A STUDY OF THE AURAL PERCEPTION OF SENTENCES
OF DIFFERENT SYNTACTIC STRUCTURES AND
LENGTHS

DISSERTATION

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by

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CHAPTER I

THE PROBLEM

Introduction

The topic of this study is the perceptual complexity of American English sentences. Complexity, in this study, is defined as the relative ease or difficulty with which spoken sentences of different sentence structures and lengths are perceived and understood. The assumptions underlying the investigation are that (1) the greater the intelligibility of a sentence, the more accurately it is perceived, and hence understood, and (2) the intelligibility scores of sentences heard under a fixed amount of signal interference, in this instance filtering, may be regarded as a measure of their relative complexity. The use of filtering is significant only as a constant and interfering variable; its sole function is simply to make the listening task a discriminating one and thereby accentuate any differences in intelligibility resulting from the length or structure of the sentences heard.
Statement of Purpose

The purpose of the study reported here was to determine whether or not the ability of listeners to perceive sentences is influenced by the syntactic structure and the length of the sentences the listeners hear. The hypotheses tested were (1) there is no difference in the aural perception of sentences of different syntactic structures, (2) there is no difference in the aural perception of sentences of different lengths, and (3) there is no relationship between differences in aural perception of the various sentence structures and their degree of naturalness.

Related Research

A survey of the research in the areas of linguistics, speech communication, psychology, and related fields indicates that there have been few experimental studies of the role of syntactic structure and sentence length in the perception of language. One notable exception is a study by Black in which he investigated the effect of different lengths of sentences upon the "aural reception" of sentences heard under several noise conditions.¹ Ten sentences rated as

natural English statements were tested at each of eight lengths ranging from 3 to 17 words. The measure of "aural reception" was the accuracy of listeners' reports of the last three words of each sentence. The results indicated that either an increase in noise or an increase in length reduced the likelihood that the final three words of the sentences would be correctly identified. Black further noted, however, that the scores of the 17-word sentences were slightly higher than those of the 15-word sentences. He suggested two possible explanations of this increase at the longer length. The first arose from comments made by E. C. Poulton (Medical Research Laboratory, Cambridge) who noted a "bowing upward" effect in his own experiments because subjects exerted greater effort on final and more difficult tasks, and hence made better scores than on earlier and less difficult conditions. Black emphasized, however, that the sentences were randomly presented and suggested as a second possibility that perhaps the readers' phrasing of the longest sentences, in part to facilitate breathing, had the effect of reducing the sentence length.

The syntactic structures of the sentences used in the present study were defined in terms of the phrase structure and transformational rules of the generative grammar proposed by
According to the model, certain basic sentences, designated as kernels, represent the core structure of a language and are characterized by a set of relatively simple phrase structure rules. The other sentence structures of the language are then specified by the phrase structure rules plus the appropriate transformational rules; these are special rules which change the underlying kernel into a new derived structure.  

This is a greatly simplified account of the generative grammar. Such a grammar is a sentence-generating model which has both phrase-structure and transformational rules as its syntactic component. Phrase-structure rules yield phrase-markers (P-markers), and the application of the transformational rules yields derived P-markers. It is thus the underlying structure of sentences, rather than the sentences themselves, which undergo transformation. Sentences are obtained only when the rules of the grammar's mormophonemic component are applied to the terminal strings of the derived P-markers.

One important feature of the transformational model is that it preserves the intrinsic syntactic relations among different types of sentences, and in this respect, it contrasts with other grammatical systems such as the Phrase Structure and Tagnemic approaches which treat sentences as instances of distinct and independent sentence...
types. A discussion and evaluation of the various grammatical systems has been presented by Postal.\(^4\)


The generative grammar was conceived as a formal linguistic model intended to describe language as an abstract system independent of the behavior of its users. More recently, however, it has become both a source of theoretical speculation about the ways in which language is produced and understood and a subject of psychological investigation as well. Moreover, a chief concern of the present study was to examine the adequacy of the model to account for the observed differences in perception of the sentences used in the experiment. Several other studies having a direct bearing on this topic will be reviewed.

Miller has suggested that the analysis of sentences into kernels plus their appropriate transformations is useful not only as a linguistic model of a grammar of language, but also as a psychological model of its users. In partial support of this contention, he cited the preliminary results of a study by Miller, McKean, and Slobin in
his presidential address to the Eastern Psychological Association.\(^5\)


In the investigation there were 18 kernel sentences along with their corresponding passive, negative, and passive-negative transformational versions. From these four sets of sentences, sentence-matching tests were constructed by taking the sentences of two sets and arranging them in two alternate columns: half of the sentences for each set appeared in the right-hand column, and the other half, in the left. The test required the subjects to match the 18 scrambled sentences in one column with their corresponding versions in the other column. For example, if the test contained the question and passive-negative sets, the subject would read the first sentence of the list which might be either a question or a passive-negative statement and then search through the other list until he located the corresponding version. He would then move to the next sentence and repeat the process until, at the end of one minute, he was instructed to stop.

The rationale of the study was that the more complicated a grammatical transformation, the longer it would take to perform it. The purpose of the tests was to provide subjects with sets of sentences to transform and observe how many the subjects could transform in a fixed amount of time. The results of the investigation indicated that
the negative transformation took less time than the passive, and the most time consuming was the passive-negative combination. The results were then interpreted as support for the transformational position, since the model would predict the passive-negative combination to be the most complicated of the structures tested.

Mehler investigated the effect of eight different sentence structures upon the ability of listeners to recall sets of sentences; the sentence structures were based on Chomsky’s model.\(^6\) The


64 test sentences of the experiment were represented by eight kernel sentences, the passive, negative, and interrogative transformations of the kernels, and the four possible combinations of the three transformations. The sentences were divided into eight sets of eight sentences each in such a way that no sentences and no transformations were represented more than once in each set. The task of the subjects was to write the set of sentences after each presentation; each set was heard five successive times and the order of the sentences was varied from trial to trial. To aid the subjects in their recall, each page of the test booklet listed eight prompting words, one for each sentence. The responses were scored for both semantic and syntactic accuracy.
One of the most obvious results of the study was the greater ease with which the kernel sentences were recalled at every trial. This result, then, is consistent with the grammatical model which would predict the kernel sentences to be psychologically simpler than their transformed versions. However, the relative order of recall of the transformed sentence types fluctuated greatly from trial to trial, indicating a lack of consistency with the predictions of grammatical complexity at the transformational level. For example, on the last trial, both the question and passive-question sentences were learned less easily than the passive-negative-question which is, transformationally, the most complex structure of the three. This apparent discrepancy should be viewed cautiously, however, since two important variables were not controlled in this study: (1) relative differences in naturalness among the sentence types, and (2) differences in sentence length. The necessity of controlling for length is emphasized by another result of the investigation indicating that the number of words in the sentences was not a good predictor of ease of learning, i.e., the passives were less difficult than were the questions which had fewer words.

Further results of the study showed that beyond the second trial, the syntactic errors decreased with each succeeding presentation. The author also noted that the majority of errors in the kernel
sentences were simply omissions of the entire sentence, while the other sentence, if not omitted, had syntactic errors which resulted in a simplification of their sentence structure, i.e., they became more like the kernel. On the basis of this result, the author advanced the "schema-plus-correction" hypothesis which states that "subjects analyze the sentences into a semantic component plus syntactic corrections when they learn them, and that this separation of semantic content from syntactic form is one reason that the general meaning of a message is generally so much easier to recall than its exact wording."

