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PHONEMIC, SYLLABIC, AND LEXICAL VALUES
ASSOCIATED WITH HESITATIONS.

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PHONEMIC, SYLLABIC, AND LEXICAL VALUES
ASSOCIATED WITH HESITATIONS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
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by

Dorothy Elaine Steingarten Pressman, B.A., M.A.

The Ohio State University
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Intelligibility and Some Perceptual Confusions Associated with Three Modes of Speaking and Filtering.

iii
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CHAPTER I

INTRODUCTION

Interruptions in the flow of speech occur frequently for the nonstutterer as well as for the stutterer. When these interruptions are gross and easily observable they are referred to as hesitations.

It was hypothesized by Lounsbury (1954) that hesitations correspond to the points of highest statistical uncertainty in language, that is, hesitations occur where decisions and choices are made. Goldman-Eisler (1950a) tested this hypothesis on fluent speakers with positive results, and Schlesinger, Forte, Fried, and Melkman (1965) tested it on a group of stutterers with positive results. The statistical uncertainty associated with the hesitations in the above experiments was found by determining the transitional probabilities of the words in the given passages.

Shannon (1951) established a method of determining the transitional probabilities of letter symbols in a language by the technique of guessing the successive letters in an unknown passage (the space between the words was counted as the 27th letter). After each guess of a letter the subject is told if he is right or wrong and the correct letter. The greater the number of wrong guesses, the more improbable the actual events would seem to be. This technique was adapted by Goldman-Eisler
(1958a) and Schlesinger, Forte, Fried and Melkmann (1965) to determine the transitional probabilities for words of a consecutive text by forward guessing.

The probability of occurrence of words in a sample may be determined in a second way. In a given sample of words, the number of times each word occurs may be tabulated. Therefore, in a given sample of words, each word \( [E_k] \) occurs a particular number of times. The number of occurrences of a given word divided by the total number of words in the sample is referred to as relative frequency in this study. Wilson (1954) has indicated that this relative frequency in a sufficiently large sample corresponds to the probability of occurrence \( p[E_k] \) of the particular word \( [E_k] \). Shannon (1948) has also suggested that the quantity \( -\log p[E_k] \) measures the occurrence of event \( [E_k] \).

The present investigation was based on the belief that differences in the hesitation behaviour of stutterers and nonstutterers could be quantified on the basis of the function \( -\log p \) where \( p \) is the relative frequency of occurrence of a particular linguistic unit.

**The Problem**

**Purpose of the study**

The present investigation was undertaken to determine in the speech of fluent and nonfluent individuals the relative frequencies of occurrence of English phonemes, syllables, and words which follow or accompany four types of hesitations: repeats, false starts, filled pauses, and unfilled pauses (Maclay and Osgood, 1959).
Specific questions

The following questions concerning the present study were asked:

1. Do fluent and nonfluent speakers differ on the mean relative frequencies of occurrence of words, syllables, and phonemes which accompany or follow hesitations?

2. Do fluent and nonfluent speakers differ in their use of the four types of hesitations: repeats, false starts, filled pauses, and unfilled pauses?

3. Do the four types of hesitations differ according to the frequencies of occurrence of the words, syllables, and phonemes associated with the dysfluencies for fluent and nonfluent speakers?

Definition of terms

Hesitation pause refers to an interruption in speech and may extend from a brief pause to periods of halting often filled with "hemming and hawing". They are syntactically irregular, generally occur unexpectedly, and may last as much as several seconds in length.

Word frequency indicates the number of times a particular word occurs in a finite sample. The word frequencies used in this study were obtained from an analysis of English words by Kucera and Francis (1967) in which the sample was 1,014,232 words of natural language text.

Syllable frequency refers to the number of times a particular syllable occurs in a finite sample. The syllable frequencies used in this study were obtained from an analysis of English syllables by Dewey (1923) in which the frequency of occurrence of the 1,370 most frequent syllables (that is those syllables which occurred more often than ten
times in 100,000 words) was determined.

Phoneme frequency refers to the number of times a particular phoneme occurs in a given finite sample. The phoneme frequencies used in this study were obtained from an analysis by Dewey (1923) of the relative frequency of occurrence of English speech sounds in a sample of 100,000 words.

Probability and Relative Frequency. In his examination of language behaviour, Wilson (1954) has defined the probability of an event as the limit of the relative frequency of its occurrence. Hence

\[ p(i) = \lim_{n \to \infty} \frac{f(i)}{n} \]

where \( p(i) \) is the "true" probability of event \( i \); \( \lim_{n \to \infty} \) symbolized the limit of the following expression as \( n \) becomes indefinitely large, \( n \) is the number of events; \( f(i) \) is the frequency of occurrence of the event \( i \). Thus if there are \( n \) events, and a particular class of event \( i \) occurs \( f(i) \) times, the "true" probability of event \( i \) is the value towards which the ratio of \( f(i) \) to \( n \) tends as \( n \) is allowed to become indefinitely large. In practice, however, Wilson (1954) has pointed out that there is never an infinite number of events. Therefore, with a reasonably large but finite sample, the following computation is made to determine an empirical estimate of true probability:

\[ p(i) = \frac{f(i)}{n} \]

Organization of the Dissertation

The introduction, problem, and definition of terms were included in this chapter. Included in Chapter II is a review of the literature dealing with pause and hesitation in language. The experimental
procedures employed in the study are described in Chapter III. In
Chapter IV the hypotheses are stated, the statistical treatment of the
data is discussed, and the results are presented. The summation,
conclusions, and implications for further research are included in
Chapter V.
In this chapter, relevant background literature concerning pause and hesitation in language will be discussed. The chapter is divided into six sections: the perception of hesitations, classifications of dysfluent speech, the function of hesitations in speech, predictability in the environments of hesitations, the frequency distributions of written English, and linguistic factors in stuttering.

The Perception of Hesitations

There are two basic ways of detecting hesitations in speech, through the use of instrumental measuring devices, and through the use of listener judgment. A pause was defined by Tosi (1965) on the basis of two parameters: one related to the range of acoustical amplitudes which may be considered to comprise a pause or a signal; the other parameter was related to the minimum time this range of acoustic amplitudes must flow in order to be considered actually within a pause or a signal. Tosi claimed that these two parameters alone, maximum acoustic amplitude and minimum duration, were insufficient to state whether or not the pause was discernible or related to the phonetic, musical, or linguistic concept of a pause. Consequently, particular
values of these two parameters need to be determined for every type of relevant experimental study.

The minimum durations of pauses in speech have been set by various researchers. The results, however, are difficult to compare due to the lack of standard specifications of pauses and the different procedures used to determine minimum durations of pauses. Using measurements on a kymograph, Snell (1918) reported the mean duration of minimum pauses at 290 msec. He measured the total duration of a phrase and detected the number and duration of the signal within the phrase. From this data he calculated the mean duration of a minimal pause. Hanley (1951), using spectrographic analysis, reported the mean duration of pauses at 360 msec for reading material and 420 msec for spontaneous speech.

Visual records of sentences were obtained by Goldman-Eisler (1958a) by transforming sound impulses into visible tracings by connecting the magnetic tape to a pen recorder. The speed of the recorder was set so as to make the pauses apparent down to a length of one-tenth of a second. The gaps which were noted on the visual record and which were classified as pauses had to be equivalent to durations of not less than 250 msec.

An electric analyser which presents the distributions of durations automatically on a series of counters was described by Verzeano and Finesinger (1949). They defined the minimum duration of a pause arbitrarily at 500 msec. The minimal duration of inter-phraseal pauses was measured automatically by Agnello (1963) and he defined the minimal
duration to be 190 msec.

The perceptual thresholds for juncture pauses and hesitation pauses were investigated by Boomer and Dittmann (1962). They established that the juncture pause, which occurs as expected between phonemic clauses, was more difficult to perceive by listeners than the hesitation pause which occurs unexpectedly. The threshold for hesitation pauses was found to occur at 200 msec. and the threshold for juncture pauses was found to occur between 500 and 1000 msec.

An apparatus for the partial analysis of temporal data, called the Duration Tabulator was described by Hargreaves and Starkweather (1959). This tabulator produced a frequency distribution of durations on a series of counters, included automatic triggering from an audio signal, and had a circuit which discriminated one duration from the next. The apparatus could also be triggered manually. Using the criterion of 500 msec. as the minimal duration of a pause, they found that the data produced by the automatic voice key appeared to be broken into many more short utterances than were perceived by the human listener. Since their basic interest was in the information which might be perceived and used by a listener, the machine was modified so that it could group utterances in a way similar to the groupings of the listeners. With the criterion pause lengthened to one second, the data produced by the machine was consistent with human judgment.

The results of hesitations detected by instrumental measuring and as perceived by listener judgment were compared by Martin (1970). He compared these two methods by examining the results of two scorers.
who listened independently to tape recordings while marking hesitations they perceived on transcripts and then comparing spectrograms of the same recordings. The two judges marked four types of hesitations on transcripts and their agreement was 91.5 per cent. An examination of the spectrograms and the marked transcripts indicated that there were silent intervals at most of the places (87%) where the listeners heard a pause. Further examination showed that many of the pauses which were only noted on the spectrograms might better be regarded as normally occurring intermittent gaps in speech. Where a pause was perceived by the listener, whether or not a silent interval was noted on the spectrogram, an elongated syllable was found to have accompanied or preceded the judged pause. Martin concluded:

...since the extended syllables which listeners hear as unfilled pauses are logically as good an indicator of hesitations as other measures commonly used (for example, filled pauses, repeats, or false starts, all of which require judgments), listener judgment seems preferable to physical recording of unfilled pauses as well, except of course in cases where the duration of real silence is an issue.

