. He further found that increasing syntactic complexity, as measured by the T-Unit, was chiefly the result of growth in nominal structures, with some slight growth occurring in the verb auxiliary and in the main verb.

Part I of the present investigation examined the T-Unit as a measure of syntactic complexity in the written language of hearing impaired students in comparison with various other measures of such complexity. While the T-Unit proved to be a useful measure of syntactic complexity, the Subordination Ratio appeared to be still more useful and reliable for assessing complexity in the types of "garbled" language usually present in the written productions of children with severe hearing impairments.

Part II examined the types of grammatical structures which were the chief contributors to increasing syntactic complexity in the written language samples. The most noteworthy finding in this section of the study was that certain types of verbs and verbals possessed considerable sensitivity to growth across the entire nine year age span sampled, whereas other constructions tended to be sensitive at either the younger or the older ages alone. While these studies, which are only part of a larger research program, were not directly concerned with problems of teaching methods and curriculum, the investigators concluded that they had some contributions to make to objectivity of written language assessment which is often an essential of sound methodology.

PART I

I. INTRODUCTION

Statement of the Problem

Language, as it is most characteristically understood, is considered to be useful for the expression of ideas, sense experiences and feelings. Notions of some lesser currency might embrace language as being a cultural tool most facilitative of an expressive-receptive communication act. Yet, whatever the notion subscribed to may be, language is in the final analysis most appropriately considered as an entity being co-extensive with the whole of the acculturation process. Of the many intellectual, socio-emotional and psycho-social factors contributing to this process of acculturation, language appears as the single most pervasive factor of all.

The communicative modality most critical to development of the language process is the socially functioning sense of hearing and the development of that language is initially dependent upon an unimpeded reception of the speech-sounds forthcoming from the members of one's own social group. When a condition of severe auditory deprivation sets in from early life a pronounced retardation in the child's acquisition of both his expressive and his receptive communication abilities invariably results. This identification of one of the focal tragedies of deafness provides the basis for the truism that no responsible teacher of the severely hearing impaired child exists who is not at the same time a practioner of the art of teaching grammar and meaning. The problem and entrusted challenge for teachers has been to develop the language productions of their hearing impaired students so that even the near limits of grammatical acceptability might hopefully be attained. That this hope has not been realized for the majority of such children is supported by the relative profusion of comparative, cross-sectional and longitudinal research studies conducted over the past

several decades on this very topic of language deviance in the severely hearing impaired child.

A study of classical works dealing with the language performances of severely hearing impaired children has revealed a remarkably concerted approach to the matter of research objectives. To wit, consistent efforts have been expended in the direction of formulating valid and reliable tools of quantitative description capable of measuring various stages of the language acquisition process and the manner in which those stages were experienced by the hearing impaired child. Traditionally, such designs were often characterized by the use of a comparison group of subjects with normal hearing so that the magnitude of the language retardation experienced by the severely hearing impaired subjects over a specified range of related language phenomena could be brought into bold relief.

While it is not wholly germane to the present paper's purpose, the question of the relevance of such comparisons nevertheless should be raised. Is it in fact justifiable or even realistic to suppose that a valid basis for comparison exists between such groups, especially when one considers the vast wealth of language experience that the hearing child brings with him to his first day in the classroom as compared to the non-hearing child? Do such comparisons have as their practical end the purpose of drawing the margins of testable between-group differences so as to dramatize the extent of the deviance? or do they attempt thereby to describe the grammatical locus of the deviance relative to correct usage? or to enumerate the relative frequency of occurrence of the errors committed by hearing and hearing impaired writers alike? or, finally, to contrast the sensitivity of various indices toward identifying those syntactic/semantic changes occurring along the continuum that extends from initial states

of outright deviance on up through to the successive stages that ultimately culminate in an accomplished and creative written production?

It appears that interrogations of this nature should preface one's reasons for comparing the written performance levels of the hearing to the hearing impaired. Perhaps after considering these and other similarly pointed questions the investigators of tomorrow would come to bring the cross-hairs of their sights more into line with those differences occurring at the intra-group level of response. Designs and hypotheses could then be couched within the framework of ascertaining just how much of a distance must be traversed along the language continuum before any conclusive evidence is given of grammatical improvement. Once a specific and yet to be empirically-determined level of accomplishment is attained, inter-group comparisons might then prove to be of more legitimate and fruitful currency.

Yet before we can bathe in the luxury of such arm-chair speculations, there still exists a critical need for the possession of quantitative indices capable of measuring the changes occurring over time within the grammar system. Granted the fact that while indices sensitive to the changes in one group of subjects may not be of similar sensitivity to another group, at present the most feasible way to probe the measurement and discrimination potential of a given index would be to compare its performance on an inter-group basis.

It is within the framework of these considerations that the purpose of the present investigation is to (1) test the efficacy of using with hearing impaired subjects a selected set of measures regarded as capable of discriminating some of the language performance patterns characteristic of hearing children, (2) ascertain the sensitivity of these various indices in separating levels of performance on the basis of time by means of contingency coefficients, (3) suggest for the

various structural aspects of language possible levels of achievement expectation for specific age groups by means of regression analyses, and (4) witness whatever long term growth rates are manifested by the hearing impaired subjects sampled at each of nine distinct age levels.

Review of Related Literature

Many of the traditional indices employed in the present enquiry have been extensively dealt with elsewhere in the literature. The writings of Rosenstein and MacGinitie (1965), Gunderson (1965), Simmons (1963), Carroll (1960, 1953, 1939), Myklebust (1960), Harrell (1957), McCarthy (1954), Heider and Heider (1940) ... have all presented either critical reviews of earlier research and/or included in their own investigations substantive accounts of the attempts to quantify language productions according to measures of length, grammatical sophistication, diversity of usage or frequency of error commission. In the attempts of these and related studies to achieve (1) meaningfulness of both purpose and group comparisons (2) relevance to clearly applicable ends, and (3) sufficiency of linguistic assessment, they more often than not contained as their principal methodological consideration the description of children's language along various developmental stages. In summarizing such studies as these as well as those of Taylor (1969), Quigley (1969), Stuckless and Marks (1966), Hunt (1965), Yedinack (1949) and Williams (1937), careful consideration must be given to (1) the conditions under which the verbal responses were elicited, (2) the essential characteristics of the stimulus materials, and (3) the manner in which the measures and classifications were defined.

A contrasting of the LaBrant (1933) with the Hunt (1965) study, as a case in point, affords an apt illustration of the discrepancies occurring when definitions of terms and units are not brought into consideration by the reviewer. The 1933

study in question made a claim for clauses to be regarded as the criterion units useful for the differentiation of linguistic behavior. Investigators up to that time had experienced considerable disillusionment with the sentence unit as a reliable gauge of language maturity. The arguments arrayed against it were, briefly, (1) that young subjects were none too careful in their observance of the rules of punctuation, and (2) that the excessive use made of coordinating conjunctions by such subjects tended to spuriously inflate the various indices dependent upon it. LaBrant, thus choosing the clause as the next best practical unit and describing it as being composed of all expressions containing predication, computed the length, subordination and frequency of clause usages. Only the ratios of subordination were found to be useful in differentiating among the various groups studied. Anderson (1937) and later Hunt (1965) questioned the validity of describing clauses solely on the basis of predication. They argued that by so doing little consideration was given to the tendency of young children to over-coordinate their subjects and predicates. Hunt in adjusting for this phenomenon described his clauses as containing a subject and predicate either one of which might be coordinated. With this refinement a slightly different disposition of data resulted. Whereas LaBrant had reported a nearly linear relationship over time with the subordination ratios, Hunt, on the other hand, found that (1) the rate of increase tapered-off over time, and (2) due to the amount of overlap in age groups, the discriminability that this index offered left much to be desired and thus was not as critical a delineator as the LaBrant data indicated.

Aside from the above methodological considerations often dealt with by investigators, many of the developmental aspects of language they reported can be identified on either logical, linguistic or even psycholinguistic grounds. Evidence for this statement can be indirectly attested to by witnessing the many

constellations of teaching and acculturation that contribute to the evolution of the language process in the growing child. It is to be expected, however, that as the level of enquiry becomes increasingly more exhaustive these many facets begin blending into an undistinguishable meld. Such was the trend among those classic studies positing the need for the establishment of normative observational data pertaining to the grosser aspects of language development. The reports of Templin (1957), Davis (1937), Fisher (1934), and Shirley (1933) are but a few to be mentioned in addition to the ones already cited. More recently, procedures and units of a more sophisticated language analysis have been developed and applied in the studies of Mellon (1969), Menyuk (1969), Schmitt (1968), O'Donnell, Griffin and Norris (1967), McNeill (1966), Hunt (1965), Brown and Bellugi (1964), and Velten (1943).

The present study, in its attempt to differentiate written productions collected from a stratified age sample of hearing impaired subjects, employed the tools of analysis established by Hunt (1965). The entire superstructure of quantitative analyses used by Hunt rested upon the identification of his unique minimal terminable syntactic unit (T-Unit). One of the principal findings of his enquiry was that sentence length, clause length and subordination ratio were all of inferior discriminability relative to the T-Unit. This unit, Hunt concluded, achieved the objective of isolating the nuances of growth occurring both within and between ranges of age.

It was the intent of the present investigation then to pursue the search for these growth sensitive indicators in the written language of hearing impaired subjects and to compare the findings with the approximate age group results of the normal hearing subjects of Hunt (1965) and the hearing impaired subjects of Taylor (1969). The purpose of such comparisons was to gain critical insight into

the sensitivity and consistency of the indicators in measuring the stepwise developmental changes occurring in the use of the grammatical structures of language.

II. METHOD AND PROCEDURE

Selection of Subjects

The procedural analysis followed in the present study was an application of the quantitative and qualitative indices of language maturity devised by Hunt (1965) to the samples of written language of hearing impaired students collected by the cross-sectional study of Stuckless and Marks (1966). In that study a representative sampling of 450 hearing impaired students were stratified on the basis of (a) type of school program, (b) chronological age, (c) sex and (d) the geographical incidence of deafness as provided by the morbidity surveys of the U. S. Bureau of the Census. All subjects in the study had hearing impairment of 70 decibels (ASA) or greater in the speech range of 500-2000 Hz. and had no apparent disability other than hearing impairment. Language performances of at least 50 words in length were elicited by four picture sequence cards depicting the preparations of a family for a picnic outing. Several copies of each subject's language sample were then made in order to be evaluated by three "master" teachers of deaf children. Somewhere in the process of these clerical transcriptions and their subsequent mailings to the present investigators the intactness of the 50 papers at each of the nine age levels had been altered, thereby leaving disproportionate totals. In view of the assumptions employed by the current design analysis, random deletions of subjects were performed on the original data so that equal proportions of 23 males and 23 females resulted for each of the nine selected age levels of 10 - 18 years.

Quantitative Indices of Analysis

The following objective quantifications were performed on every language sample examined at each of the nine age levels.

(1) Length of composition in words. Despite the popularity of this gross

measure in many of the conventional studies of grammatical deviance, its validity as a viable indicator of language maturity has been regarded with reservations by many investigators. Its inclusion in the present study was based more on the exploratory grounds of comparison with the same measure of length using T-Units as the counting device in lieu of words rather than for any specific grammatical interests. Words were defined as any collocation of letters treated as a meaningful unit by an acceptable lexicon.

(2) Length of composition in T-Units. The minimal terminable syntactic unit as defined by Hunt (1965) consists of a discrete main clause capable of expansion or embedding by structural dependencies that can serve either as modifiers, complements or substitutes for the words occurring within the main clause. From both a practical and theoretical stance this measure has considerably more objectivity and hence future promise as a baseline index than does the arbitrarily defined sentence unit.

(3) Length of clauses in words: Synopsis Factor #1. All verbs having subjects and tense markers were considered as clauses. This measure was computed as the total number of words divided by the total number of clauses. The comparability of this index to earlier investigations is limited due to the manner of defining a clause. Amplification on this point is given later in the discussion of the results for this particular index.

(4) Clause dependency orders. This measure, in a manner different from the following two measures of clause subordination, indicates the depth of clause subordinations by enumerating the frequency of dependent clauses to (a) main clauses and (b) to successive occurrences of dependent clause annexations falling within a given T-Unit. Each instance of annexation beginning with a Zero-Order or no annexation to the main clause and then a First-Order or one dependent

clause annexation to the main clause, and so forth is referred to in this paper as a numbered-order dependency.

(5) Subordination ratio. This traditional measure as devised by LaBrant (1933) and later modified by subsequent investigators is the number of dependent clauses taken as a proportion to all clauses both dependent and independent and expressed as either a decimal fraction or a per cent. It was included in the present analysis to (a) compare it to earlier samples of hearing impaired subjects scored on this measure, and (b) compare it to the following T-Unit subordination ratio by means of testing for the strength of its relationship with advancing age level via a contingency coefficient.

(6) Ratio of clauses/T-Units: Synopsis Factor #2. This ratio was intended by Hunt (1965) to be a replacement or at least an improvement upon the older measure of the Subordination Ratio. It is the ratio of all clauses to main clauses. It provides an arithmetical link with the first and third Synopsis Factors.

(7) Length of T-Units in words: Synopsis Factor #3. This index which was found by Hunt (1965) and Taylor (1969) to be a very significant indicator of language maturity can be computed as either (a) the product of the first two Synopsis Factors or (b) the total number of words divided by the total number of main clauses.

(8) Ratio of T-Units/sentence: Synopsis Factor #4. Whether sentence length increases more as a function of (a) a coordination of T-Units of (b) the expansion of the T-Unit itself, can be indicated by this measure.

(9) Length of sentences in words: Synopsis Factor #5. Computed as the total number of words divided by the total number of sentences, this measure was found to fluctuate considerably from age to age by Hunt (1965) and Taylor (1969). The

sentence was defined as a punctuated unit beginning with a capital letter and ending with a period.

Thus the Synopsis Factors of the three mean lengths and the two ratios along with the other dependent variables were contrasted with the independent variables of Sex and Age Level as the chief objective indices for analyzing the present language samples with the aim of identifying those most sensitive to changes over time.

Data Processing and Design

For every sample of writing a frequency count was performed on the number of (a) sentences, (b) words, (c) dependent and independent clauses and (d) independent clauses --- only. All counts were made independently by two investigators and any differences were resolved by them in conference with a third investigator. These routine enumerations were essential for the computational superstructure built upon the study's cornerstone --- the minimal terminable syntactic unit. As has been explained, the T-Unit is a single independent predication annexed, if at all, by any given grammatically correct subordinations. While these T-Units are not necessarily delimited to the boundaries established by a writer's punctuation --- which is especially the case when dealing with deviant writings --- they can as a rule be identified with sentences both simple and complex. The coordinations present in sentence compounding, however, do not affect the T-Unit frequency counts in a given corpus but they do exert a lengthening effect on the T-Units themselves.

After the number of T-Units was outlined for every corpus, the other objective measures of differential language behavior were secured. These dependent quantitative variables afforded bases of comparison to the studies of Taylor (1969), and Hunt (1965).

The greater part of the descriptive, parametric and non-parametric

statistics involved in the study were performed by the IBM 360/75 electronic data processing system at the University of Illinois. The programs employed were those contained in J. W. Dixon (Ed.) Biomedical Computer Programs and X Series Supplement, University of California Press, 1968. The analytical procedures used in (a) testing the statistical significance of the F ratios and then identifying the specific locus of these differences among the multiple comparisons of the age year levels via the "studentized range statistic" were those methods described by Lindquist (1953; Pp. 207-214) and Winer (1962; Pp. 77-85), respectively; (b) the methods used to perform a test for trends and the subsequent fitting of the data to regression lines of best fit were described in Winer (1962; Pp. 65-76); (c) Siegel (1956; Pp. 175-179, 196-202) was followed in the computations of the chi squares and contingency coefficients to demonstrate the strength of each variable's relationship with advancing age level; (d) finally an intercorrelation of the variables was performed to determine the non-chance relationships existing among them.

Similar to the procedures employed by Hunt (1965) percentages were used to show the relative rate or gain in growth from year one to year five to year nine. In so doing, the number of occurrences of usage of a particular construction appearing at year nine was always taken as 100 per cent --- the assumption being that such performances were the target toward which the younger students moved.

The basic design employed was that of a 2 x 9 (Sex by Age Levels) factorial analysis of variance. This permitted comparison of the language indices of the males and females for each age level as well as testing for any possible interactions between sex and age on any of the dependent variables.

III. RESULTS

Variables of Mean Composition Length

The literature of Taylor (1969), Myklebust (1960), Goda (1959), Yedinack (1949), Heider and Heider (1940), Thompson (1936) and Stormzand and O'Shea (1924) have all proposed a variety of measures appertaining to the total productivity of a written language sample. The indices chosen for the present enquiry are the Mean Number of Words and Mean Number of T-Units per Composition. The fact that these two units are defined independently of the sentence contributes substantially to their objectiveness.

The F ratios of Table 1 give sufficient grounds for rejecting the hypothesis of no differences existing both between sexes and then among age levels when composition length was computed as a function of the total number of words produced. These differences are brought into greater relief by Figure 1. The noticeable dip in male performances at years 12 and 13 may be attributable to the chance fluctuations often found concomitant to small samples ($n_{males} = 23$).

A test for trends on the criterion scores revealed a very strong linear component with no evidence of quadratic or cubic trends appearing. The regression analysis performed using this linear component of the data showed that 96 per cent of the observed variation in (Y) mean number of words over (x) time can be accounted for by the relation of $Y = 143.35 + (10.75) X$, given $X = 1$ = age 10, $X = 2$ = age 11 .... Further analysis revealed that only chance departures from the linearity of the trend were exhibited occasionally by the males and females.

It is to be noticed in Figure 1 that the margins between sex differences were somewhat larger than those reported by Myklebust (1960) at the lower ages but, as was reported by Myklebust, such differences became minimal with the presently sampled subjects. Of purely incidental interest in Figure 1 is the

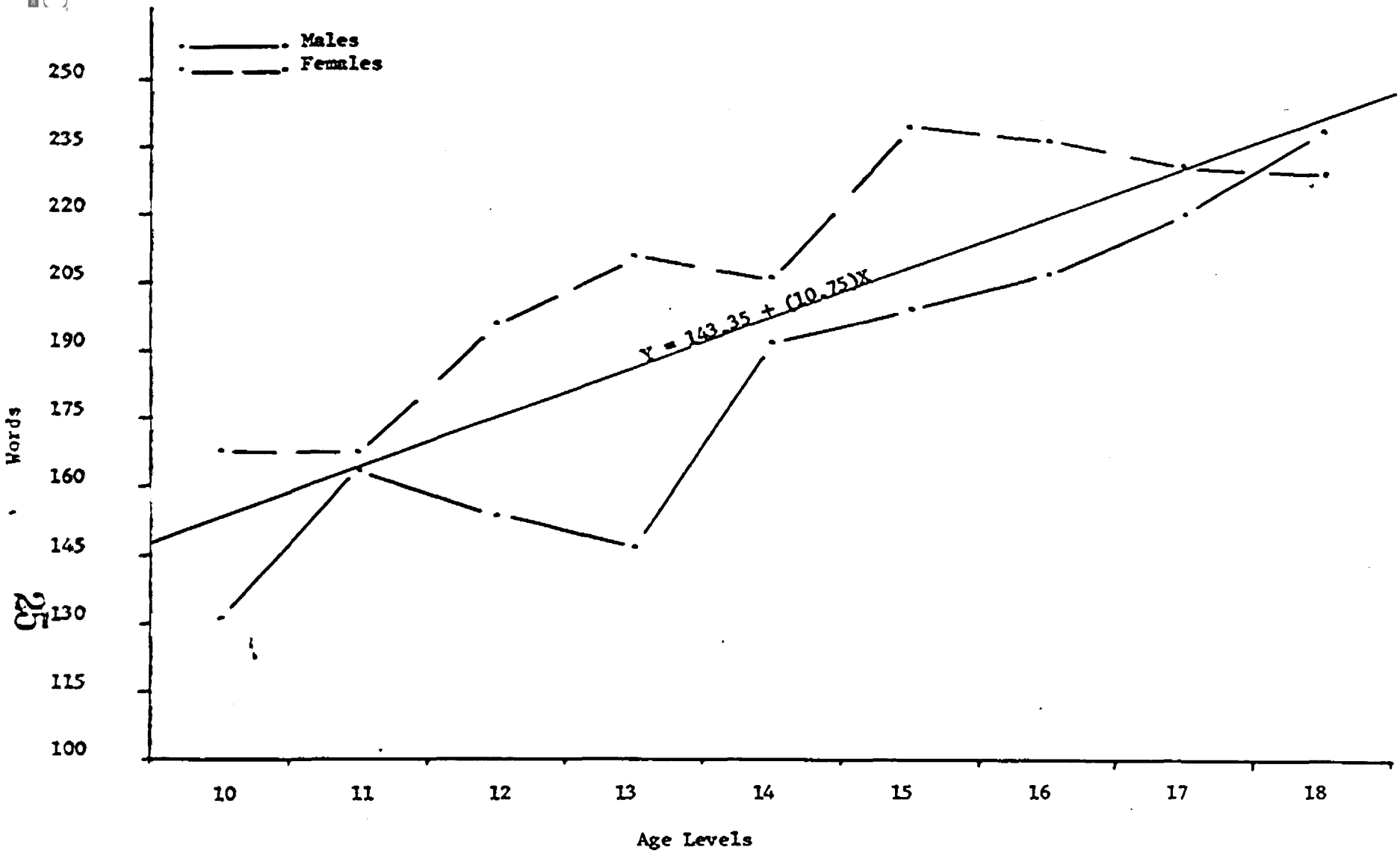
TABLE 1

Analysis of Variance Summary for Mean Composition Length Variables

Variable	Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Composition Length in Words	Sex	1	71771.50	71771.50	6.58	< .05*
	Age Level	8	332598.91	41574.86	3.81	< .01*
	Sex and Age Level	8	44791.61	5598.95	0.51	n.s.
	Within	396	4319025.30	10906.63		
	Total	413	4768187.32			
Composition Length in T-Units	Sex	1	502.26	502.26	2.73	n.s.
	Age Level	8	1323.43	165.43	0.90	n.s.
	Sex and Age Level	8	627.70	78.46	0.43	n.s.
	Within	396	72997.04	184.34		
	Total	413	75450.43			

*Significant

ure 1. Mean Composition Length in Words



coincidence of the expected with the actual performance level for the 11 year old males and 17 year old females.

The dashed line of Figure 2 compares the linear trend of the present data with the data of similar studies. Some of the discrepancies in the range of the number of words produced by the different studies can be attributed to either the nature of the stimulus materials used to elicit the language performance, and/or the sample size. Both the Taylor subjects and the present subjects show a decided improvement in length over time.

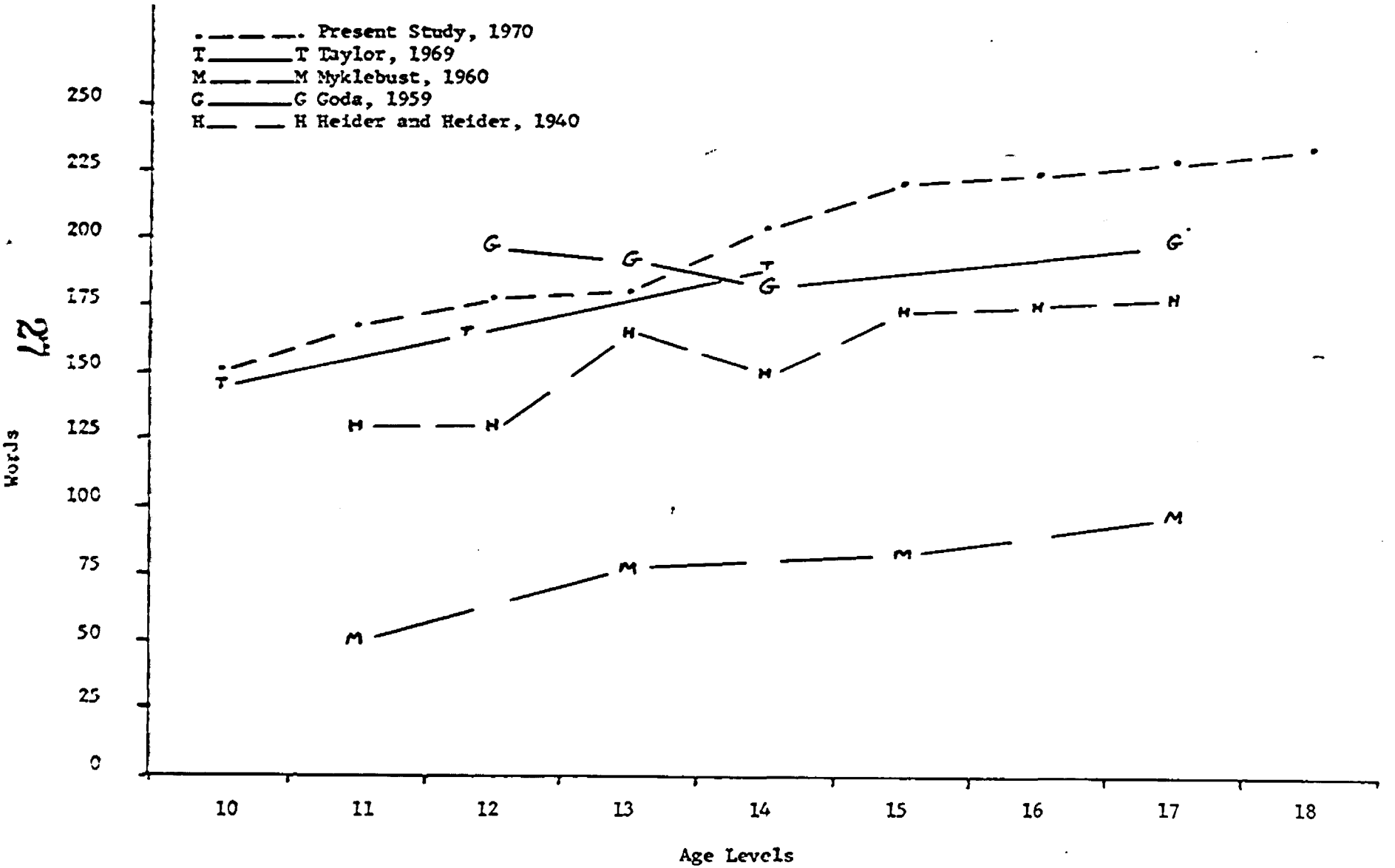
Referring back to the F ratios reported in Table 1 for the variable of Composition Length in T-Units, it is evident that only the tenability of the hypothesis of no differences can be maintained for the main effects of sex and age. The graphic portrayal of Figure 3 shows that all subjects produce compositions of the same length, aside from a few possibly chance differences, when the criterion measure is the T-Unit. Though the gross number of T-Units produced at each age level, represented by the line of "maximum range values", fluctuates considerably, the actual dispersion on a unit to unit basis (standard deviation) is quite consistent throughout the nine years tested.

