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GRADUATE COLLEGE

AN EXPERIMENTAL INVESTIGATION OF SPEECH RETENTION AS A FUNCTION OF AUDITORY FORM

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AN EXPERIMENTAL INVESTIGATION OF SPEECH RETENTION

AS A FUNCTION OF AUDITORY FORM

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AN EXPERIMENTAL INVESTIGATION OF SPEECH RETENTION AS A FUNCTION OF AUDITORY FORM

CHAPTER I

THE PROBLEM

Background of the Problem

According to Guilford: "As a rule. material that is easy to learn is also easy to retain."[1] Guilford asserted that "meaningful, logically related material, and poetry are forgotten less rapidly than nonsense material and prose."[2] He presented a figure with four curves to illustrate the retention of four different kinds of materials after specified time intervals.[3]

An interesting feature of the figure is that only one of its four curves was plotted from data. The curve for the retention of nonsense syllables was based on Ebbinghaus's results.[4] The three other curves were all hypothetical; none

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[1] J. Guilford, General Psychology (New York: D. Van Nostrand Co., Inc., 1939), p. 410.

[2] Ibid. [3] Ibid., p. 409.

[4] H. Ebbinghaus, Memory: A Contribution to Experimental Psychology, trans. H. Ruger and C. Bussenius with new introduction by E. Hilgard (New York: Dover Publications, Inc., 1964), pp. 68-75.

was produced from experimental findings.

Ebbinghaus did report that stanzas of Byron's "Don Juan" were more easily learned than series of nonsense syllables of equal length.[5] And other scholars have agreed with Guilford; for example, McGeoch and Irion concurred when they stated: "The conclusion that the use of some rhythm as opposed to none accelerates learning provides one of the reasons why poetry is more easily memorized than prose."[6]

In spite of the general agreement with Guilford's assertion, one must keep in mind that the curves Guilford used to illustrate the retention of prose, poetry, and "substance" were hypothetical. Deese and Hulse made this point clear when they observed:

> It is customary to summarize the variation by saying that highly organized material is more resistant to forgetting than material of a low degree of organization, and such summaries are usually accompanied by curves . . . which are meant to represent a wide variety of empirical data. However, there has been no systematic study of forgetting curves as a function of organization within a single experiment.[7]

It follows that the assertion that poetry is more readily retained than prose has not been supported by systematic experimental study.

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[5] Ibid., p. 51.

[6] J. McGeoch and A. Irion, The Psychology of Human Learning (2d ed. rev.; New York: Longmans, Green and Co., 1952), p. 476.

[7] J. Deese and S. Hulse, The Psychology of Learning (3d ed.; New York: McGraw-Hill Book Co., Inc., 1967), pp. 382-383.

Statement of the Problem

Speakers of English use three auditory forms in their oral communication. The three forms are commonly known as song, poem, and prose. They can be distinguished from one another by the uses to which speakers put them, as well as by their auditory characteristics.

Prose, the most widely used form, is used in a variety of situations from everyday conversation to formal public address. Prose is used whenever the spoken words are not to be retained directly. As Guilford observed: "The substance of a prose passage is retained long after the words in which it was clothed are forgotten."[8] Who, for instance, remembers more than a few phrases after having heard a political speech?

On the other hand, songs and poems are used when learning particular words in sequence is important. For example, songs are used by grade-school teachers to teach the alphabet, and songs and poems are used by advertisers to sell their products. Who will ever forget, "you can take Salem out of the country, but you can't take the country out of Salem" or "Winston tastes good like a cigarette should"?

In spite of the fact that teachers, advertisers, and others use songs and poems with the idea that they are more

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[8]Guilford, op. cit., p. 410.

easily remembered than prose, no one had ever tested to determine if indeed they are. Is an auditory, verbal stimulus more readily retained in song form than in prose form? Is an auditory, verbal stimulus better retained in poem form than in prose form? Is an auditory, verbal stimulus remembered better in song form than in poem form? These were the primary questions which led to the present investigation.

Characteristics of the Auditory Forms

In addition to differing from each other according to the uses to which speakers put them, songs, poems, and prose differ in terms of their auditory characteristics. In particular, they differ from each other on one or more of three basic dimensions; evenness of rhythm pattern, length of presentation time, and extent of acoustic similarity. By comparing and contrasting songs, poems, and prose on these three dimensions, the auditory characteristics of each can be identified.

Seashore defined rhythm as the grouping of auditory stimuli by time and intensity.[9] In other words, rhythm is the " . . . recurrence of a beat, . . . "[10] or "an ordered recurrent alternation of strong and weak elements in the flow

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[9]C. Seashore, Psychology of Music (New York: McGraw-Hill Book Co., Inc., 1938), p. 139.

[10]The American College Dictionary (New York: Random House, 1967), p. 1042.

of sound and silence in speech. . . ."[11] As rhythm applies to the auditory forms of song, poem, and prose, it is the recurrent grouping of syllables and words by time and intensity.

According to Aristotle:

> Prose . . . is to be rhythmical, but not metrical, or it will become not prose but verse. It should not even have too precise a prose rhythm, and therefore should only be rhythmical to a certain extent.[12]

According to Sapir, songs and poems are more rhythmical than prose.[13] The statements by Aristotle and Sapir seem to be consistent with one another and to represent the same position as to a primary difference between the auditory forms.