Martin and Strange (1968) investigated whether hesitations were perceived while speech was being decoded. In four experiments, subjects listened for pauses and other hesitation phenomena in spontaneous speech. Three of the experiments involved reproducing heard speech including the hesitations, and the fourth task was simply the marking of heard hesitations. The results suggested that attending to the acoustic (hesitations) and message aspects of speech were incompatible operations.
Four hesitation types in spontaneous speech, repeats, false
starts, filled pauses, and unfilled pauses, were defined by Maclay and
Osgood (1959). All repetitions of any length which were judged to be
nonsignificant semantically were called repeats. Incomplete or self-
interrupted utterances (e.g. "I saw a very big... is an incomplete
utterance with a false start following very, while "I saw a very big//
a very small boy" is a self-interrupted utterance with a false start
following "big") were classified as false starts. All occurrences of
the English hesitation devices such as [z, w, r, o, m] were
called filled pauses; and unfilled pauses were all occurrences of
abnormal silence, that is, a silence of unusual length, or nonphonemic
lengthening of phonemes. Maclay and Osgood analysed the linguistic
distribution of these hesitations as they were perceived by two judges
who independently scored tape recordings of spontaneous speech. A
written text was used as a guide and a framework within which to place
the scores. After each judge had independently scored a semi-literal
transcription, a final text was obtained by combining the two ratings
and counting only the hesitations on which both judges agreed as to
type and location. The analysis of the distribution of the hesitations
indicated that although both filled and unfilled pauses occur more
frequently before lexical than before function words, filled pauses
occur relatively more frequently before function words and at phrase
boundaries, while unfilled pauses occur relatively more frequently
before lexical words and within syntactic phrases. Repeats were
reported to involve function words and occur antecedent to lexical
items; and false starts typically involve lexical items (blocking
after a lexical choice and returning to correct it).

The relative length of hesitations in two types of speech activity was measured by Goldman-Eisler (1961a). Nine subjects were asked to describe and then summarize the meaning of cartoons. Two types of verbal activity were used since description involved only reporting sequences of observed phenomena as they were experienced; whereas summarizing involves explicit abstraction and verbal formulation of the meaning of the cartoons. Relative hesitancy was defined to be the ratio of total pause time to total speech time; this ratio was significantly larger for summaries than for descriptions. Thus, there was more pausing for the same amount of speech when subjects had to formulate the meaning of the cartoons than when they had to describe them. The relative length of filled and unfilled pauses was also measured by Goldman-Eisler (1961b). The length of filled and unfilled pauses relative to the output of speech (the number of words produced) was determined. The relative length of unfilled pauses was found to be greater than the relative length of filled pauses both for descriptions and for the summaries. The summaries, which represent responses to a considerably more difficult cognitive task than the descriptions, did have longer lengths for both the filled and unfilled pauses.

Successive speech and silence durations in selected passages of spontaneous speech were investigated by Henderson, Goldman-Eisler, and Skarbek (1966). They found that relatively long pauses tend to occur with short utterances, and these periods alternated with periods in which relatively short pauses and long utterances occurred together. It was suggested that those periods during which relatively long pauses
and short utterances occurred together were used for planning, and the succeeding periods during which long utterances and short pauses occurred together were periods of relative fluency.

**Classifications of Dysfluent Speech**

A relatively comprehensive classification of dysfluencies is essential to the systematic investigation of the dysfluent aspects of speech. Dysfluent speech has been classified in several ways. Bloomfield (1933) discussed two phenomena which classical rhetoric called *aposiopesis* and *anacolouthon*. In *aposiopesis*, he explained, the speaker breaks off or is interrupted: I thought he ______, and in *anacolouthon*, he starts over again: It's high time we - oh well - I guess it won't matter. In addition, Bloomfield mentioned that when a speaker hesitates, English and some other languages offer special hesitation forms, such as [r] or [z].

Aposiopesis and anacolouthon were classified by Maclay and Osgood (1959) under the single classification false start and all occurrences of English hesitation devices, such as [ə, ə, r, ə, m] were classified filled pauses. They defined two additional categories. Silences of unusual length and nonphonemic lengthening of phonemes were called unfilled pauses, and all repetitions of any length which were judged to be nonsignificant semantically were called repeats. Kahl (1956) had earlier established the following eight categories of speech disturbances: (1) "ah", (2) sentence correction, (3) sentence incompletion, (4) repetition of words, (5) stutter, (6) intruding incoherent sound, (7) tongue slip, (8) omission of words or parts
of words. The first five categories correspond to those defined by Maclay and Osgood as follows: unfilled pauses (1), false starts (2,3), repeats (4,5). Unfilled pauses were not defined by Mahl.

Eight classifications of dysfluent speech were also discussed by Johnson (1961). This classification may be compared to the four categories used by Maclay and Osgood (1959) as follows: interjections of sounds, syllables, words, or phrases (filled pauses), part word repetitions (repeats), word repetitions (repeats), phrase repetitions (repeats), revisions (false starts), incomplete phrases (false starts), broken words (unfilled pauses), prolonged sounds (unfilled pauses).

The classification of Maclay and Osgood was used in the present investigation because of its comprehensiveness, conciseness, and applicability to the dysfluencies of both normal speakers and stutterers. It was adapted in the manner described above to include the dysfluencies described by Johnson to be characteristic of stutterers.

The Function of Hesitations in Speech

Hesitations in speech have been accounted for in several ways. Goldman-Eisler (1961b) in a comparative study of two types of hesitations, concluded that unfilled pauses and filled pauses serve different functions in spontaneous speech. The results of the study indicated that the silent pause was related primarily to cognitive activity, and the filled pause was related to emotional activity. The effect of filled and unfilled pauses on a cognitive task, simple addition, was reported by Livant (1963). He reported that the time
required for the mental solution of addition problems was significantly greater if the subject filled the pause with the vocalizations habitually used to fill pauses in speaking, then if the pause was filled with silence.

In an attempt to define the role of hesitations in spontaneous speech Maclay and Osgood (1939) examined a sample of 50,000 words. They found that both filled pauses and unfilled pauses occur significantly more frequently before lexical words than before function words and explained the use of filled pauses on the basis of conversational requirements:

Let us assume that the speaker is motivated to keep control of the conversational "ball" until he has achieved some sense of completion. He has learned that unfilled intervals of sufficient length are the points at which he has usually lost this control - someone else has leapt into his gap. Therefore, if he pauses long enough to receive the cue of his own silence, he will produce some kind of signal /m, r/ or perhaps a repetition of the immediately preceding unit) which says, in effect, "I'm still in control - don't interrupt me!"

Mahl (1936) suggested that the emotional states of speakers will influence the frequency of hesitations in speech. This notion was based on the assumption that "one effect of anxiety, regardless of its source, is to disrupt all complicated ongoing behaviour, irrespective of its behavioural relation to the source of the anxiety." According to Mahl, speech is merely an instance of such complex behaviour susceptible to the disruptive effect of concurrent anxiety. The speech behaviour of patients in a psychotherapy situation was explored as a means of validating hesitation measures as indices of patient anxiety. Mahl reported that speech disturbances and silences seem to be
expressive attributes that are useful as anxiety indices. The occurrence of hesitations in children's speech was examined by Levin and Silverman (1965). They investigated the effect of situational variables, that is, whether the child was speaking in public or in private, on hesitation behaviour. An attempt was made to determine whether pauses may best be thought of as a response to stress or as an attempt to think about and organize one's thoughts. Forty-eight children told two stories in each of two situations: to an audience of four adults, and to a microphone while no one was listening. It was reported that there was a greater incidence of nondeliberate hesitations in the public situation than in the private situation. This result applied to filled pauses and unfilled pauses and tends to support the contention of Mahl (1956) that a state of upset creates an inhibition of thinking which may be reflected in nonfluencies.

**Predictability in the Environments of Hesitations**

A method of determining the transition probabilities of occurrence of letter symbols in a language was proposed by Shannon (1951). He suggested a technique of guessing the successive letters in an unknown passage. After each guess of a letter, the informer is told if he is right or wrong and the correct letter. The greater the number of wrong guesses, the more improbable the actual events would seem to be. If a letter were frequently guessed correctly, it would have a high transition probability; and if it were rarely guessed correctly, it would have a low transition probability.

It was hypothesized by Lounsbury (1954) that hesitation pauses
correspond to points in sentences where decisions and choices are made. Goldman-Eisler (1958a) tested this hypothesis experimentally. An adaptation of Shannon's guessing technique was employed; in this case, words being guessed rather than letters. The transition probability for each word was estimated on the basis of the guesses. The results indicated that words which had been preceded by a pause were significantly harder to guess (i.e. had low transition probabilities) than the words which were spoken fluently. A further experiment (Goldman-Eisler, 1958b) illustrated that redundancy and fluency (i.e. high transition probabilities) were closely linked, and high information and pauses (i.e. low transition probabilities) were closely linked. This experiment consisted of four sentences recorded from spontaneous speech. The duration of the hesitation pauses was measured and the transition probabilities of the words were estimated in the same manner as was described in the earlier experiment (Goldman-Eisler, 1958a).