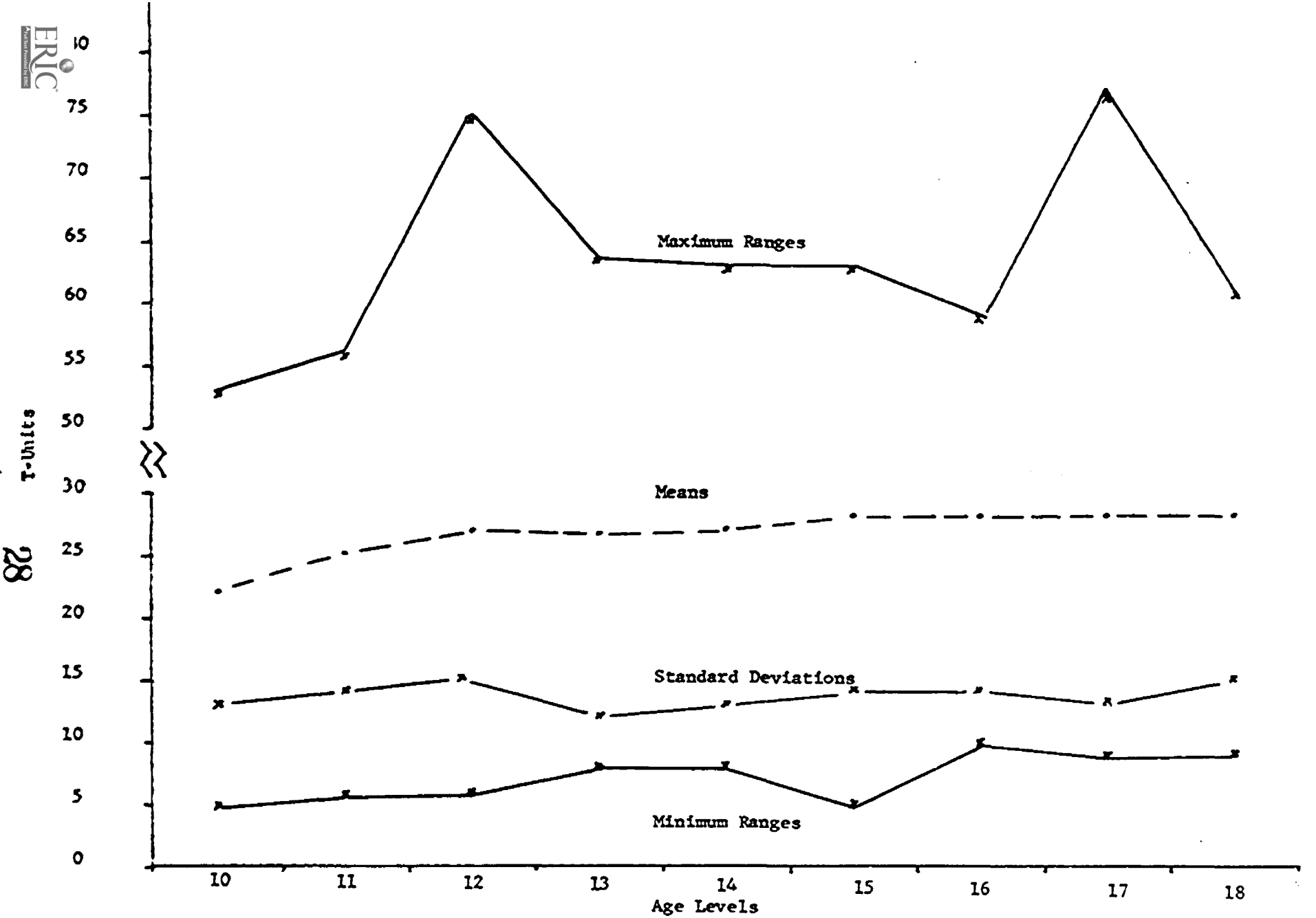
In summary then, if the criterion measure used was word-count the females showed a greater verbal productivity than did the males while the older subjects exhibited more output than did the younger subjects, but if the criterion measure was the minimal syntactic terminable unit no such differentiations were possible. This interesting comparison could be taken to mean that the writings of the present females and older subjects though greater in length were actually not grammatically different from males and younger Ss on the basis of T-Units produced.

Synopsis Factor #1: Length of Clauses

Since Hunt (1965) considered a "clause" as any subject-predicate unit either

Figure 2. Comparative Data on the Mean Composition Length in Words of Deaf Subjects from Five Investigations.




T-Units
10
75
70
65
60
55
50
30
25
20
15
10
5
0
Maximum Ranges
Means
Standard Deviations
Minimum Ranges
10
11
12
13
14
15
16
17
18
Age Levels

of which may be coordinated, then the results of the present study would not readily comparable to the earlier studies of LaBrant (1933) and even Heider Heider (1940). Take for example the following illustration of coordirated dicates:

I CAME, SAW AND CONQUERED.

lier clause definitions would compute the mean length as ...

5 words/3 predications = 1.67 words/clause;

reas later versions of the clause taking coordination into account would pute the length as ...

5 words/1 clause = 5 words/clause.

s latter and perhaps more orthodox version of the clause will be employed in present analysis.

Another procedure borrowed from Hunt was the practice of showing relative wth gains by comparing on a per cent basis the position attained by a low age el relative to that of the highest level of age sampled; the rationale being t the performances attained by the oldest group were those toward which the nger groups were striving. Table 2 compares these relative growth gains of present subjects to the hearing subjects of Hunt (1965) and the deaf subjects Taylor (1969). As a reference to Figure 4 will show, the present 10 year olds se variance approached closely that of the 14 year olds exhibited a criterion re performance superior to that of the 13 year olds, a span of nearly four rs. If their performance had been nearer where it was theoretically expected be, namely in the vicinity of 5.85 words/clause, the growth relative to age would be a total of 15 percentage points rather than the 9 shown in Table 2. we compare the lowest level criterion scoring of 5.73 occurring at year 11 the 18 year olds, a relative gain of 17 percentage points is achieved, an rovement which is just 6 per cent less than the improvement witnessed on the

TABLE 2

A Comparison of the Growth Gains in the Mean Clause Lengths of Hunt (1965) and Taylor (1969) with Present Subjects at Three Selected Age Levels Contrasting the Achievements of the Younger Ages Relative to the Highest Age Sampled in Per Cents

	Ages					
	10	14	18	11	13	15
Present Study (Deaf)	6.23 91%	6.37 93%	6.88 100%	5.73 84%	6.13 90%	6.79 100%
Hunt, 1965 (Hearing)	6.6 77%	8.1 94%	8.6 100%			
Taylor, 1969 (Deaf)				6.44 89%	7.09 98%	7.22 100%

Hunt hearing subjects in the same time period. These two groups of subjects did show identical increments of growth in the later time period of comparison occurring specifically between years 14 and 18.

A glance at the Taylor data shows most of the growth to have occurred in the earlier time period with practically no growth thereafter. The present subjects at these same age levels showed on the contrary that their Clause Lengths increased most at the higher age levels.

The analysis of variance summary of Table 3 gives cause to reject the hypothesis of no differences existing among Age Levels only. The "Tukey (a) Procedure" allocated the differences in the ordered age levels to occur only between the low scoring 11 year olds and the high scorings of the upper age bracket beginning with year 15. With no significant deviations from linearity occurring among the plotted means of any age level the line best fitting the linear trend is $Y = 5.73 + (0.137) X$. This relationship can account for as much as 77 per cent of the observed variation of Words/Clause over the nine ages sampled in the present study.

In summary, we can expect the mean Length of Clauses to show a proportionate increase with advancing age. Since a similar trend was reported to occur with Length of Composition in Words but not with Length of Composition in T-Units, it would seem that such length increases came about by excessive main clause coordination. Subsequent analyses confirmed this observation.

Measures of Subordination

A substantial body of the research literature dealing with language and its aberrations has dealt with the occurrence of subordinate clauses per main clause (Simmons, 1963, Harrell, 1957; Heider and Heider, 1940; LaBrant, 1933; Smith 1926). Hunt (1965) in searching for purer indices of syntactic maturity than those already in existence believed that he could make an improvement by suggesting an index based on the minimal terminable syntactic unit. A discussion of

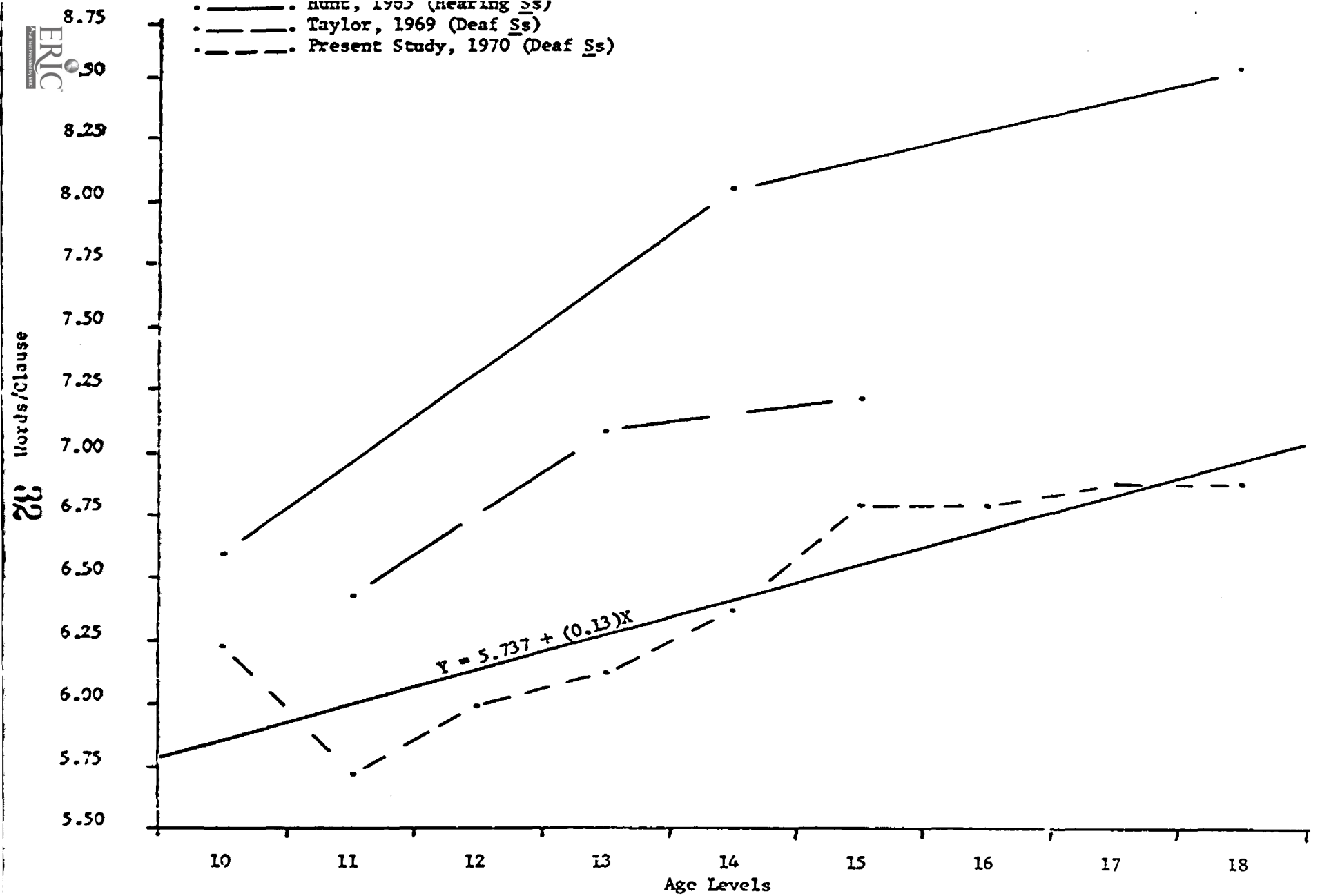

. ——— . Hunt, 1965 (Hearing Ss)
. — — . Taylor, 1969 (Deaf Ss)
. — — — . Present Study, 1970 (Deaf Ss)
Y = 5.737 + (0.13)X
Words/Clause
8.75
8.50
8.25
8.00
7.75
7.50
7.25
7.00
6.75
6.50
6.25
6.00
5.75
5.50
10
11
12
13
14
15
16
17
18
Age Levels

TABLE 3

Analysis of Variance Summary for Mean Clause Length in Words

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	1.35	1.35	0.62	n.s.
Age Level	8	66.73	8.34	3.81	$<.01^{*}$
Sex and Age Level	8	34.44	4.30	1.96	n.s.
Within	396	866.01	2.19		
Total	413	968.53			

*Significant

the results of both Hunt's study and the present study on these measures will yield empirical evidence to the contrary. The measures that will be analyzed and compared are (a) Clause Dependency Orders, (b) Subordination Ratio, and (c) Synopsis Factor #2: Ratio of Clauses/T-Units.

(a) Clause dependency orders. This measure is an indicator of the depth of clause subordination occurring within the T-Unit. It is the numbered-order of subordinate clause annexations to main clauses. Thus a Zero-Order Dependency is characterized as a simple T-Unit or main clause without any subordinate clauses attached to it. A First-Order Dependency differs from the previous order only by the addition of a single subordinte clause within the T-Unit. Second-Order Dependencies and all higher orders are formed by the successive annexations of dependent clauses to the dependent clauses of lower orders within any given minimal terminable syntactic unit.

As an illustration ...

i) (Zero-Order) ----- THE GENTLEMAN LET SLIP A FAUS PAX.

ii) (First-Order) ---- THE GENTLEMAN WHO HAD A TENDENCY TO THINK OUT LOUD LET SLIP A FAUS PAX.

iii) (First-Order) ---- THE GENTLEMAN WHO HAD A TENDENCY TO THINK OUT LOUD LET SLIP A FAUS PAX, THEN BLUSHED AT THE THOUGHT OF IT.

iv) (Second-Order) --- THE GENTLEMAN BLUSHED BECAUSE HE HAD COMMITTED A FAUS PAX WHICH WAS ATTRIBUTABLE TO HIS TENDENCY OF THINKING OUT LOUD.

In (iii) the ideas expressed by each of the dependent clauses clearly them to the main clause and therefore the subordination depth is no deepe a First-Order Dependency: whereas in (iv) the second subordinate clause i clearly dependent upon the first subordinate clause than upon the main cla for both its functional meaning and place of occupation within the T-Unit, thus becomes a Second-Order Dependency.

The hypotheses to be tested were that no differences existed in the population means of (i) Zero-Order, (ii) First-Order, and (iii) Second or Higher Order Dependencies across levels of Sex and across levels of Age.

Table 4 shows the percentages of the occurrence of Zero-Order Dependencies in the written language samples of the subjects. The per cent figures for the 17 and 18 year old males and the 18 year old females shows a decreased use of one clause T-Units. Such simple T-Unit constructions at all other age levels comprised an average of 86 per cent of the total writings produced. All observed differences in the use of these simple constructions could be ascribed to the fluctuations of chance.

It might be parenthetically stated that this lessened dependence shown by the oldest subjects in the use of single main clauses was noted also by the investigations of Heider and Heider (1940) and Stormzand and O'Shea (1927) who reported in their findings that the frequency of simple sentences decreased with advancing age in favor of more grammatically complex sentences.

The results for the analysis of variance for First-Order Dependencies are presented in Table 5. As the F ratios reveal, the only non-chance differences occurring were those to be found existing among the Age Levels. Thus with Sex not being a significant main effect, the scores were combined and presented as the clear-bars of the histogram in Figure 5. A test of multiple comparisons revealed that the exact loci of the age level differences were found to occur between the low scoring 10, 12 and 13 year olds and the high scoring 18 year olds. A closer examination of the 11 year old performances on this variable, one that also proved to be true on many of the subsequent variables, revealed an unusually high variance ($S^2 = 25.83$) that made the group comparable to the older ages which specifically in this case was with the 17 year olds ($S^2 = 29.68$). It was deduced then that the presence of a few atypically sophisticated writers among

TABLE 4

The Distribution of Zero-Order Dependencies
Across Sex and Age Levels

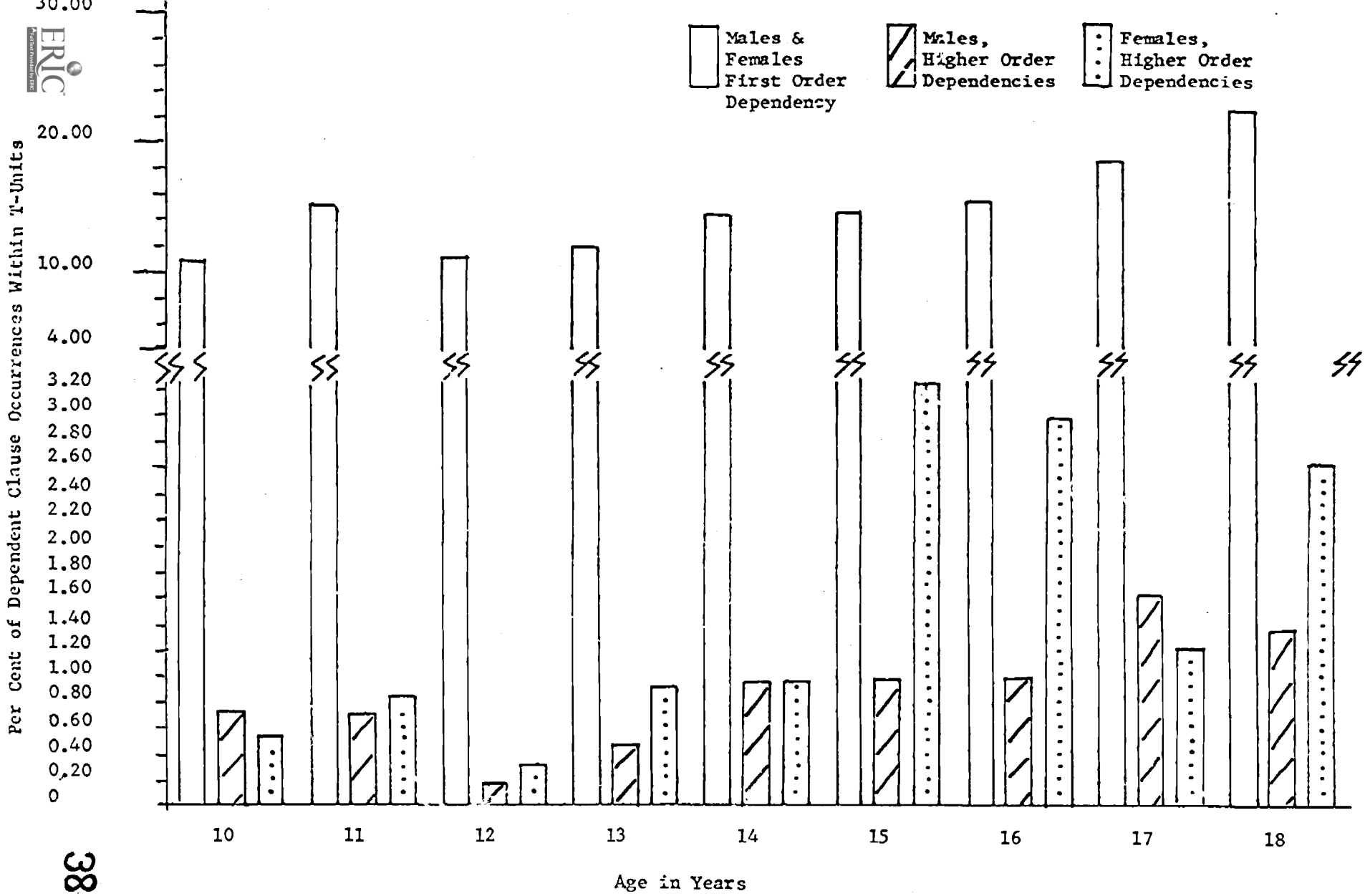
	Age Levels																	
	10		11		12		13		14		15		16		17		18	
	Main Clauses		M.	Cls.	M.	Cls.	M.	Cls.	M.	Cls.	M.	Cls.	M.	Cls.	M.	Cls.	M.	Cls.
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Males	397	88.62	497	88.59	503	89.98	493	88.67	542	85.90	532	86.08	564	83.31	490	77.04	511	75.70
Females	510	88.85	487	80.50	596	87.01	578	86.92	518	83.28	551	80.79	511	81.89	536	83.49	494	75.88
Combined	907	88.75	984	84.39	1099	88.34	1071	87.72	1060	84.60	1083	83.31	1075	82.63	1026	80.28	1005	75.79

TABLE 5

Analysis of Variance Summary for All T-Units Annexed by a Single Dependent Clause (First-Order Dependency)

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	15.63	15.63	0.75	n.s.
Age Level	8	530.59	66.32	3.20	$<.01^{*}$
Sex and Age Level	8	142.15	17.87	0.01	n.s.
Within	396	8212.39	20.74		
Total	413	8900.76			

*Significant


Males & Females First Order Dependency
Males, Higher Order Dependencies
Females, Higher Order Dependencies
Per Cent of Dependent Clause Occurrences Within T-Units
30.00
20.00
10.00
4.00
3.20
3.00
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0
10
11
12
13
14
15
16
17
18
Age in Years

the 11 year olds caused a spurious inflation of the mean, thus resulting in a positively skewed distribution.

While an overall test for nonlinearity gave no cause to suggest that the data departed from a straight line, the chance fluctuations that did occur as evidenced by the clear-bars of Figure 5 seemed to show with every triennium a modest increase in the use of two clause T-Units. If we cast the 11 year olds on the basis of their variance with the 17 and 18 year olds, the triennial trend of improvement shows a nearly perfect stepwise progression with time.

Second and Higher Order Dependencies were found to significantly discriminate the subjects on the basis of both Sex and Age Levels as can be seen by the F ratios of Table 6. It should be explained however that because of the extremely few instances of the third dependent clause being attached to the second, and the fourth to the third, et cetera, it was considered desirable to group all dependencies from the second up through to the sixth order and refer to them collectively as Second or Higher Order Dependencies.

Referring back to the histogram of Figure 5, it can be shown how the slashed-bars of the males were significantly surpassed by the buttoned-bars of the females in the older age bracket beginning with age 15.

Among the females themselves significant gains were found in their increased use of such dependencies between the upper ages of the 15, 16 and 18 year olds and the lower ages of the 10 and 12 year olds, as revealed by the Tukey test of comparisons among ordered means.

The males, despite a 0.9 per cent improvement among the 17 and 18 year olds relative to the low scoring 12 and 13 year olds, did not differ on the basis of chance alone in their usage of Higher Order Dependencies. The Tukey test may have been too conservative for these particular comparisons.

TABLE 6

Analysis of Variance Summary for All T-Units Annexed by Second or Higher-Order Dependencies and for Subordination Ratios

Variable	Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Second or Higher-Order Dependencies	Sex	1	3.13	3.13	6.14	<.05*
	Age Level	8	16.00	2.00	3.92	<.01*
	Sex and Age Level	8	6.35	0.79	1.54	n.s.
	Within	396	203.52	0.51		
	Total	413	229.00			
Subordination Ratios	Sex	1	24.64	24.64	0.22	n.s.
	Age Level	8	6231.66	778.96	6.95	<.01*
	Sex and Age Level	8	797.77	99.72	0.88	n.s.
	Within	396	44379.30	112.07		
	Total	413	51433.37			

*Significant

In summary it can be stated that with increasing age the hearing impaired subjects of the study increased the rate of their usage of single subordinate clauses (First-Order) until they nearly doubled the frequency of that usage in the ninth year relative to the proportions initially employed by the first year subjects.

On Second and Higher Order Dependencies the females became increasingly and, finally, significantly differentiated from the males over time producing from two and one-half to three times the number of such subordinations at the sixth, seventh and ninth years (15, 16 and 18 year olds) tested relative to their first few years. The lower variance found existing among the eighth year (age 17) females intimated the presence of a spuriously deflated mean that was probably brought about by a few atypically unsophisticated writers.

As for the production of Zero-Order dependencies --- main clauses only --- all of the 18 year olds and just the males among the 17 year olds exhibited a slightly decreased dependence on such simple constructions in favor of more complex arrangement of clauses, not quite enough however to be considered as anything more than a chance occurrence.

These results for the variable of Clause Dependency Orders can not be too closely compared to the findings of Hunt (1965, Pp. 25-28), principally because (1) sex was not a significant main effect in that study for dependencies above the first-order and (2) the ages for that study's three grade levels can only be approximated by the present investigators.

On the assumption that the age of a first grade hearing child is from 5 to 6, then Hunt's Grade Four subjects, in the approximate 9 to 10 year range of age, wrote about 25 per cent fewer T-Units composed of single main clauses than did the 10 year old deaf subjects of the present study as tabulated in Table 5.

The Grade Eight, circa 13 to 14 years, and the Grade Twelve, circa 17 to 18 years, subjects of Hunt produced an average of 40 and 45 per cent, respectively, fewer such elementary Zero-Order dependencies than did the present deaf subjects sampled within comparable age brackets.

As to the use of a main clause plus a dependent clause within a given T-Unit, the hearing subjects of Hunt employed an average of 20 per cent more of these First-Order dependencies than did deaf subjects of similar ages in the present study; whereas for Second and Higher-Order dependencies differences in such usage for the hearing subjects rose to as much as 110, 116 and 260 per cent, at each of the respective grade levels, over similar usages by the deaf subjects.