On the rhythm dimension, then, songs and poems are similar to one another; they both have even rhythm patterns.[14] The syllables and words in songs and poems are grouped in a regular, even manner. And on this dimension, both songs and poems differ from prose. Prose does not have an even rhythm pattern, and its syllables and words are not grouped in a regular, even manner.

Closely related to the rhythm dimension, yet distinct from it, is the dimension of length of presentation

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[11] Webster's Third New International Dictionary of the English Language Unabridged (Springfield, Mass.: G. and C. Merriam Co., 1967), p. 1950.

[12] Aristotle Rhetoric iii. 7. 1408^{b}. 30-32.

[13] E. Sapir, Language (New York: Harcourt, Brace, and World, Inc., 1921), pp. 228-231.

[14] Ibid., p. 229.

time. Length of presentation time is determined by two separate components. The two components are (1) the duration of exposure of items in a sequence and (2) the duration of the interval between exposures of items. The duration of exposure of items is the component of length of presentation time which is of primary importance in distinguishing between the auditory forms.

Vowels and a few consonants are prolonged in songs. They are not, as a rule, prolonged in poems or prose. The result of the prolongation is that a song with words identical to those of a poem generally requires more time for auditory presentation than the poem requires. There is little difference between the total time required for the auditory presentation of a poem and that required for the presentation of a comparable sequence of prose.

The third dimension on which a difference occurs between the three auditory forms is that of acoustic similarity. A number of different devices are used to make auditory, verbal stimuli more or less acoustically similar. Exact repetition, rhyme, alliteration, and assonance are primary devices used for this purpose.

Acoustic similarity is similar to rhythm in that it is produced by a recurrence of items (syllables or words) or sounds (or sound complexes). As with even rhythm patterns, acoustic similarity is used more frequently in the

composition of songs and poems than in the construction of prose.[15]

In addition to presenting a recurrence of similar features, exact repetition reduces the total number of different words in a sequence of a given length. Thus a sequence in which a repetition of words or phrases is present, and is detected by one who attempts to learn and to recall the sequence, is functionally shorter than a sequence in which it does not occur. With respect to exact repetition, the difference between songs and poems on the one hand and prose on the other is mainly one of degree. But generally speaking, songs and poems utilize exact repetition more frequently than prose does, especially in the development of a chorus.

The characteristics of the three auditory forms on the dimensions identified are summarized as follows: Songs have even rhythm patterns, require prolonged time intervals for auditory exposure, and utilize relatively high degrees of acoustic similarity. Poems have even rhythm patterns and utilize relatively high degrees of acoustic similarity, but they do not require prolonged time intervals for auditory presentation. Prose sequences have irregular rhythm patterns, do not require prolonged time intervals for auditory exposure, and rarely utilize acoustic similarity.

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[15] Ibid., pp. 229-230.

If song, poem, and prose as auditory forms were placed on a continuum based upon the characteristics presented, prose form would be located at one end of the continuum and song would be located at the other. Poem form would be located between prose and song, but it would be placed closer to the song end of the continuum than to the prose end since it shares more common features with song form than with prose.

Previous Investigations of the Problem

Although no experiments had been conducted which answered the questions raised in the present investigation, several studies had produced results which suggested the hypotheses tested in the experiment here reported and thus provided a point of departure for it. Selected investigations are categorized and presented under the following headings: (1) temporal grouping, (2) length of presentation time, (3) acoustic similarity, and (4) stimulus length.

Temporal Grouping

Temporal grouping is important to the present study because it is a function of rhythm, and rhythm is a dimension on which songs and poems differ from prose. Ryan investigated the effects of grouping upon retention by using aurally presented serial-learning lists in two short-term-memory experiments.[16] Experiment I in the series investigated

[16] J. Ryan, "Grouping and Short-Term Memory: Different Means and Patterns of Grouping," Quarterly Journal of Experimental Psychology, XXI (1969), 137-147.

the relative effectiveness of temporal grouping, non-temporal grouping, and no grouping. In order to make the test, five conditions were created. These conditions were (1) the ungrouped condition, (2) the non-temporally grouped condition created by interleaving brief pips between appropriate items, (3) the subjectively grouped condition produced by instructing subjects to group stimulus items into groups of three, (4) the non-temporally and subjectively grouped condition produced by pips and instructions, and (5) the temporally grouped condition. Fifty students at Cambridge University served as subjects, with ten each randomly assigned to one or another of the five conditions.

Forty sequences of nine digits each were compiled from a table of random numbers. However, two restrictions were placed on the numbers drawn: no repetitions of any one digit were allowed; and no obvious patterns (e.g., 2, 4, 6, 8) were permitted. The same forty sequences were used in the same order for all conditions except for the ungrouped condition where the forty sequences were supplemented by sixteen additional sequences. Thus a total of fifty-six sequences were used in the ungrouped condition.