The sentences were subjected to two different treatments: each sentence was prepared for the experimental subjects by substituting blanks for words of low transition probability; and each sentence was also prepared by substituting blanks for words with high transition probability. The subjects read the material at a conversational pace and attempted to fill in the blanks with the words most suitable to the context. The readings were recorded on tape and the duration of the pauses which preceded the filling in of the blanks was determined. The subjects were found to vary widely in the time they took to fill in the blanks, and the duration of their hesitations in doing so, differed from that of the pauses in the original utterance. But when
the length of the pauses of the original speaker was compared with those of the readers who were successful in filling in the blanks correctly, there was a positive and significant relation. Where the blanks were not filled correctly, the relationship did not hold. Thus, those who thought alike appeared to behave alike in the matter of pauses. In addition, the transitional probability of each word was related to the length of the hesitation when the reader filled in the blanks. The shortest hesitations occurred before the words which were easiest to predict, which confirmed the previous result (Goldman-Eisler, 1958a).

Tannenbaum, Williams, and Hillier (1965) conducted two experiments to study the predictability of words in hesitation contexts. The first study compared the predictability of the first word after hesitations with words sampled from fluent contexts. The second study involved gathering predictability data for all words in a language sample. An entire single message was recorded and transcribed, and the location of the various hesitations was determined in the manner suggested by Maclay and Osgood (1959). In this experiment, word predictability was defined in terms of the scores yielded by the Cloze procedure (Taylor, 1953) which requires that every fifth word of a language sample be deleted and subsequently predicted (i.e., guessed) by a group of native speakers of the language. The results supported the hypothesis that words subsequent to hesitations tend to be less predictable than words uttered in fluent context. This supports the result obtained by Goldman-Eisler (1958a). Tannenbaum, Williams, and Hillier also found that there was a differential pattern of word predictability between
filled pauses and repeats. The filled pause category conformed to the results that words subsequent to the hesitations were less predictable than words uttered in fluent contexts. This was not supported for words antecedent to filled pauses. The repeat category of hesitation indicated the opposite trend, the antecedent word prior to the hesitation being the one of greater uncertainty. This led the authors to suggest that different types of hesitations may indicate different encoding decision points. The filled pause and unfilled pause types of hesitation occur at the point where a speaker for one reason or another cannot immediately elicit the right word, phrase or sentence. In such circumstances, the succeeding unit to the hesitation could be expected to be difficult to replace, since the speaker paused because he was uncertain. An alternate type of "hesitation-producing" behaviour may stem from feedback during encoding. The speaker, hearing himself say what he may not intend, interrupts his message production. Feedback-induced hesitations may be characterized by repeats and false starts since it is after receiving the feedback, that the speaker will backtrack to correct himself or be momentarily stunned and repeat himself. In this case the highest uncertainty would be in the preceding word which precipitated the hesitation rather than in the subsequent word.

The difference between the predictability of disrupted and fluent spontaneous speech was also examined by Feldstein, Rogalski, and Jaffe (1966). They also used the Cloze technique (Taylor, 1953) to determine predictability. Disrupted speech was defined in terms of the types of speech disturbance described by Mahl (1956). They found that predictability was affected by whether the sample was a monologue or a
dialogue, and by the topical focus of the speech segments. The results, however, did not support the hypothesis that disruption and predictability as measured by the Cloze procedure, are inversely related.

*Frequency Distributions in Written English*

Two kinds of constraints operating in language have been distinguished by Garner and Carson (1960), namely, distributional constraint and sequential constraint. Distributional constraint is the amount of constraint due to the fact that single English letters or words do not occur equally often. The amount of this constraint is affected by the size of the alphabet or word sample chosen. Sequential constraint is the amount of constraint produced by the sequential properties of the language and is due to the fact that the conditional probabilities of letters and words are not the same as first order probabilities. The measurement of sequential constraint is more difficult than the measurement of distributional constraint. The number of possible sequences of letters, for example, is so large that any direct computation of sequential constraint from measurements of the language are impractical. The result has been that attempts to measure sequential constraint (and thus redundancy) have made use of the assumption that humans are sufficiently aware of the constraints operating in printed English, and that they will use this knowledge in their performance and thus provide an estimate of redundancy. The above studies concerning predictability of words associated with hesitations are dealing with sequential constraint when the transition probabilities of words are estimated. The following studies indicate
some aspects of distributional constraints.

Dewey (1923) has tabulated the distribution of the English speech sounds in a sample of 100,000 words. Of the forty phonemes which he considered, nine make up more than half of vocal behaviour. He further observed that the most frequently used sound occurs more than 100 times as often as the least used sound. The plosives of twelve different languages were studied by Zipf (1965), who found that voiceless plosives occur more frequently than voiced plosives. One explanation for the difference in phonemic frequencies has been suggested by Miller (1963). He explained the differences in terms of the articulatory complexity of the sounds, and pointed out the seven alveolar consonants which are relatively easy to produce, comprise more than half of the consonantal tokens used. Wang and Crawford (1960) found that the relative frequency of consonants in English is not seriously affected by the type of literary content or by the dialect of the sample. This agrees with the hypothesis proposed by Herdan (1962) that such counts are random samples of a statistical universe of consonant probabilities in the language.

A preference for certain syllables as well as for certain sounds was found by Dewey (1923). The twelve most frequently used syllables [ə], [ʌv], [ɪn], [ænd], [ɪ], [θ], [tu], [ɪŋ], [ə], [rɪ], [ɪt], [ʌɛt], make up more than one-fourth of verbal behaviour. Seventy different syllables constitute 50 per cent of speech behaviour, but 1,370 syllabic types are required before 93.4 per cent of English syllable tokens are included. The syllable [ʊθ] alone makes up about 7 per cent of the syllables uttered and hence occurs on the
average of once in every $\frac{1}{4}$ successive syllables. In a study based upon conversational speech by telephone, French, Carter, and Koenig (1930) showed that various combinations of consonants and vowels (CV) occurred more frequently than others in syllables. The CVC syllables comprised 33.5 per cent of all the syllable tokens which were spoken; CV syllables made up 21.8 per cent; VC syllables made up 20.3 per cent; V syllables made up 9.7 per cent; CVCC syllables made up 7.8 per cent; VCC and CCVC syllables made up 2.8 per cent each; CCV syllables made up 0.8 per cent; and the complicated CCVCC syllables made up only 0.5 per cent.

Historically, the word has been subjected to various frequency counts. It has also been analysed according to structure. Zipf (1965) has shown that the majority of commonly used words and monosyllables, and the 200 most frequently used words in telephone conversations, according to French, Carter and Koenig (1930) were also almost all monosyllables.

The frequency distribution for English words has been expressed graphically by Zipf (1965) in the form of a function. A relation between the frequency of occurrence of an event and its rank when the events are ordered with respect to frequency of occurrence are expressed by the "Zipf curve". He found these curves to have uniform shape under a variety of circumstances, such as different topics, different authors, and even different languages. A
mathematical rationalization for the "Zipf curves" was provided by Mandelbrot (1965). He proposed that if the assumption is made that word-boundary markers (spaces) are scattered randomly through a text, then there will necessarily be more occurrences of short words than long words. When you add to this the fact that the variety of different words available increases exponentially with their length, "the phenomenon that Zipf reported becomes inescapable; a few short words will be used an enormous number of times, while a huge number of longer words will occur infrequently or not at all."

Linguistic Factors in Stuttering

Several investigators have noted that when a stutterer reads the same passage two or more times in succession, he tends to stutter on the same words from reading to reading (Johnson, Brown, Curtis, Edney, and Keaster, 1948; Johnson, 1955). Johnson and Knott (1937) first reported this finding and called it the consistency effect. The consistency effect suggests that stuttering is not random but is a response to certain cues or stimuli.

The "loci" of stuttering in the speech sequence has also been investigated. Brown (1945) found that "stutterings" were most likely to occur on words which begin with consonant sounds other than [t], [h], [w], and [θ]; were nouns, verbs, adjectives, or adverbs; were the first, second, or third word in a sentence; or were five or more

1. This rationalization is explained by G. A. Miller in his introduction to the 2nd edition of The Psycho-Biology of Language by G. K. Zipf, 1965.
letters in length. According to Brown, the greater the number of these four attributes a word possesses, the more likely it was to be stuttered. The dysfluencies of normal male speakers were examined by Silverman and Williams (1967). They found that the dysfluencies of normal males tended to occur on words possessing the same attributes which Brown had described for stutterers. This study was replicated by Chaney (1969) who found similar results for normal female speakers. These results are compatible with the hypothesis that dysfluencies tend to occur at points of relatively high uncertainty.

Listeners have been found to react differently to various types of dysfluencies. Boehmiller (1958) found that sound or syllable repetitions were classified by laboratory observers as stuttering more often than were other kinds of dysfluencies, and false starts and filled pauses were judged to be stuttering least often of the dysfluencies. Williams and Kent (1958) reported that their laboratory observers, in judging dysfluencies to be stuttered or nonstuttered, classified syllable repetitions and prolongations primarily as stuttered, and false starts primarily as nonstuttered.