On the basis of Mehler's study, Miller hypothesized that when a sentence is heard, it is recoded into the kernel sentence plus a "footnote" indicating the appropriate transformations necessary to reproduce the original sentence exactly.\(^7\) Hence, the greater the number of transformations that must be remembered, the greater the possibility of error during recall. This interpretation, then, allowed him to account for the results observed in Mehler's investigation: namely, (1) the greater ease with which the kernel sentences were recalled, and (2) the greater number of syntactic errors in the transformed sentences which resulted in a simplification of their sentence structure.

\(^7\)Miller, American Psychologist, XI (1962), 748-62.
Following Miller's line of reasoning, Gough tested the hypothesis that the speed, or latency of understanding a sentence, would vary with the number and nature of the transformations separating it from its kernel. Sentences of several grammatical types "descriptive of relatively simple, unambiguous events," were presented to the subjects, followed by a drawing depicting events which confirmed or falsified the statements. The measure of understanding was determined by the amount of time required for listeners to make judgments about the truth or falsity of the statements.

The eight "events" of the experiment were the possible permutations of a boy or girl hitting or kicking a boy or girl; each event was represented by an ink drawing plus another of its mirror image which reversed the position of the actor (left or right).

The stimulus sentences to be verified were eight kernel sentences describing the events along with their negative, passive, and negative-passive versions, i.e., 32 test sentences. The 32 sentences were arranged so that each sentence was paired with the event which verified it, and another event which falsified it. This yielded 64 sentence-event pairs plus their mirror image counterparts or 128 sentence-picture items which were presented to each subject.
The experimenter read the sentences from behind a screen, and coincident with the initial consonant of the last word, depressed a button which illuminated the picture and started an electronic timer. The subjects were instructed to decide if the sentences they heard were true or false on the basis of the picture shown at the end of each sentence and to indicate their decision by pressing one of two buttons.

The results of the experiment indicated that the active sentences were verified faster than the passives, and the affirmatives faster than the negatives. These results were then interpreted as support for the hypothesis that listeners' speed of understanding of sentences varies with the number of transformations separating them from their kernels.

Two other results were that true sentences were verified faster than false ones, and truth value interacted with the affirmative-negative variable. The latter finding was taken to mean that negative sentences do not differ from affirmatives simply by a syntactical transformation. Rather, the author proposed a semantic component since if the hearer of a negative sentence transforms it into a kernel plus a syntactic footnote, then the verification of the kernel would result in a truth value which is opposite the correct one; thus, the truth value of the kernel must be reversed to that of the original
sentence, and this operation is not syntactic but presumably semantic.

The author further pointed out that the sentence types were confounded with both their relative frequency of occurrence in the language and the length of the sentences, and therefore other interpretations of the data are conceivable.

In a second study, Gough reported two experiments which further examined the relationship between the syntactic structure of sentences and their speed of verification. In the first experiment, the sentence-event stimuli and the procedures were identical to those of his earlier study except that the picture upon which verification was based was delayed three seconds after the initial consonant of the last word rather than occurring concurrently with that word.

Gough noted that according to the "transformational decoding hypothesis" the verification of sentences could not occur until a sentence was decoded into its kernel. Thus, by delaying the evidence for verification until the transformational decoding process was completed, the verification time of all but the kernel sentences should be reduced. His results indicated, however, that even with

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delay of evidence, active sentences were still verified faster than passives and affirmatives faster than negatives. He interpreted these results as lack of confirmation of the hypothesis that sentences are reduced to their kernels at the moment they are heard but noted that a transformational description of sentence complexity is still possible, since verification time, even after delay of evidence, varied with the number of transformations.

In the second experiment, Gough tested the hypothesis that the differences in verification time among the sentence types were an artifact of the differences in the length of the sentences. The lengths of the passive and passive-negative sentences were made shorter than their active counterparts by deleting their agent phrases. This resulted in a comparison of sentences like "The girl (didn't) hit the boy" with sentences like "The boy was (not) hit."

Two kernel sentences, "The boy hit the girl" and "The girl hit the boy," were used along with their negative, passive, and negative-passive counterparts. Four slides were prepared depicting each event and its mirror image, and these were paired with the sentences yielding 32 sentence-event items. Again, the experimenter read the sentences to each subject and presented the slide simultaneously with the last word of each sentence. In this instance, active sentences were still verified faster than passives, and the author concluded that
the length of the sentences did not account for the relationship between sentence type and verification of time.

Summary

In general these studies showed consistency in their results, although there was some evidence of contradictory results as well. For example, Miller, Mehler, and Gough have all produced results supporting the hypothesis that kernel sentences are, in fact, psychologically less complex than their transformational counterparts, and that the number of transformations separating sentences from their kernels provides a reliable index of relative difficulty of understanding sentences of different syntactic structures. One exception,

10 It is important to point out that the results of these studies as well as those of the present study to be reported simply demonstrate a correspondence between the human behavior observed and the transformational decoding hypothesis, but do not establish it as a psychological reality.

however, may be noted. Mehler's study showed marked inconsistency in the relative order of recall of the transformed sentences from trial to trial, although it could be argued that he was testing a recall or learning process, whereas the other studies were presumably testing understanding. The apparent discrepancy might then be attributed to the difference in the psychological process involved.
With respect to the effect of sentence length upon the perception of sentences, Black has shown that as length increased the likelihood of correctly identifying the last three words of sentences decreased; he noted, however, a slight increase at the longest length. The implication of this latter finding, then, is that differences in aural perception of sentences of different lengths are not a simple matter of a linear relationship between taxation of the perceptual process or the auditory memory span and the addition of more and more words to sentences.

In contradistinction with Black's results, Gough found that differences in speed of understanding of active and passive sentences could not be attributed to length, i.e., longer actives were verified faster than shorter passives. Gough's method of controlling length is open to speculation, however, since deleting agent phrases from passive sentences results in elliptical passives, and presumably the underlying sentence length remains, because the agent is still present by implication. In addition, Gunter has shown that ellipses which are out of context are not clear, and hence this in itself would seem to make their understanding more difficult.\(^{11}\) Further, according

to the grammatical model from which Gough has chosen to formulate his hypotheses, elliptical passives are even more complex than their underlying form, since an additional transformation is required to delete the agent phrase; this increase in complexity might well offset the presumed advantage of the shortened length.

In the present study the effects of different sentence structures and lengths upon the aural perception of sentences were further examined. The method of constructing the stimulus sentences differed from that of the previous investigations in that the sentences were semantically independent of each other, whereas in the other studies they were derived from specific kernel sentences and therefore were semantically related. By relaxing this semantic constraint, it was possible to use sentences which were representative of natural English statements and to equate the length of the sentences; hence some of the limitations of the other studies were avoided.