For all conditions except the temporally grouped condition, the lists were presented at a uniform rate of one digit every 0.55 seconds. For the temporally grouped condition, the digits were presented at a rate of one digit every 0.45 seconds with a 0.9-second interval between groups of

digits within a single list. All lists required five seconds for auditory presentation, and all intervals between lists were ten seconds in duration. Appropriate instructions were presented for each treatment condition, stimulus lists were presented via tape-recording, and subjects were individually tested using spoken recall.

The results showed that temporally grouped stimuli were more readily retained than either the ungrouped sequences ($p<.002$) or the non-temporally grouped sequences ($p<.02$). Although there were slight differences between the temporally grouped condition and the other conditions with the former resulting in the fewest number of errors, no other significant differences were found. Ryan explained the results of her study by pointing to the reduction in the number of transposition errors which were obtained with the temporally grouped sequences, and she concluded that the temporally grouped stimulus sequences improved recall because the unfilled interval between the clusters of items within a single list permitted more processing and therefore better integration of the numbers prior to the 0.9-second interval. Ryan also suggested that perhaps the pips sounded extraneous to the sequences and were not efficient non-temporal groupers, in which case she conceded that her experiment did not give a fair test to non-temporal grouping.

Experiment II was designed to determine the effectiveness of different patterns of temporal grouping upon

retention. The stimulus sequences used in this experiment were the same as those used in the previous experiment, i.e., randomly selected numbers. Two experimental conditions and one control condition were specified. For the control condition, ungrouped random numbers were used as stimulus items; and for the two experimental conditions, grouped random numbers were employed. In one of the experimental conditions, the random numbers were grouped regularly or evenly; in the other, the random numbers were grouped irregularly or unevenly. The irregularly grouped sequences were grouped temporally into all permutations of the following combinations of clusters: 117, 126, 135, 144, 225, and 234. The regularly grouped sequences were grouped temporally into the combination 333.

The results showed that the following conditions differed significantly ($p<.05$) from the ungrouped condition: 333, 243, 423, and 432. The regularly grouped condition differed significantly ($p<.01$) from the easiest of the irregularly grouped conditions which was the 243 condition. Ryan stated that the decrease in errors could again be accounted for by a decrease in "order errors," or errors made when numbers actually in the list were recalled at incorrect positions within the list, as opposed to a decrease in "item errors," or errors made when numbers not actually in the list were given as responses by subjects or errors made when subjects failed to respond.

The words to a song, poem, or prose passage are likely to place greater demands on an individual's information processing system than the random numbers that Ryan used as stimuli. Her two experiments suggest, however, that auditory, verbal stimuli within which the syllables and words are grouped by a regular rhythm pattern are more readily retained than auditory, verbal stimuli within which the syllables and words are not grouped by a regular rhythm pattern. If the effect Ryan reported occurs in retention as a function of auditory form, then other things equal, songs and poems should be better retained than prose.

Length of Presentation Time

Length of presentation time is the dimension on which songs differ from poems and prose. In songs, vowels and certain consonants are prolonged. As a result, a song with words identical to those of a poem generally requires more time for auditory presentation than a poem. There is little difference between poems and prose on this dimension.

Although no studies had been conducted which examined presentation time in regard to the auditory forms of song, poem, and prose, several studies had been conducted which investigated various aspects of presentation time. Two of those studies are summarized below.

Martin and Schulz investigated the relationship between two conditions of intra-stimulus-response interval

and retention in short-term memory using an aurally presented paired-associate task.[17] In one treatment condition the intra-stimulus-response interval was two seconds in length; and in the other it was six seconds in length. A second variable, pronunciability, was also examined. Trigrams of four different degrees of pronunciability were used as either stimulus or as response terms in eight-pair lists and the numbers two (2) through nine (9) were used as the corresponding terms. For example, when the trigrams were used as stimulus terms, the numbers were used as response terms; and when the numbers were used as stimulus terms, the trigrams were used as response terms.

The procedure employed was to present the lists for fifteen study and fifteen test trials alternately. During the study trials, the two and six second intra-stimulus-response intervals were maintained; but during the test trials, all subjects were given two seconds within which to respond.

The results suggested that easy pronunciability plays a positive role in performance and that it facilitates retention more when the trigrams are used as response terms than when they are used as stimulus terms. The results also indicated that the longer intra-stimulus-response interval

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[17] E. Martin and R. Schulz, "Aural Paired-Associate Learning: Pronunciability and the Interval between Stimulus and Response," Journal of Verbal Learning and Verbal Behavior, I (1963), 389-391.

produces superior performance to the shorter interval ($p < .05$). However, since the interaction effect was not statistically significant, rehearsal of stimuli and responses by subjects could not be suggested to account for the superior performance observed under the six second intra-stimulus-response condition.

In a second study, Bugelski investigated the relationship between item presentation time during a single learning trial and total learning time.[18] Using a short-term-memory design with a visually presented paired-associate task, Bugelski exposed each stimulus item for a fixed time of two seconds and varied the presentation time for response items, which he exposed for two, four, six, eight, or fifteen additional seconds each. The stimulus items remained visible while their corresponding response items were exposed. Eight pairs of trigrams were selected for presentation in three different orders. Two successful anticipations of response items when appropriate stimulus items were presented was established as the criterion used to indicate successful completion of the task.