The relationship of dysfluencies to parts of speech have also been investigated. In a study by Soderberg (1967) prolongations were found to be significantly related to lexical words; and repetitions were found to be significantly related to function words and pronouns. The results of this study, do not in the main, support the contention of Brown (1937) that lexical words are stuttered more frequently than function words. Maclay and Osgood (1959) had found similar results with normal speakers. They reported that unfilled pauses occurred
more frequently before lexical words and repetitions occurred most frequently on function words.

It was suggested by Taylor (1966) that less stuttering occurs on function words because these words usually begin with vowels rather than consonants. According to Taylor, initial consonants in words tend to involve greater articulatory complexity than do vowels, and generally appear to carry more information. Therefore, these initial consonants are associated with stuttering. Wingate (1967), on the other hand, indicated that less stuttering occurs on function words because they are usually shorter than lexical words.

Stuttering, information load, and response strength were investigated by Schlesinger, Forte, Fried, and Melkman (1965) in an attempt to determine whether stutterings tend to occur, like normal nonfluencies, at points of highest information load. They found that the locus of stuttering could be predicted by the transition probability of words as estimated by forward word-by-word guessing and by the response as measured by frequency of occurrence in language. Words of high transition probability and high frequency were stuttered on about half as often as words of low transition probability and low frequency, with words of low transition probability and high frequency occupying an intermediate position.

Summary of the Review of the Literature

In this chapter, the literature pertinent to the present study was reviewed. The perception of hesitations, the classifications of dysfluent speech, the function of hesitations in speech, predictability
in the environments of hesitations, the frequency distributions of written English, and the linguistic factors in stuttering were discussed.
CHAPTER III

PROCEDURES

The investigation was undertaken to determine in the speech of fluent and nonfluent individuals the relative frequencies of occurrence of English phonemes, syllables, and words which follow or accompany four types of hesitations, repeats, false starts, filled pauses, and unfilled pauses. The experiment was also conducted to ascertain whether or not generalizations could be made as to the hesitation behaviour of fluent and nonfluent individuals.

Subjects

Twenty male adults participated in this study as speakers. The subjects ranged in age from 19 to 30 years old, and consisted of undergraduate students, graduate students, and faculty at the Ohio State University. Ten of the subjects had been diagnosed as stutterers, and ten were normal speakers. Each subject was given ten passages to read, each of which contained approximately 120 words. The reading task was divided into three sessions, to take into consideration changes in speech behaviour which may occur on different days.
Stimuli

The ten passages (Appendix A) consisted of fine samples of imaginative prose and five samples of informative prose. These samples were selected from the corpus compiled by Kucera and Francis (1967). The following ten categories, representing a range of subject matter and prose style were included in the sample:
(1) press editorial, (2) press reportage, (3) popular lore, (4) belles lettres, (5) learned prose, (6) general fiction, (7) mystery and detective fiction, (8) adventure and western fiction, (9) romance and love story, and (10) humor.

Recording of the stimuli

The ten passages were read by each speaker in the presence of the experimenter and recorded on a Wollensak (model T-1500) tape recorder in an IAC sound treated room. The speaker was approximately six inches from the microphone. Each passage had been typewritten on a page 8 1/2 x 11 inches, and the text occupied 4 x 8 inches. The speakers were encouraged to read the passages naturally. Each subject read the passages in a predetermined randomized order according to a 10 x 10 Latin Square (Fisher and Yates, 1949). The following instructions were presented to the subjects prior to the reading task:
You will be asked to read several passages aloud. Please read the passages naturally at a normal reading rate. You will not be asked any questions on the material contained in the passages. Do you have any questions?

The master tapes containing the recorded stimuli for each speaker were later reproduced on the Wollensak (T-1500) and then re-recorded on a Magnecord (type 1022) tape recorder in a randomized ordering. During the re-recording process, each recorded sample was monitored with a VU-meter in order to maintain a constant intensity level.

Identification of the hesitations

The acoustically recorded stimuli were presented to two judges under conditions of classroom quiet. A preliminary training session of one hour and 30 minutes preceded the judging. This session included a general discussion of the four types of hesitations, repeats, false starts, filled pauses, and unfilled pauses (Maclay and Osgood, 1959), and some sample texts were jointly scored. A hesitation was considered to be an auditory experience of nonfluency, that is, a detected repetition of a phoneme, a syllable, or a word that was judged to be nonsignificant semantically (repeats); all incomplete or self-interrupted utterances (false starts); all occurrences of the English hesitation devices such as
/ə, æ, r, ə, m/ (filled pauses); and any silence of unusual
length or nonphonemic lengthening of phonemes (unfilled pauses).

After the training session, each of the two judges listened
to the recordings and independently marked provided transcripts
for the perceived hesitations according to the four classifications
mentioned above. Each passage read by a speaker was heard by the
judges at least twice. Approximately 20 one-hour sessions were
required by each scorer to complete the listening task.

The hesitations were perceived to have occurred just prior to,
or accompanying a phoneme, syllable, or word, and were designated
as to the type of hesitation. The master text was obtained
by examining the two transcriptions of the judges, and employing
only those hesitations on which both judges agreed as to type
and location. The following passage (Figure 1) taken from the
master text, illustrates how the four types of pauses were
marked on the transcripts.
He's hurt; "A woman's voice said, and then he heard a sort of wail from the man's wife. The man on the ground began to move; one of his hands flattened out on the front of his sweater, soaking into a dark streak of dirt than ran diagonally across the white wool on his shoulder, as though the bright V woven into the neckline had melted, running @ darker color.

The girl kneeled by her husband with one arm at his back. "Can you hear, can you talk to me?" she begged. An incoherent sound came from the red mouth.

The girl looked around quickly at several of the people. None of the crowd had stepped forward to help.

An example of a transcript of a passage read by a speaker and scored by a listener.

Figure 1. A letter, syllable or word enclosed by a circle indicated a repetition; f referred to a filled pause and † marked an unfilled pause.
Reliability of the judges

The method used to determine the reliability of the judges in scoring the loci and type of hesitation was per cent agreement. The formula for computing this statistic was recommended by Festinger (1944):

\[
\text{Percentage of agreement} = \frac{\text{sum of agreements} \times 100}{\text{sum of agreements} + \text{sum of disagreements}}
\]

The transcripts of the investigator were compared with the transcripts of the second observer and the total number of agreements and disagreements of the presence or absence of hesitations according to type and location occurring in all of the ten passages of the twenty subjects was tallied. The result of this composite tabulation for the twenty subjects was reported in terms of percentage of agreement between the investigator and the second observer. This method of determining reliability indicated that the two judges agreed 93.5 per cent of the time for both location and type identification of the hesitations.

Tabulation of the values representing the frequencies of occurrence of the linguistic unit associated with the hesitations.

The passages which were read had been obtained from verbatim samples used by Kucera and Francis (1967) in an analysis of the frequency of occurrence of the words occurring in edited English of 1961. Therefore every word in the passages used in this study has associated with it a value representing the number of times it occurred in the total sample. Similarly, the phonemes and syllables had associated with them values representing their frequency of occurrence in a sample analysed by Dewey (1923).
The following procedure for tabulating the data was employed. For each of the 20 speakers, the master text of ten scored passages was assembled and a number of analyses were made.

1. **Words using word values.** The entire text of a particular speaker was examined, and each word which was repeated entirely was determined. The frequency of occurrence of each word repeated, as given by Kucera and Francis (1967), was written down, and the median of all these frequencies was found. The median value, divided by the sample size, 1,014,232, gave a relative frequency value \( p \) associated with this median, and the quantity \(-\log_2 p\) was written to one decimal place in the appropriate chart on the row corresponding to the speaker and the column relating to the repeat type of hesitation. This chart found in Appendix B was divided into two sections, corresponding to the fluent and the nonfluent speakers. In an analogous manner, each word which was immediately preceded by an unfilled pause was listed. The corresponding logarithmic value of the median relative frequency was then obtained. This procedure was also followed for filled pauses and false starts, yielding four different relative frequency values for each speaker associated with word hesitations.

2. **Syllables using syllable values.** A second analysis was performed in which all syllables which were judged to have been repeated in the master text were determined. The frequency of occurrence of each syllable repeated according to its position
(initial, medial, or final), as given by Dewey (1923) was written down. In addition, the frequency of occurrence of the first syllable of each word which had been repeated entirely was found in the same manner. The median of all these frequencies was then determined. The median value, divided by the sample size, 143,000, gave a relative frequency value "p" associated with this median, and the quantity \(-\log_2 p\) was written to one decimal place in the appropriate chart on the row corresponding to the speaker and the column relating to the repeat type of hesitation. This chart was also divided into two sections, corresponding to the fluent and the nonfluent speakers (Appendix B). In an analogous manner, each syllable which was immediately preceded by an unfilled pause was listed. The corresponding logarithmic value of the median relative frequency was then obtained. This procedure was also followed for filled pauses and false starts, yielding four different relative frequency values for each speaker associated with syllable hesitations.

3. **Phonemes using phoneme values.** A third analysis was performed in which all phonemes which were judged to have been repeated in the master text were determined. The frequency of occurrence of each phoneme repeated according to its position in the word (initial, medial, or final), as given by Dewey (1923) was written down. In addition, the frequency of occurrence of the first phoneme in all repetitions of syllables and words was found in the same manner. The median of all these frequencies was then found. The median value, divided by the sample size,
372,729, gave a relative frequency value "$p" associated with this median, and the quantity $-\log_2 p$ was written to one decimal place in the appropriate chart on the row corresponding to the speaker and the column relating to the repeat type of hesitation. This chart (Appendix B) was divided into two sections, corresponding to the fluent and the nonfluent speakers. In an analogous manner, each phoneme which was immediately preceded by an unfilled pause was listed and the corresponding logarithmic value of the median relative frequency was then obtained. This procedure was also followed for filled pauses and false starts, yielding four different relative frequency values for each speaker associated with phoneme hesitations.