**Organization of the Study**

This chapter has included a brief statement of the purpose of the study and a review of research related to the present investigation. In Chapter II a description of the experimental procedures of the study will be provided. The topic of Chapter III will be the analysis of the data and discussion of the results. The summary and conclusions will be presented in Chapter IV.
CHAPTER II

PROCEDURES

A pool of 352 sentences with different sentence structures and lengths was constructed. The syntactic description of the sentences was derived from a generative grammar; four lengths of sentences were represented: 8, 10, 12, and 14 words. One-half of the sentences were subsequently selected as the stimuli for the experiment according to ratings assigned them indicating the extent to which they were representative of natural English statements. The 176 test sentences were composed of eleven sets of sixteen sentences which were recorded by two speakers and randomly presented to two groups of twelve listeners. Each set of sentences differed in sentence structure and contained four sentences of each of the four lengths. The two speakers read a different pair of sentences of each of the four lengths within the eleven sets. One group of the listeners heard all of the sentences under a single condition of low-pass filtering, and the other group heard the sentences under a non-filtered condition. In both instances, the sentences were played through monaural sets of earphones. The task of the
listeners was to write as much of each sentence as possible immediately after its presentation. The sentences were separated by a 45-second time interval which provided sufficient time to write the longest sentences. Several sentences were given prior to the experiment to acquaint the listeners with the nature of the assignment.

The data were tabulated by recording the mean percentage of the intelligibility scores of the four sentences of each sentence length for every listener. This procedure was repeated for all of the eleven sentence types and both listening conditions.

The details of the above procedures are discussed under the following headings: Construction and Selection of the Test Sentences, Selection of Speakers and Recording Procedures, Judging Procedures, and Tabulation of Results.

**Construction and Selection of the Test Sentences**

The structural descriptions of the sentences for this study were based upon the grammatical model proposed by Chomsky in 1957.\(^1\)

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\(^1\)N. Chomsky, *Syntactic Structure*, 1957.

According to this grammar, the kernel, or core, sentences of a language are formed from a set of generative, or phrase structure rules. These sentences may be thought of as simple, active, affirmative, declarative sentences such as "The police caught the convict";
"John reported the story"; "The editor printed the article," etc. All other sentences are then derived by applying transformational rules to the kernel sentences. The transformational rules are of two types: (1) single-base, or simple, transformations which convert a sentence from one form to another, and (2) double-base, or generalized transformations which either embed one sentence into another or conjoin one sentence with another. For example, the simple tra-

formations would yield sentences such as "The convict was caught by the police" (a passive); "Didn't John report the story" (a negative-question); and "Wasn't the article printed by the editor" (a passive-negative-question). Similarly, the generalized transformation could produce such sentences as "The police caught the convict, and John reported the story" (a compound); "When John reported the story, the editor printed the article" (a complex); and "After the police caught the convict, John reported the story and the editor printed the article" (a compound-complex).

Each of thirty-two graduate students in English and Speech constructed eleven original and semantically unrelated sentences. Each person was given a set of instructions indicating the eleven sentence types and length of the sentences he was to compose; the

eleven sentences contributed by any one person were different in sentence structure, but identical in length. Contractions and unhyphenated compounds were counted as one word, and the vocabulary was limited to words relatively common to "everyday" conversation. A copy of the instructions is included in the Appendix.

The pool of 352 sentences contained eleven sets of thirty-two statements, each set characterized by a different syntactic structure. Within each set were eight sentences at each of four lengths: 8, 10, 12, and 14 words.

The eleven sentence structures, or sentence types, included:

(1) simple, active, affirmative, declarative sentences analogous to the kernel sentences of the generative grammar; (2) passive, negative, and question constructions and their four possible combinations which are formed by the single-base, or simple, transformational rules; and (3) compound, complex and compound-complex sentences described by the double-base, or generalized, transformations.

Six judges rated the 352 sentences on a one-to-four scale according to "naturalness." The judges individually read aloud each of the sentences and responded to the criterion, "Is this an easy, natural sentence to speak?" The four most natural statements of each of the four lengths, i.e., those receiving the lowest ratings,
for each sentence type became the 176 test sentences for the experiment. The sentences are listed in the Appendix.

The reliability of this technique of selecting natural sentences is demonstrated by the rank order correlation between the mean ratings of the 16 test sentences for each of the eleven sentence types and those for the eliminated sentences. The ratings upon which the ranks were derived are given in Table 1. The correlation, \( \rho = 0.25 \), is statistically significant beyond the .001 level of confidence and indicates that the raters' judgments of naturalness led to a nearly identical relative ordering of the sentence types for the sentences selected, and the sentence types for those rejected. The only essential difference between the two groups of sentences, then, was the magnitude of the ratings they received.

**Selection of the Speakers and Recording Procedures**

**Selection of the Speakers**

The two speakers who recorded the sentences for this experiment were professional radio announcers. They were selected because their profession requires them to be articulate and fluent speakers; consequently, they could be expected to give intelligible, accurate renditions of the sentences they were to read. Further, their ability to control their vocal level greatly simplified the
TABLE 1

MEAN RATINGS OF THE SIXTEEN TEST SENTENCES AND THE SIXTEEN ELIMINATED SENTENCES FOR EACH OF THE ELEVEN SENTENCE TYPES

<table>
<thead>
<tr>
<th>Sentence Type</th>
<th>Mean Ratings&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Test Sentences</th>
<th>Eliminated Sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple (Kernel)</td>
<td></td>
<td>36.75</td>
<td>57.00</td>
</tr>
<tr>
<td>Passive</td>
<td></td>
<td>36.50</td>
<td>56.25</td>
</tr>
<tr>
<td>Negative</td>
<td></td>
<td>33.50</td>
<td>43.00</td>
</tr>
<tr>
<td>Question</td>
<td></td>
<td>33.50</td>
<td>47.50</td>
</tr>
<tr>
<td>Pass.-Neg.</td>
<td></td>
<td>42.25</td>
<td>57.25</td>
</tr>
<tr>
<td>Pass.-Quest.</td>
<td></td>
<td>40.00</td>
<td>56.50</td>
</tr>
<tr>
<td>Neg.-Quest.</td>
<td></td>
<td>33.25</td>
<td>41.50</td>
</tr>
<tr>
<td>Pass.-Neg.-Quest.</td>
<td></td>
<td>48.00</td>
<td>60.25</td>
</tr>
<tr>
<td>Compound</td>
<td></td>
<td>31.75</td>
<td>41.75</td>
</tr>
<tr>
<td>Complex</td>
<td></td>
<td>41.25</td>
<td>50.75</td>
</tr>
<tr>
<td>Compound-Complex</td>
<td></td>
<td>58.25</td>
<td>69.00</td>
</tr>
</tbody>
</table>

<sup>a</sup>The lowest possible mean rating was 24.00, and the highest 96.00.
recording task, since the extreme variations in loudness typical of inexperienced speakers were minimized.

Recording Procedures

The 176 test sentences were divided into two equal groups of 88 sentences. Each speaker read one group of sentences which contained two sentences of each length for each of the eleven sentence structures. Neither script duplicated any sentences.

The speakers were instructed to read the sentences as naturally as possible at a comfortable vocal level. Both speakers were given ample opportunity to familiarize themselves with their script prior to the recording.

The recordings were made at The Ohio State University Listening Center recording studio. The microphone (RCA Poly-directional, Model 77-DX) was suspended from a boom approximately two feet in front of the speakers at an angle slightly above the head. The recordings were made on an Ampex tape recorder (Model 351) at a predetermined intensity level of approximately -7 VU meter reading.