An analysis of variance conducted on the data obtained indicated that there was no significant difference in total learning time between any of the five conditions of response-

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[18] B. Bugelski, "Presentation Time, Total Time, and Mediation in Paired-Associate Learning," Journal of Experimental Psychology, LXIII (1962), 409-412.

term presentation. However, a striking difference was found in the number of trials to criterion between the longest and the shortest presentation times (3.3 trials versus 10.2 trials respectively). Bugelski concluded that presentation time multiplied by the number of trials required to reach the criterion established equals a constant. According to Kausler, analytical investigations since the Bugelski study have provided further generalization for Bugelski's findings.[19]

From the two studies of presentation time reported, the conclusion could be drawn that additional presentation time facilitates recall.[20] If the effect observed in these two experiments is obtained in retention as a function of auditory form, then songs, since they require extended durations of exposure, should produce superior recall to that for poems and prose.

Acoustic Similarity

Acoustic similarity is a dimension on which songs and poems differ from prose. It is similar to rhythm in that acoustic similarity is produced by the recurrence of an item or sound as rhythm is produced by the recurrence of a beat.

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[19] D. Kausler, Readings in Verbal Learning (New York: John Wiley and Sons, Inc., 1966), p. 140.

[20] See also G. Keppel and R. Rehula, "Rate of Presentation in Serial Learning," Journal of Experimental Psychology, LXIX (1965), 121-125.

Examples of devices used to produce acoustic similarity include exact repetition, rhyme, alliteration, and assonance. These devices which have the potential of grouping syllables and words within a sequence are used more frequently in the composition of songs and poems than in the construction of prose. Although acoustic similarity had not been studied experimentally to determine its effects, if any, on retention in the context of the auditory forms, acoustic similarity had received attention in verbal-learning experiments.

Baddeley investigated acoustic similarity in a study of long-term memory using serial-learning lists.[21] List A was comprised of ten acoustically similar words while List B, the control list, was composed of ten acoustically dissimilar words of equal frequency of occurrence according to the Thorndike-Lorge norms. The words were presented via tape-recording at a three-second rate for four trials with recall tests following each trial. Retesting was conducted after the subjects had spent twenty minutes working on an irrelevant task. The retest, as well as the tests during the learning phase of the experiment, measured recall of the order of the words only, and not the recall of the words themselves; the words were visually available during the entire experiment. However, caution was taken to prevent

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[21]A. Baddeley, "The Influence of Acoustic and Semantic Similarity on Long-Term Memory for Word Sequences," Quarterly Journal of Experimental Psychology, XVIII (1966), 302-309.

the order of the words presented visually from being used as a cue to the order of the words in the auditory sequence.

The acoustically similar list resulted in significantly inferior learning ($p < .05$) when compared to the acoustically dissimilar list. But whereas significant forgetting occurred following the learning phase with the control list ($p < .01$), no forgetting occurred with the acoustically similar list. The difference between the two forgetting rates was significant ($p < .05$).

Baddeley, interpreting his findings to indicate that short-term memory interacted with long-term memory to produce the results he reported, developed a technique to eliminate short-term memory as a contaminating source of variance. The technique was based on the use of an irrelevant task between presentation and testing in the learning phase of the experiment identical to the one introduced between the learning phase and the retesting.

Finally Baddeley introduced the lists visually in an experiment which included the short-term-memory-control technique. In other respects the design was exactly like the first experiment. This time, the results indicated no significant differences between the experimental condition and the control condition in either the learning or the retesting phases, except at trial two where the control list was superior ($p < .05$). By trial four, however, the acoustically similar list was slightly, but not significantly, superior.

From these experiments, the conclusion could be drawn that acoustic similarity is ineffective and not a potent source of variance in the retention of verbal materials. However, two features of Baddeley's experiments deserve further attention. (1) All of the words in the acoustically similar list were acoustically similar to a number of other words in the list. For example, all of the words had the same vowel sound, and five began with the phoneme [m]. Three of the pairs were composed of words which rhymed. On top of this, there was no pattern established for the similarity. If the similarity had occurred as it does in songs and poems with perhaps alliteration within the lines and rhyme between the last words of lines, significant differences might have been found. (2) Only order recall was tested, not recall of the words. Conceivably, rhyme as used in songs and poems could serve as an additional cue for the recall of words. Thus, available evidence was inconclusive for the purposes of the present investigation.

Baddeley's study did point up another factor which had to be taken into account in the design of the present investigation. The number of presentations of the stimulus could well prove to be a potent source of variance in retention as a function of auditory form. From the results Baddeley reported, the inference was made that differences between the auditory forms would indeed be altered by additional presentations beyond the initial presentation of the

stimulus sequences. Yet, the direction of change was not altogether clear.

Acoustic similarity in the form of exact repetitions of syllables and words has the additional effect of reducing the total number of different items in a verbal sequence of a given length. As a result of reducing the number of different items in a sequence, exact repetition has the potential of reducing the functional length of a stimulus sequence. Since songs and poems utilize exact repetition more frequently than prose, especially in the development of a chorus, stimulus length is potentially an important factor in predicting retention as a function of auditory form.