(b) Subordination ratio. A time honored measure of dependent clause frequency is the Subordination Ratio. Simmons (1963) and Smith (1926) regarded this measure as being the single best indicator of sentence flexibility and sophistication. According to Harrell (1957) and LaBrant (1933), the Subordination Ratio was the number of dependent predications divided by the total number of predications both dependent and independent. Hunt (1965) slightly modified this definition by limiting the Subordination Ratio to the number of dependent clauses to all clauses. Since the "clause" is defined by Hunt as consisting of a subject and predicate, both of which may be coordinated, then when two predicates appeared in the earlier definition of the ratio they would be counted as one, if coordinated, in the latter definition. Although the differences between the two definitions are probably of no practical consequence, the latter, more recent one is used in the present analysis.

The F ratios computed for the Subordination Ratio data are presented in Table 6. The specific locus for non-chance changes occurring among the Age Levels was found to occur between the 10 and 12 year old grouping and the 16,

17 and 18 year old grouping of ages. The 11 year olds had again reflected an atypically high variance relative to the lower age bracket.

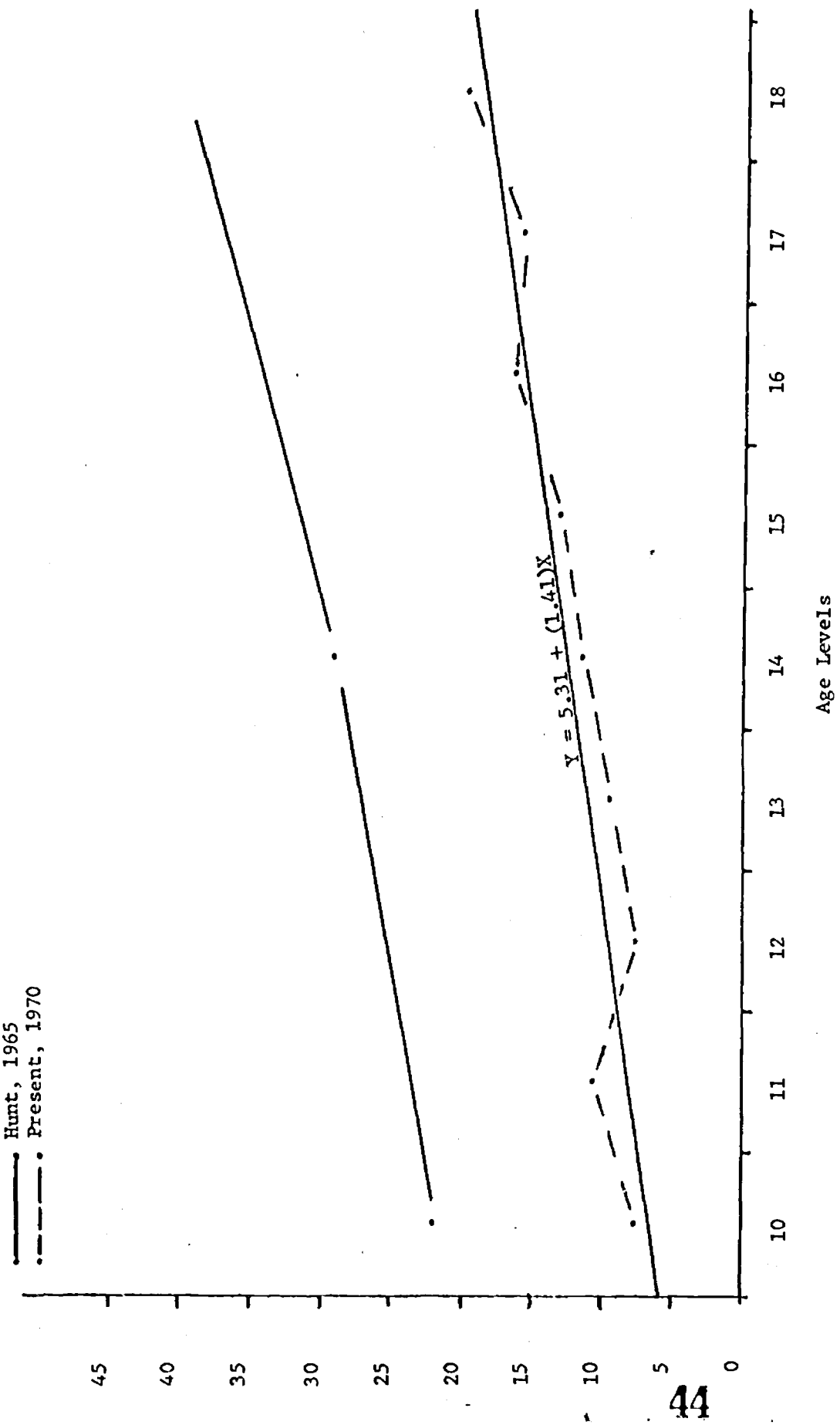
The graph of Figure 6 shows a very definite linear trend with no evidence of any statistically significant deviation from it. The regression equation of $Y = 5.31 + (1.41) X$ can account for as much as 88 per cent of the observed variation produced by the number of dependent clauses occurring relative to all clauses across the nine years tested.

The deaf subjects in comparison to their approximate hearing peers at the 10, 14 and 18 year old age levels produced respectively an average of 15, 20 and 25 per cent fewer instances of clausal subordination as measured by this variable.

The findings on the present subjects are consistent with the results reported by Simmons (1963) and Heider and Heider (1940) even though the older definition of subordination based on the incidence of predicates was employed by them instead of the presently used clausal definition. All of the studies quoted witnessed the same increase with time in the ratio of subordination.

The growth gains of Table 7 contrasting the hearing subjects of Hunt with the deaf subjects of the present study reveal about equal increment gains of about 20 per cent in the earlier time period of comparison; whereas in the latter time period the deaf subjects showed a gain of nearly one and one-half times the growth experienced by the hearing subjects. It would appear then that this index is sensitive to the growth in the language of both deaf and hearing subjects alike.

In summary the hypothesis of no differences occurring among Age Levels only in the present subjects' use of subordinate clauses relative to main clauses, was rejected. A substantial 61 per cent growth gain occurred over the nine years sample, in contrast to an only 45 per cent gain in hearing subjects of



igure 6. Comparison of Subordination Ratio Data of Present Deaf Subjects with the Hunt (1965) Hearing Subjects.

TABLE 7

A Comparison of the Subordination Ratios of Hunt (1965) with Present Subjects at Three Selected Age Levels Contrasting the Achievements of the Younger Ages Relative to the Highest Age Sampled in Per Cents

	Ages		
	10	14	18
Present Study (Deaf)	7.5 39%	11.5 59%	19.4 100%
Hunt, 1965 (Hearing)	22.2 55%	28.8 72%	40.1 100%

similar ages.

(c) Synopsis Factor #2: Ratio Clauses/T-Units. As did the Subordination Ratio and to some extent the Clause Dependency Orders, the present new index proposed by Hunt (1965) of Clauses/T-Units measures the incidence of flexible structures occurring within a given T-Unit. Flexibility is operationally understood here as being the number of dependent clauses appearing relative to a clause within a minimal terminable syntactic unit.

The results for this index are represented by the dashed line of Figure 7. With no statistically significant departures from linearity the regression of (Y) Clauses/T-Units on (X) Age levels and characterized by the relation of Y = 1.07 + (0.02) X can account for as much as 84 per cent of the observed variation over time.

The F ratio results of Table 8 give grounds for rejecting the hypothesis of no differences among Age Levels only. Despite the modest rate that is shown in Figure 7 of the subjects' Ratio of Clauses/T-Units, the criterion performances of the 10, 12 and 13 year olds were still found to differ more than that which could be expected on a chance basis alone from the older age levels of years 16, 17 and 18. Again the variance reported for the year 11 subjects (S^2 = 0.028) was comparable to a group in the upper age bracket which in this case was the 15 year old level (S^2 = 0.031) and thus did not differ statistically from the older ages.

Referring back to Figure 7 we see that the hearing subjects of Hunt (1965) exhibited a superior yet parallel development to the present subjects with a more pronounced acceleration of rate occurring at the older age levels of the former. The rate increase of the present deaf subjects is much more modest and can be brought into greater relief by the percentage comparisons of Table 9. Though the total range of differences for the criterion scores of the deaf

Figure 7. The Ratio of Clauses Per T-Unit for the Present Hearing Impaired Subjects as Contrasted with the Hearing Subjects of Hunt (1965).

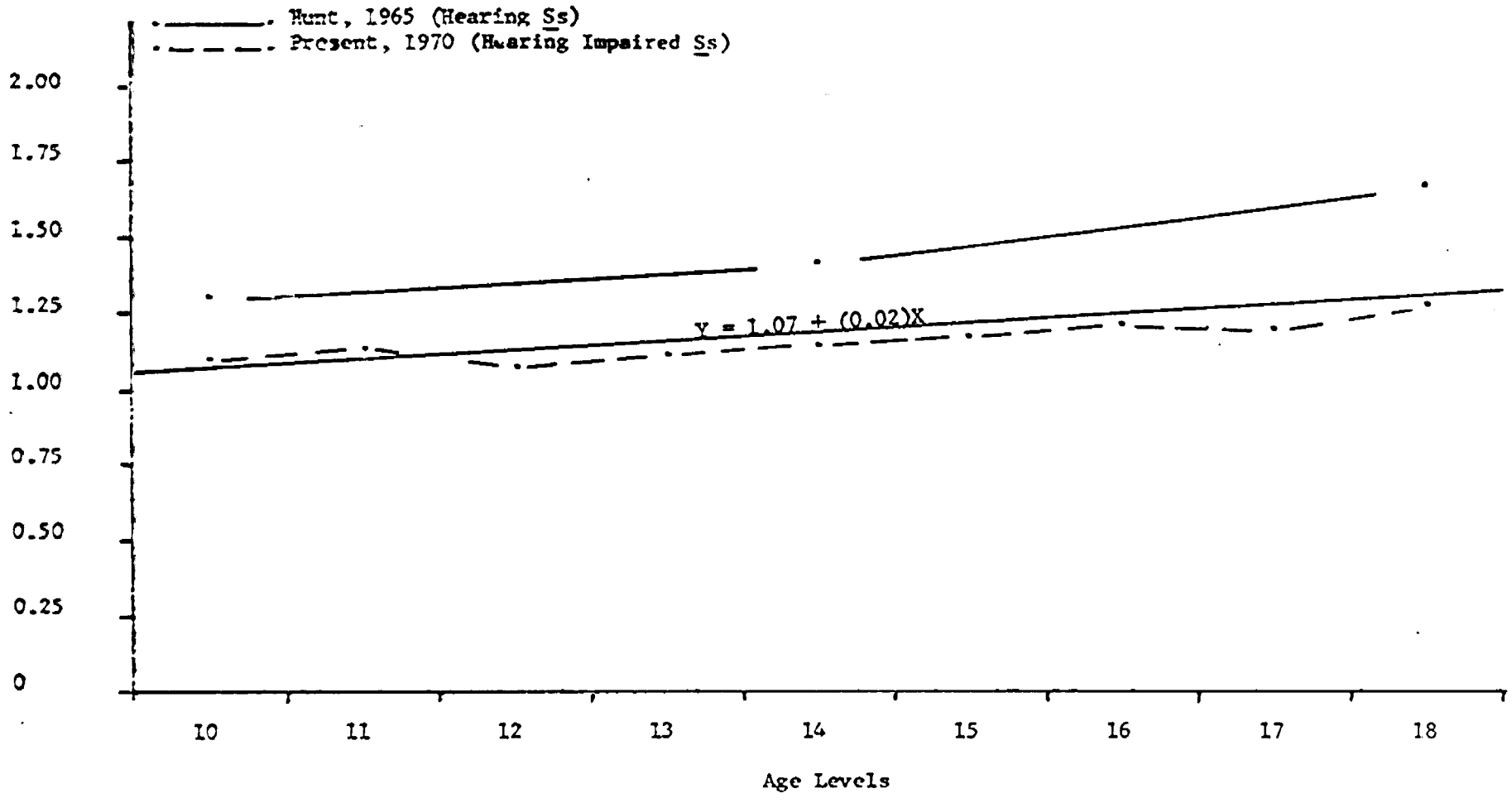


TABLE 8

Summary of the Analysis of Variance for the Ratio of Clauses/T-Unit

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	0.0024	0.0024	0.08	n.s.
Age Level	8	1.3113	0.1639	5.77	<.01*
Sex by Age Level	8	0.2091	0.0261	0.92	n.s.
Within	396	11.2412	0.0284		
Total	413	12.7640			

*Significant

TABLE 2

A Comparison of the Ratio of Clauses Per T-Unit in Clauses of Hunt (1965) with Present Subjects at Three Selected Age Levels Contrasting the Achievements of the Younger Ages Relative to the Highest Age Sampled in Per Cents

	Ages		
	10	14	18
Present Study (Deaf)	1.10 87%	1.15 91%	1.27 100%
Hunt, 1965 (Hearing)	1.30 77%	1.42 85%	1.68 100%

subjects shows an improvement of 0.17 score units compared to the 0.38 score units of the hearing subjects, the per cent gain for both groups during the first half-decade of age comparisons is found to be nearly doubled by tne second-half decade gains. In other words, in the first five year comparison the deaf subjects showed an increase of 4 percentage points in their ratios of Clauses/T-Units whereas the normal language subjects showed a doubling of that gain, namely an 8 percentage-point increase in the same time period. In the second five years, the deaf subjects doubled their earlier gain to a little more than 8 percentage units and the hearing subjects did similarly by achieving a little less than a 16 percent point increase.

In summarizing all three measures of subordination it can briefly be stated that (1) all indicated significant differences occurring among the Age Levels, (2) Second and Higher Order Dependencies could also significantly differentiate the superior performance of the females to the males, and (3) the growth gains for both the hearing subjects of Hunt (1965) and the present deaf subjects were the most dramatic for the Subordination Ratio index.

By witnessing the parallelisms existing in the table and figures for the subordination indices one is forced to admit the possibility that the linguistic processes of the severely hearing impaired on the quantitative measures used in this study are not necessarily generically different from those of hearing children of comparable age but that they are only suppressed along a temporal dimension.

Synopsis Factor #3: Length of T-Units in Words

The three Synopsis Factors are presented in Table 10 with comparison figures entered from the Hunt (1965) and Taylor (1969) studies. Reading the percentages down the Mean Clause Length columns of the present study and the Hunt study, the hearing impaired subjects exhibit a 2 and 7 per cent growth in the first and second-half decades of age comparisons, respectively, whereas the hearing subjects

TABLE 10

A Contrast of the Clause-to-T-Unit Length Factors of the Present Subjects with the Hearing Subjects of Hunt (1965) and the Hearing Impaired Subjects of Taylor (1969) Showing the Growth Rates in Per Cents Down Each Column

Ages	Present Study, 1970 (Deaf Ss) Mean Clause Length		Ratio of Clauses/ T-Unit		Mean T-Unit Length	Hunt, 1965 (Hearing Ss) Mean Clause Length		Ratio of Clauses/ T-Unit		Mean T-Unit Length
10	6.23 91 %	x	1.10 87 %	=	6.49* 74 %	6.6 77 %	x	1.30 77 %	=	8.6 60 %
14	6.37 93 %	x	1.15 91 %	=	7.35 84 %	8.1 94 %	x	1.42 85 %	=	11.5 80 %
18	6.88 100%	x	1.27 100%	=	8.75 100%	8.6 100%	x	1.68 100%	=	14.4 100%
Ages	Present Study, 1970 (Hearing Impaired Ss)					Taylor, 1969 (Hearing Impaired Ss)				
11	5.73 84 %	x	1.13 96 %	=	6.47 81 %	6.44 89 %	x	1.07 **	=	6.89 **
13	6.13 90 %	x	1.14 97 %	=	6.99 87 %	7.09 98 %	x	1.19 **	=	8.44 **
15	6.79 100%	x	1.18 100%	=	8.01 100%	7.22 100%	x	1.08 **	=	7.80 **

*Approximate values due to rounding errors.

**No per cents were available due to non-linear arrangement of data.

showed a 17 and 6 per cent rate for the same respective time periods. When the present subjects are compared to the Taylor subjects, however, the comparison dissolves, perhaps due to the admitted flaw in the latter's sampling procedures. Increases of 6 and 10 per cent with the present subjects are seen to be reversed by 9 and 2 per cent decreases with the Taylor subjects.

Moving to the ratio of Clause/T-Units columns for the 10, 14 and 18 year olds, both deaf and hearing subjects nearly doubled their gains for each time period. The largest gains however occured in the last column of the T-Unit Length variable where 10 and 16 per cent increases occurred for the deaf subjects and equal increments of 20 per cent for the normal language subjects over the two comparison periods of time. Quite clearly this index appears to show sensitivity to the changes in language sophistication over time.

The polygon of mean criterion scores in Figure 8 shows a much more abrupt acceleration than did the polygons of the previous two Synopsis Factors. As much as 92 per cent of the linear variation in (Y) the Mean Number of Words Per T-Unit can be predicted over (X) Age Levels from the relation $Y = 5.93 + (0.309)X$. With no significant departures from linearity in the observed data and with an F ratio as large as 8.40 (Table 11), the *a posteriori* test of multiple comparisons revealed non-chance differences occurring between the lower ages of 10, 11 12 and 13 and the higher age bracket beginning at year 15, with the 14 year olds differing significantly from the 18 year olds.

In summary, the subjects of the present investigation showed for all three Synopsis Factors their greatest rate of growth increase to occur within the later-time periods of comparison with the most substantial spurt occurring on the variable of T-Unit Length in words. The normal hearing writers in the Hunt study on the other hand tended to have their early growth in one factor offset by their later growth in the other factor so that the increments leveled off

ure 8. A Comparison of T-Unit Length in Words Attained by the Present Hearing Impaired Subjects to the Lengths Attained by the Hearing Subjects of Hunt (1965)

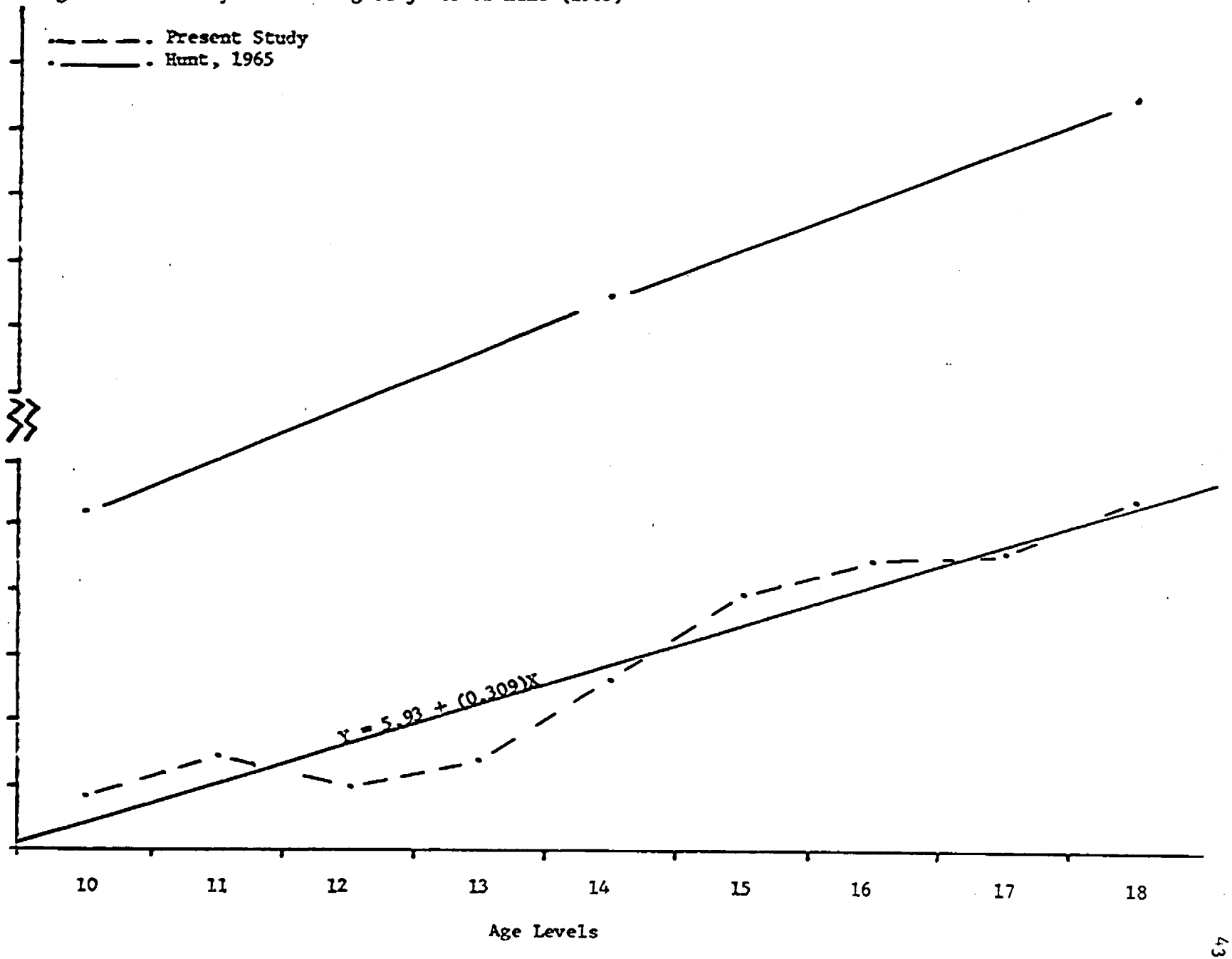


TABLE 11

Analysis of Variance Summary for Mean T-Unit Length in Words

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	2.0914	2.0914	0.49	n.s.
Age Level	8	286.7516	35.8440	8.40	<.01
Sex by Age Level	8	41.0106	5.1263	1.20	n.s.
Within	396	1690.7854	4.2697		
Total	413	2020.6390			

equally on the T-Unit Length in Words variable. Hunt (1965) concluded that this latter variable was a better index of language maturity than either of its two contributing factors taken separately. However, before any similar conclusion is deduced for the present data, an analysis of each variable's contingency coefficient will first be performed. These will be discussed in a later section of this chapter.

Synopsis Factor #4: Ratio of T-Units/Sentence

This present ratio unlike the previous ratio of Clauses/T-Units which was sensitive to changes in subordination can indicate the extent to which main clauses are being coordinated within sentences. If we subtract the whole number one from the absolute magnitude of this ratio's value and convert it to a per cent the resultant figure indicates the extent to which a second T-Unit has been connected to the first T-Unit within the sentence. These values may be regarded as a kind of "reverse reciprocal" of the growth rate gains of Table 12 and are themselves presented in Table 13.

Looking first at the performance of the normal hearing writers in these tables, there is witnessed a distinct yet linearly inverse trend functional to time. It was Hunt's initial conclusion that when sentence length increased due to the excessive coordination of T-Units in lieu of the expansion of T-Units themselves that a basic degree of immaturity of language usage was present. If this assertion is true, then the immaturity of the present hearing impaired subjects on this particular variable can be said to be quite marked.

In looking at the performance levels of the two groups of deaf subjects in Table 14, it can be seen that the greatest show of "immaturity" occurs in the earlier time periods of comparison for both groups of subjects, and that the "immaturity" seems to be greater in the Taylor subjects than in the present subjects. It must be realized however that it is very difficult to allow for

TABLE 12

A Comparison in the Growth Rates of the Ratio of T-Units/Sentence in T-Units of Hunt (1965) and Taylor (1969) with Present Subjects at the Three Selected Age Levels Contrasting the Achievements of the Younger Ages Relative to the Highest Age Sampled in Per Cents

	Ages					
	10	14	18	11	13	15
Present Study (Deaf)	1.08 89%	1.16 95%	1.22 100%	1.02 92%	1.09 98%	1.11 100%
Hunt, 1965 (Hearing)	1.60 137%	1.37 117%	1.17 100%			
Taylor, 1969 (Deaf)				1.16 84%	1.32 96%	1.38 100%

TABLE 13

The Reverse Reciprocal Frequencies of the Present Subjects' Growth Rates that Show Their Tendency to Increase Sentence Length Through the Coordination of a Second T-Unit with the First T-Unit as Compared to the Hunt (1965) and Taylor (1969) Subjects

	Ages					
	10	14	18	11	13	15
Present Study (Deaf)	8%	16%	22%	2%	9%	11%
Hunt, 1965 (Hearing)	60%	37%	17%			
Taylor, 1969 (Deaf)				16%	32%	38%

TABLE 14

Analysis of Variance Summary for the Ratio of T-Units Per Sentence

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	0.01031	0.01031	0.104	n.s.
Age Level	8	2.21488	0.27686	2.785	<.01*
Sex by Age Level	8	0.95958	0.11995	1.206	n.s.
Within	396	39.37111	0.09942		
Total	413	42.55588			

*Significant

differences attributable to age factors such as "maturity" to smooth out in the long-run when you are comparing performances only two to three years apart. This was the case with the Taylor age levels of years 11, 13 and 15. Also since Taylor had admitted the possibility of sampling errors, it would seem all the more difficult to draw any definitive conclusions about the probable reasons as to why her data came out as it did.