The randomized version of the 176 sentences used in the experiment was made by copying the appropriate sentences from the original recordings of the speakers. An identifying number preceded each sentence, and a 45-second time-interval separated
the sentences; this interval provided sufficient time for the listeners to write the longest sentences included in the study. The original recordings of both speakers were played back from an Ampex tape recorder (Model 351) at a maximum deflection of 0 as read from a VTVM on the 0 dB scale. The randomized version of the sentences was then made by copying the sentences on a single track of the tape with an Ampex tape recorder (Model PR-10-2) at a level of -7 average fluctuation of the VU meter.

The close control of the recording and playback levels was in part a result of an earlier conception of this study in which several fixed amounts of white-noise provided the signal interference. In this preliminary study, reliable signal-to-noise (S/N) ratios were crucial, and the ratios were established by recording the desired amount of noise on a second track of the tape. In spite of these precautions, however, this method proved to be unreliable: minor variations in loudness from sentence to sentence were unavoidable. These variations produced instable S/N ratios, which consequently resulted in inconsistent and uninterpretable intelligibility scores among the various types of sentences. The use of filtering, then, minimized this problem, since the interfering effects of filtering are not markedly affected by minor variations in loudness levels. Thus, the slight fluctuations were no longer crucial to intelligibility so long as an adequate listening level was maintained.
In the first version of this study, the effects of the different lengths of sentences upon aural perception, even under the listening conditions with noise, were nearly identical to those of the present study reported in the following chapter. Apparently, the effects of the varying S/N ratios were randomized as a result of the greater number of sentences representing the four lengths, i.e., there were 44 sentences of each length, and 16 of each sentence type. Consequently, an alternate solution to the use of filtering might have been a larger sample of sentences within each type represented in the study.

**Judging Procedures**

Two groups of twelve adults served as listeners in this experiment. The members of both groups were all freshmen or sophomores enrolled in an introductory psychology course. One group heard the randomized sentences under a condition of 720 cps low-pass filtering, and the other group listened to the same sentences with no filtering. In both instances, the sentences were played back at a comfortable listening level from an Ampex (Model 601) tape recorder through monaural sets of headphones (Permoflux Model PDR-8). The playback gain was controlled by an amplifier (McMartin, Model LT 80-A) intermediate between the tape recorder and headsets; the approximate level was 85 dB (re .0002 dyne/cm²). In the case of the filtered
condition, the sentences were played through a variable high-pass and low-pass filter set (Allison, Model 2AR) which attenuated the frequencies higher than 720 cps.

The task of the two groups of listeners was simply to write in their test booklets as much of each sentence as possible immediately after the sentence was presented. Several sentences were given prior to the test to familiarize the listeners with the experimental setting and to acquaint them with the task.

**Tabulation of Results**

The listeners' responses were scored by recording the number of words correctly identified, sentence by sentence, for each listener. Incorrect spellings, changes in number, and alteration of tense were not considered as errors.

Each listener's total number of words correctly identified for the four sentences of each of the four lengths were subsequently converted into percentage scores; this was done for each of the eleven types of sentences. A total of 44 percentage scores, then, was derived for each listener, i.e., 4 lengths x 11 sentence types = 44. The conversion was necessary for the later statistical analyses, since the number of correct words for any given sentence was, in part, a function of its length.
Summary

In the first part of this chapter the construction and selection of the test sentences were described. Next, the selection of the speakers and the details of the recording procedures were discussed. The following two sections were concerned with the judging procedures and tabulation of results.
CHAPTER III

ANALYSIS AND RESULTS

The purpose of this study was to determine the effects of different sentence structures and lengths upon the ability of listeners to perceive sentences. The measure of perception was the intelligibility scores of the sentences heard under a condition of low-pass filtering and another condition with no filtering.

This chapter treats the statistical analysis of the data that were obtained under the experimental conditions and presents the results of the investigation. The first and second sections of the chapter treat (1) the effect of different sentence structures upon the aural perception of sentences and (2) the effect of different lengths of sentences upon the aural perception of sentences. In the third section, the interacting effects between the different sentence structures and lengths upon the aural perception of sentences are treated. The final section presents an analysis of the relationship between the differences in aural perception of the types of sentences and their degree of naturalness.
Effect of Different Sentence Structures upon the Aural Perception of Sentences

Eleven sets of sixteen sentences, previously rated as natural English statements, were randomly presented to two groups of twelve listeners; the sets of sentences differed in syntactic structure, and each set contained four sentences of each of four lengths. One group of listeners heard the sentences under a single low-pass condition of filtering, and the other group heard the sentences without filtering. The task of both groups was to write as much of each sentence as possible immediately after it was presented. The mean percentages of the intelligibility scores of the sentences for the two experimental conditions are given in Tables 2 and 3. Each row of the tables represents one of the eleven sentence types, and each column designates one of the four lengths. Thus, the value of 82.14 in the upper left-hand corner of Table 2 indicates that the mean intelligibility of the four simple, or kernel, sentences with a length of eight words was 82.14 per cent when heard under the filtered condition.

The differences among the various sentence types and lengths, as well as the interaction between the two, were tested by means of a three-dimensional analysis of variance design (AXBXS). This
TABLE 2

MEAN PERCENTAGES OF THE INTELLIGIBILITY SCORES OF THE SENTENCES FOR EACH OF THE ELEVEN TYPES OF SENTENCES AND FOUR LENGTHS UNDER THE LOW-PASS CONDITION OF FILTERING

<table>
<thead>
<tr>
<th>Sentence Type</th>
<th>Sentence Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Simple (Kernel)</td>
<td>82.14</td>
</tr>
<tr>
<td>Passive</td>
<td>94.50</td>
</tr>
<tr>
<td>Negative</td>
<td>84.20</td>
</tr>
<tr>
<td>Question</td>
<td>84.14</td>
</tr>
<tr>
<td>Pass. -Neg.</td>
<td>81.73</td>
</tr>
<tr>
<td>Pass. -Quest.</td>
<td>81.77</td>
</tr>
<tr>
<td>Neg. -Quest.</td>
<td>62.76</td>
</tr>
<tr>
<td>Pass. -Neg. -Quest.</td>
<td>71.70</td>
</tr>
<tr>
<td>Compound</td>
<td>72.66</td>
</tr>
<tr>
<td>Complex</td>
<td>75.25</td>
</tr>
<tr>
<td>Compound-Complex</td>
<td>81.51</td>
</tr>
<tr>
<td>Mean</td>
<td>79.31</td>
</tr>
</tbody>
</table>
TABLE 3

MEAN PERCENTAGES OF THE INTELLIGIBILITY SCORES OF THE SENTENCES FOR EACH OF THE ELEVEN TYPES OF SENTENCES AND FOUR LENGTHS UNDER THE NON-FILTERED CONDITION