Stimulus Length

Gerver investigated the effect of stimulus length on retention in a study of short-term memory using serial-learning, verbal stimuli.[22] Although the study investigated two other variables, level of grammaticalness and presentation rate, stimulus length was the variable of major concern to the present investigation. The stimulus sequences, which were presented at two levels of presentation rate, were three to nine words in length and were presented aurally via tape-recording.

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[22]D. Gerver, "Effects of Grammaticalness, Presentation Rate, and Message Length on Auditory Short-Term Memory," Quarterly Journal of Experimental Psychology, XXI (1969), 203-208.

An analysis of variance was conducted on the data gathered in the experiment. It revealed that the shorter stimulus sequences produced retention scores which were significantly superior to those for the longer stimuli at both the faster ($p < .001$) and the slower ($p < .01$) presentation rates. In addition, the analysis of the data supported the conclusion reported previously regarding the effect of length of presentation time on retention.

The results of Gerver's study suggest that songs and poems are more readily retained than prose. A song or poem has more repetitions than a comparable sequence of prose, thus a song or poem presents a functionally shorter stimulus sequence than that of prose. And Gerver's investigation clearly demonstrated that shorter stimuli are more readily retained than longer ones.

The Hypotheses

On the basis of the studies reviewed, speech with the following characteristics would be predicted to be more easily remembered than speech with alternative characteristics: (1) speech that is grouped regularly or evenly by rhythm, (2) speech that is presented for an extended duration of exposure, and (3) speech that has fewer different words to be remembered. No clear predictions could be made with respect to acoustic similarity, except for exact repetition.

Songs, poems, and prose differ from each other in terms of their auditory characteristics. In particular,

they differ from each other on the dimensions predicted to characterize speech that is relatively easier to remember.

Hypotheses relating the three auditory forms were derived from the experimental findings reviewed. These hypotheses seemed tenable and deserved further exploration in an experimental investigation of speech retention as a function of auditory form.

The experiment conducted was designed to test the following hypotheses:

(1) Speech in song form is more readily recalled than speech in prose form.

(2) Speech in song form is more readily recalled than speech in poem form.

(3) Speech in poem form is more readily recalled than speech in prose form.

(4) The differential effects of the three auditory forms are altered by additional presentations beyond the initial presentation of the stimulus sequences. In short, an interaction of auditory form with number of presentations was predicted.

CHAPTER II

THE METHOD

Experimental Design

To test the hypotheses stated in the concluding section of the previous chapter, a 3 X 2 factorial design was generated. The factors in the present study were auditory form and number of presentations. The three levels of auditory form were song, poem, and prose, and the two levels of presentation were one and three presentations of a stimulus sequence.

Analysis of variance was specified as the primary statistical tool to be used to test the data for significant differences. It was chosen because it is robust with respect to violations of the requirements for homogeneity of variance and normal distribution of error.[23] Individual comparisons between song-poem and prose and between song and poem were to be made using orthogonal comparisons; additional individual comparisons required by the experimental hypotheses were to be made using the Newman-Keuls procedure.

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[23]W. Hays, Statistics for Psychologists (New York: Holt, Rinehart and Winston, 1963), p. 408.

Stimulus Sequences

Stimulus sequences for the experimental investigation of speech retention as a function of auditory form consisted of song, poem, and prose. The procedures for selection, development, and preparation of stimuli are the subjects of the following paragraphs.

Selection and Development of Stimuli

Stimuli were selected and developed in the following manner: First a song was selected which met two primary requirements. The requirements were (1) that the song's lyrics contain a number of items which could be tested for recall and (2) that its lyrics be unfamiliar to the subjects. The first requirement insured that an adequate recall test could be constructed from the song, and the second prevented a contamination of results. After due consideration, the song "Sons Of" from the musical Jacques Brel Is Alive and Well and Living in Paris was selected.[24]

Second, the poem form of the stimulus sequence was developed from the song by deleting the song's melody. Thus the words to the poem were identical to those to the song. The difference between the song and the poem was that the

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[24] J. Brel, "Sons Of," English lyric to the French composition entitled "Fils De," English lyrics by E. Blau and M. Shuman, music by G. Jouannest (New York: Hill and Range Songs, Inc., 1968).

song had both a set melody and a fixed rhythm while the poem had only a fixed rhythm pattern.

Third, the prose sequence was developed from the poem primarily by breaking the poem's rhyme pattern and by altering its rhythm pattern.[25] The rhyme was broken by substituting a word of equal frequency of occurrence for one of the words in each rhyming pair.[26] The rhythm pattern was altered by contracting words where feasible to make the sequence sound more like conversational speech, by adding words necessary to construct complete English sentences, and by inserting a phrase associated with speechmaking to replace the four remaining words of the chorus. Thus, not only was the rhythm altered, but the repetition of the chorus was deleted.[27]

Throughout the process of development of stimuli, the length of the three forms was kept constant, and an attempt was made to keep levels of difficulty and meaningfulness constant. All three forms when developed contained the same number of words; and the key words, which were to become test items, were either identical or of equal frequency of occurrence.

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[25]It was necessary to reverse the order for the prose sequence of certain lines in the poem; and two alliterative words were deleted.

[26]The Thorndike-Lorge listings were used to determine frequency of occurrence. See E. Thorndike and I. Lorge, The Teacher's Word Book of 30,000 Words (New York: Bureau of Publications, Teachers College, Columbia University, 1944).