4. **Repetitions using word values.** A new chart was formed whose first column was the column of word repetitions from the first analysis of word values. The second column, representing syllable repetitions was formed by looking at only those syllables which were judged to have been repeated, and then determining the values which corresponded to the words in which the syllables were embedded. The median of these embedded syllabic values was then found and the corresponding logarithmic value of the median relative frequency was then determined. The third column was formed by using the values of the words in which phonemes were judged to have been repeated in the master text. In all three cases, the frequency of occurrence values were determined from the data compiled by Kucera and Francis (1967),
and the sample size was 1,014,232 words. Using the values for words, the median value for frequency of occurrences for each speaker was determined in an analogous manner as was described above, for each of the columns representing repetitions of words, syllables, and phonemes.

5. General hesitation values for words, syllables, and phonemes. A new list was formed of all word hesitations regardless of type for each speaker. In this instance, only those values representing words which were repeated entirely, or which immediately followed a filled or unfilled pause, or which were associated with a false start were included. The median value and the logarithmic value of the median relative frequency was then obtained for each speaker for word hesitations in general.

The next column consisted of values obtained from syllable hesitations, using the value of the word in which the syllable occurred. In this instance only those occurrences where syllables were perceived to have been repeated, or where there was a syllable repetition immediately following a filled or unfilled pause, or where false start was perceived associated with a syllable were considered. The median value and the corresponding logarithmic value of the median relative frequency was then obtained for each speaker for syllable hesitations in general.

The third column consisted of values obtained from phoneme hesitations, regardless of type for each speaker, using the value of the word in which the phoneme hesitation occurred or with
which it was associated. In this instance, only those occurrences where phonemes were perceived to have been repeated, or where there was a repetition of a phoneme immediately following a filled or unfilled pause, or where a phoneme was perceived to have been associated with a phoneme were considered. The median value and the corresponding logarithmic value of the median relative frequency was then obtained for each speaker using word values, for all hesitations associated with phonemes. In all three cases, the values for frequency of occurrence were determined from the data compiled by Kucera and Francis (1967), and the size of the sample was 1,024,232 words. The chart representing the logarithmic values of the median relative frequency of occurrence of the median hesitation values for words, syllables, and phonemes, is found in Appendix B.

**Computations**

The following estimate of probability has been recommended by Wilson (1954):

\[ p(i) = \frac{\text{frequency of occurrence of event } i}{\text{the number of events}} \]

The value \(-\log_2 p\) has been referred to as the "information", or "self-information" in bits in a state of probability \(p\) (Shannon, 1948; Woodward, 1953; Attneave, 1959). Therefore the following computation gives numerical values:

\[ -\log_2 \left( \frac{\text{number of times linguistic unit } i \text{ occurs}}{\text{total number of elements in the sample type}} \right) \left( \frac{\text{number of times linguistic unit } i \text{ occurs}}{\text{total number of elements in the sample type}} \right) \]

For each speaker and for every combination of linguistic types and hesitation types, the values tabulated in the columns were consulted and the median value determined. This value represented the median
frequency of occurrence associated with a particular speaker, hesitation type, and linguistic unit. Median values were also obtained for hesitation values for each linguistic unit. The hesitation value per linguistic unit was defined as the median frequency of occurrence value for each speaker of (1) word hesitations, (2) syllable hesitations, and (3) phoneme hesitations. Each hesitation value was the median frequency of occurrence value of all the hesitations associated with each linguistic unit separately and was determined using word values. A total hesitation value was obtained by determining the median for each speaker from all the frequency of occurrence values associated with both hesitation types and linguistic unit combined.

These median values were then employed with the total number of occurrences of the given linguistic type in the sample used to form the ratio referred to in this study as relative frequency of occurrence. The logarithm to the base 2 (log2) of the ratio was then computed as described above. These computations yielded what this study refers to as hesitation values in bits.

Summary

A description of the subjects, stimuli, recording procedure, identification of the hesitations, reliability measures of the judges, tabulation of the values representing the frequencies of occurrence of the linguistic units, and the computations performed was presented in this chapter.
This investigation was undertaken to examine the difference between the hesitations of fluent and nonfluent speakers in terms of the relative frequency of occurrence values of the words, syllables, and phonemes which succeeded or accompanied four types of perceived hesitations. The four types of hesitations used were repeats, false starts, filled pauses, and unfilled pauses (Maclay and Osgood, 1959).

In this chapter, the statement of the hypotheses will be presented; the statistical tests used will be described; and the results will be discussed.

Statement of Hypotheses

The following null hypotheses were formulated for testing:

1. There is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of word, syllabic, and phonemic hesitations.

2. There is no significant difference in mean relative frequencies of occurrence of word, syllabic, and phonemic hesitations.
3. There is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of phonemic hesitations.

4. There is no significant difference in the mean relative frequencies of occurrence of the four types of hesitations, repeats, false starts, filled pauses, and unfilled pauses associated with phonemic dysfluencies.

5. There is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of syllabic hesitations.

6. There is no significant difference in the mean relative frequencies of occurrence of the four types of hesitations, repeats, false starts, filled pauses, and unfilled pauses associated with syllabic dysfluencies.

7. There is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of word hesitations.

8. There is no significant difference in the mean relative frequencies of occurrence of the four types of hesitations, repeats, false starts, filled pauses, and unfilled pauses associated with word dysfluencies.

9. There is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of word, syllabic, and phonemic
hesitations associated with the hesitation type, repeats.

10. There is no significant difference in the mean relative frequencies of occurrence of word, syllabic, and phonemic hesitations associated with the hesitation type, repeats.

Statistical Tests of Hypotheses

The statistical procedure employed in this study to test the hypotheses was a two-factor repeated measures analysis of variance, designated by Lindquist (1953) as a Type 1 mixed design. The analysis of variance was used because it provides a means of determining the statistical significance of differences among treatments as well as differentiating groups with respect to treatments. The analyses of variance which were performed were unbalanced, that is, some cells had no entries in them, and therefore the resulting F-ratio may only be considered approximate. Further analyses were carried out in the form of t-tests when the analysis of variance indicated significance. The t-tests were divided into two categories: those t-tests concerned with differences between two groups of speakers, and those t-tests concerned with differences between two treatments within the same group of speakers.

\[ t = \frac{\bar{x}_1 - \bar{x}_2 - (\mu_1 - \mu_2)}{s\sqrt{1/n_1 + 1/n_2}} \]

2. \[ t = \frac{d - (\mu_1 - \mu_2)}{\sqrt{\sum (d - \bar{d})^2/(n - 1)n}} \]

3. \[ t = \frac{d - (\mu_1 - \mu_2)}{\sqrt{\sum (d - \bar{d})^2/(n - 1)n}} \]
The effects of fluent and nonfluent groups and linguistic units on hesitations

The hypothesis, that there is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of word, syllabic, and phonemic hesitations, was treated in two ways. In the first analysis of variance, the values for phonemes, syllables, and words, respectively, were used to determine the mean relative frequencies of occurrence of the hesitations which were associated with each linguistic unit. This hypothesis was rejected at the .05 level of confidence. A summary of the analysis of variance appears in Table 1. The mean hesitation values of the two groups for phonemes, syllables, and words appear graphically in Figure 2. Three t-tests were performed for difference between two population means of unpaired samples after significance was indicated by the analysis of variance; and the hypothesis of no difference at each linguistic unit between the group of fluent speakers and the groups of nonfluent speakers was tested. This hypothesis was rejected at the .05 level of confidence for word hesitations.

The same hypothesis, that there is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of word, syllable, and phoneme hesitations, was treated using word values to determine the mean relative frequencies of occurrence of the hesitations which were associated with each linguistic unit. In this case, the values used were the frequencies of occurrence of the word
in which the phonemic or syllabic dysfluency was embedded. This hypothesis was rejected at the .05 level of confidence. A summary of the analysis of variance appears in Table 2. Three t-tests for difference between two population means of unpaired samples were also performed, one for each of the linguistic units, phonemes, syllables, and words. The means of the two groups of speakers for phoneme, syllable, and word hesitations appear graphically in Figure 3. The hypothesis of no difference for each linguistic unit between the group of fluent speakers and the group of nonfluent speakers was rejected at the .05 level of confidence for words and phonemes, but not for syllables.