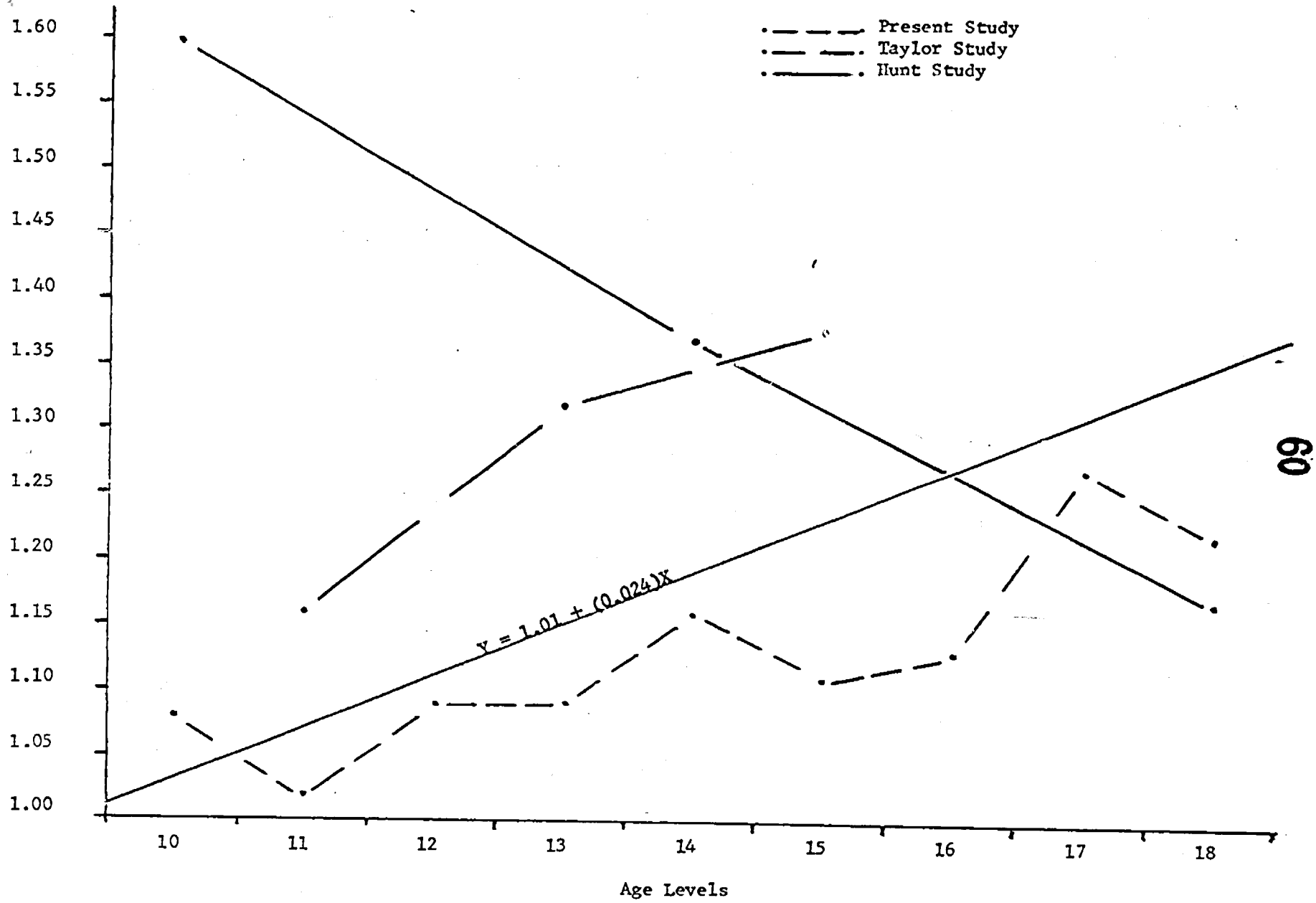
Figure 9 summarizes these relationships graphically. Although an overall test for nonlinearity showed no significant deviations from the linear trend the prediction equation can only account for 69 per cent of the observed variation of this ratio over age levels. Though Hunt (1965) found significant F ratios for both time and the interaction of time with Sex, and though Taylor (1969) found no significance at all, the F ratios of Table 14 for the present study reveal a significance for Age Level only. The test of multiple comparisons revealed the locus of non-chance change to occur only between the low scoring 11 year olds and the high scoring 17 year olds.

In summary, the results for the hearing impaired subjects of both the Taylor (1969) study and the present study show an increase in their observed Ratios of T-Units/Sentence with advancing time; whereas the hearing subjects of Hunt (1965) revealed an opposite and therefore inverse relationship over time.

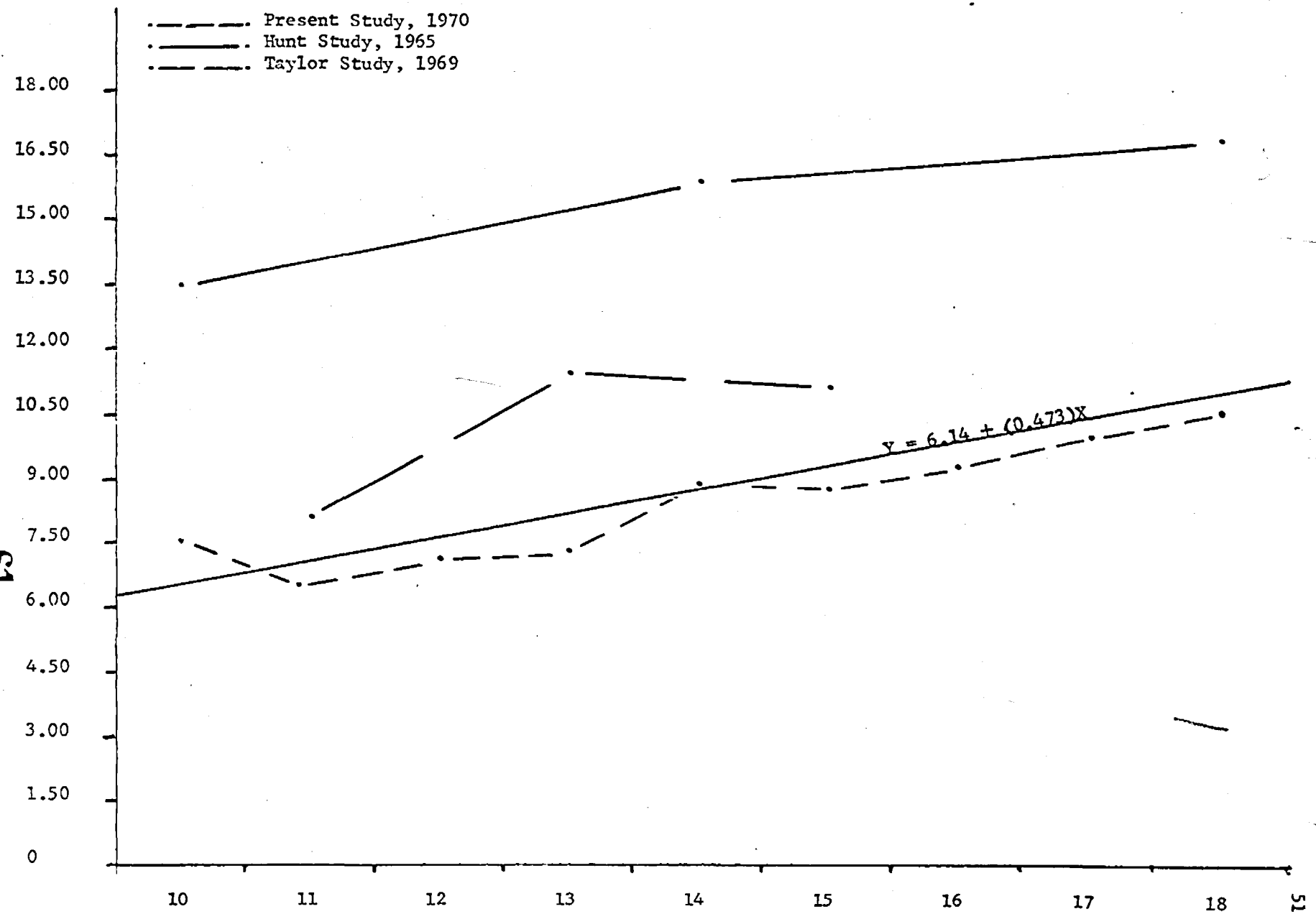
Synopsis Factor #5: Mean Sentence Length

The final dependent variable of Sentence Length is presented in Figure 10. Unlike the erratic fluctuation of the Taylor data which may be attributable as has been mentioned previously either to sampling procedure problems, or to the comparison of age groups that are closely aligned in years, the present deaf subjects demonstrate a decided proportional increase with advancing time. The test for a trend resulted in a significantly linear arrangement of mean criterion scores with as much as 88 per cent of the observed variation being accounted for

Figure 9. Comparing the Present Subject's Ratio of T-Units/Sentence to the Age Groups Total in Hunt's (1965) Study of Hearing Subjects and Taylor's (1969) Study of Hearing Impaired Subjects



ure 10. A Comparison of the Mean Sentence Length in Words Produced by the Present Subjects to both the Hearing Subjects of Hunt (1965) and Hearing Impaired Subjects of Taylor (1969)



in the relation of Y = 6.14 + (0.743)X, given X = 1 = year 10, X = 2 = year 11 ... The F ratios of Table 15 provided grounds for rejecting the hypothesis of no differences among the Age Levels only. A posteriori multiple comparisons reveal that (a) the 10 year olds, despite their high variance of 9.22 relative to the lower ages, along with the 12 and 13 year olds differed from all of the higher age groups beginning with age 14, (b) the low scoring 11 year olds differed from every age group except the 12 year olds, and (c) within the higher age bracket the 14 and 15 year olds differed from the 17 and 18 year olds while age 16 differed from age 18 only within this bracket.

Many of these differences are consistent with the age performances noted on the earlier variables. Firstly, the present variable is logarithmically additive with the highly discriminating T-Unit Length variable and therefore derives some of its mensurational strength from it. Secondly, the high variance of the 10 year olds relative the 11, 12, 13 and 14 year olds' variances may be indicative of more immaturity than maturity as was the case with the Ratio of T-Units/Sentences. Thirdly, although the growth rate percentages of Table 16 show that hearing impaired and normal hearing subjects in the 10 to 14 age time period gained equally (14 per cent) there was a dramatic reversal in the later time period of age 14-18. It appears that as the hearing impaired subjects showed increases in their Ratios of T-Units/Sentences so also did they show similar increases in Sentence Length. And although the hearing subjects showed a decline in their Ratios of T-Units/Sentences they showed only a moderate increase in Sentence Length with rate of increase attenuating over increasing advances of time. Fourthly, the results of this variable of length would appear as a more precise indicator of growth for the hearing impaired than for the hearing subjects despite the inclination of the latter to employ more main clause coordinations and perhaps a less skillful use of punctuation marks. In

TABLE 15

Analysis of Variance Summary for the Mean Length of Sentences in Words

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	0.3482	0.3482	0.03	n.s.
Age Level	8	701.4210	87.6776	7.87	.01*
Sex by Age Level	8	70.7146	8.8393	0.79	n.s.
Within	376	4412.3380	11.1423		
Total	413	5184.8218			

*Significant

TABLE 16

A Contrast of the T-Unit-to-Sentence Length Factors of the Present Subjects to the Hearing Subjects of Hunt (1965) and the Hearing Impaired Subjects of Taylor (1969) Showing the Growth Rates in Per Cents Down Each Column

	Present Study, 1970 (Hearing Impaired Ss)					Hunt, 1965 (Hearing Ss)				
	Mean T-Unit Length		Ratio of T-Units/ Sentence		Mean Sentence Length	Mean T-Unit Length		Ratio of T-Units/ Sentence		Mean Sentence Length
10	6.49 74 %	x	1.08 89 %	=	7.01* 66 %	8.6 60 %	x	1.60 137%	=	13.5 80 %
14	7.35 84 %	x	1.16 95 %	=	8.53* 80 %	11.5 80 %	x	1.37 117%	=	15.9 94 %
18	8.75 100%	x	1.22 100%	=	10.68 100%	14.4 100%	x	1.17 100%	=	16.9 100%

Ages	Present Study, 1970 (Hearing Impaired Ss)					Taylor, 1969 (Hearing Impaired Ss)				
11	6.47 81 %	x	1.02 92 %	=	6.60 74 %	6.89 **	x	1.16 84 %	=	7.99* **
13	6.99 87 %	x	1.09 98 %	=	7.62* 86 %	8.53 **	x	1.32 96 %	=	11.26* **
15	8.01 100%	x	1.11 100%	=	8.89* 100%	7.84 **	x	1.38 100%	=	10.82* **

*These figures only approximate the values of Figure 10, due to rounding errors.

**No per cents were available due to nonlinear arrangement of data.

summary it can be said that between hearing impaired and normal hearing subjects of the presently sampled ages of comparison an inverse relationship holds with advancing age in the use of main clause coordination.

Intercorrelations of All Variables

Table 17 presents only those sample correlations which indicate the presence of a correlation greater than zero in their respective populations. In instances where a correlation coefficient is given for "all years" the specific r's for each age level are usually of the same order of magnitude.

Length of composition in words. This relates very highly with the same measure using T-Units and exhibits a moderate degree of relationship with the two measures of subordination --- the Subordination Ratio and Synopsis Factor #2 --- and also the Sentence Length Factor.

Length of composition in T-Units. Earlier this could not demonstrate the existence of differences on the basis of age levels or sex when tested by the analysis of variance exhibits a positive yet low relationship with the subordination indices and a low inverse trend with Clause Length for about a third of the age levels sampled. The latter negative coefficients just barely reached significance at the .05 level.

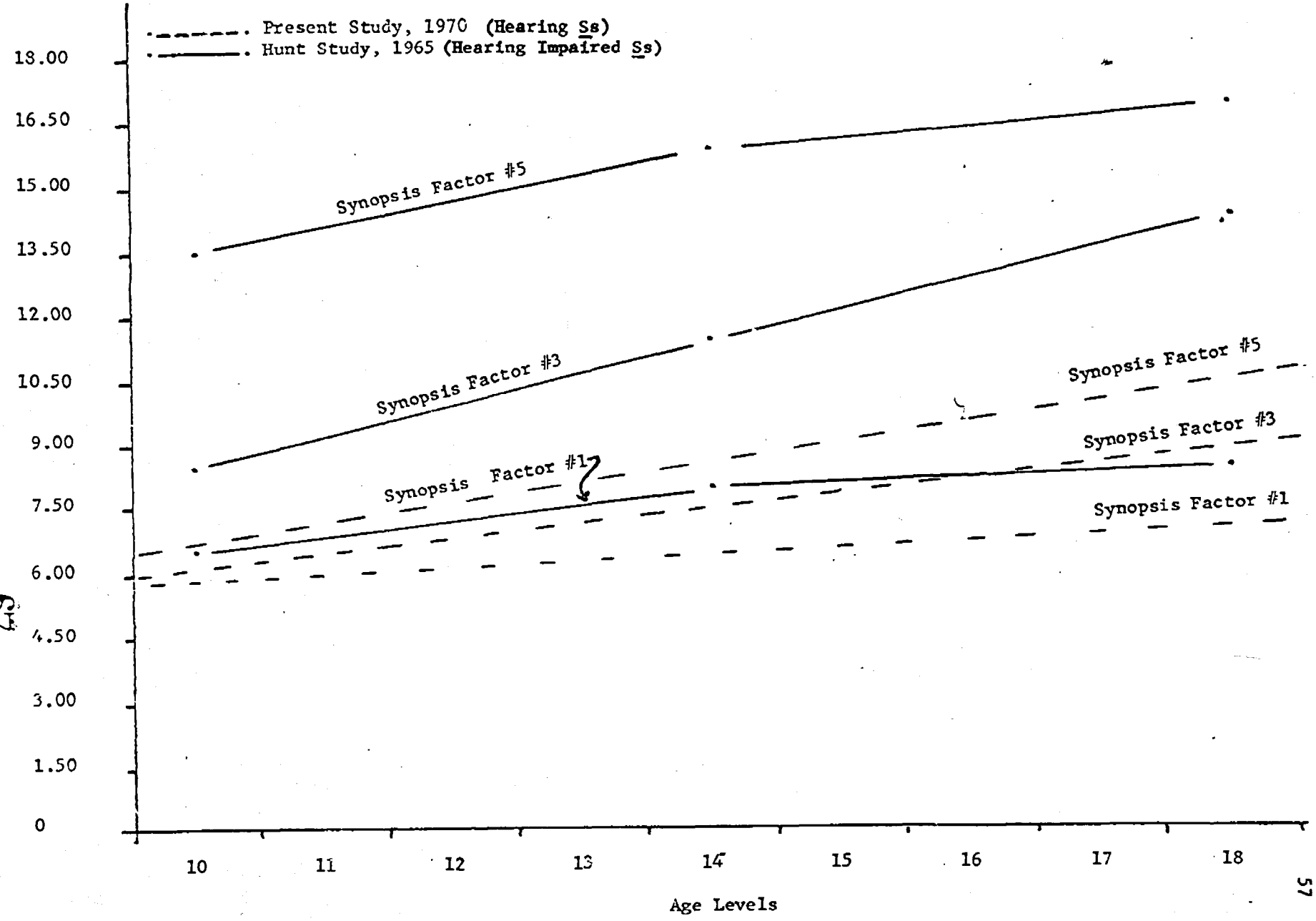
Clause length in words. This variable relates substantially with T-Unit Length but only moderately with Sentence Length. Figure 11 presents these three factors in graphic contrast to each other and to the Hunt (1965) results. Taylor's data are not included because of (a) the acknowledged probability of sampling procedure errors, (b) the essential nonlinearity of many of the criterion score means, and (c) the close alignment of her age level samples which possibly could not have permitted the effect of time to influence the criterion performances of the subjects. It is to be noted that the figural presentation of the present data is effected through the use of regression lines.

TABLE 17

Significant (.05) Intercorrelations of All Variables

	2	3	4	5	6	7	8	9	10
*y = Year Level	13 y* .35 17 y .32			11 y .34 16 y .30			13 y .38		
1. Sex									
2. Chronological Age									
3. Length of Composition in Words			All .90 Years		All .46 Years	11 y .52 12 y .50 13 y .42 14 y .39 15 y .60	11 y .46 13 y .42 14 y .44 17 y .33		11 y .56 13 y .42 14 y .33 15 y .49 17 y .59
4. Length of Composition in T-Units				10 y .31 15 y .33 17 y .32	11 y .35 12 y .41 13 y .47	11 y .34 12 y .38 13 y .36			
Synopsis Factor #1 5. Length of Clause in Words					10 y .37	10 y .40	All .88 Years		All .55 Years
6. Subordination Ratio						All .98 Years	11 y .49 14 y .57 15 y .48 16 y .66 17 y .67 18 y .59		11 y .50 15 y .65 16 y .62 17 y .48 18 y .49
Synopsis Factor #2 7. Ratio of Clauses/T-Units							11 y .50 15 y .48 16 y .66 17 y .69 18 y .64		11 y .61 15 y .68 16 y .63 17 y .68 18 y .51
Synopsis Factor #3 8. Length of T-Units in Words									11 y .62 15 y .66 16 y .86 17 y .76 18 y .84
Synopsis Factor #4 9. Ratio of T-Units/Sentence									11 y .58 15 y .59 16 y .61 17 y .52 18 y .47
10. Length of Sentence in Words									

ure 11. Contrasting the Hearing Impaired Subjects' Results on Three Synopsis Factors of Length to the Hearing Subjects of Hunt (1965).



Since at least 77 per cent and as much as 92 per cent of the observed variation in the length factors over time were accounted for by these linear regressions, it was felt reasonably justified to present the data in this fashion chiefly for the simplicity of a visual contrast over time. Although the absolute magnitude of criterion score distances covered by the dashed line data of the hearing impaired versus the solid line data of the normal hearing writers are large and not be expected to occur on the basis of chance alone, each of these two groups does nevertheless show significant growth within itself over time.

T-Unit length and sentence length in words. Both of these covary with each other at a moderately high level but only with the upper age bracket. When one considers the previously mentioned high variance occurring in the 11 year old group, it can be explained why this age level is found in the correlations of the upper age bracket in Table 18.

Subordination ratio and ratio of clauses/T-Unit. These logically exhibit a very high correlation with each other while also showing some unexpected moderate correlations with the #3 and #5 Synopsis Factors of Length. Perhaps the flexibility of subordinating structures that affected Sentence and T-Unit Length could be attributable to the multiplicative relationship these variables have with each other.

Ratio of T-Units/sentence. This variable, perhaps the weakest index of all, understandably relates only to the factor which it arithmetically helps to establish --- Sentence Length, and then only moderately at the more mature age levels.

In summary it can be said that the two Synopsis Factors contributing to T-Unit Length are highly and significantly intercorrelated for all age levels and subjects taken together as well as for each grade level taken separately.

TABLE 18

Contingency Coefficients Showing the Associative Strength of Each Variable over a Nine Year Time Interval

Variable	Chi Square	Contingency Coefficient
Length of Composition in Words	29.96	.260
Length of Composition in T-Units	n.s.*	--
Length of Clauses in Words	n.s.*	--
Subordination Ratio	73.12	.387
Ratio Clauses/T-Unit	21.38	.222
Length of T-Unit in Words	50.17	.329
Ratio of T-Units/Sentence	27.25	.248
Length of Sentences in Words	40.38	.298

*n.s. not significant (.05)

Sentence Length in Words correlates moderately with all dependent variables except Composition Length in T-Units. As Hunt (1965) had pointed out, this factor showed more promise as an index of maturity with older writers than did any other of the Synopsis Factors. The present inter-correlation of factors with the older age groups is consistent with Hunt's observation.

Contingency Coefficient Results

In this last and final analysis of the criterion scores the null hypothesis tested was that no relationship existed between a given language measure and the independent variable of Age Levels. When discrepancies between the frequencies observed and the frequencies expected within the allotted calls of a chi squire contingency table were too great to be reasonably attributed to chance then the hypothesis was discredited and the contingency coefficient was computed to reveal the comparative strength of the relationship existing between the two variables in question.

All criterion scores of the dependent variables were trichotomized for the chi square analysis on the basis of (1) age and (2) a performance score grouping into (a) "high scores" falling at or above a plus one standard deviation, (b) "middle scores" falling below a plus one and above a minus one standard deviation, and (c) "low scores" falling at or below a minus one standard deviation.

Table 18 presents the contingency coefficients for all nine years of data. It is to be quickly noted however that these coefficients can not be compared to any other coefficients that were not themselves computed on the basis of a 3 x 9 contingency cell matrix. The results indicate that Subordination Ratio (.387) and T-Unit Length (.329) are the best indicators of a hearing impaired subject's age or maturity level. Notably the Length of Sentences and Compositions in Words revealed a substantial non-chance association with increasing levels of time. Despite the fact that Subordination Ratio and the Ratio of Clauses/T-Unit correlated extremely highly in a Pearson r, they are at opposite poles on the

present index of association with the latter having a contingency coefficient of only .222.

In order to achieve comparability with the Hunt (1965) 3 x 3 contingency data, a similar contingency matrix was prepared for the present subjects using the ages of 10, 14, and 18. Table 19 contrasts the performances of these two groups. Again, for the present subjects, the Subordination Ratio demonstrated the strongest degree of relationship with time while the Ratio of Clauses/T-Unit showed the weakest relation. Length of Clauses and Sentences in Words did not exceed the critical chi square values established for 4 degrees of freedom. The Hunt data showed an unmistakably strong association between both Clause Length and T-Unit Length in Words with advancing time. Subordination Ratio proved an even stronger relation than Ratio of Clauses/T-Unit with time for the hearing subjects.

TABLE 19

Comparison of the Contingency Coefficients of the Present Hearing Impaired Subjects with the Hearing Subjects of Hunt at Ages 10, 14 and 18

	Present Study		Hunt, 1965	
	Chi Square	Contingency Coefficient	Chi Square	Contingency Coefficient
Length of Clauses in Words	n.s.*	--	33.10	.616
Subordination Ratio	36.8	.459	20.30	.523
Ratio Clauses/T-Unit	10.8	.269	18.42	.496
Length of T-Unit in Words	11.3	.275	50.35	.694
Ratio of T-Units/Sentence	12.4	.287	n.s.*	--
Length of Sentences in Words	n.s.*	--	17.03	.489

*not significant (.05)

IV. SUMMARY

1. Purpose of the Study

This study sought to determine through the use of a selected group of quantitative dependent variables the feasibility of applying to written language samples obtained from hearing impaired students various indices of growth which had proven to be of some sensitivity to the changes witnessed over time in the language of subjects with normal hearing. These variables which were of traditional or quasi-traditional orientation were subjected to a series of statistical analyses to determine (a) the strength of their association with distinct levels of time and (b) the approximate levels of achievement expectation so that inferences could be made for the population on the basis of the regression equations generated from each variable's criterion scores.

It was thus hoped that insight could be gained into the sensitivity and consistency of the indicators in measuring the stepwise developmental changes transpiring over time in the grammatical structures of language.

2. Method and Procedure

The grammatical analyses employed were those devised by Hunt (1965) which were themselves functional to his concept of the minimal syntactic terminable unit (T-Unit). This index was defined as consisting of a main clause and any dependent structures attached to it, if any. These analyses were then applied to the stratified age samples of written language collected by the Stuckless and Marks (1966) study. A total of 23 males and 23 females were sampled at each of nine Age Levels with the analysis of their criterion scores being accomplished through a 2 x 9 (Sex by Age Level) factorial analysis of variance. Appropriate other analyses were initiated to further clarify both the significant F ratios and the sensitivity power of each variable to increasing Age Levels.

3. Results

The main effect of Sex revealed non-chance differences for the Composition Length in Words and Higher Order Dependency variables. In both instances the females showed superior performances to the males.

In testing for the existence of differences within the independent main effect variable of Age Levels, highly significant F ratios were found in all instances except Composition Length in T-Units in Words was the only index showing in an a posteriori comparison the existence of between year differences at nearly every age level.

Without exception all variables demonstrated a markedly linear trend with very little if any quadratic or cubic components. From the regression analysis made subsequent to the identification of the appropriate trend on each dependent variable, the independent variable of Age Level was found to account for as much as 80 per cent and more of the observed variation in the criterion score changes. This however was not true for the variable of Ratio of T-Units/ Sentence where a total of 31 per cent of the variation in the criterion scores was left unaccounted for by the linear regression of score performances over time.

In terms of growth gains at selected five year intervals and for the whole span of the nine years sampled, the indices of Subordination Ratio, Sentence and T-Unit Lengths in Words showed the total growth gains of 41, 34 and 26 per cent, respectively. When analyzed at the five year intervals, the greatest spurt in growth always was found to occur during the latter half-decade period of time. Most of the remaining variables showed only nominal growth gains that occurred for the most part within the earlier half-decade of comparison. These results would seem to suggest that the above three indices of language maturity show the greatest promise with the older levels of age. This conclusion was further

corroborated by the intercorrelation matrix which showed significant and from moderate to high relationships occurring for these variables at the older age levels.

Finally, when the relationship of each variable with increasing time was explored by the use of contingency coefficients, it was found that the only two really substantial indices giving witness to the changes concomitant with time were Subordination Ratio and Length of T-Units in Words across all nine years of data. Strangely enough the Ratio of Clauses/T-Units which also measures the extent of subordination and which intercorrelates extremely highly with the Subordination Ratio measure was found to show the weakest strength of association with time. There might be proffered as an explanation to this phenomenon the reasoning that whatever variance was not common to the two measures on the basis of their intercorrelation could have been thrown into greater contrast when they were separately tested for their association with time.