[27]See Appendix B for a copy of the stimuli used in the experiment.

Preparation of Stimuli

When the stimuli had been selected and developed, they were prepared for auditory presentation. The preparation amounted to tape-recording the song, poem, and prose sequences. For the recordings, the sequences were read aloud or sung, as was appropriate, by a male college professor who was an experienced public speaker, oral interpreter, and singer.

As an added measure of security in preventing the even rhythm pattern of the poem from creeping into the prose sequence and contaminating it, the prose sequence was recorded before the speaker was exposed to or read the poem version or the song from which the poem was derived. Similarly, to prevent contamination from the song's melody, the poem was recorded before the song version.

The recordings, which were accomplished in one of the music department's recording studios at California State College, Hayward, were made using the following recording equipment: an Altec 639-B microphone, an Altec 250-SU mixer (or control board), an Ampex AG-350-2 recorder, and Scotch Brand 201 recording tape. In addition, a seven-foot Steinway and Sons grand piano was played by an advanced student of piano to provide the accompaniment for the song. The stimuli were recorded at a tape speed of seven and a half inches per second; the recordings were two-track monaural.

Three second-order recordings were made from each original on an Ampex PR-10 semi-high-speed duplicator. The duplicator consisted of a master and three slave units; so all three second-order recordings were made simultaneously. The re-recordings were accomplished at a tape speed of fifteen inches per second, assuring high quality reproductions. For the second-order recordings, Scotch Brand 201 recording tape was again used.

The second-order recordings were clipped and then spliced together with Scotch Brand splicing tape such that three recordings of the song were on one reel, three recordings of the poem were on a second reel, and three recordings of the prose piece were on a third reel. The three recordings on each reel were separated from each other by twenty-two and a half inches of blank tape. The blank tape provided space to stop and start the playback unit before and after each presentation of a stimulus sequence.

After the sequences had been recorded, each was timed. One presentation of the prose required twenty-one and a half seconds; one presentation of the poem required twenty-seven seconds; and one presentation of the song required fifty-two seconds.

Subjects

The factorial design employed in the experiment reported here necessitated the use of six groups (N = 30) of

subjects. The number of subjects assigned to each of the six groups was set at thirty since population statistics based on large random samples approach being distributed normally.[28] In all, one-hundred-eighty subjects were required to conduct the experiment.

All of the subjects who participated in the experiment were students recruited from speech classes at California State College, Hayward, during the winter and spring quarters of 1971. Participation in the experiment was one of several ways students could earn bonus points for the speech class in which they were enrolled. Ninety of the students who volunteered to participate in the experiment were males and ninety were females. Their ages ranged from seventeen to fifty-five years, with a mean age of twenty-two and one-half. All subjects were naive with respect to the specific hypotheses under investigation.

Experimental Procedures

Subjects were assigned to groups in the following manner: The first subject tested was assigned randomly to one of the six groups. The following subjects were assigned systematically to groups as they arrived at the experimental station. The systematic assignment proceeded in numerical order through the six groups until thirty subjects had been

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[28] H. Walker and J. Lev, Statistical Inference (New York: Holt, Rinehart and Winston, 1953), p. 143.

assigned to each. Each subject was individually tested.

Once a subject was assigned to a group, he was given instructions appropriate to the task he was to perform.[29] The instructions were presented both visually and aurally. This was accomplished by providing a written copy of the instructions for the subject while the experimenter read them aloud to him. The subject's copy was available to him throughout the experiment for reference in the event that he forgot what he was to do next.

Stimuli were presented via the tape-recordings described previously. Following each presentation of a stimulus sequence, an irrelevant task was introduced to diminish the effects of short-term-memory traces. The irrelevant task required the subject to count backwards from the number two hundred (200) until he was stopped by the experimenter. The subject was instructed to count at a rate of approximately one number per second. The irrelevant task consumed two minutes each time it was employed.

Following the final introduction of the irrelevant task, a recall test was administered to the subject. The test consisted of the stimulus sequence photolithographed on Speech Department letterhead stationery. Twelve words were deleted from each form of the sequence, and in place of each deleted word was a blank 2.15 centimeters long. The same

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[29] See Appendix A for a copy of the experimental instructions presented to subjects.

words or their equivalents in frequency of occurrence were deleted from each form. The subject was given one minute to complete the test sequence.[30]

When the test period ended, the subject was asked to complete a personal data questionnaire. Of the seven items contained in the questionnaire, the one of primary concern was designed to determine if the subject had been previously exposed to the song from which all three stimulus sequences were derived. If a subject had been exposed to the song, his data were not entered in the data file, and the next subject was assigned to the same treatment condition.[31] In all, the data from four subjects had to be discarded because the subjects had been previously exposed to the song form of the stimulus.

Experimental Environment

The experimental space was a music rehearsal studio which had been converted into a faculty office. It was twelve feet long by ten feet wide and nine feet high. Acoustic tile had been installed to control sound volume. The facility was furnished with desk, chairs, table, and bookshelf.

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[30] See Appendix C for a copy of the recall tests used in the experiment.