Discussion

Hesitations of the nonfluent group of speakers were associated with words having a mean value of 10.7 bits and the hesitations of the fluent group of speakers were associated with words having a mean value of 13.9 bits. Since these values represent the logarithm to the base 2 (log_2) of the relative frequency of occurrence of the words associated with hesitations, the nonfluent group of speakers had hesitations associated with words of approximately 2^{3.2} or 9.4 times the frequency of the fluent group of speakers. The nonfluent group of speakers experienced hesitations associated with phonemes in words having a mean value of 12.3 bits and the fluent group of speakers had hesitations associated with phonemes in words having a mean value of 14.7 bits. This represents a difference of 2.4 or the nonfluent group of speakers had phonemic hesitations associated with words which were 2^{2.4} = 5.2 times as frequent as the words in which the fluent group of speakers had similar phonemic hesitations.
TABLE 1. Summary of an analysis of variance for two groups of speakers, fluent and nonfluent, and for three linguistic units, phonemes, syllables, and words. The scores used were the logarithms of the median relative frequency of occurrence values associated with phoneme, syllable, and word hesitations.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between subjects</strong></td>
<td>130.98</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groups</td>
<td>33.00</td>
<td>1</td>
<td>33.00</td>
<td>6.07 *</td>
</tr>
<tr>
<td>Error</td>
<td>97.98</td>
<td>18</td>
<td>5.44</td>
<td></td>
</tr>
<tr>
<td><strong>Within subjects</strong></td>
<td>391.83</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linguistic units</td>
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<td>2</td>
<td>158.57</td>
<td>105.71 *</td>
</tr>
<tr>
<td>Interaction</td>
<td>20.68</td>
<td>2</td>
<td>10.34</td>
<td>6.90 *</td>
</tr>
<tr>
<td>Error</td>
<td>54.02</td>
<td>36</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>522.81</td>
<td>59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at the .05 level
FIGURE 2. The mean hesitation values for phoneme, syllable, and word dysfluencies (using phoneme, syllable, and word values respectively) for the fluent and the nonfluent groups of speakers.
TABLE 2. Summary of an analysis of variance for two groups of speakers, fluent and nonfluent, and for three linguistic units, phonemes, syllables, and words. The scores used were the logarithms of the median relative frequency of occurrence values of the linguistic unit associated with the hesitation, using word values.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between subjects</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Groups</td>
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<td>86.58</td>
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<tr>
<td>Error</td>
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<tr>
<td>Within subjects</td>
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<td>10.56</td>
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</tr>
<tr>
<td>Linguistic unit</td>
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<td>92.03</td>
<td>15.8 *</td>
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<tr>
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<td>2</td>
<td>2.91</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Error</td>
<td>179.69</td>
<td>31</td>
<td>5.80</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>578.94</td>
<td>44</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at the .05 level
FIGURE 3. The mean general hesitation values for phoneme, syllable, and word dysfluencies (using word values) for the fluent and the nonfluent groups of speakers.
The nonfluent group of speakers experienced hesitations on syllables in words having a mean value of 15.8 bits and the fluent group of speakers had hesitations on syllables in words having a mean value of 17.4 bits. In this case, the nonfluent group experienced hesitations on syllables in words which were 3.1 times as frequent as the hesitations of the fluent group. When hesitations occurred, therefore, the nonfluent group of speakers experienced them on more frequent words than the fluent group of speakers. Depending on the linguistic unit, the fluent speakers had hesitations associated with words which were approximately 3 to 9 times less frequent than the words which were associated with the hesitations of the nonfluent group.

**The effects of linguistic units upon hesitations**

The hypothesis, that there is no significant difference in the mean relative frequencies of occurrence of word, syllabic and phonemic hesitations, was also treated by two analyses of variance. The first analysis used phoneme, syllable, and word values, respectively, to determine the mean relative frequencies of occurrence of the hesitations which occurred in each linguistic unit. This hypothesis was rejected at the .05 level of confidence. A summary of the analysis of variance appears in Table 1.

This same hypothesis was treated with an analysis of variance using the mean relative frequencies of the word values in which the phonemic, syllabic, and word hesitations were embedded. This hypothesis was also rejected at the .05 level of confidence. A summary of this analysis of variance appears in Table 2.
The effects of fluent and nonfluent groups and differing types of hesitations on phoneme dysfluencies

The hypothesis, that there is no difference between the groups of fluent and the nonfluent speakers in the mean relative frequencies of occurrence of phonemic hesitations, was treated by an analysis of variance. The hypothesis was not rejected at the .05 level of confidence.

The hypothesis, that there is no significant difference in the mean relative frequencies of occurrence of the four types of hesitations, repeats, false starts, filled pause, and unfilled pause associated with phonemic dysfluencies, was not rejected at the .05 level of confidence. A summary of the analysis of variance involving these two hypothesis appears in Table 3. The mean hesitation values of the four types of hesitations and the two groups of speakers appear graphically in Figure 4. No significant interaction was noted between the groups of speakers and the hesitation types, repeats, false starts, filled pauses, and unfilled pauses.

The effects of fluent and nonfluent groups and differing types of hesitations on syllable dysfluencies

The hypothesis, that there is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of syllabic hesitations, was treated by an analysis of variance. The hypothesis was not rejected.

The hypothesis, that there is no significant difference in the
TABLE 3. Summary of an analysis of variance for two groups of speakers, fluent and nonfluent, and four types of hesitations, repeats, false starts, filled pauses, and unfilled pauses. The scores used were the logarithms of the median relative frequency of occurrence values associated with phoneme hesitations.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
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<th>MS</th>
<th>F</th>
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</thead>
<tbody>
<tr>
<td>Between subjects</td>
<td>4.41</td>
<td>19</td>
<td>.34</td>
<td>1.50</td>
</tr>
<tr>
<td>Groups</td>
<td>.34</td>
<td>1</td>
<td>.34</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>4.07</td>
<td>18</td>
<td>.23</td>
<td></td>
</tr>
<tr>
<td>Within subjects</td>
<td>15.51</td>
<td>50</td>
<td>.31</td>
<td></td>
</tr>
<tr>
<td>Hesitation types</td>
<td>1.27</td>
<td>3</td>
<td>.42</td>
<td>1.37</td>
</tr>
<tr>
<td>Interaction</td>
<td>.75</td>
<td>3</td>
<td>.25</td>
<td>.81</td>
</tr>
<tr>
<td>Error</td>
<td>13.50</td>
<td>44</td>
<td>.31</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>19.92</td>
<td>69</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at the .05 level
The mean hesitation values in bits of the four types of hesitations, repeats, false starts, filled pauses, and unfilled pauses are plotted for the fluent and nonfluent groups of speakers.

R = repeats  FS = false start  FP = filled pause  UP = unfilled pause

--- fluent group  --- nonfluent group

FIGURE 4.
mean relative frequencies of occurrence of the four types of hesitations, repeats, false starts, filled pause, and unfilled pause associated with syllabic dysfluencies, was rejected at the .05 level of confidence. A summary of the analysis of variance appears in Table 4. No significant interaction was noted between the groups of speakers and the hesitation types. In addition, twelve t-tests for difference between two paired population means were performed, one for each of the possible combinations of the four types of hesitations within the fluent and the nonfluent groups of speakers. The hypothesis, that there is no difference between the mean relative frequencies of occurrence of any two hesitation types within the linguistic unit of syllable (using syllabic values) was tested. The hypothesis was not rejected for any of the combinations of hesitation types within the fluent group of speakers. The hypothesis was rejected at the .05 level of confidence within the nonfluent group of speakers for the following combinations of hesitation types repeats-filled pause, and false start-filled pause. The significant combinations are illustrated in Figure 5.

The effects of fluent and nonfluent groups and four differing types of hesitations on word dysfluencies

The hypothesis, that there is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of word hesitations; was rejected at the .05 level of confidence. A summary of the analysis of variance appears in Table 5. In addition, four t-tests for difference
TABLE 4. Summary of an analysis of variance for two groups of speakers, fluent and nonfluent, and four types of hesitations, repeats, false starts, filled pauses, and unfilled pauses. The scores used were the logarithms of the median relative frequency of occurrence values associated with syllable hesitations.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
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<th>F</th>
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</thead>
<tbody>
<tr>
<td>Between subjects</td>
<td>116.43</td>
<td>19</td>
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</tr>
<tr>
<td>Groups</td>
<td>15.48</td>
<td>1</td>
<td>15.48</td>
<td>2.76</td>
</tr>
<tr>
<td>Error</td>
<td>100.94</td>
<td>18</td>
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<tr>
<td>Within subjects</td>
<td>192.93</td>
<td>51</td>
<td>3.78</td>
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</tr>
<tr>
<td>Hesitation types</td>
<td>46.91</td>
<td>3</td>
<td>15.64</td>
<td>5.14 *</td>
</tr>
<tr>
<td>Interaction</td>
<td>8.24</td>
<td>3</td>
<td>2.75</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Error</td>
<td>137.78</td>
<td>45</td>
<td>3.06</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>309.35</td>
<td>70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at .05 level
between two population means of unpaired samples were done, one t-test for each of the four types of hesitations. The means of the two groups of speakers for the four types of hesitations appear graphically in Figure 4. The hypothesis, that there is no significant difference in the mean relative frequencies of occurrence of word dysfluencies (using word values) in the four types of hesitations between the fluent and the nonfluent groups of speakers, was rejected at the .05 level of confidence for the hesitation types, repeats and unfilled pauses. The hypothesis was not rejected for the hesitation types, false starts and filled pauses.