<table>
<thead>
<tr>
<th>Sentence Type</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple (Kernel)</td>
<td>100.00</td>
<td>100.00</td>
<td>99.83</td>
<td>99.40</td>
<td>99.81</td>
</tr>
<tr>
<td>Passive</td>
<td>100.00</td>
<td>100.00</td>
<td>99.13</td>
<td>95.25</td>
<td>98.59</td>
</tr>
<tr>
<td>Negative</td>
<td>100.00</td>
<td>99.97</td>
<td>98.83</td>
<td>94.94</td>
<td>98.38</td>
</tr>
<tr>
<td>Question</td>
<td>100.00</td>
<td>98.96</td>
<td>99.48</td>
<td>96.43</td>
<td>98.72</td>
</tr>
<tr>
<td>Pass.-Neg.</td>
<td>99.22</td>
<td>99.38</td>
<td>98.44</td>
<td>96.58</td>
<td>98.41</td>
</tr>
<tr>
<td>Pass.-Quest.</td>
<td>100.00</td>
<td>100.00</td>
<td>97.22</td>
<td>95.83</td>
<td>98.26</td>
</tr>
<tr>
<td>Neg.-Quest.</td>
<td>97.40</td>
<td>100.00</td>
<td>98.78</td>
<td>97.62</td>
<td>98.45</td>
</tr>
<tr>
<td>Pass.-Neg.-Quest.</td>
<td>98.96</td>
<td>98.36</td>
<td>99.13</td>
<td>95.58</td>
<td>98.01</td>
</tr>
<tr>
<td>Compound</td>
<td>99.50</td>
<td>100.00</td>
<td>97.83</td>
<td>96.51</td>
<td>98.46</td>
</tr>
<tr>
<td>Complex</td>
<td>100.00</td>
<td>100.00</td>
<td>99.62</td>
<td>94.79</td>
<td>98.60</td>
</tr>
<tr>
<td>Compound-Complex</td>
<td>98.70</td>
<td>98.75</td>
<td>99.48</td>
<td>95.02</td>
<td>97.99</td>
</tr>
<tr>
<td>Mean</td>
<td>99.43</td>
<td>99.57</td>
<td>98.89</td>
<td>96.18</td>
<td></td>
</tr>
</tbody>
</table>
procedure is described by Lindquist. Each listener's total number of words correctly identified for the four sentences of each length were converted into mean percentages; this procedure was repeated for each of the eleven types of sentences. Thus, 44 scores were derived for each listener (4 lengths X 11 types = 44). These were entered into a matrix in which the eleven major column headings designated the type of sentence, the four sub-column headings under each type indicated the four lengths, and the twelve successive rows represented the listeners. Two such matrices, one for each experimental condition, accommodated the data.

The analysis of variance for each experimental condition is summarized in Tables 4 and 5. Both F-ratios for sentence type, (B) on each table, are statistically significant, indicating that the structure of the statements affected the listeners' aural perception of them.

The critical difference values,

\[ d = t_{0.05} \sqrt{\frac{2(MS \text{ error})}{n}} \]

between the means of the various types of sentences for both the filtered and non-filtered conditions are respectively: 2.61 and 1.53;
in other words, differences between the pairs of means exceeding these values are significantly greater than chance expectations at the .05 level of confidence.

TABLE 4

SUMMARY OF THE ANALYSIS OF VARIANCE OF SENTENCE STRUCTURE AND LENGTH OF THE SENTENCES HEARD UNDER THE LOW-PASS CONDITION OF FILTERING

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Variance</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentence Length (A)</td>
<td>3</td>
<td>944.65</td>
<td>87.23&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sentence Type (B)</td>
<td>10</td>
<td>975.04</td>
<td>91.55&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Subjects (S)</td>
<td>11</td>
<td>850.11</td>
<td></td>
</tr>
<tr>
<td>AB</td>
<td>30</td>
<td>562.91</td>
<td>51.98&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>AS</td>
<td>33</td>
<td>10.83</td>
<td></td>
</tr>
<tr>
<td>BS</td>
<td>110</td>
<td>10.65</td>
<td></td>
</tr>
<tr>
<td>ABS</td>
<td>330</td>
<td>10.83</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Significant beyond the .001 level of confidence.
### TABLE 5

**SUMMARY OF THE ANALYSIS OF VARIANCE OF SENTENCE STRUCTURE AND LENGTH OF THE SENTENCES HEARD WITHOUT FILTERING**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Variance</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentence Length (A)</td>
<td>3</td>
<td>195.83</td>
<td>21.98a</td>
</tr>
<tr>
<td>Sentence Type (B)</td>
<td>10</td>
<td>11.85</td>
<td>3.22b</td>
</tr>
<tr>
<td>Subjects (S)</td>
<td>11</td>
<td>21.48</td>
<td></td>
</tr>
<tr>
<td>AB</td>
<td>30</td>
<td>14.09</td>
<td>3.91a</td>
</tr>
<tr>
<td>AS</td>
<td>33</td>
<td>8.91</td>
<td></td>
</tr>
<tr>
<td>BS</td>
<td>110</td>
<td>3.68</td>
<td></td>
</tr>
<tr>
<td>ABS</td>
<td>330</td>
<td>3.61</td>
<td></td>
</tr>
</tbody>
</table>

*a* Significant beyond the .001 level of confidence.

*b* Significant beyond the .01 level of confidence.

An examination of Table 2 reveals several significant variations in intelligibility among the various sentence structures for the filtered condition. The right-hand column of means shows that the simple, or kernel, sentences (listed first) were the most intelligible, i.e., the critical difference is 2.61 per cent, while the simple sentences are from 3.57 per cent to 16.95 per cent more intelligible than the sentences of the other types. This result, then, indicates that the
simple sentence was perceptually the least difficult in structure. Next easiest to perceive were the passive and negative constructions (listed second and third) which were equally intelligible, but differed significantly from the remaining sentence types. The question and passive-negative structures, which were also equivalent, were next in order. The last six sentence types listed on the table, with the exception of the passive-negative-question, did not differ from each other. Finally, the least intelligible, and hence perceptually most difficult of all the sentences were the passive-negative-questions.

In the second chapter it was noted that the syntactic descriptions of the sentences of this study were based upon the phrase structure and transformational rules of a generative grammar. The adequacy of this grammatical model to explain, or predict the differences in perception of the various types of sentences will now be examined.

According to this model, the kernel sentences are generated by a set of relatively simple phrase structure rules and provide the structural foundation from which all other sentences are derived as transformed versions. Inherent in this approach are several psychological implications. First, the notion of a kernel sentence implies the existence of a syntactic structure which is less complex than all
others in the language. This implication is borne out by the results of this investigation which have shown that the simple sentences were most readily perceived under adverse filtering conditions. This result is further supported by the intelligibility scores for the unfiltered listening condition. Again, the right-hand column of Table 3 shows the mean percentages of intelligibility for each sentence type. In spite of the very small range of differences, the simple sentence emerged as the most intelligible structure and differed significantly from the passive-question, passive-negative-question, and compound-complex sentences; in this instance, the critical difference is 1.53 per cent, and there were no other significant variations among the remaining ten sentence types listed on the table.

The designation of two types of transformational rules suggests another level of complexity: the simple transformations modify the kernel structure, and the generalized transformations combine kernels into larger units. The previously observed experimental differences between the two transformational types support this supposition. That is, the compound, complex, and compound-complex sentences, which are the product of the generalized transformations, did not differ from each other when heard under the filtered condition. They did, however, as a group differ from
all but two of the simple transformed types, i.e., the passive-question and the negative question.