[31] See Appendix D for a copy of the personal data questionnaire used. The questionnaire was supplemented by conversation.

During experimental sessions, the subject was seated at the desk, and the experimenter was seated across the room from the subject where a tape-recorder was stationed. The recorder, an Ampex 2000 Series unit, was used as the playback unit for the presentation of stimuli. Both subject and experimenter were seated on comfortable office chairs.

Scoring of Tests

The recall tests used in the experiment were scored in the following manner: Each word correctly recalled and entered in the appropriate blank added two points to the subject's total score. Each word correctly recalled but entered in an inappropriate blank added one point to the subject's total score. No response or extra-task words added zero points to the subject's score.

Since there were twelve blanks in each test, the maximum score for any one subject on any of the tests was twenty-four points.

CHAPTER III

THE RESULTS

Preliminary Procedures

This chapter presents the results of the experiment conducted to investigate retention as a function of auditory form. The organization of the report of results is as follows: (1) The analysis of variance conducted on the data is summarized. (2) The orthogonal comparisons planned before the data were gathered are presented. (3) The analysis employing the Newman-Keuls procedure is reported. And (4) the experimental hypotheses are reviewed and evaluated in light of the findings from the experiment.

Preliminary to the analysis of variance, the recall tests used to measure retention in the experiment were scored, sorted into the six cells and arranged according to the 3 X 2 factorial design, and ordered within the cells for computational convenience. The scores recorded are presented in descending order in Table 1.

Since no prior knowledge was available regarding the effects of the treatment conditions upon within-cell variance, it seemed appropriate to test for homogeneity of variance as a preliminary test on the model underlying analysis of

TABLE 1

ORDERED RECALL TEST SCORES

	One Presentation			Three Presentations		
	Prose	Poem	Song	Prose	Poem	Song
(1)	14	15	20	22	22	24
(2)	14	15	16	20	18	24
(3)	12	14	16	18	17	24
(4)	12	11	15	18	17	24
(5)	12	11	14	16	17	24
(6)	12	11	14	16	16	23
(7)	12	11	14	15	16	23
(8)	11	10	14	15	14	22
(9)	10	10	14	14	14	21
(10)	10	9	14	14	14	21
(11)	10	9	14	14	14	20
(12)	10	9	14	13	14	20
(13)	9	9	13	13	14	19
(14)	9	9	13	12	13	19
(15)	9	9	13	12	13	18
(16)	8	9	12	12	13	18
(17)	8	8	12	12	12	18
(18)	8	8	12	12	12	18
(19)	7	8	12	12	12	17
(20)	7	7	12	12	12	17
(21)	7	7	11	11	12	17
(22)	6	6	11	9	10	17
(23)	5	6	10	9	10	16
(24)	5	6	10	9	10	16
(25)	4	6	10	8	10	14
(26)	4	5	9	7	10	14
(27)	4	5	9	7	9	14
(28)	4	4	8	6	7	12
(29)	4	4	8	5	5	10
(30)	2	4	8	3	2	9
ΣX	= 249	255	372	366	379	553

variance. But since the F test is robust with respect to departures from homogeneity of variance, a highly sensitive test was unnecessary. As Winer observed: "The experimenter need be concerned about only relatively large departures from the hypothesis of equal population variances."[32] Winer suggests Hartley's F_{max} test as "a relatively simple, but adequate, test" for homogeneity of variance.[33] The computational formula employed for this test is as follows:

$$F_{max} = SS(largest)/SS(smallest)^{34}$$

Sums of squares could be used instead of mean squares because the number of observations in each cell was equal. Table 2 presents within-cell sums of squares for each of the six cells.

Substituting the variances from Table 2 into the formula, one obtains $F_{max} = 558.8/215.2 = 2.60$. The critical value for a .05-level test is $F_{.95}(6,29) = 2.91$.[35] Since the F_{max} statistic derived from the data does not exceed the critical value specified, the hypothesis of homogeneity of variance seems tenable.

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[32] B. Winer, Statistical Principles in Experimental Design (New York: McGraw-Hill Book Co., Inc., 1962), p. 93.

[33] Ibid. [34] Formula from ibid., p. 240.

[35] Ibid., p. 653.

TABLE 2

SUMS OF SQUARES FOR WITHIN-CELL VARIANCE

	One Presentation	Three Presentations
Prose	318.3	558.8
Poem	261.5	461.0
Song	215.2	509.4

The Analysis of Variance

An analysis of variance (fixed-factors model) was conducted on the data gathered and presented in Table 1. The results are summarized in Table 3. Formulae for the analysis were derived from Dahlke's integrated treatment.[36]

The analysis revealed significant differences associated with both main effects. The critical values in respect to form, (F-1), and to number of presentations, (P-1), for .01-level tests are $F_{.99}(2,174) = 4.75$ and $F_{.99}(1,174) = 6.81$ respectively.[37] Since the observed F ratios for the main effects were well beyond the appropriate critical values specified, the null hypothesis was rejected in respect to them.

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[36] A. Dahlke, "An Integrated Approach to the Analysis of Variance" (mimeographed paper, Department of Psychology, The University of Oklahoma, 1966).

[37] H. Arkin and R. Colton, Tables for Statisticians (2d ed.; New York: Barnes and Noble, Inc., 1963), p. 125.