The hypothesis, that there is no significant difference in the mean relative frequencies of occurrence of the four types of hesitations, repeats, false starts, filled pause, and unfilled pause associated with word dysfluencies was rejected at the .05 level of confidence. A summary of the analysis of variance appears in Table 5. A significant interaction (.01 level) between the two groups and the four types of hesitations was also noted. In addition, twelve t-tests for difference between the means of two paired population samples were done. One t-test was performed for each of the possible combinations of the four types of hesitations within the fluent and within the nonfluent groups. The hypothesis, that there is no difference between the mean relative frequencies of occurrence of any two hesitation types within the linguistic unit of words (using word values), was rejected at the .05 level of confidence, within the fluent group for the combinations of hesitation types, repeats-false starts, and false starts-unfilled pause. The hypothesis was rejected at the .05 level of...
### TABLE 5. Summary of an analysis of variance for two groups of speakers, fluent and nonfluent, and four types of hesitations, repeats, false starts, filled pause, and unfilled pause. The scores used were the logarithms of the median relative frequency of occurrence values associated with word hesitations.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
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<tbody>
<tr>
<td>Between subjects</td>
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<tr>
<td>Groups</td>
<td>156.81</td>
<td>1</td>
<td>156.81</td>
<td>9.62 *</td>
</tr>
<tr>
<td>Error</td>
<td>293.25</td>
<td>18</td>
<td>16.29</td>
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</tr>
<tr>
<td>Within subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hesitation types</td>
<td>125.34</td>
<td>3</td>
<td>41.78</td>
<td>5.97 *</td>
</tr>
<tr>
<td>Interaction</td>
<td>93.90</td>
<td>3</td>
<td>31.30</td>
<td>4.47 *</td>
</tr>
<tr>
<td>Error</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>970.02</td>
<td>68</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at .05 level
confidence within the nonfluent group for all possible combinations with the exception of the combination: filled pause-unfilled pause. These results are illustrated in Figure 5.

The effects of fluent and nonfluent groups and linguistic units on one type of hesitation: repeats.

The hypothesis, that there is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of word, syllabic, and phonemic hesitations associated with the hesitation type, repeats, was rejected at the .05 level of confidence. A summary of the analysis of variance appears in Table 6. Three $t$-tests of difference between two population means of unpaired samples were also performed between the two groups for each linguistic unit. The hypothesis, that there is no difference between the two groups for each linguistic unit, was rejected at the .05 level of confidence for phonemes, syllables, and words. The means of the two groups of speakers appear graphically in Figure 6.

The hypothesis, that there is no significant difference in the mean relative frequencies of occurrence of word, syllabic, and phonemic hesitations for the hesitation type repeats, was rejected at the .05 level of confidence. No significant interaction between the two groups of speakers and the linguistic units was observed. In addition, six $t$-tests were performed for differences between two paired population means. One $t$-test was performed for each of the possible combinations of linguistic units within the fluent group and within the nonfluent group. The hypothesis, that there is no difference between any two
<table>
<thead>
<tr>
<th>Linguistic Unit</th>
<th>FLUENT GROUP</th>
<th>NONFLUENT GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHONEMES</td>
<td>FP R FS FP R FS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UP</td>
<td>UP</td>
</tr>
<tr>
<td><strong>R</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYLLABLES</td>
<td>FP FS FP FS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UP</td>
<td>UP</td>
</tr>
<tr>
<td><strong>R</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WORDS</td>
<td>FP R FS FP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UP</td>
<td>UP</td>
</tr>
<tr>
<td><strong>R</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FIGURE 5. Significance (0.05 level) for the mean hesitation values between possible pairings of the four types of hesitations, repeats, false starts, filled pause, and unfilled pause of the fluent and nonfluent groups of speakers is illustrated by the presence of the arrow [→].

R = repeats, FS = false starts, FP = filled pause, UP = unfilled pause
TABLE 6. Summary of an analysis of variance for two groups of speakers, fluent and nonfluent, and three linguistic units, phonemes, syllables, and words. The scores used were the logarithms of the median relative frequency of occurrence values associated with the linguistic units and the repeat type hesitation.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
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<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between subjects</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>206.02</td>
<td>1</td>
<td>206.02</td>
<td>47.165 *</td>
</tr>
<tr>
<td>Error</td>
<td>78.62</td>
<td>18</td>
<td>4.37</td>
<td></td>
</tr>
<tr>
<td>Within subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linguistic units</td>
<td>428.51</td>
<td>2</td>
<td>214.29</td>
<td>23.97 *</td>
</tr>
<tr>
<td>Interaction</td>
<td>37.20</td>
<td>2</td>
<td>18.60</td>
<td>2.07</td>
</tr>
<tr>
<td>Error</td>
<td>260.04</td>
<td>29</td>
<td>8.97</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1010.40</td>
<td>52</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at .05 level
FIGURE 6. The mean repeat type hesitation values for phoneme, syllable, and word dysfluencies (using word values) for the fluent and the nonfluent groups of speakers.
<table>
<thead>
<tr>
<th>Type of Hesitation</th>
<th>FLUENT</th>
<th>NONFLUENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repetition</td>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

Mean hesitation values over the four types

**FIGURE 7.** Significance (.05 level) for the mean hesitation values between possible pairings of the three linguistic units, phonemes, syllables and words of the fluent and nonfluent groups of speakers is illustrated by the presence of the arrow [*•*].

*W = words  \quad S = syllables  \quad P = phonemes*
combinations of linguistic units for the nonfluent group, was rejected at the .05 level of confidence for all possible combinations. These results are illustrated in Figure 7.

Summary

A statement of the hypotheses, the statistical treatment of the data and the results have been presented in this chapter. The following chapter is concerned with the summary, discussion, and conclusions of the study.
CHAPTER V

SUMMARY AND CONCLUSIONS

This investigation was undertaken to examine the difference between the hesitations of fluent and nonfluent speakers on the basis of the relative frequency of occurrence values of the words, syllables, and phonemes which succeed or accompany perceived hesitations. The four types of hesitations employed in the study were repeats, false starts, filled pauses, and unfilled pauses (Maclay and Osgood, 1959).

Twenty male adults participated as speakers in the study. Ten of the subjects had been diagnosed as stutterers, and ten were normal speakers. Each subject read ten passages representing a range of subject matter and prose style. The ten passages were read and recorded in a sound-treated room in the presence of the experimenter. The passages were originally read by the speakers in a randomized order; and the readings were divided into three sessions per speaker. The acoustically recorded passages were later re-recorded in a randomized ordering of speaker-passage combinations. These final recordings were presented to two judges who listened to the recordings and independently marked provided transcripts for the perceived hesitations. The hesitations were perceived to have occurred prior to or accompanying a phoneme, syllable, or word, and were designated as a repeat, false start, filled pause, or unfilled pause.
Hypotheses were formulated and subjected to statistical analyses. The statistics, a two-factor analysis of variance a t-test for difference between two paired population means, and a t-test for difference between two population means of unpaired samples were employed.

Summary of the Results

Ten hypotheses were formulated with the following results:

1. There is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of word, syllabic, and phonemic hesitations. Since the F-ratio was significant at the .05 level, the hypothesis was rejected.

2. There is no significant difference in the mean relative frequencies of occurrence of word, syllabic, and phonemic hesitations. Since the F-ratio was significant at the .05 level, the hypothesis was rejected.

3. There is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of phonemic hesitations. Since the F-ratio was not significant at the .05 level, the hypothesis was not rejected.

4. There is no significant difference in the mean relative frequencies of occurrence of the four types of hesitations, repeats, false starts, filled pause, and unfilled pause associated with phonemic dysfluencies. Since the F-ratio was not significant at the .05 level, the hypothesis was not rejected.
5. There is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of syllabic hesitations. The F-ratio was not significant at the .05 level and therefore the hypothesis was not rejected.

6. There is no significant difference in the mean relative frequencies of occurrence of the four types of hesitations, repeats, false starts, filled pause, and unfilled pause associated with syllabic dysfluencies. Since the F-ratio was significant at the .05 level, the hypothesis was rejected.

7. There is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of word hesitations. This hypothesis was rejected at the .05 level of confidence.

8. There is no significant difference in the mean relative frequencies of occurrence of the four types of hesitations, repeats, false starts, filled pause, and unfilled pause associated with word dysfluencies. The F-ratio was significant at the .05 level and therefore the hypothesis was rejected.

9. There is no significant difference between the group of fluent speakers and the group of nonfluent speakers in the mean relative frequencies of occurrence of word, syllabic, and phonemic hesitations associated with the hesitation type, repeats. The F-ratio was significant at the .05 level and therefore the hypothesis was rejected.
10. There is no significant difference in the mean relative frequencies of occurrence of word, syllabic, and phonemic hesitations associated with the hesitation type, repeats. Since the F-ratio was significant at the .05 level, the hypothesis was rejected.

Discussion of the results

The passages read by the subjects, as analysed in this study, displayed differences in the nature of the hesitations of the fluent and nonfluent speaker. These observed differences were both in terms of linguistic units involved in the hesitations and in the type of hesitation behaviour which was displayed.

Analysis of the linguistic units involved in the hesitations showed that there is no difference in the hesitations involving phonemes between the fluent and the nonfluent groups of speakers; there is some difference in the hesitations involving syllables between the two groups of speakers; and there is a significant difference in the hesitations involving words between the two groups of speakers. In general, the hesitations of the nonfluent group of speakers were associated with words, syllables, and phonemes, that were more frequently occurring than the hesitations of the fluent group of speakers.