Still further gradations of complexity are suggested depending upon the number of transformations that have been applied to the kernel sentence. For example, a thrice transformed passive-negative-question is presumably more complex than a passive-negative, a passive-question, or a negative-question sentence which is derived by two transformations. Similarly, these sentences would be more complex than the passive, negative, and question sentences which have been transformed only once. Again, the results of the study for the filtered condition were in accord with this general scheme with two notable exceptions. The first was the perceptual equivalence of the singularly transformed question sentences to the passive-negative sentences. This result, however, is a predictable one and simply points out the greater perceptual difficulty of the question over the passive and negative sentence types. Table 2 shows that both the passive and negative sentences were more easily perceived than the questions; accordingly, the resulting combination of the passive and negative into a single structure was more difficult to perceive than either of its two component types, equal to the question, and less difficult than any of the question combinations. The second exception was the equivalence of the
compound and complex sentences derived from one generalized transformation to the compound-complex ones derived from two generalized transformations. In this instance, the experimental results are inconsistent with the implications of the grammatical model. In other words, the number of generalized transformations applied to kernel sentences was not a reliable predictor of perceptual difficulty. With this exception, then, the results of this investigation have shown that the relative differences in aural perception among the various types of sentences are in accord with the psychological implications of the grammatical model upon which the sentence structures are based.

**Effect of Different Lengths of Sentences upon the Aural Perception of Sentences**

Each of the eleven types of sentences in this study contained four sentences of each of four lengths: 8, 10, 12, and 14 words. Within each length, then, were 44 sentences equally represented by the various sentence structures. The effect of the different lengths of sentences upon the ability of the listeners to perceive the sentences was tested by an analysis of variance. The results of this analysis for the two listening conditions are summarized in Tables 4 and 5. The two F-ratios for sentence length, (A) on both tables, are significant indicating that the ability of the listeners to perceive the
sentences was also affected by the particular length of the statement.

The mean percentages of the intelligibility scores of the four lengths for each listening condition were given on the bottom rows of Tables 1 and 2, and are summarized below:

<table>
<thead>
<tr>
<th></th>
<th>with filtering</th>
<th>without filtering</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 words</td>
<td>79.31</td>
<td>99.43</td>
</tr>
<tr>
<td>10 words</td>
<td>77.13</td>
<td>99.57</td>
</tr>
<tr>
<td>12 words</td>
<td>82.39</td>
<td>98.89</td>
</tr>
<tr>
<td>14 words</td>
<td>75.79</td>
<td>96.18</td>
</tr>
</tbody>
</table>

The critical difference for the listening condition with filtering is 2.63 per cent and 2.39 per cent for the condition without filtering; differences between the above means exceeding these values are significantly greater than chance at the .05 level of confidence.

The mean scores for the filtered condition show that the optimal sentence length was 12 words; the mean intelligibility score of this length was 82.39 per cent and differs significantly from the mean values of the other three lengths. The only other significant variation is between the 8- and 14-word sentences. For the unfiltered condition, the results indicate that the three shortest lengths were equally intelligible, and all were more easily perceived than the longer 14-word sentences.
The greater difficulty encountered with the 14-word sentences under the two listening conditions is not a surprising result, since one would normally expect longer sentences to be less readily perceived than shorter ones. The greater perception of the 12-word sentences for the filtered condition, however, is contrary to such expectations and warrants an alternate explanation. An obvious starting point is the reliability of the experimental result. However, in view of the experimental controls at the various levels of the experiment, this explanation is an implausible one; it was previously noted that there were 44 sentences of each length equally represented by all sentence types; the sentences were rated as natural English statements; the vocabulary was common to "everyday" conversation; both speakers read an equal number of sentences of each length and type; the recording procedures were identical for all sentences; the sentences were randomly presented; the 12 listeners heard all sentences; the amount of filtering was constant; the listening level was constant; and finally, the scoring of errors and tabulation of results was identical for all sentences.

The perceptual advantage of the 12-word sentence length, suggested by the results of this investigation, is also partially
confirmed by the results of a similar study by Black.\textsuperscript{2} In his study, listeners reported the last three words of sentences of varying lengths heard under several noise conditions. Ten sentences at each of eight lengths were tested: 3, 5, 7, 9, 11, 13, 15, and 17 words. Though his results show a decrement in intelligibility with increasing length, a close examination of the mean scores reveals that the 11-word sentences are considerably greater than the 9-word ones and nearly equal to those of 7 words. This observation led to a subsequent examination of the sentence types within each length; in all but one instance, the sentences for the three shortest lengths had simple sentence structures, while more than half of the 11-word sentences had structures other than the simple, or kernel. Hence, the greater perception of the 3- and 5-word sentences, and the slightly higher scores of the 7-word ones over those of 11 words, quite likely reflects differences in sentence type as well as sentence length, i.e., the simple sentence has previously been demonstrated as the most easily perceived type. Considering this potential advantage, then, the intelligibility increase at 11 words becomes an even more convincing result.

Black also noted a slight increase in intelligibility at the longest length of 17 words. This increase, however, is not likely attributable to differences of sentence structure, since the distribution of sentence types for all but the three shortest lengths approximated each other. He suggested that perhaps "with the longest sentences the phrasing of the readers, in part to accommodate breathing, had the effect of reducing the length of the sentence." This explanation might also apply to the 11- and 12-word sentences, although any differences in phrasing would more likely be peculiar to this approximate length rather than to accommodate breathing.

Another explanation worthy of testing is that the 12-word length provides optimal redundancy for making judgments under adverse listening conditions. In both studies, the listeners were required to base their judgments upon a partial hearing of the sentences; for the shorter sentences, not enough information may have been present to facilitate the making of such judgments, while the longer ones taxed the auditory memory.

**Interacting Effects of Different Sentence Structures and Lengths upon the Aural Perception of Sentences**

Tables 4 and 5 show that the F-ratios for the interaction between sentence type and sentence length, (AB), under both listening conditions are statistically significant. In other words, these
results imply that the effect of a given sentence structure upon the perception of sentences also depends upon the particular length involved, or conversely, that the effect of any given length, depends upon the sentence structure as well. The mean intelligibility scores of the sentences for the various sentence structures at each length are given in Tables 1 and 2.

Previously, it was noted that there were four sentences of each of the four lengths within each of the eleven types of sentences. Thus, the results of the simple effects of sentence type were based upon comparisons between pools of 16 sentences, while the comparisons of sentence length were represented by 44 sentences. Considering the relatively small number of sentences representing the various sentence-type and sentence-length combinations, then, the reliability of this result is questionable, or at any rate, does not justify conclusions about the effects of specific combinations. The result does, however, pose a significant question, and one that bears further testing.

**Relationship between the Relative Naturalness and the Aural Perception of the Sentence Structures**

The method of rating the sentences for naturalness was discussed in the preceding chapter. Briefly summarized, six judges rated 352 sentences on a one to four scale responding to the
criterion, "Is this an easy natural sentence to speak?" The four most natural sentences of each of the four lengths, i.e., those receiving the lowest ratings, for each sentence type were selected as the 176 test sentences for the experiment. Further, the relative ordering of the sentence types according to degree of naturalness was shown to correlate highly for both the test and non-test sentences.

The purpose of this analysis was to determine whether or not there was a relationship between the differences in aural perception of the various sentence structures and their degree of naturalness. Table 6 gives the ranks of the eleven sentence types; the ranks for naturalness were assigned according to the mean ratings of the test sentences which are listed in Table 1, and the ranks for aural perception, according to the mean intelligibility scores shown in the right-hand column of Table 2. Thus, the rating of 6 in the left-hand column of Table 6 designates that the simple sentence was sixth in degree of naturalness, while the corresponding rank of 1 in the right-hand column indicates that the simple sentence was the most easily perceived of the eleven sentence structures.