4. Conclusions

It is the opinion of the present investigators that while the concept of the minimal syntactic terminable unit is a valid and potentially strong indicator of language maturity, its applicability to assessing syntactic growth of the severely hearing impaired child is limited. Instead, the Subordination Ratio appeared in this study to be a more sensitive measure of increasing syntactic complexity in the written language of students with severe hearing impairment.

V. CONCLUSIONS

A practising understanding of the grammatical acquisition process in the language retarded child has been a long subscribed-to pedagogical goal. The language impaired child's practised production of an acceptable language form also has been long regarded as the realization of a substantial educational achievement. The hall-mark of such an achievement in language production normally has been identified by its grammatically advanced distance from some initial state of rank deviance. It can be seen then from the results of the present investigation that the number of stepping stones yet to be traversed in advancing from same such initial state of rank deviance to an acceptable state of relative non-deviance and even further to an accomplished state of creative, lucid expression is indeed great. So great in fact that there appears little profit to be gained by comparing the languags of the hearing impaired to the hearing subjects.

The results reported for nearly all variables --- Composition length in T-Units excluded --- showed that with increasing time there appeared to be a concomitant increase in language sophistication. The trends of these variables showed through varying degrees of growth increments substantially linear increases with time.

Each of the Length variables of Clauses, T-Units and Sentences showed significant achievements occurring over the nine years tested with the principal incremental gain in nearly every instance occurring within the 14 to 18 year old period of comparison. The first two of these variables exhibited from a moderate to strong relationship with each other; whereas the latter while not covarying with them did seem to be affected mostly by an unusual amount of between clause coordinations than by any expansions occurring within the clauses

themselves

The Ratios of Clauses/T-Units and T-Units/Sentence, whose chief function was to serve as measuremental intermediaries to the Length factors, proved to be weak indicators of the changes in language sophistication occurring over time. One ratio however, Subordination Ratio, demonstrated an unusual sensitivity to such maturational changes in view of both its growth gains and its degree of association with time itself.

Thus with so much growth frequently occurring within the hearing impaired group and with the differences between that group and the normally hearing group being so substantial it was surmised that little was to be gained by drawing any between-group contrasts.

Briefly, stated then, the two principal conclusions of the present investigation are (1) the nature of the deviance seems not so much to be indicative of the existence of generic differences in the language abilities of the severely hearing impaired child as it does in the suppression of those abilities along a temporal dimension relative to the hearing child of comparable age; and (2) although the T-Unit Length variable was a substantial indicator of language maturity in these age samples, the more traditional measure --- Subordination Ratio --- proved to be far superior in measuring language growth over time.

PART II

I. INTRODUCTION

The first part of this study concluded with the clear indication that the traditional Subordination Ratio measure was the most sensitive indicator of language maturation in the presently sampled population of hearing impaired subjects. To a somewhat lesser extent however, the recently developed measure of T-Unit Length in Words was also demonstrated to possess a certain sensitivity to those maturational changes normally expected to occur with increasing age. Since this latter index obviously has a greater number of quantitatively identifiable variables affecting it than does the former index of structural flexibility, then an attempt will be made in the present part of the investigation to determine just what structures went into the production of these T-Units and ultimately affected the lengthening of them with increasing time.

An analysis will be made both of those variables which are essential to the formation of the T-Unit and those which though non-essential are nevertheless of considerable value in producing clear, succinct expressions of thought. The ultimate effect of these latter variables will be the expansion of the T-Unit Lengths themselves.

II. RESULTS

Variables Minimally Essential to the T-Unit

Under this heading there will appear the following unmodified nominals, predicates and "adjectives". All examples demonstrating each construction are taken directly from the language samples of the present study.

Unmodified Nominals functioning as: (a) Subjects ... DOGS BARKED, (b) Objects of Transitive Active Verbs ... A WOMAN COOKED HAMBURGERS, (c) Predicate Nominatives of Intransitive Linking Verbs ... THIS IS A TREE, (d) Predicate Nominatives of Transitive Passive Verbs ... THE DOG IS NAMED CORKY.

The following predicates occurring in Main Clauses along with any structures that are peculiar to such verbs: (a) Intransitive Linking Verb, (b) Intransitive Complete Verb, (c) Transitive Active Verb, (d) Transitive Passive Verb, (e) Factive Infinitive functioning as Object of Transitive Active Verb ... SPOT LOVED TO PLAY WITH THEM, (f) Interrogative Infinitive functioning as Object of Transitive Active Verb ... FATHER TAUGHT ME HOW TO PLAY THE GAME.

"Adjectives" structurally defined by Hunt (1965) as being only those words that can serve as predicate adjectives following Intransitive Linking Verbs ... THE FAMILY IS HAPPY, AND Transitive Passive Verbs ... THE HAMBURGERS WERE GOOD.

Unmodified nominals functioning as subjects, objects and predicate nominatives. Specific grammatical variables functioning within these contexts and included here are Common and Proper Nouns, Personal Pronouns, Factive Infinitivals and Gerunds.

According to the meaning they represent, Common Nouns are distinguished from Proper Nouns. These perhaps are the simplest instances of the nominal class. For instance, nouns that name a mass of objects or things collected in a group without distinguishing one named thing from another are regarded as "common"; whereas, in contradistinction, there also exist those capitalized nouns usually upheld as being "proper" to a given individual element within a larger class of objects and are thus identified on this count.

Since such nouns as these as well as others do not have inflections in written English, then the task of ascertaining whether they were of the nominative or objective case in many of the grammatically scrambled sentences produced by the present subjects was a considerable challenge. Because of this, the present analytical summaries will not always distinguish between the various grammatical functions of the various structures being discussed. On the basis

of an analysis of variance on the Common Noun scores, no statistical differences were found to occur either between sexes or among age levels themselves. Growth rates from Year 10 to 14 showed a 17 per cent increase; whereas there was a loss in growth gain of 14 per cent in going from Year 14 to 18.

Similar analysis conducted on the use of Proper Nouns revealed only chance differences occurring among age levels. Growth gains reported for these constructions showed only a 5 per cent gain in a 9 year span.

As can be seen in Table 20, the use of simple structural pronouns functioning as "personal" referents to antecedent nouns, substantial non-chance differences were reported for both main effects of Sex and Age Levels. With a 32 and 15 per cent gain in growth occurring in the earlier and later five year time spans, respectively, --- a 47 per cent increment for the entire 9 years --- females were found statistically superior to the males at the .05 level of significance. Differences appeared among the Age Levels at the 99 per cent level of confidence. These differences when subjected to the Tukey (a) Procedure indicated that males in the ninth year differed from those in the first year whilst females at ages 13, 15, 17 and 18 differed from the 10 year olds. When applying a line of best fit to this data plot (Figure 12), the relation of $Y = 6.94 + (0.906) X$ can account for as much as 89 per cent of the observed variation in the production of these constructions.

Hunt (1965) reported in his 10, 14 and 18 year old hearing subjects a decidedly downward trend in the use of Common and Proper Nouns and Personal Pronouns with significant differences occurring both between sexes and among age levels. Hunt interpreted the latter finding on the Pronouns as indicative of the tendency of younger students to write a greater number of short clauses which would necessarily demand an increased number of pronouns being used as referents to antecedent nouns. Older subjects on the other hand with their

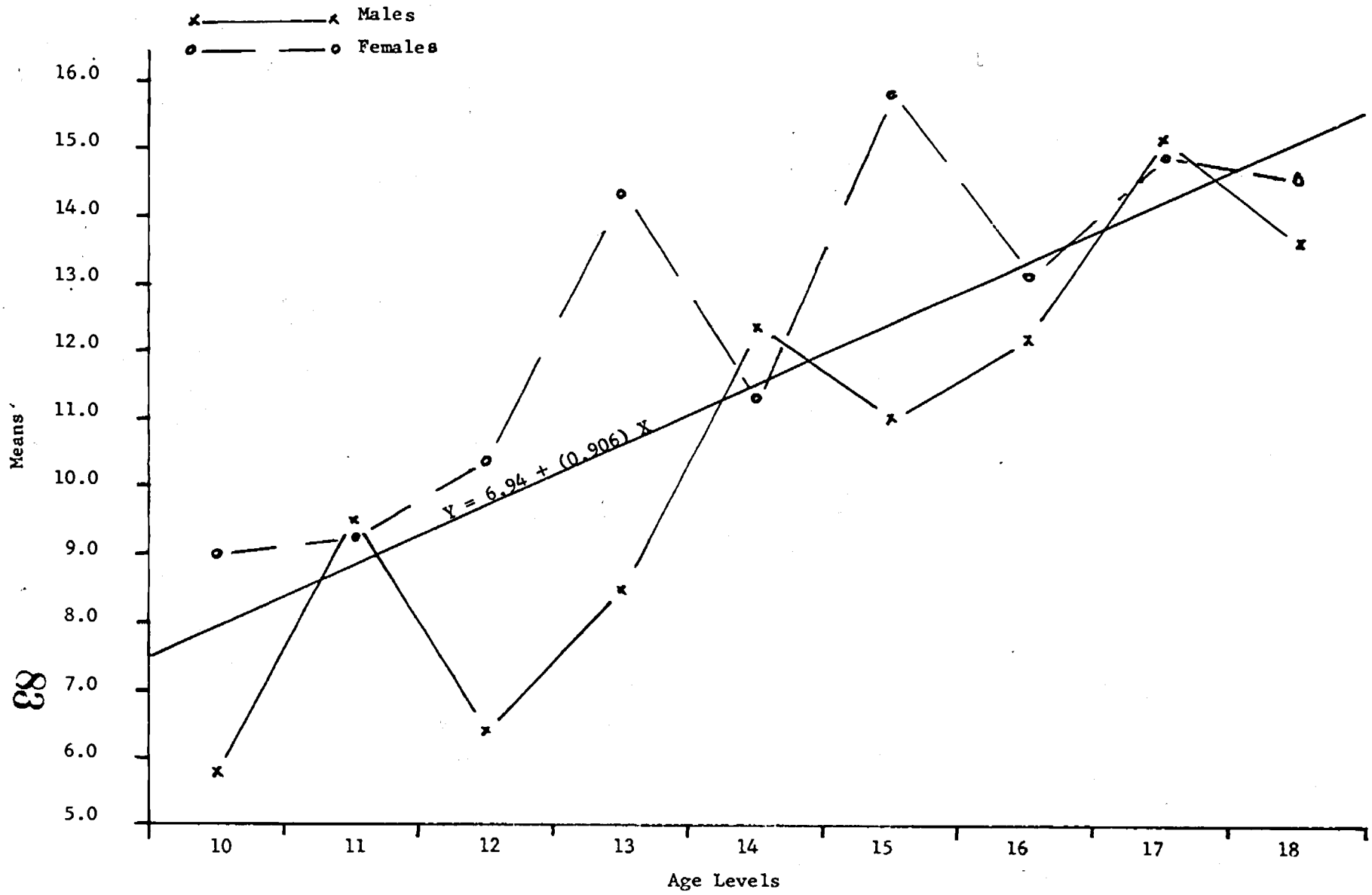
TABLE 20

Analysis of Variance Summary for Personal Pronouns

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	442.47	442.47	4.82	$<.05^*$
Age Level	8	2536.05	317.01	3.45	$<.01^*$
Sex and Age Level	8	591.27	73.91	0.81	n.s.
Within	396	36379.30	91.87		
Total	413	39949.09			

*Significant

Figure 12. Mean Proportion of Male and Female Personal Pronoun Productions.



tendency to tighten up their writing and thereby give more information within a lengthened clause do not for this reason have to make as much use of such constructions.

Thus with the present deaf subjects showing only a 0.65 proportion mean gain in their clause length over a nine year age span from the initial mean clause length of 6.23 words, the same line of reasoning would perhaps still be applicable to the present results of increased Personal Pronoun usage. If this reasoning be valid then the present index of usage reveals a marked immaturity for this sample of deaf children.

The next variable essential to the T-Unit is the Factive Infinitival. When an infinitive in its verbal function is used as an objective complement with the usual omission of the traditional signpost "to", it is said to express the factive idea. To do so, it frequently follows those verbs connoting sentience (see, hear ...), or change (make, transform ...). Example ... SPOT LOVED TO PLAY.

In looking at Figure 13, females showed a superiority in the production of these devices over males, a fact borne out by an F ratio statistically significant beyond the .01 level. Statistical differences were also reported (Table 21) among age levels with only the males showing a significant change occurring between the high scoring 17 year olds and the low scoring 10, 11, 12 and 13 year olds. Performances of the females were of a consistently high enough order as to preclude any abrupt non-chance changes among their age groupings.

The linear relation of $Y = 0.97 + (0.329)\ X$ accounts for as much as 84 per cent of the observed variation occurring over the age span sampled. Dramatic growth gains were also witnessed for the entire group with a 41 per cent increment occurring during the first five years and a total gain of 67 per cent

Figure 13. Mean Proportion of Factive Infinitival Constructions Used by Males and Females.

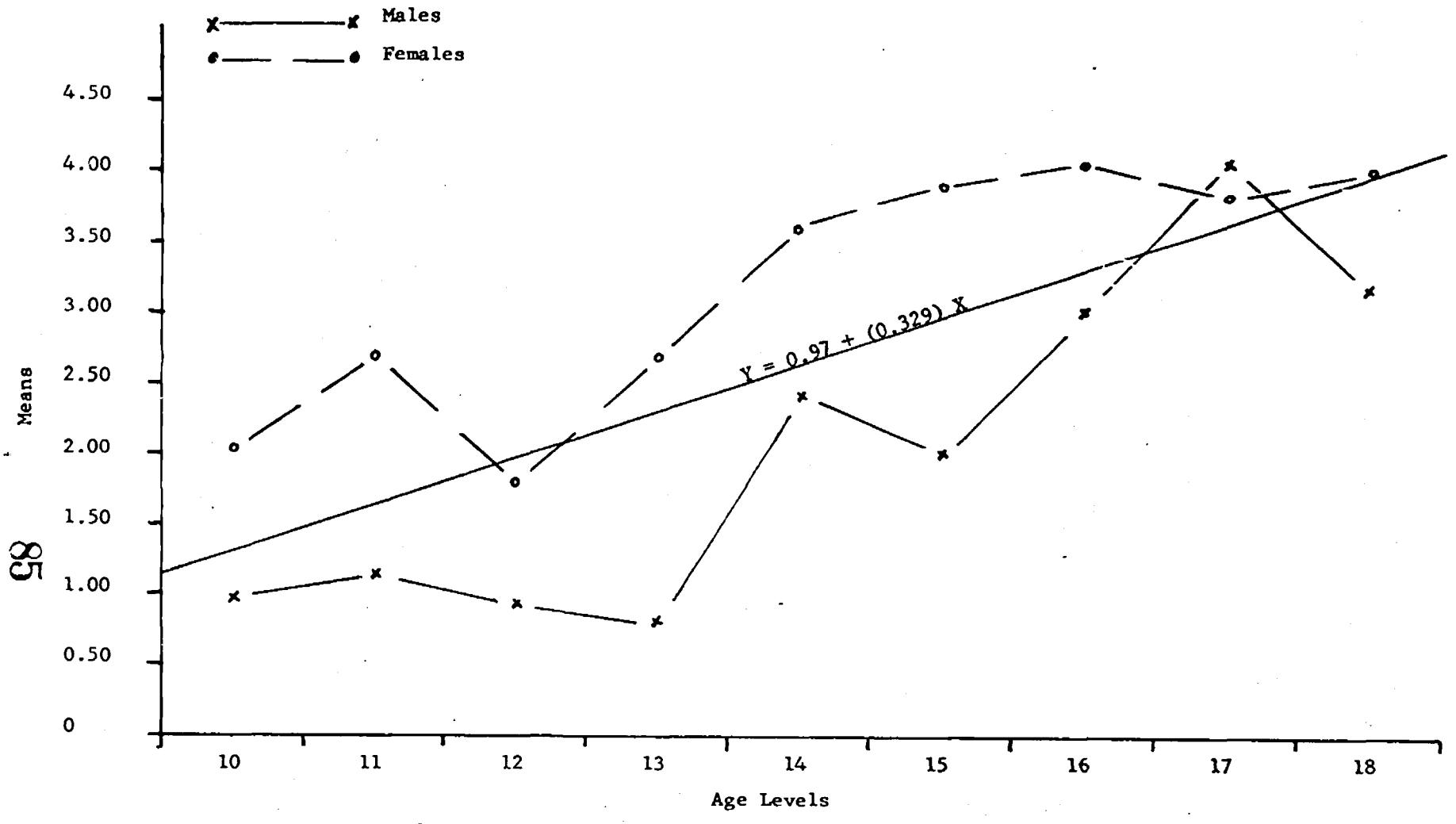


TABLE 21

Analysis of Variance Summary for all Factive Infinitives

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	125.57	125.57	13.83	<.01*
Age Level	8	357.79	44.72	4.93	<.01*
Sex and Age Level	8	38.09	4.76	0.52	n.s.
Within	396	3594.26	9.08		
Total	413	4115.71			

*Significant

representing the entire nine year span. Hunt's (1965) hearing subjects while showing a substantial 39 per cent increment over a similar time period demonstrated its most notable advance (30 per cent) in the latter five year span of comparison without any sex differences being evident.

It appears then that the use of Factive Infinitivals by the present population presents a valuable index sensitive to changes in language maturity.

A nonfinite verb structure functioning as a verbal noun and distinguished from the similarly inflected present participle on the basis of its substantive use within the sentence is the Gerund. Because of its ability as a nominal to appear in sentence positions wherever subjects, objects, complements or adverbial objectives appear, it is grammatically classified as a noun. On the other hand however, not being limited by person, number or mode while still possessing tense and voice modification, it has the capability of taking adverbial modification --- characteristics clearly native to verbs. Thus the Gerund is in every sense of the word a true verbal noun.

In the present study it was found that those verbal nouns functioning as subjects, direct objects, objects of infinitives and adverbial objectives were either not used at all (subjects) or used so infrequently by various sexes and age groups that no statistical differences were recognizable.

Predicates. Finite verbs in that they assert or predicate are usually inflectionally denoted by both person, number and mode (mood, manner). A classification of such verbs according to their meanings produces either those that serve as "transits" of action from doer to receiver or those that make "intransitive" any activity by demonstrating the "completeness" of the subject-agent's own activity. While the latter may have no "voice", such modification when exerted upon the former usually results in the verb "actively" representing the subject-agent as doing the action. However, when the verb denotes the object-receiver to which the action is being directed then the subject is said to be "passively" acted upon.

In instances such as those supplied by certain transitive passive verbs and those intransitive verbs where predication can not be made without the assistance of subjective complements (predicate nominatives and predicate adjectives) to complete their meaning then the verbs are referred to as "linking" (copulative).

The data collected on Intransitive Linking Verbs and as analyzed in Table 22 produced no statistical differences across age levels, a fact which obviated an analysis of trends and any computation of a line best fit. As reference to Figure 14 will show, females (statistically) surpassed the males in the use of this construction even though their overall growth rate was a little more than half that of the males (30 versus 53 per cent) for the entire nine year span.

The only differences not to be expected on the basis of chance for Transitive Passive Verb productions were those found occurring between the high scoring 15 year olds and the low scoring 10, 11, and 12 year olds, (Table 23). With no statistical deviations from linearity being manifested the regression equation of $Y = 0.015 + (0.041) X$ could only account for 39 per cent of the observed variation in the number of Transitive Passive constructions produced over time, (Figure 15). With so much uncontrolled variation on this, one must be wary in interpreting the overall growth gain of 85 per cent for the total time span of nine years. It is interesting to note that the largest increment of that growth (60 per cent) occurred within the latter time period between ages 14 to 18.

In a study conducted by Schmitt (1968) it was similarly revealed but from a different focal point that for hearing impaired subjects Passive Voice constructions were the most difficult to both comprehend (read) and produce (write). He reported that his 17 year old subjects were statistically sur-

TABLE 22

Analysis of Variance Summary for Intransitive Linking Verbs

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	89.04	89.04	5.74	$<.05^*$
Age Level	8	142.13	17.77	1.15	n.s.
Sex and Age Level	8	104.83	13.10	0.85	n.s.
Within	396	6143.74	15.51		
Total	413	6479.74			

*Significant

Figure 14. Mean Proportion of Male and Female Productions of Intransitive Linking Verbs.

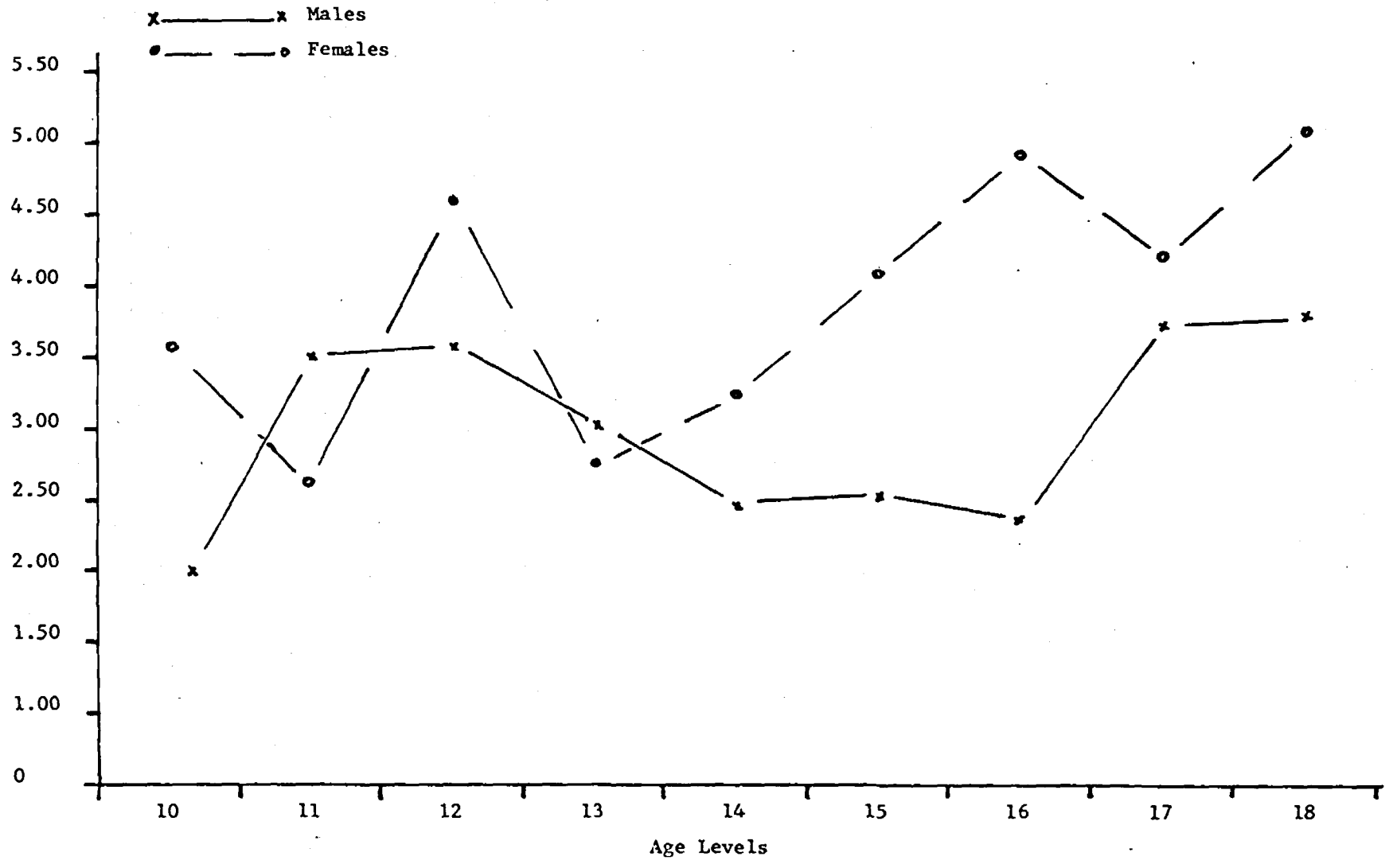


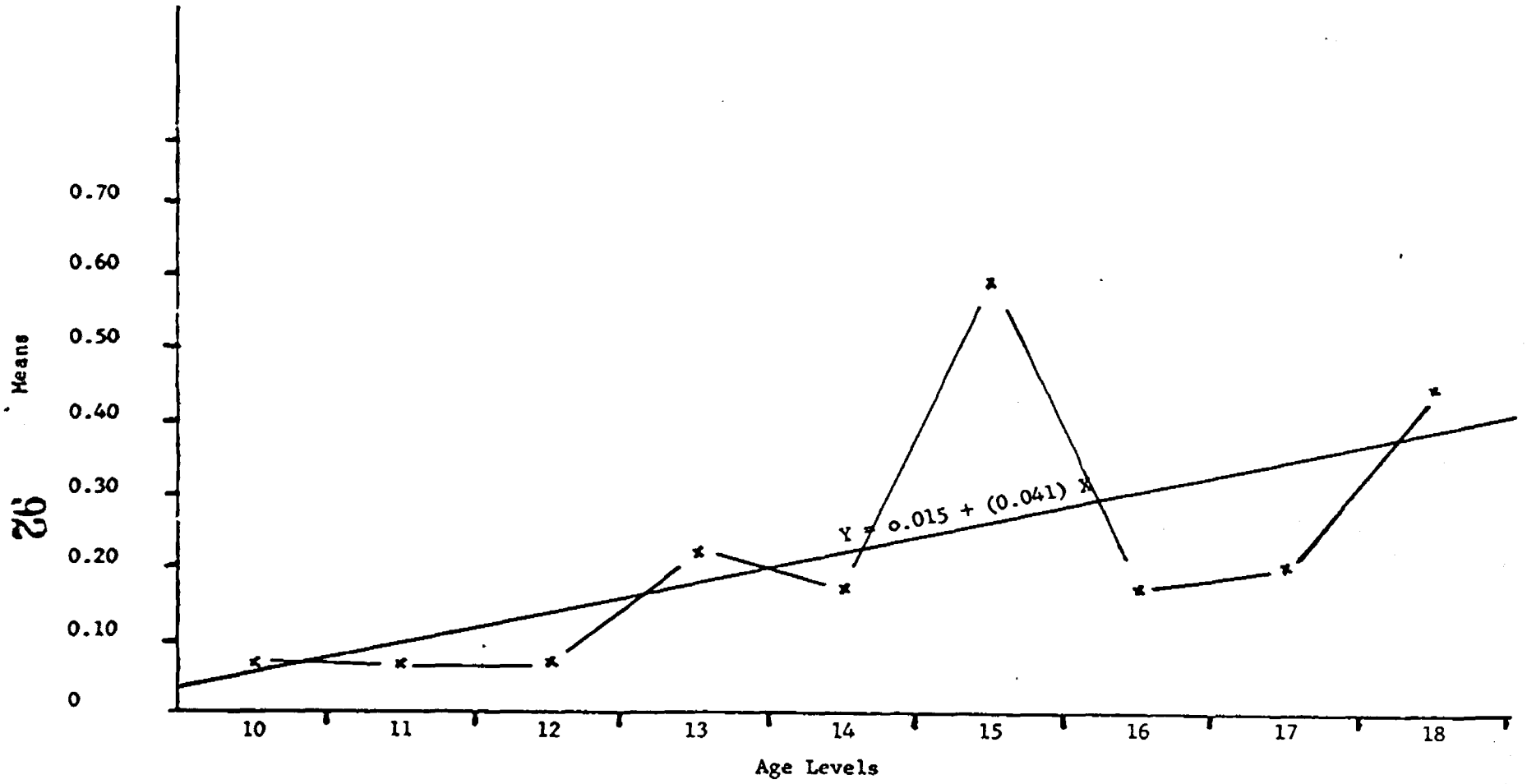
TABLE 23

Analysis of Variance Summary for Transitive Passive Verbs

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	0.41	0.41	0.68	n.s.
Age Level	8	11.85	1.48	2.45	$< .02^*$
Sex and Age Level	8	3.79	0.47	0.79	n.s.
Within	396	238.96	0.60		
Total	413	255.01			

*Significant

Figure 15. Mean Proportion of Transitive Passive Predicates Produced by the Combined Sexes Over Time.



passed in their handling of these materials by 8 year old hearing children. This finding induced Schmitt to formulate a Passive-Active Rule that he felt was generalizable to the population from which his sample was drawn. In brief it stated that deaf (sic) subjects by ignoring the signposts of the passive voice tend to process sentences containing these constructions as though the verbs were in the active voice.