Considerable discussion has been centered around the functional units of encoding. Maclay and Osgood (1959) and Boomer (1965) have suggested that pauses and other hesitation phenomena might provide some insight as to the nature of the psycholinguistic units of encoding and their selection. Maclay and Osgood (1959) have indicated that the
speaker is operating with units at least as large as the word in encoding, and Boomer (1965) has suggested that the phonemic clause is the unit of encoding. The phonemic clause is defined to be a phonologically marked segment containing one primary stress and ending in a terminal juncture (Trager and Smith, 1951). The data obtained in this study indicated that as the hesitations were analysed according to their association with the linguistic units, the difference between the fluent and nonfluent groups of speakers became greater as the linguistic unit increased in size from phoneme, to syllable, to word. This difference was in terms of the relative frequencies of occurrence of the linguistic units associated with the hesitations. If the above notions concerning the units of encoding are accepted, then these results suggest that as the word unit of encoding is approached, the difference between the fluent group of speakers and the nonfluent group of speakers becomes significant.

These differences between the fluent and the nonfluent groups of speakers might also be interpreted as the result of an initial problem which exists at the phonemic level for the nonfluent speaker, and is magnified at the syllabic level, and still further magnified at the word level, finally creating a significant difference in the behaviour patterns of the hesitations between the two groups of speakers. At the word level, the nonfluent group of speakers experienced hesitations associated with words which were 3 to 9 times more frequent than the hesitations of the fluent group of speakers.

Repetitions of sounds and syllables have been the dysfluent speech behaviour most frequently associated with the stutterer
The present study indicated that there was a significant difference between the fluent and the nonfluent group of speakers on the basis of the relative frequency of occurrence of the words which contained phonemic and syllabic repetitions. The nonfluent group of speakers had repetitions in words which occurred more frequently than the fluent group of speakers. The results of two analyses which were performed on hesitations associated with phonemes indicated that when the relative frequency of occurrence of the phonemes were considered for the dysfluencies of the fluent and nonfluent group of speakers, there was no significant difference between the two groups. When, however, the relative frequency of occurrence of the word which contained the phonemic dysfluency was used in the analysis for the fluent and nonfluent groups of speakers, there was a significant difference noted between the two groups. The nonfluent group of speakers experienced hesitations associated with phonemes in words which occurred with much greater frequency than the words associated with the phonemic hesitations of the group of fluent speakers.

Implications

The difference between the fluent and the nonfluent group of speakers in their hesitation behaviour was small at the phonemic level, larger at the syllabic level, and significantly large (.05 level) at the word level. This may imply that there is a difference in the encoding process of the two groups of speakers at the word level. The practical implications which emerge from this difference at the word
level between the two groups of speakers concern the speech therapist who should consider concentrating on words and larger linguistic units in stuttering therapy, rather than on phonemes and syllables.

**Directions for further research**

It would be of interest to duplicate this study using spontaneous speech samples instead of passages which were read, to determine if the differences observed in this study between the fluent and the non-fluent group of speakers appear as strongly evident. Similar experiments could be conducted using different classifications of dysfluent speech behaviour and alternate methods of analysis. Further study on the relationship between emotional loading and the hesitations associated with frequency of occurrence of words might be considered.

A study might also be attempted to examine the hesitation phenomena which involves units larger than the word, to test if the trend to differences between the two groups of speakers continues to increase as the linguistic unit analysed becomes even larger.
APPENDIX A

PASSAGES READ BY SPEAKERS
After brief exposure to the embassy reception line, one senses that America's relationship with the world community is roughly like that between the rich man and his poor kin. Behind his back they may gossip about him as a "nouveau riche" wanting style and breeding. At the same time they are jostling constantly for special position in his esteem. Thus the British work to maintain the special status of senior partner, while thirteen other Atlantic Treaty nations try to keep the British from acquiring special status. If the British make the atomic bomb, the French must also make it, for it is the membership key to Uncle Sam's most exclusive club. If the Secretary of State has urgent business in London, he must make trips of equal duration to Paris and Bonn or the French and Germans will become suspicious.
All across the South there are signs that racial violence is finding less approval among whites who themselves would never take active part but might once have shown a tolerant attitude toward it. There are many causes for this change. One of the most important is economic. Business leaders are aware now that they suffer greatly from any outbreak of violence. They are putting strong pressure on their police departments to keep order. In the past these same Southerners were inclined to look the other way. And as the businessmen have begun to act, a real sense of co-operation has sprung up. This co-operation has emboldened other Southern whites to add their voices to demands for peaceable accommodation. They realize that by acting in concert, rather than individually, they will not be picked out as objects of retaliation - economic and otherwise.
For another second or two he gave into the annoyance that was directed at himself; then his mind moved on to be confronted by something far more serious, and as the thought expanded, the implications jarred him. It no longer mattered that Burton had outsmarted him. The important thing was that Burton had gone somewhere to meet a blackmailer with a gun in his pocket. And that gun was empty. Even before his mind had rounded out the idea he thrust one hand into his trousers pocket and pulled out the six slugs he had taken from the revolver. He considered them with brooding eyes, brows bunched as his brain grappled with the problem and tried to find some solution.
Of more importance to the West than Poland's boundaries was the character of her government. At Yalta the West still believed that Eastern Europe could be kept in its orbit, in spite of the onrushing Soviet armies. Though little democracy had ever been practised in this region and much of it was still ruled by feudalistic means, it was taken for granted that at least the forms of Western democracy would be established in this area and Western capitalism preserved within it. Believing devoutly as they did in Anglo-Saxon institutions, it was important to both Roosevelt and Churchill that the Poles should have them. The issue was acute because the exiled Polish Government in London, supported in the main by Britain, was still competing with the new Lublin Government formed behind the Red Army.
There was the freshness of color, the freedom of perception, the lack of self-consciousness, but with a twist that made the forms leap from the page and smack you in the eye. We used to kid him by saying he only painted that way because he was so nearsighted. It may have been true for all I know, because his glasses were like the bottoms of milk bottles, but it didn't prevent the paintings from being exciting. He also had, at times, an uncanny absent-minded air like a sleepwalker; he would look right through you while you were talking to him, and if you said, "For Christ's sake, Donald, you've got Prussian blue all over your shirt," he would smile and nod, and an hour later the paint would be all over his pants as well.
The Supreme Court decision in mid-1960 was in a case of a company making sewer pipe from clay which it mined.

The company, in figuring its taxable earnings, deducted a percentage of the revenue it received for its finished products. Such "depletion allowances," in the form of percentages of sales are authorized by tax law for specified raw materials producers using up their assets. The High Court held that the company must apply its percentage allowance to the value of the raw materials removed from the ground, not to the revenue from finished products. A measure passed by Congress just before adjourning softened the ruling's impact on prior-year returns still under review for clay making companies that make brick and tile products. The measure allows such companies in those years to apply their mineral depletion allowances to fifty percent of the value of the finished products rather than the lower value of the raw clay alone.
"He's hurt:" A woman's voice said, and then he heard
a sort of wail from the man's wife. The man on the ground
began to move; one of his hands flattened out on the
pavement and supported him. Blood dripped down the
front of his sweater, soaking into a dark streak of dirt
that ran diagonally across the white wool on his shoulder,
as though the bright V woven into the neckline had
melted, running a darker color. The girl kneeled by her
husband with one arm at his back. "Can you hear, can you
talk to me?" she begged. An incoherent sound came
from the red mouth. The girl looked around quickly at
several of the people. None of the crowd had stepped
forward to help.
To remain secure and prosperous themselves, wealthy nations must extend the kind of co-operation to the less fortunate members that will inspire hope, confidence and progress.

A rich nation can for a time, without noticeable damage to itself, pursue a course of self-indulgence, making its single goal the material ease and comfort of its own citizens - thus repudiating its own spiritual and material stake in a peaceful and prosperous society of nations. But the enmities it will incur, the isolation into which it will descend, and the internal moral and spiritual softness that will be engendered, will, in the long term, bring it to economic and political disaster. America did not become great through softness and self-indulgence.
Fourteen of the sculptures you took possess properties of a most curious and terrifying nature, as you will observe when your limbs begin to wither and your hair falls out in patches. In time, these minor manifestations will multiply and effloresce, riddling you with frambesia, the king's evil, sheep rot, and clonic spasm, until your very existence becomes a burden and you cry out for release. All this, though, is simply a prelude, a curtain-raiser, for what ensues, and I doubt whether any Occidental could accurately forecast it. If, however, it would help to intensify your anguish, I can delimit the powers of a few of the divinities you've affronted and describe the punishment they meted out in one analogous instance.
In the dim underwater light they dressed and straightened up the room, and then they went across the hall to the kitchen. She was intimidated by the stove. He found the pilot light and turned on one of the burners for her. The gas flamed up two inches high. They found the teakettle and put water on to boil and then searched through the icebox. Several sections of a loaf of dark bread; butter; jam; a tiny cake of ice. In their search for what turned out to be the right breakfast china but the wrong table silver, they opened every cupboard door in the kitchen and pantry. While she was settling the teacart, he went back across the hall to their bedroom, opened one of the suitcases, and took out powdered coffee and sugar. She appeared with the teacart and he opened the windows.
APPENDIX B

LOGARITHMIC VALUES OF THE MEDIAN RELATIVE FREQUENCY OF OCCURRENCE ASSOCIATED WITH THE HESITATIONS OF THE TWENTY SPEAKERS.
Table of values for the logarithm of the reciprocal of the median relative frequency of occurrence of hesitations associated with phonemes (using phoneme values).

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Table of values for the logarithm of the reciprocal of the median relative frequency of occurrence of hesitations associated with words (using word values).

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