The relationship between the two sets of ranks was tested by means of a rank-order correlation which yielded the value of, \( \rho = .04 \). This correlation suggests that there is no relationship
### TABLE 6

**RANKS OF NATURALNESS AND AURAL PERCEPTION FOR THE ELEVEN SENTENCE STRUCTURES**

<table>
<thead>
<tr>
<th>Sentence Type</th>
<th>Rank</th>
<th>Naturalness</th>
<th>Aural Perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple (Kernel)</td>
<td>6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Passive</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>3.5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>3.5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Pass. - Neg.</td>
<td>9</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Pass. - Quest.</td>
<td>7</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Neg. - Quest.</td>
<td>2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Pass. - Neg. - Quest.</td>
<td>10</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Compound</td>
<td>1</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Complex</td>
<td>8</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Compound - Complex</td>
<td>11</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

between the perceptual complexity of the various sentence structures used in this study and their degree of naturalness. An interesting implication of this result is that speakers may be in the ambiguous position of either being intelligible, but sounding less natural, or sacrificing intelligibility for the sake of naturalness.
Summary

This chapter described the procedures used to analyze the data that were obtained under the experimental conditions. The first and second sections concerned the effect of different sentence structures and sentence lengths upon the aural perception of sentences. The third section treated the interacting effects of both sentence structure and sentence length upon the perception of the sentences. The final section presented an analysis of the relationship between the relative naturalness and perceptual complexity of the sentence structures.
CHAPTER IV

SUMMARY AND CONCLUSIONS

The purpose of the study reported here was to determine whether or not the ability of listeners to perceive sentences is influenced by the syntactic structure and length of the sentences the listeners hear. Eleven sets of sixteen sentences, previously rated as natural English statements, were randomly presented to two groups of listeners; each set of sentences differed in syntactic structure and contained four sentences of each of four lengths. One group of listeners heard the sentences under a single low-pass condition of filtering, and the other group heard the sentences without filtering. The task of both groups was to write as much of each sentence as possible immediately after it was presented. The data obtained from the experimental conditions were tabulated by recording the mean percentage of the intelligibility scores of the four sentences of each length for every listener; this was repeated for each of the eleven sentence types and both listening conditions. The differences among the various sentence structures and sentence lengths, as well as the interaction between the two,
were tested by means of a three-way analysis of variance design. The relationship between the differences in aural perception of the sentence structures and their degree of naturalness was also tested.

The following conclusions were drawn from the results of the investigation:

1. The ability of listeners to perceive sentences is affected by the syntactic structure of the statements they hear.

2. The differences in aural perception of different sentence structures corresponds with the psychological implications of grammatical complexity of a transformational linguistic theory, and the differences can be specified by the phrase structure and transformational rules of a generative grammar.

3. The ability of listeners to perceive sentences is affected by the length of the statements they hear.

4. Sentences of 12 words are more easily perceived, aurally, than are sentences of other lengths (within the range of from 8- to 14-word sentences).

5. No relationship was established between the differences in aural perception of the various sentence structures and their degree of naturalness.
INSTRUCTIONS FOR CONSTRUCTING SENTENCES

Please write eleven unrelated sentences, one for each of the eleven sentence types indicated below. Each sentence should contain the exact number of words designated for each sentence type; contractions and unhyphenated compounds are counted as one word. Try to limit your vocabulary to words which are relatively common to everyday conversation.

The sentences you submit are going to be read aloud and recorded, so try to make them as natural and easy to speak as possible. As an informal test, you might wish to first say them aloud before writing them down.

Note: Try to construct your passive sentences in such a way that they can be easily converted into their active counterparts.

Note: All sentences other than the passive, negative, and questions should be active, declarative, affirmative statements.

SIMPLE (words)-

PASSIVE (words)-

NEGATIVE (words)-

QUESTION (words)-

PASSIVE-NEGATIVE (words)-

PASSIVE-QUESTION (words)-

NEGATIVE-QUESTION (words)-

PASSIVE-NEGATIVE-QUESTION (words)-

COMPOUND (words)-

COMPLEX (words)-

COMPOUND-COMPLEX (words)-
Rated Test Sentences
(Simple)

Words (8)

1. John went to the store to buy milk.
2. The scientists had to revise their original formula.
4. George threw the fish back in the lake.

Words (10)

5. Bright students know all the answers to the hardest questions.
6. Donald hit the ball over the fence into the field.
7. The local newspaper is going to expand its news coverage.
8. The fan is creating a disturbance in the study room.

Words (12)

9. I received a nice long letter from my mother and father yesterday.
10. Both young men struggled desperately to lower the sails of the boat.
11. The police found the wrecked car at the bottom of the cliff.
12. The small foreign car gives the best mileage on the open road.

Words (14)

13. I am going to Mexico for six months near the end of next year.
14. My father works for a very large company in the field of atomic energy.
15. The blue and white striped coat is in the closet on the second floor.
16. All the rivers in the vicinity of the recent flood are freezing over rapidly.
Rated Test Sentences
(Passive)

Words (8)
17. The flowers were donated by the women's club.
18. The book was read by the entire class.
19. The door was opened by the man inside.
20. The tree was struck by lightning four times.

Words (10)
21. He was caught twice and then released by the police.
22. That wild young horse has been tamed by skillful riders.
23. Several large boxes of food were donated by the students.
24. The boxer was hit below the belt by his opponent.

Words (12)
25. The thief who stole the ring was arrested by the police officers.
26. The president was accused of being a socialist by the opposing candidate.
27. The cart was pushed through the narrow streets by the old woman.
28. All the recent books about modern painting were misplaced by the librarian.

Words (14)
29. The pretty young lady was beaten by two teenage boys from the east side.
30. The organ is played in church every Sunday by a professor from the university.
31. This hand-carved table was brought all the way from India by my father.
32. Several of the author's recent novels have been approved by the editor for publication.
Rated Test Sentences
(Negative)

Words (8)
33. Please don't leave the dining room without permission.
34. I don't like the modern school of art.
35. The pitcher couldn't afford to lose another game.
36. Some people won't drink coffee from paper cups.

Words (10)
37. I wouldn't defend Cuba for all the rice in China.
38. Betty didn't go to the bridge party with Sue yesterday.
39. Most American girls don't marry before the age of 18.
40. We don't want to buy any mops or brooms today.

Words (12)
41. I am not going to stay in Columbus after graduation next year.
42. The people of this church aren't very generous with their weekly donations.
43. The selection of a beauty contest winner isn't always an easy task.
44. The guest speaker at the lecture didn't make a very good impression.

Words (14)
45. Some people simply aren't able to cope with the minor distractions of everyday living.
46. The minimum wage laws of many states aren't adequate for people with large families.
47. The streets in some parts of town aren't wide enough for two-way traffic.
48. It isn't safe for women to walk along poorly lighted streets late at night.
Rated Test Sentences
(Question)

Words (8)

49. Are you going to the ball game alone?
50. Do you know the recipe for pound cake?
51. Did you see the big political rally yesterday?
52. Did the heavy frost kill the farmer's crops?

Words (10)

53. Why do some people respond so quickly to simple emotions?
54. Why are women required to wear hats in some churches?
55. What are you going to do after the basketball game?
56. How can they find the merchandise in this disorganized store-room?

Words (12)

57. Are you going to attend the next football game at the stadium?
58. When are you going to repair the broken fence in the pasture?
59. How long have you felt this way about the Federal Income Tax?
60. When will the construction company begin to build the new housing development?