The results of the present investigation seem to have corroborated this finding of Schmitt's by simply analyzing the mean proportion of Passive Voice constructions appearing across age levels.

With no differences appearing in the use of Intransitive Complete Verbs among males and females as shown in Table 24, the high usage of these constructions by the 16 year olds was different enough from the younger age bracket of the 10, 11, 12 and 13 year olds to approach significance. Statistical deviations from linearity were not evident despite some marked fluctuations at the 16 and 17 year levels. The linear trend is best represented in Figure 16 by the relation of $Y = 8.22 + (0.544) X$, accounting for as much as 93 per cent of the observed variation in the number of Intransitive Complete Verbs produced by the present subjects. Growth gains for this variable showed nearly equal increments of improvement within the earlier and later five year spans, 18 and 20 per cent respectively.

The production of Transitive Active predicates which showed only a 31 per cent gain over nine years revealed no differences other than what might be expected to occur on the basis of chance alone.

When all Transitive Predicates and Intransitive Predicates appearing as main clause verbs were combined no statistical differences were discernible on either the basis of age levels or on the basis of sex. Hunt's (1965)

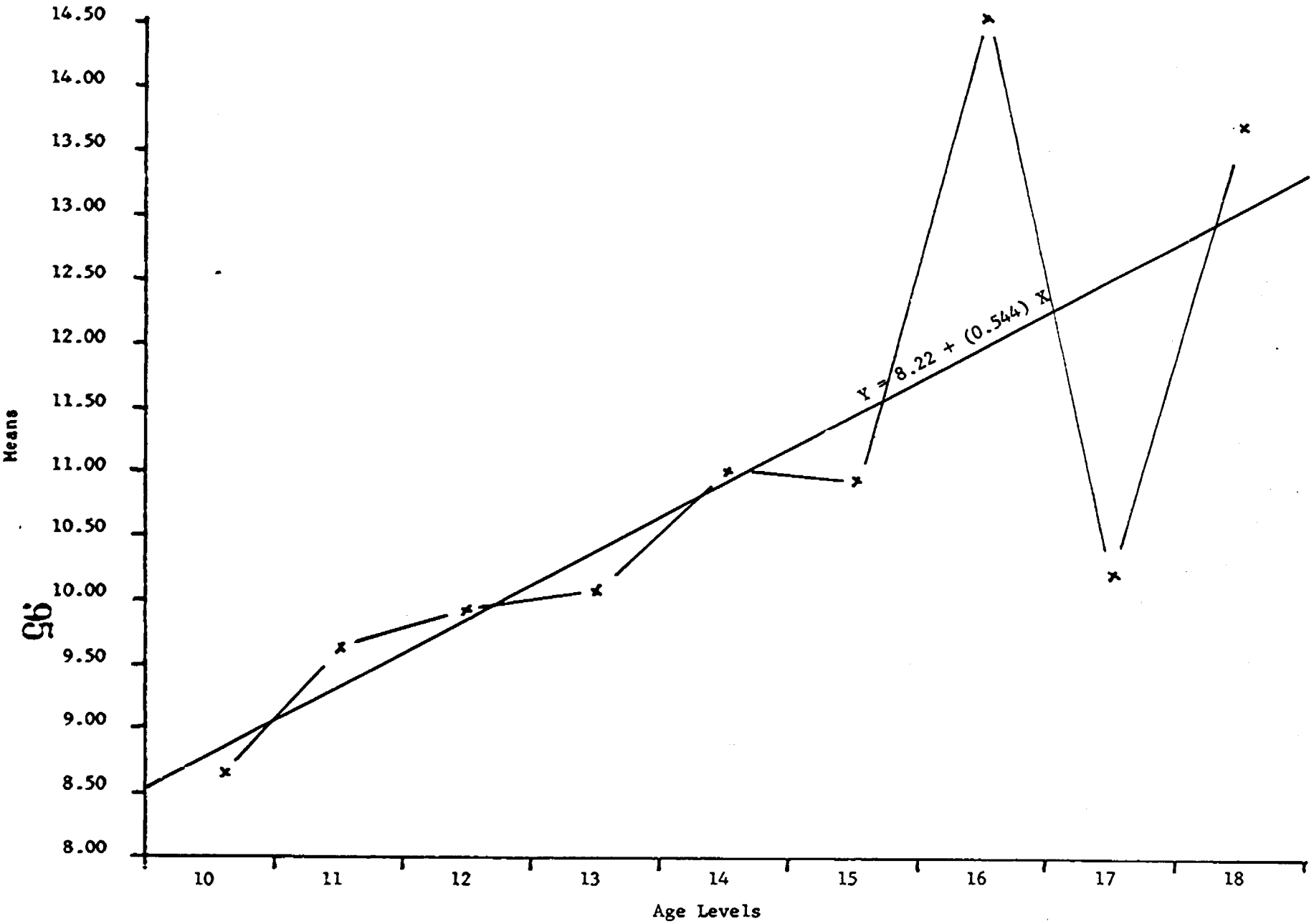
TABLE 24

Analysis of Variance Summary for Intransitive Complete Verbs

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	69.81	69.81	1.48	n.s.
Age Level	8	881.26	110.16	2.33	<.05*
Sex and Age Level	8	279.02	34.88	0.66	n.s.
Within	396	18711.57	47.25		
Total	413	19941.66			

*Significant

Figure 16. Mean Proportion of Intransitive Complete Verb Constructions Appearing for the Combined Sexes.



analyses of transitive and intransitive main verbs showed a general decline in their frequency of usage with the exception of transitive active verbs which showed a 10 per cent gain from year one to year nine.

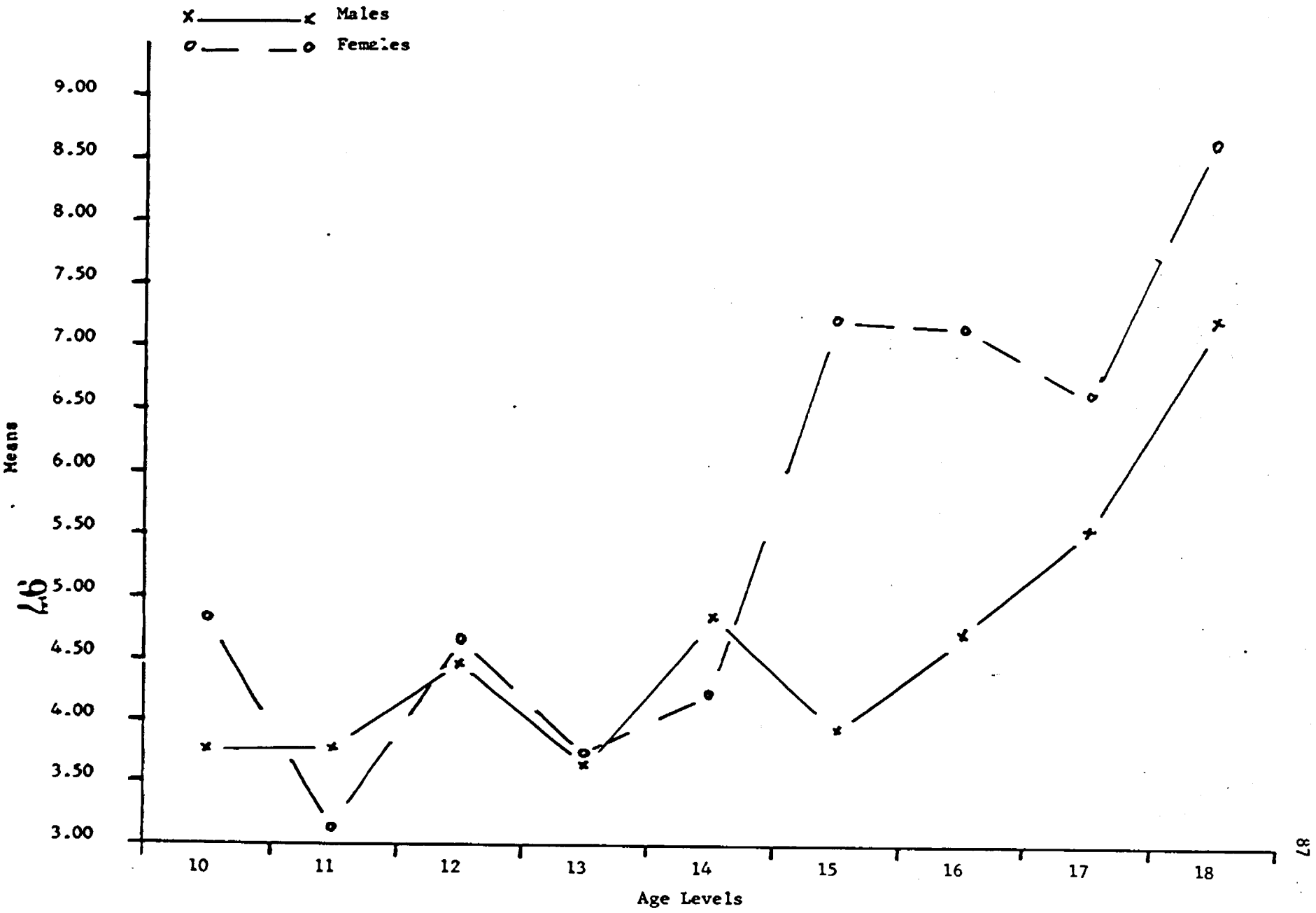
It would appear that for the present hearing impaired subjects Transitive Active verbs have practically no sensitivity to changes in their language maturation over time; whereas Intransitive Linking and Intransitive Complete verbs show considerable promise in being sensitive to the changes in language maturity. More investigation is indicated however in the use of Transitive Passive constructions with hearing impaired subjects when one considers how much uncontrolled variation such constructions produced in the present study.

Adjectives. Following Hunt (p. 101, 1965), articles, demonstratives, genitives and the like are not included within this classification since there exists no possibility that such words could ever serve in the positions of predicate adjectives. On this variable as well as the few other noun modifier variables, no regression, trends or parametric analyses were possible since the data had been collected in such a way that only the frequency count totals were available for each age level of subjects. Use was made of nonparametric chi square tests and contingency coefficients to demonstrate the existence of differences and degree of relationship with time.

With eight degrees of freedom from a 2 x 9 contingency table a chi square of 674.79 proved to be significant beyond the .001 level. It was also found on further analysis that both sex and age levels with one and eight degrees of freedom respectively, also produced chi square values (16.23, 147.17) significant beyond the .001 level.

In reference to Figure 17 it would appear that females became superior to males at the higher age levels beginning with year 15, and that older subjects tended to do better than younger subjects in the production of such adjectives.

Figure 17. Mean Proportion of Adjective Modifiers of Nouns Produced by Males and Females.



The degree to which these adjective units corresponded with time is demonstrated by a 0.492 contingency coefficient and a total growth gain of 46 per cent, 30 per cent of which occurred during the 10 to 14 year time period. However, in attempting to compare the present data in a 3 x 3 contingency table to the coefficient obtained by Hunt (0.370), a non-significant chi square occurred. However, Hunt did reveal that for his subjects the largest increment in growth (38 per cent) occurred during the first five year span with only a 2 per cent gain in the latter period.

Non-Essential Elements to the T-Unit

Since the T-Unit has already been described as consisting of a discrete main clause capable of expansion or embedding by dependent clauses or modifiers, if any, then the following would serve as elements of T-Unit expansion: (1) Predicates occurring in Dependent Clauses; (2) Modifiers ... (a) Genitives of Nouns and Pronouns, (b) Phrasal Genitives, (c) Adjectival Prepositional Phrases, (d) Adjectival Verbals, (e) Adjectival Clauses, (f) Noun Adjuncts, (g) Numerals, (h) Demonstratives, (i) Quantifiers; (3) Verbal Nouns modified by Prepositions; (4) Auxiliaries.

Dependent Clause Verbs. Intransitive Predicates when analyzed separately as to their "linking" or "complete" function within main clauses were earlier found to be substantial indicators of language complexity. When such predicates appeared in dependent clause positions, no between sex differences were discernible; however, on a year to year basis, differences of a statistical nature did occur, as seen in Table 25.

As reference to Figure 18 will show, so gradual was the change exhibited over the years that the only testable a posteriori differences exhibited were those found between the high productions of the 18 year olds and the low productions of the 10 and 11 year olds. The observed variation of those productions

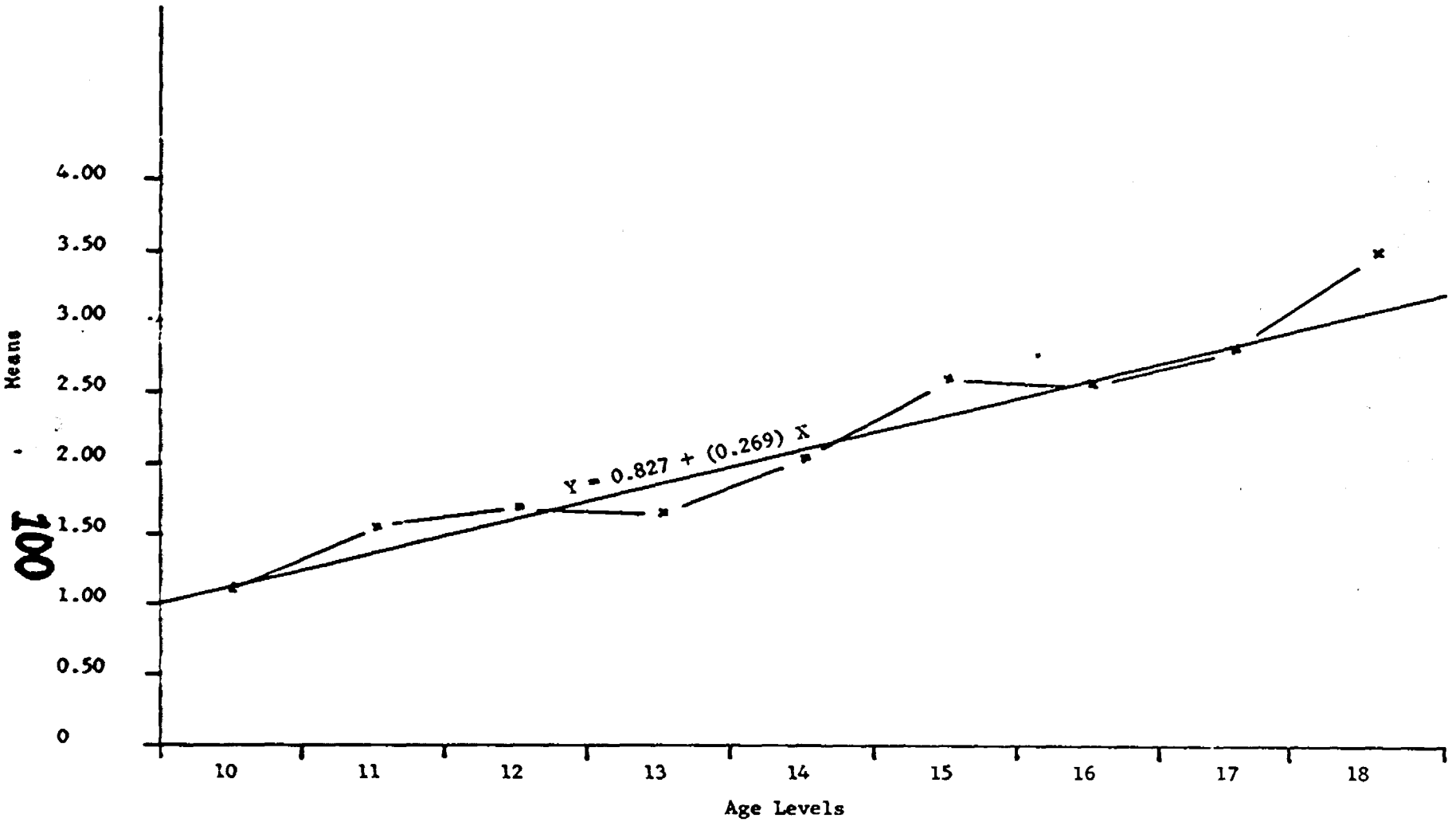
TABLE 25

Analysis of Variance Summary for Intransitive Verbs Appearing Within Dependent Clauses

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	24.64	24.64	3.01	n.s.
Age Level	8	210.50	26.31	3.21	<.01*
Sex and Age Level	8	18.21	2.28	0.28	n.s.
Within	396	3245.48	8.20		
Total	413	3498.83			

*Significant

igure 18. Intransitive Predicates Appearing for the Combined Sexes Across Age Levels as Mean Proportions within Dependent Clauses.



was 95 per cent accounted for by the linear relation of Y = 0.827 + (0.029) X.

Total gains for growth characterizing the nine years reflected a 68 per cent increase with 42 per cent of that growth occurring in the 14 to 18 year old time period.

Again, it would appear that Intransitive Verb productions exhibit considerable sensitivity to changes in language maturational behavior while at the same time serving as a substantial source of lengthening the T-Units produced.

Figure 19 presents the data plot for Transitive Verb constructions occurring within Dependent Clauses. Statistical differences (Table 26) appeared only among the Age Levels with the 17 and 18 year olds showing a statistical improvement over low scoring 10, 12 and 13 year olds.

Aside from the atypically high performance of the 11 year olds, a consistent linear advance with increasing age was found to occur over the years sampled and is represented by the relation of Y = 0.854 + (0.194) X. This equation accounts for 57 per cent of the observed variation in the usage of these constructions within dependent clauses. This latter observation would tend therefore to mitigate the practical significance of a 65 per cent increment in growth occurring throughout the age range sampled, 37 per cent of which took place during the 14 to 18 year bracket.

Auxiliaries. These are old English verbs which have lost most of their inflection and much of their original meaning as independent verbs. They provide the ancillary function of contributing various nuances of meaning within the verb phrase.

The use of Modal, Emphatic and Perfect Auxiliaries failed to be differentiated (statistically) on the basis of either main effect of Sex of Age Levels.

Figure 19. Mean Proportion of Transitive Predicate Constructions Occuring Within Dependent Clauses for Combined Sexes.

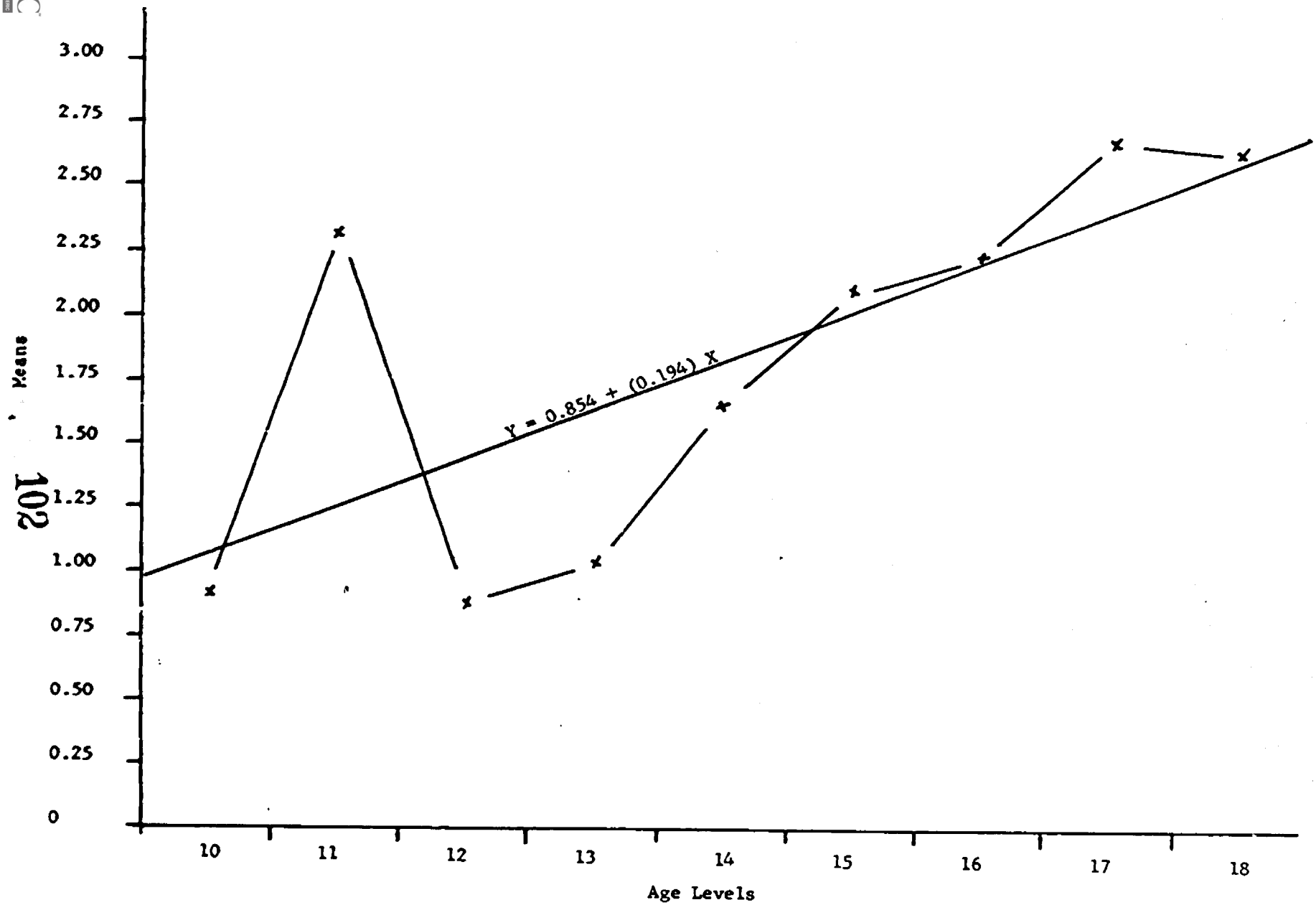


TABLE 26

Analysis of Variance Summary for Transitive Predicates Appearing Within Dependent Clauses

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	16.64	16.64	2.81	n.s.
Age Level	8	181.74	22.72	3.84	$<.01^*$
Sex and Age Level	8	33.51	4.19	0.71	n.s.
Within	396	2341.48	5.91		
Total	413	2573.37			

*Significant

As to the use of Progressive Auxiliary functions, young subjects were found not to show more than chance differences from older subjects, but females did tend to make a significantly greater use of such constructions than did males. The overall growth gains for both sexes did not exceed 15 per cent for the entire age range sampled (Table 27, Figure 20).

The usage of Passive Auxiliary construction did not appear to be statistically differentiated on the basis of sex alone as shown in Table 28 and Figure 21. Although differences of a statistical nature were found among the age levels, the trend was decidedly non-linear with a substantial portion of quadratic elements contributing to it. For this reason, any further analyses of regression factors, growth gains and a posteriori Tukey ratings were unfeasible.

It seems then that Auxiliaries contributed very little mensurational sensitivity to maturational language growth factors.

Gerunds. When the Gerund appeared functioning as the Object of a Preposition substantial differences appeared (Table 29). Although males and females did not produce more or less of these functions than that which could be expected on the basis of chance alone, 16 and 17 year old Age Levels were found to produce significantly more of such elements than did 10, 11, 12 and 13 year olds.

Seventy-eight per cent of the variation observed in the production of these gerundial elements could be represented by the straight line relation of $Y = -0.062 + (0.050) X$ without any significant deviations from this trend appearing other than what could be expected to occur on a chance basis five per cent of the time (Figure 22).

The growth gain of 84 per cent characterized the entire age range sampled with equal gains of 42 per cent occurring within each of the two five year time spans. Hunt (1965) also reported a dramatic total growth rate of 90 per cent

TABLE 27

Analysis of Variance Summary for Progressive Auxiliary Usage

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	97.59	97.59	7.58	<.01*
Age Level	8	80.60	10.08	0.78	n.s.
Sex and Age Level	8	74.35	9.29	0.72	n.s.
Within	396	5097.83	12.87		
Total	413	5348.37			

*Significant

Figure 20. Mean Proportion of Usage by Males and Females of Progressive Auxiliary Constructions.