Words (14)

61. When will the next report of the national debt be released for official publication?
62. Are most of the downtown stores planning to open branches in the shopping centers?
63. Do many of the insurance companies offer reduced rates to owners of compact cars?
64. How does the school board plan to meet the problem of increasing student enrollments?
Rated Test Sentences
(Passive-Negative)

Words (8)

65. An accident victim shouldn't be moved by observers.
66. The bank robbery wasn't committed by professional gangsters.
67. Spicy foods shouldn't be eaten by young children.
68. The loan wasn't approved by the finance company.

Words (10)

69. The shot wasn't heard by the people in the building.
70. Bright young men are not often stumped by difficult problems.
71. Smoking in bed isn't permitted by the cautious hotel management.
72. Electric razors aren't frequently used by men with heavy beards.

Words (12)

73. The lead role in the play wasn't played by a professional actor.
74. Even the best books don't always receive good reviews by the critics.
75. The value of the antique vase wasn't recognized by the original owner.
76. The speaker's talk couldn't be heard by anyone in the back row.

Words (14)

77. The men involved in the prison riot weren't shown any mercy by the warden.
78. The date of the high school prom hasn't been decided by the senior class.
79. The mayor of this city isn't respected even by the people within his party.
80. Sound decisions can't be made by people who refuse to look at the facts.
Rated Test Sentences
(Passive-Question)

Words (8)
81. Were the books delivered by the department store?
82. Have the trees been damaged by the lightning?
83. Was the wheat crop ruined by the storm?
84. Why was he questioned by the police officer?

Words (10)
85. Are the same magazines being ordered by the people upstairs?
86. Were the results of the last experiment checked by anyone?
87. Were all of the streets blocked by the snow storm?
88. Will the hospital bill be paid by the insurance company?

Words (12)
89. Which candidates will be presented awards by the panel of judges tomorrow?
90. Was a property tax increase recommended by the city council last night?
91. Are all of the state parks maintained by the department of forestry?
92. Why were the results of the survey withheld by the public officials?

Words (14)
93. How much of the original price was refunded by the manager of the garage?
94. How was the problem of customer parking finally solved by the downtown business merchants?
95. Will the trophy for the outstanding chess player be presented by last year's winner?
96. Were all of the floats for the holiday parade built by local civic groups?
Rated Test Sentences
(Negative-Question)

Words (8)
97. Didn't you say that dinner was almost ready?
98. Don't they ever go to visit her father?
99. Don't you think some people distort the facts?
100. Why doesn't the farmer buy a new tractor?

Words (10)
101. Can't you see the tall white building across the street?
102. Why can't parents keep their children out of the streets?
103. Didn't the old bear freeze to death in the cold?
104. Doesn't the mortgage on the house expire in two weeks?

Words (12)
105. Are you sure you can't come to the meeting with us today?
106. Didn't you send pretty yellow flowers to your mother on her birthday?
107. Haven't most cities passed laws requiring seat belts in all new cars?
108. Why doesn't anyone live in that old brick house on the corner?

Words (14)
109. Aren't there any brave men in America willing to defend their country against aggression?
110. Didn't the struggling young artist have enough money to buy the materials he needed?
111. Why doesn't someone ask the noisy people in the theater to lower their voices?
112. Wasn't the man from the electric company supposed to check the basement wiring today?
Rated Test Sentences
(Passive-Negative-Question)

Words (8)

113. Weren't the streets paved by the city workers?
114. Wasn't the forest destroyed by the big fire?
115. Aren't foreign languages learned more easily by children?
116. Aren't most people misled by glorified advertising claims?

Words (10)

117. Wasn't he just told by the nurse to wait outside?
118. Isn't the cake usually cut by the guest of honor?
119. Why wasn't the television repaired by a qualified service man?
120. Why wasn't the message taken by someone in the office?

Words (12)

121. Wasn't the girl told to write the feature article by the editor?
122. Wasn't the blue house on the corner painted by that European fellow?
123. Why weren't the children punished by their parents for breaking the window?
124. Wasn't the traffic problem solved by the addition of the new freeway?

Words (14)

125. Shouldn't the boys in the class be informed about the matter by their teacher?
126. Why can't the tickets for the concert be donated by the fine arts society?
127. Aren't all students required to take courses in American history by the public schools?
128. Why can't the repair man's overdue accounts be collected by a collection agency?
Rapid Test Sentences
(Compound)

Words (8)

129. The big man shouted and the girl cringed.
130. The pillow split open and feathers went everywhere.
131. The pie was sour and the crust crumbled.
132. We entered and the maid took our coats.

Words (10)

133. This dress is pretty, but that one is less expensive.
134. The convict attempted to escape, but the guard stopped him.
135. Book covers are interesting, but it's what's inside that counts.
136. She baked an angel food cake and everyone liked it.

Words (12)

137. He tried to stop smoking, but the nervous strain was too much.
138. The fall season is very colorful, but I like early springtime best.
139. The hunter fired his gun, and the deer fell to the ground.
140. The ball crashed through the window, and children ran in every direction.

Words (14)

141. The circus clown rolled on the ground, and all the children began to laugh.
142. The cherry pie was very good, but everyone was too full to enjoy it.
143. The car began to sputter, and the driver realized he was out of gas.
144. Every morning we make a pot of coffee, and by noon it is gone.
Rated Test Sentences
(Complex)

Words (8)

145. When he was young, he liked New York.
146. When the factory closed, many families moved away.
147. When puppies are born, their eyes are closed.
148. While the gabby woman talked, her cake burned.

Words (10)

149. If the rain continues, the river is going to overflow.
150. While he was busy working, she was out playing bridge.
151. Since the flood began, many families have been left homeless.
152. When the horse jumped the fence, the inexperienced rider fell.

Words (12)

153. If this building begins to burn, walk calmly to the side exit.
154. After the guests had taken their seats, Ann began to play softly.
155. After the old couple retired, they decided to move into an apartment.
156. After the new baby was born, they moved into a larger house.

Words (14)

157. If the economy collapses, it will take more than paper money to restore it.
158. If he is going to teach the class, I prefer to take another course.
159. Whenever union strikes are called, the parties involved quickly attempt to reach an agreement.
160. When the railroad joined the east and west, the United States became truly united.
Rated Test Sentences
(Compound-Complex)

Words (8)

161. When spring comes, birds sing and flowers bloom.
162. When war comes, people fight or they die.
163. When snow falls, children sing and adults moan.
164. When smokers quit, coughs disappear and appetites increase.

Words (10)

165. Since he died, she drinks constantly, but everyone understands why.
166. Some sang and others danced, while the band played on.
167. When the program started, a door slammed and somebody screamed.
168. When heavy snows come, cars get stuck and traffic stops.

Words (12)

169. When he entered, I asked him to leave, but he stayed anyway.
170. When the couple finally arrived, the party was over, so they left.
171. After the pipe broke, water went everywhere, so she called the plumber.
172. When the books came, they were damaged, and the carton was ripped.

Words (14)

173. When he lit his cigarette, the match dropped, and his pants caught on fire.
174. Before the game ended, the outcome was obvious, and many spectators started to leave.
175. When the demonstration started, everything was orderly, but somehow it got out of hand.
176. When the book came out, it was very popular, and everyone wanted a copy.
BIBLIOGRAPHY