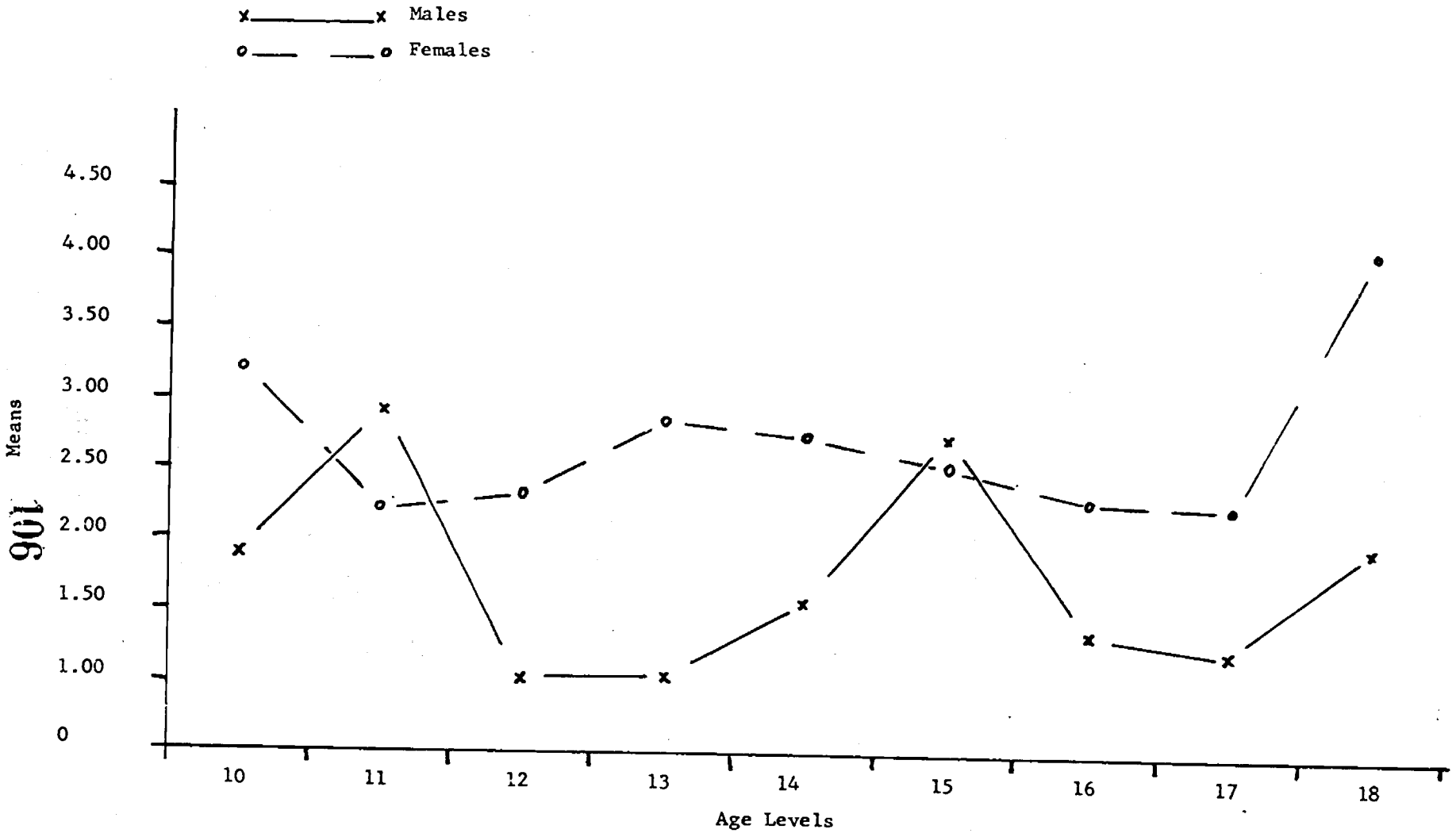


TABLE 28

Analysis of Variance Summary for Passive Auxiliary Constructions

Source of Variation	DF	Sum of Square	Mean Square	F	Probability of a Larger F
Sex	1	0.09	0.09	0.05	n.s.
Age Level	8	35.00	4.38	2.42	<.02*
Sex and Age Level	8	7.78	0.97	0.54	n.s.
Within	396	714.78	1.81		
Total	413	757.65			

*Significant

igure 21. Mean Proportion of Passive Auxiliary Usages by Combined Sexes.

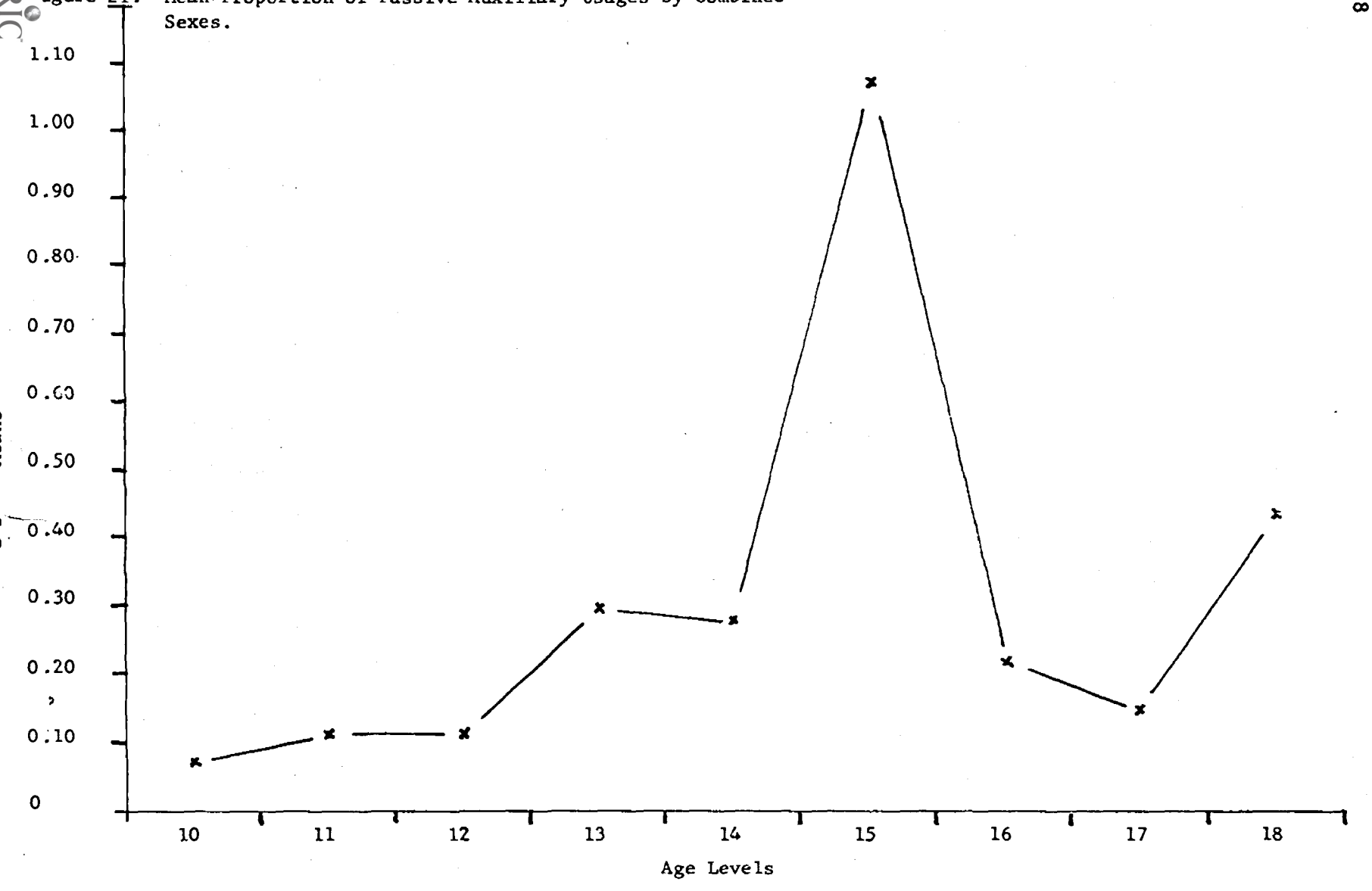


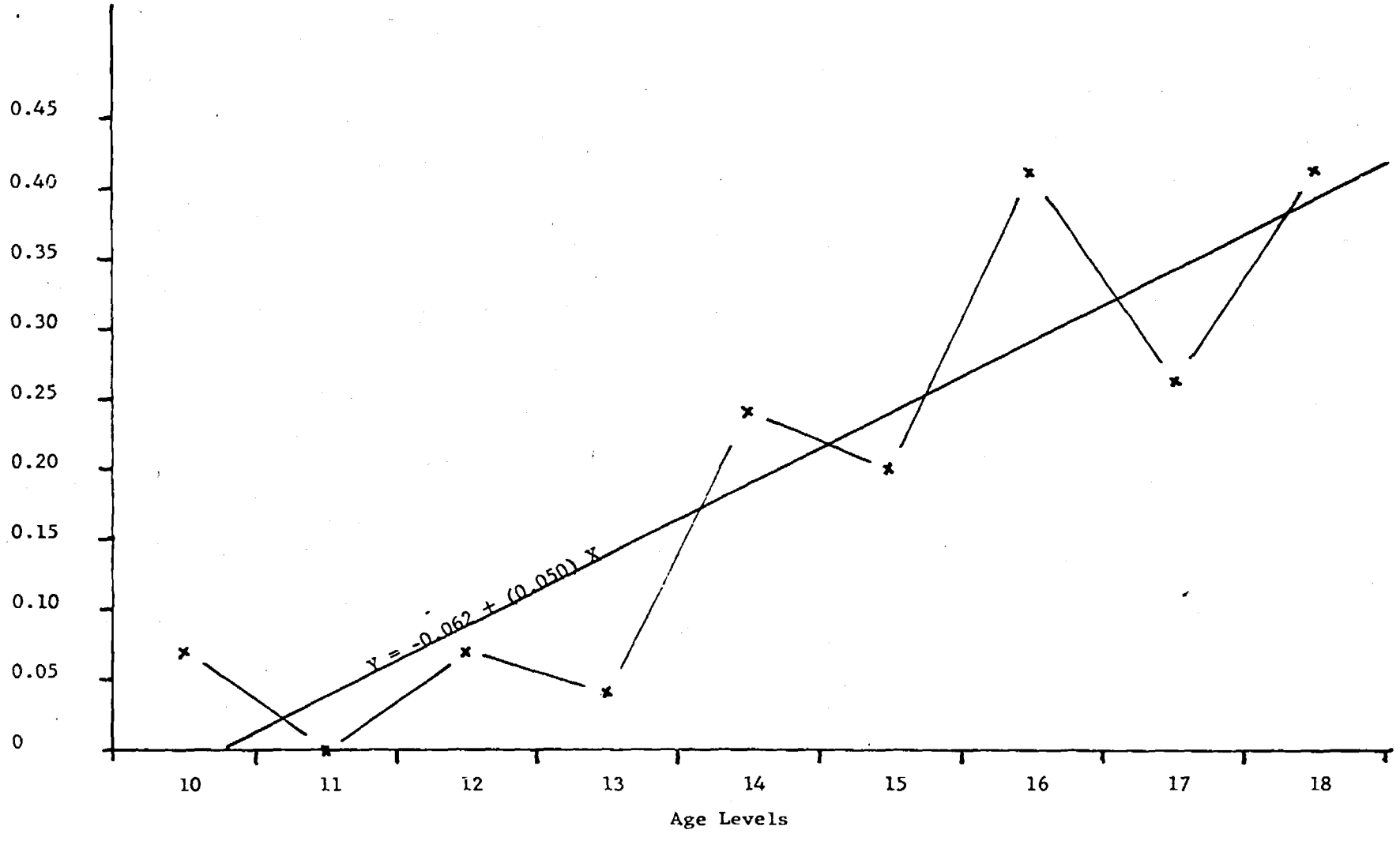
TABLE 29

Analysis of Variance Summary for Gerunds Functioning as Objects of Prepositions

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	0.00	0.00	0.00	n.s.
Age Level	8	9.00	1.13	4.17	<.01*
Sex and Age Level	8	1.35	0.17	0.62	n.s.
Within	396	106.96	0.27		
Total	413	117.31			

*Significant

Figure 22. Mean Proportion of Gerunds Functioning as Objects of Prepositions for the Combined Sexes.



for his hearing subjects (no sex differences) with the 30 per cent gain occurring in the first time period being doubled by the older subjects falling within the later time period of age comparisons. Despite the relatively low frequency of verbal nouns appearing at the younger age levels, it would appear that they provide a sensitive index to those changes of language maturation experienced in the presently sampled subjects.

Special Adjective Modifiers. A group of "special adjectives" were analyzed to see who used them most frequently. "Numerals" while showing no differences on the basis of sex, did nonetheless produce a chi square (21.27) significant beyond the .01 level with eight degrees of freedom among the frequencies produced by the various age levels. As Figure 23 will show, the distribution of these frequencies of usage were not consistent enough to admit of any systematic decrease or increase with time.

"Demonstrative" modifiers were employed on an entirely chance basis throughout the age levels by both sexes.

"Quantifiers" when modifying nouns showed a significant increase in their usage by females. A reference to Figure 24 will show that the most probable locus of this activity occurred in the 12 to 15 year age bracket. Among the frequency totals of the age levels for Quantifiers, a chi square of 44.90 ($P < .001$) was reported with a contingency coefficient (0.254) slightly lower than the coefficient reported for the Numberals (0.286). Growth gains could be demonstrated only for the quantifiers, a jump of 45 per cent for all nine years, 36 per cent of which occurred from year 14 to 18. The obvious non-linearity of the data in Figure 23 made a growth gain analysis meaningless.

Noun Adjuncts. With a chi square of 34.12 and eight degrees of freedom ($P < .001$), it is safe to assume that older subjects employ more of these constructions than do younger subjects without any differentiations possible

gure 23. Mean Proportion of Numeral Modifiers of Nominals Occuring with Nominals for Combined Sexes.

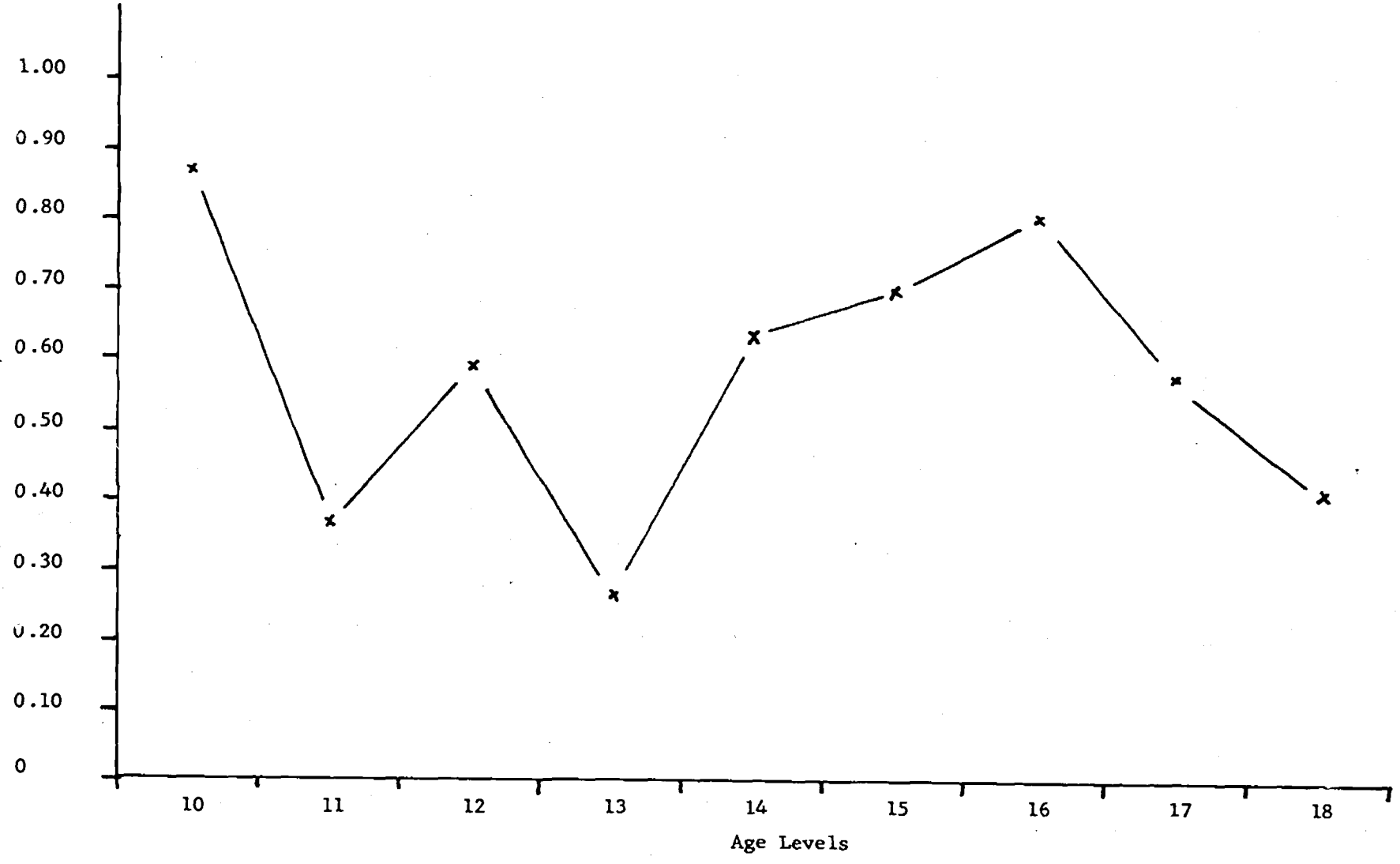
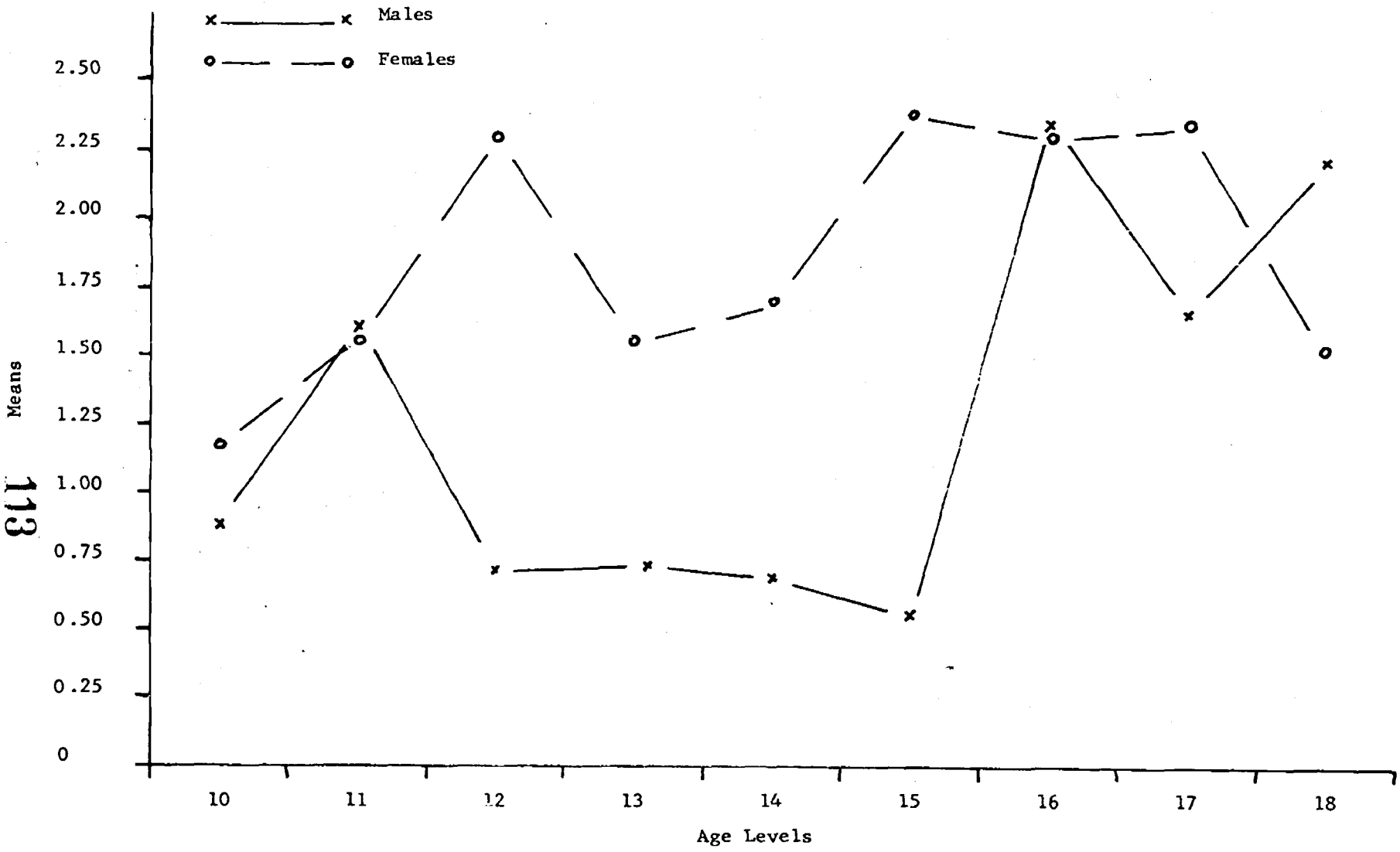


Figure 24. Mean Proportions of Male and Female Productions of Quantifiers Modifying Nominal Constructions.



on the basis of sex. The degree to which this variable associates with time is quite low as indicated by its contingency coefficient of 0.183; however, its overall growth gain of 47 per cent shows substantial improvement over time with a full 30 per cent of that gain occurring within the 10 to 14 year bracket. (Figure 25) Examples of some typical noun adjuncts are ... GAS STATION, FAMILY PICNIC.

Genitives of Nouns and Pronouns. Females and older subjects were found to use more of these noun modifications than did males and younger subjects with the most probable locus of the sex differences occurring during the 12 to 16 year age bracket.

A contingency coefficient of 0.224 demonstrated some modest associative strength with advancing time despite a large growth gain of 50 per cent occurring during the first five year span with only about half of that gain being witnessed during the latter five year span (Figure 26).

Phrasal Genitives. When the possessive case of the noun was modified by the preposition "of" instead of the apostrophe with "s" (morphemic ending), no differences in usage were discernible for either age or sex. Also with an obviously nonlinear trend prevailing across the nine years sampled the feasibility of computing growth gains was minimal.

Adjectival Clause Modifiers of Nouns. Adjective clauses usually modify nouns expressed or clearly implied in the preceding (independent) clause.

In Figure 27 the data plotted on the present subjects show a somewhat linear increase with time. A chi square of 26.06 ($P < .01$) and eight degrees of freedom was computed on this variable producing a contingency coefficient of 0.401. Growth gains for the entire nine years reflected a 76 per cent increment of improvement with 59 per cent of the gain occurring among the older age grouping.

Figure 25. Mean Proportion of Noun Adjunct Nominal Modifiers Produced by the Combined Sexes.

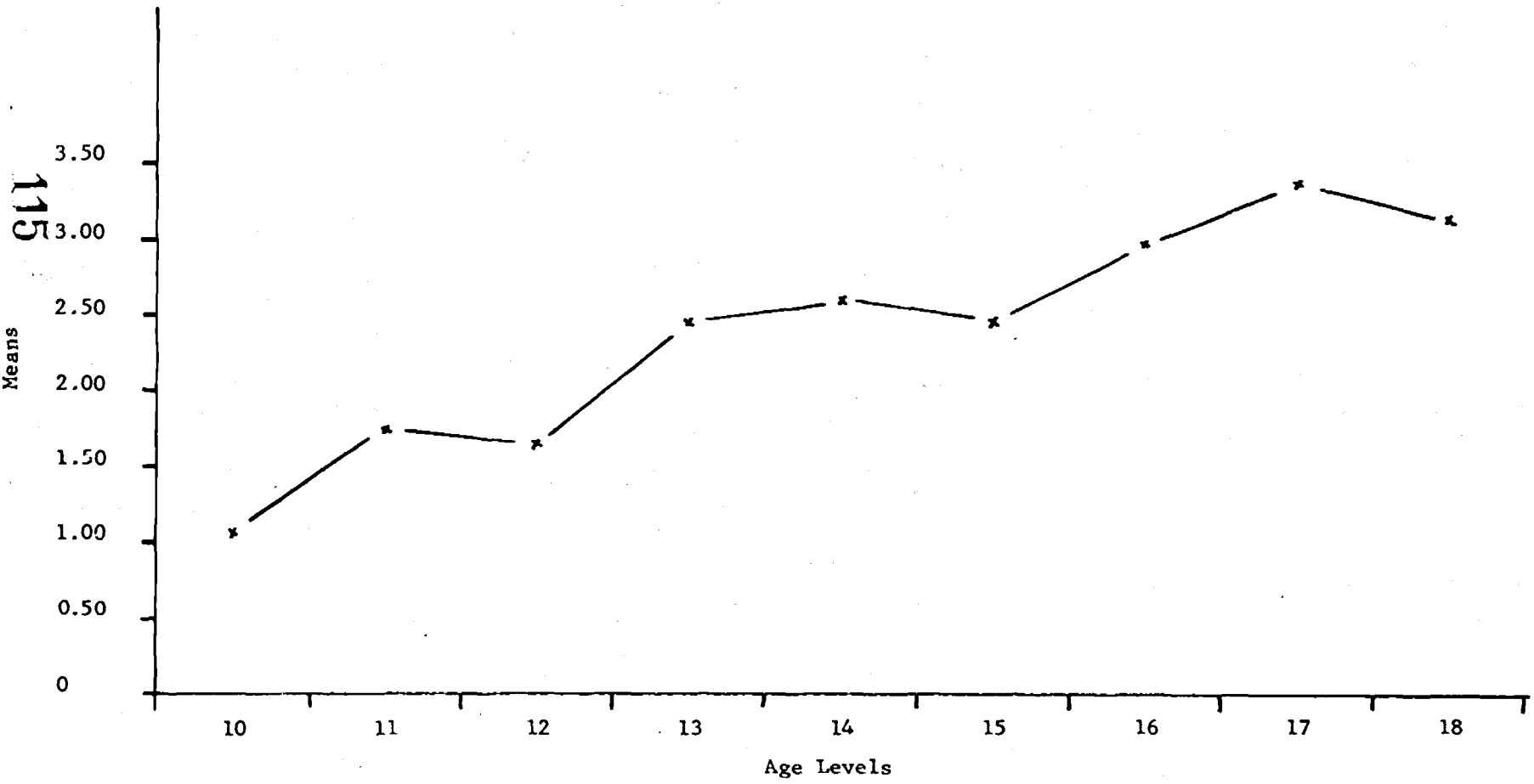


Figure 26. Mean Proportions of Males and Females Using Nominal and Pronominal Genitive Modifiers of Nouns.

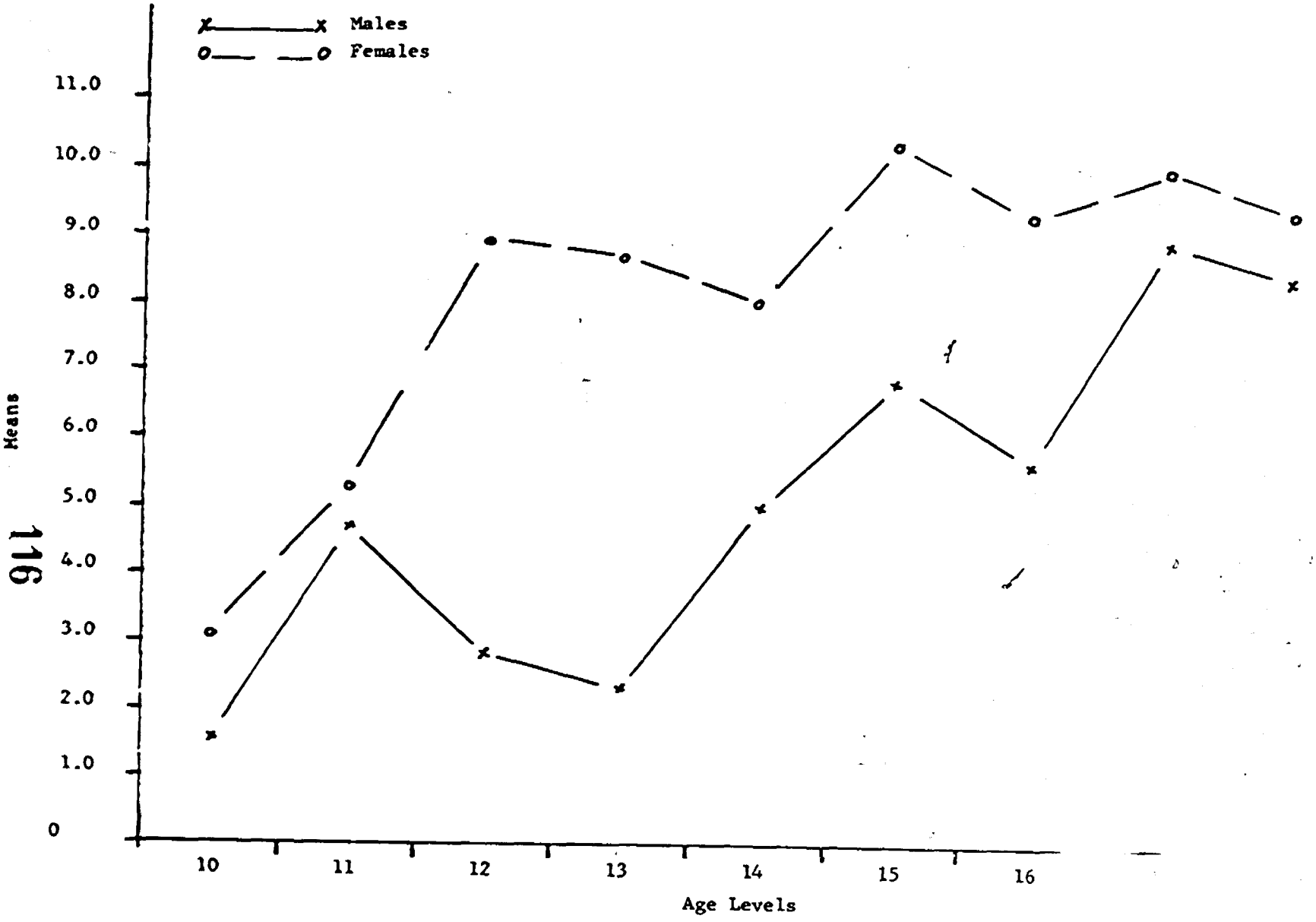
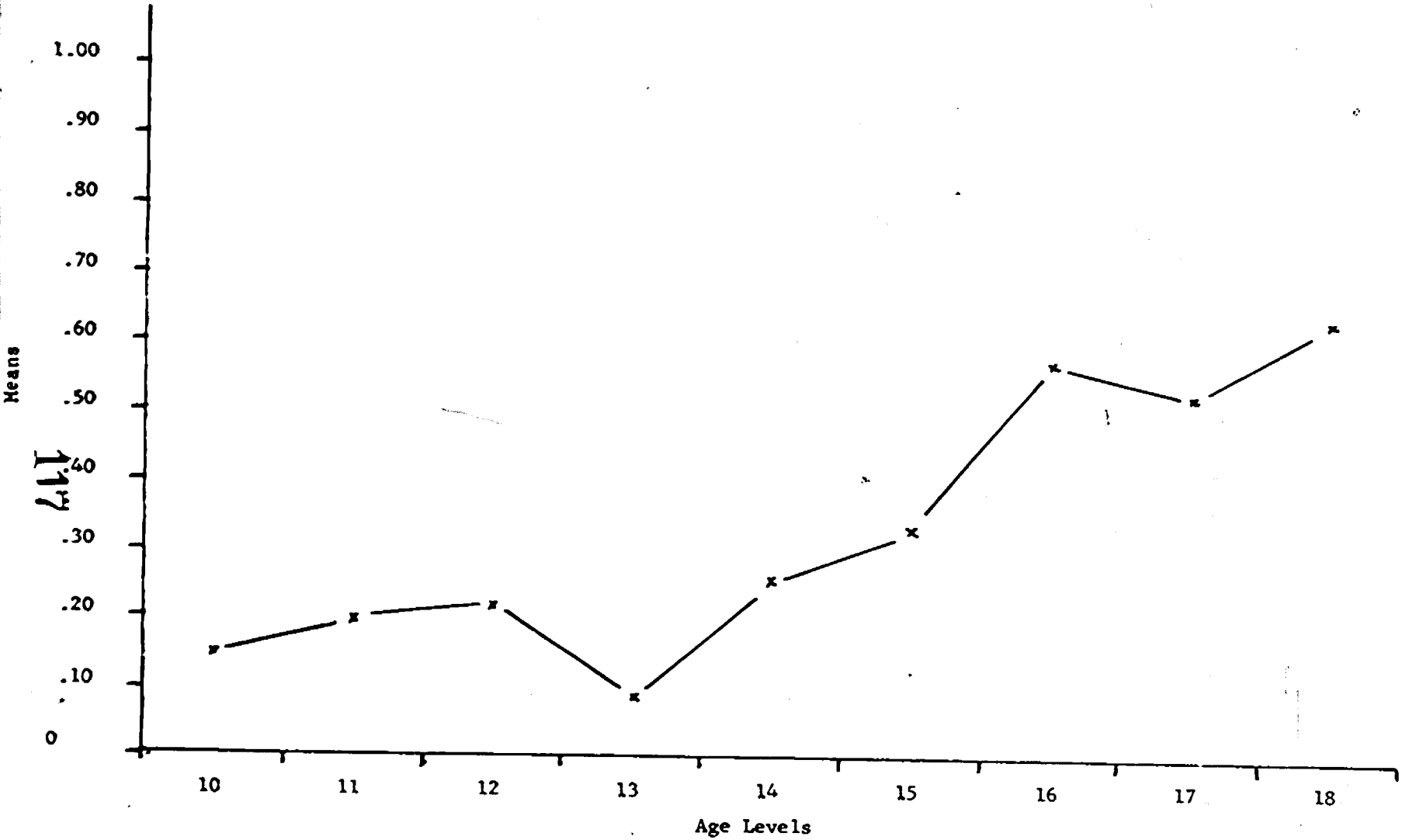


Figure 27. Mean Proportion of Adjectival Clause Modifiers of Nominal Structures Produced by Combined Sexes.



Verb Form Modifiers of Nouns. There were more "participial" forms correctly used than there were instances of "dangling participles". The linear improvement of such non-dangling structures is shown in Figure 28. While no differences were established on the basis of sex, 18 year olds exhibited a greater facility in producing participles correctly used than did 10, 11 and 12 year olds, (Table 30). In fact 86 per cent of this observed facility of correct usage could be accounted for by the relation of $Y = 0.125 + (0.131) X$. In terms of growth gains, a 69 per cent improvement characterized the entire nine years with 57 per cent occurring after age 14.

As to the specific kinds of non-dangling structures employed, "Present Participles" were found to exhibit significant increases over time with the 18 year olds being statistically differentiated from every age level (10-17). The lower mean proportions of usage compiled by the 10, 11 and 13 year olds were statistically surpassed by all other age levels, (Table 31). Despite a few non-chance departures from linearity, the regression equation of $Y = - 0.001 + (0.079) X$ accounted for about 76 per cent of the variation found to occur in the production of Present Participle structures (Figure 29).

As to the relative gain in growth of the data shown in Figure 29, a 100 per cent increment occurred in the entire nine year span since no evidence of this construction was produced by the year one subjects. A substantial 63 per cent of this growth occurred during the latter five year time period. It would appear then that this construction possesses an unusual degree of sensitivity to those maturational changes transpiring in the language behavior of the presently sampled subjects.

The use of "Past Participles" produced significant changes for both main effects of Sex and Age Levels, (Table 32). As shown in Figure 30, females surpassed (statistically) the performances of the males, especially at the higher

Figure 28. Mean Proportion of Non-Dangling Participial Functions Appearing for Combined Sexes.

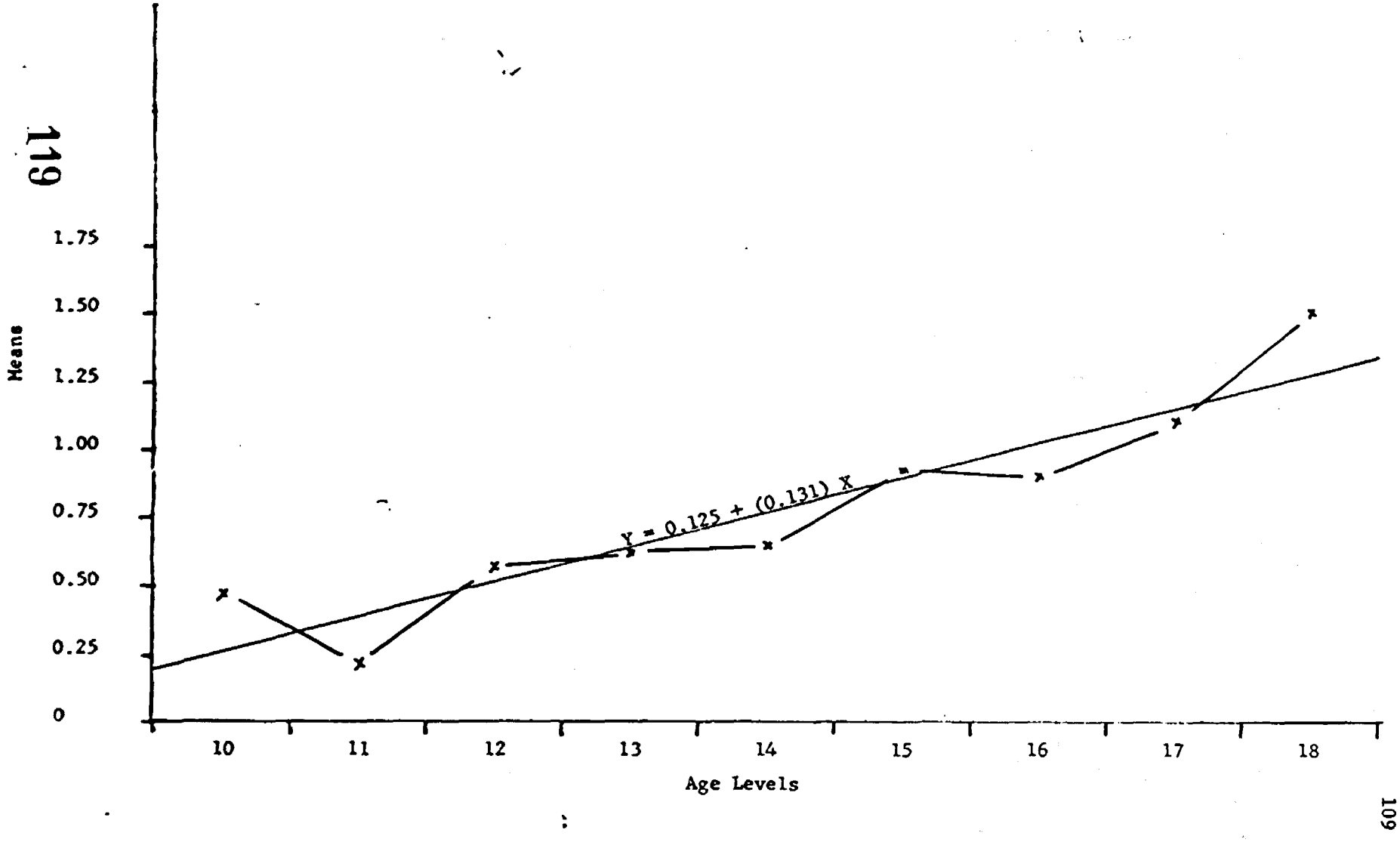


TABLE 30

Analysis of Variance Summary for Non-Dangling Participial Structures

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	0.87	0.87	0.35	n.s.
Age Level	8	54.85	6.86	2.72	<.01*
Sex and Age Level	8	22.32	2.79	1.11	n.s.
Within	396	996.96	2.52		
Total	413	1075.00			

*Significant

TABLE 31

Analysis of Variance Summary for Non-Dangling Present Participles

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	0.16	0.16	0.23	n.s.
Age Level	8	22.57	2.82	4.21	$<.01^{*}$
Sex and Age Level	8	3.11	0.39	0.58	n.s.
Within	396	265.39	0.67		
Total	413	291.23			

*Significant

Figure 29. Mean Proportion of Present Participle Functions Produced by the Combined Sexes.

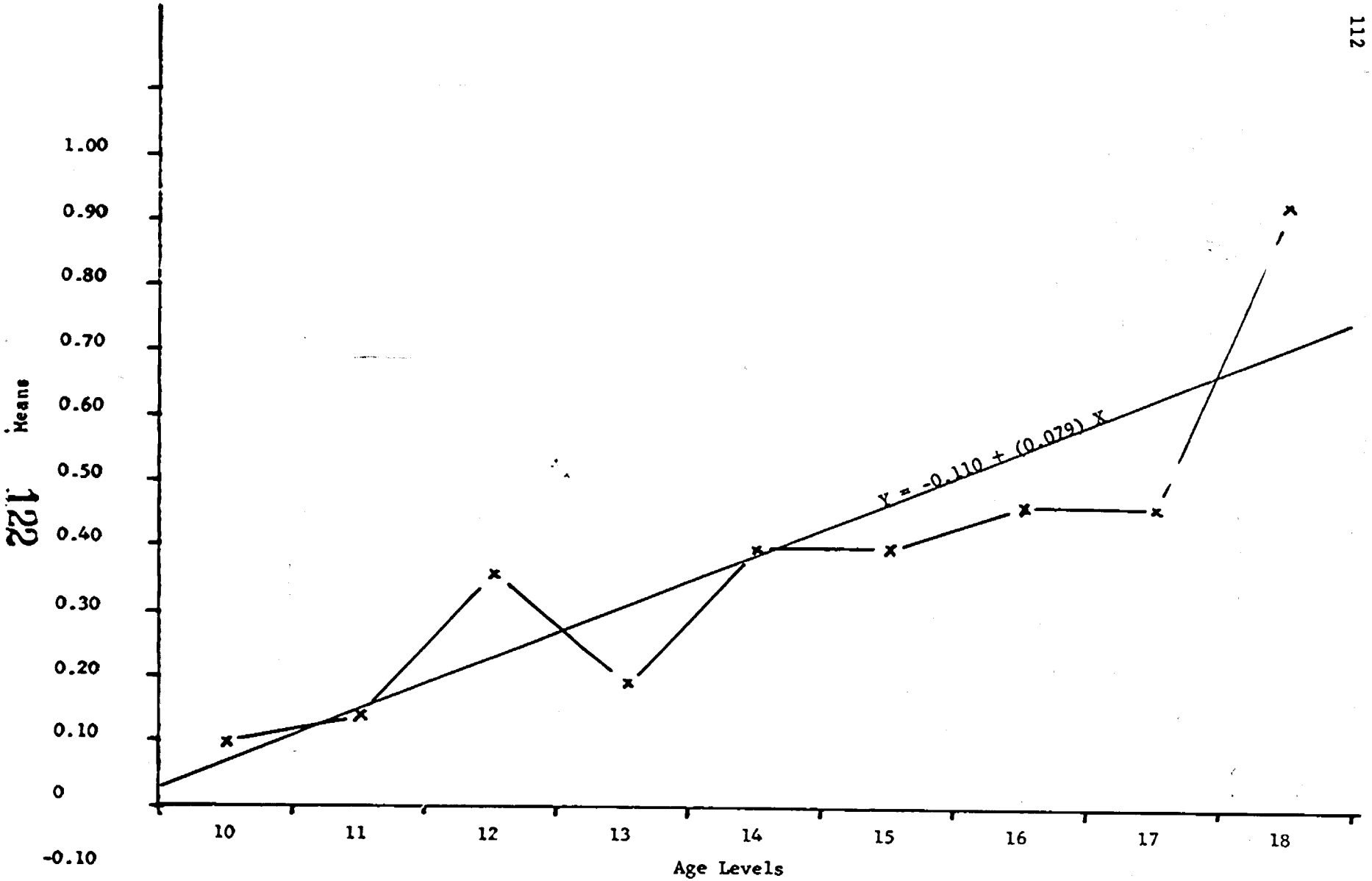


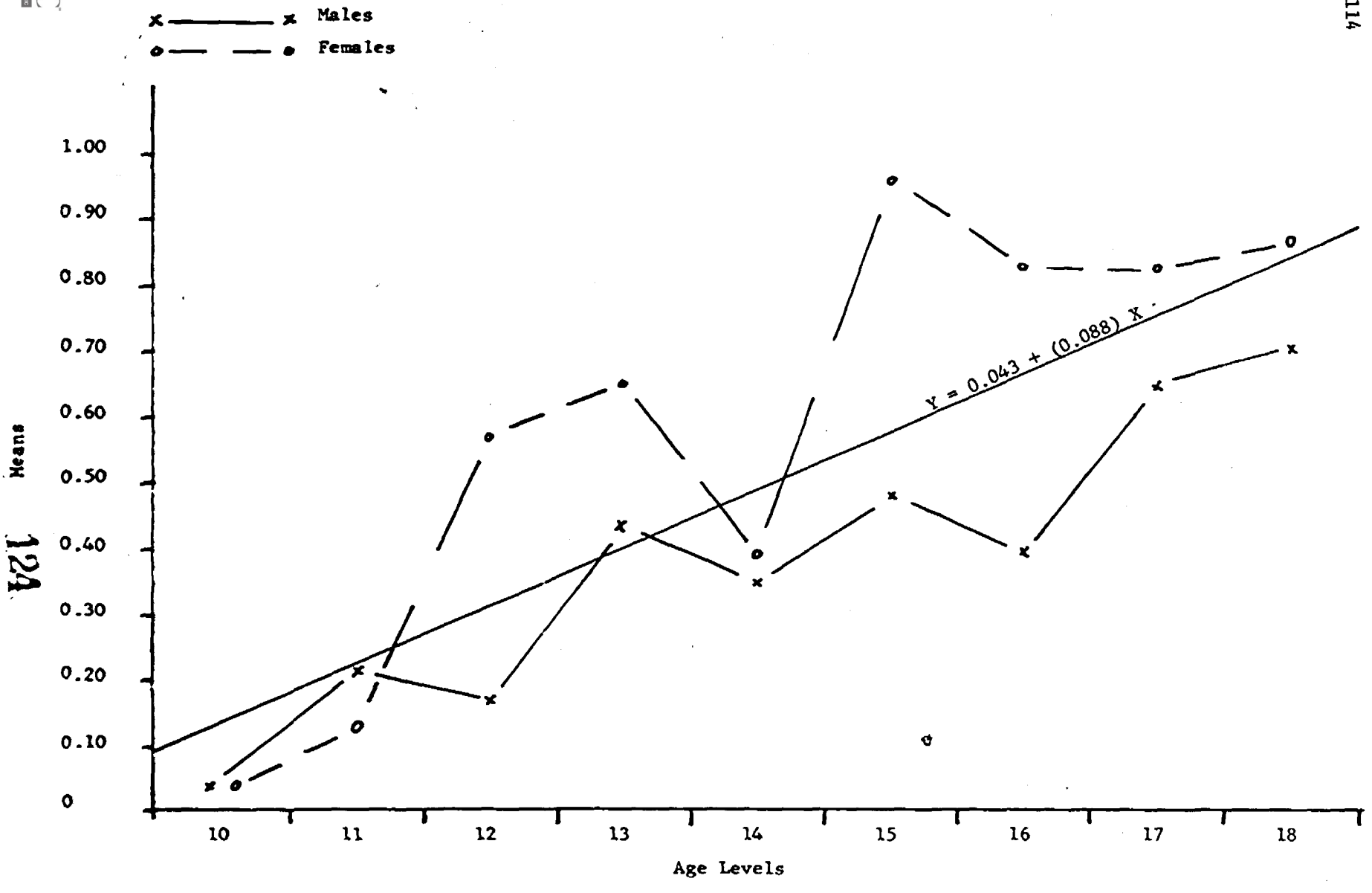
TABLE 32

Analysis of Variance Summary for Non-Dangling Past Participles

Source of Variation	DF	Sum of Squares	Mean Square	F	Probability of a Larger F
Sex	1	4.26	4.26	5.44	< .05*
Age Level	8	25.03	3.13	3.99	< .01*
Sex and Age Level	8	3.65	0.46	0.58	n.s.
Within	396	310.44	0.78		
Total	413	343.38			

*Significant

Figure 30. Mean Proportion of Past Participle Constructions Produced According to Sex.



age levels. While no significant improvement was found to take place among the Males separately, Females at ages 15, 16, 17 and 18 wrote more Past Participles than did those females sampled at age 10. With only chance departures from linearity being evidenced, the straight line equation of Y = 0.043 + (0.088) X had accounted for 86 per cent of the observed variation in Past Participle usage occurring over time. Growth gains reported over the nine year span reflected a 94 per cent increment, 53 per cent of which took place in the latter five years of comparison.

III. SUMMARY AND CONCLUSIONS

Several of the grammatical constructions that showed considerable sensitivity to the maturational language changes occurring within the presently sampled population revealed their most marked growth in the five year period commencing with age 14.

Present Participles and Transitive Passive Verbs occurring within Main Clauses demonstrated gains of at least 60 per cent during this older age bracket. Hunt's data on Present Participles showed a non-linear arrangement of scores that made the computation of growth scores impractical. Also, his breakdown of predicates did not reveal whether they were active or passive, linking or complete, thus making any direct comparisons somewhat difficult.

Constructions demonstrating gains of at least 50 per cent were Adjectival Clause Modifiers of Nouns, Non-Dangling Participles and Intransitive Linking Verbs.

Showing at least 40 and 30 per cent gains respectively during this latter time period of comparison were Intransitive Predicates occurring within Dependent Clauses and Noun Adjuncts.

Of the few variables on which non-parametric procedures were employed the Adjectival Clause Modifiers of Nouns were perhaps the strongest indicators of maturity as tested by their association with time (contingency coefficient = 0.401). On the other hand, those variables amenable to parametric testing produced varying degrees of uncontrolled variation contributing to their total variance. Dependent Intransitive Verbs showed the greatest amount of accounted-for variance (95 per cent).

As to those grammatical constructions demonstrating substantial growth

gains that were more equally distributed between the two five year spans of comparison, Gerunds, it was found, when functioning as the Object of Prepositions were by far the most common. Past Participles, Intransitive Complete Verbs, Factive Infinitives and Transitive Verbs occurring within Dependent Clauses also showed substantial though somewhat more modest growth gains evenly distributed among younger and older subjects.

The Genitives of Nouns and Pronouns and then the Personal Pronouns themselves were the only two constructions revealing their largest growth increment to occur during the 10 to 14 year old time span.

Progressive and Passive Auxiliaries as well as Numeral Noun Modifiers exhibited erratic and consequently non-linear data plots with no meaningful way left to measure their own idiosyncratic growth gains.

The above Summary of the Results of Part II tended somewhat to corroborate the conclusions of Part I, namely that a substantial distance has yet to be traversed before analyses of this nature can bear their true fruition. It would be inferred from the present analyses of Part II that the indices showing optimum sensitivity in the written language productions of hearing impaired writers would be those whose distribution of growth gains were relatively even across the time periods of comparison. Indices peaking at either the younger or older time periods would appear to have less discriminatory value throughout the entirety of any given span of years. However, it is variables of the latter ilk that are the very ones explaining the slight lengthening that occurred in the Clause, T-Unit and Sentence factors of measurement discussed in Part I.

The educational implications of these findings are meager in one sense of the term and contributory in another sense. Firstly, they do not offer any

prescriptions as to the specific modus operandi of grammar instruction for teachers of the hearing impaired. All that the present results seem to indicate is that on the basis of whatever grammatical principles hearing impaired children have already been exposed to, the present constructions signalled out for analysis have showed varying degrees of sensitivity to the maturational changes occurring in their language behavior.

On the other side of the coin these results do contribute to the educational assessment process of measuring grammatical progress in hearing impaired children. Subordination Ratio, T-Unit Length in Words, Gerunds functioning as Objects of Prepositions, Intransitive Verbs, Transitive Passive Verbs and both Present and Past Participles have shown substantial promise as indicators of growth over a period at least as long as nine years.

The research focus to be assumed from this point onward would seem to be in the area of deep and surface T-Unit structures with an analysis of the rules most predominantly characterizing the deviance of hearing impaired writers being the principle objective.

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