TABLE 3

SUMMARY OF THE ANALYSIS OF VARIANCE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F Ratio
(F-1)	1006.344	2	503.172	37.67
(P-1)	989.355	1	989.355	74.07
FP(R-1)	2324.133	174	13.357	--
(F-1)(P-1)	41.079	2	20.540	1.54

No significant interaction effect was found. The critical value for a .05-level test for the interaction of form with number of presentations, (F-1)(P-1), is $F_{.95}(2, 174) = 3.06$.[38] Since the F ratio observed did not reach this specified level, the null hypothesis was retained in respect to the interaction.

Since no interaction effect was found, no tests for significance due to simple main effects were conducted. And totals summed over replications and levels of presentation were regarded to be the best estimates of effects associated with auditory form.

Orthogonal Comparisons

Only two independent comparisons of the three auditory forms were possible. The number of comparisons which

[38] Ibid.

are independent of each other and of the grand mean for any factor (or variable) in an experiment is equal to the degrees of freedom associated with the main effects for the factor in the analysis of variance.[39]

Although only two independent comparisons were possible for the factor of auditory form, three different sets of such comparisons were available; and a decision had to be made prior to data collection as to which set of orthogonals to use. The logical choice seemed to be to compare song-poem to prose and to compare song to poem. This choice seemed to be the logical choice because the characteristics of poem form seemed more similar to song than to prose.

The results of the orthogonal comparisons are summarized in Table 4. Formulae for the two comparisons are from Winer.[40] Comparison A compares song-poem to prose and uses the following weighted sums: (1)(ΣX for song) + (1)(ΣX for poem) + (-2)(ΣX for prose). And Comparison B compares song to poem and employs the following weighted sums: (1)(ΣX for song) + (-1)(ΣX for poem) + (0)(ΣX for prose). Since each comparison has one degree of freedom, sums of squares equal mean squares and the table is appropriately shortened in appearance. The error term used as the denominator in calculating the F ratios was the same as

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[39]Hays, op. cit., p. 473.

[40]Winer, op. cit., p. 209.

that used in calculating F ratios for the over-all analysis of variance.

TABLE 4

SUMMARY OF THE ORTHOGONAL COMPARISONS

Comparison	Mean Square	F Ratio
A	300.669	22.51
B	705.675	52.83

Significant differences were found to be associated with both orthogonal comparisons. The critical value for a .01-level test in each case was $F_{.99}(1,174) = 6.81$.[41] The observed F ratios were well beyond the critical value specified.

Analysis Using the Newman-Keuls Procedure

Since the over-all F value for form (F = 37.67) was significant, application of the Newman-Keuls procedure was in order. The Newman-Keuls procedure can be used to make comparisons of all pairs of ordered means within a logical grouping.[42] Again, totals for the three auditory forms summed over both replications and levels of presentation were used for the computations.

[41] Arkin and Colton, loc. cit.

[42] Winer, op. cit., p. 210.

The results of the analysis using the Newman-Keuls procedure are summarized in Table 5. Formulae for the q_r statistic used in this procedure are from Winer.[43]

TABLE 5

SUMMARY OF ANALYSIS USING THE NEWMAN-KEULS PROCEDURE

Comparison	Difference	q_r
Song-Prose	310	10.95
Poem-Prose	19	.67
Song-Poem	291	10.28

The analysis using the Newman-Keuls procedure revealed significant differences between song and prose and between song and poem. Song form produced higher retention scores than either poem form or prose form. The critical value for a .01-level test of the comparison between song and prose is $q_{.99}(3,174) = 4.20$. The critical value for a .01-level test of the comparison between song and poem and of the comparison between poem and prose is $q_{.99}(2,174) = 3.70$. And the critical value for a .05-level test of the comparison between poem and prose is $q_{.95}(2,174) = 2.80$.[44] The difference for the comparison between poem and prose was not significant.

[43] Ibid., pp. 77, 211.

[44] The critical values for the q_r statistic are from ibid., p. 649.

Evaluation of Experimental Hypotheses

What remains to complete the report of results is a critical examination of the experimental hypotheses presented in the concluding section of the first chapter. For this examination, the hypotheses are reviewed and evaluated in light of the findings from the experiment.

Hypothesis (1) stated that speech in song form is more readily recalled than speech in prose form. Data from the experiment analyzed using the Newman-Keuls procedure are interpreted to support this hypothesis. The sum of the scores for the song form was superior to that for the prose form; and the difference was significant well beyond the .01 level of confidence.

Hypothesis (2) stated that speech in song form is more readily recalled than speech in poem form. Data from the experiment analyzed using orthogonal comparisons and using the Newman-Keuls procedure resulted in significant differences which are interpreted to support this hypothesis. The significant differences were well beyond the .01 level of confidence.

Hypothesis (3) stated that speech in poem form is more readily recalled than speech in prose form. Results from the experiment cannot be interpreted to support this hypothesis. No significant difference was found between the recall-test scores for the poem and those for the prose.

Finally, hypothesis (4) stated that the differential effects of the three auditory forms are altered by additional presentations beyond the initial presentation of the stimulus sequences. The experiment failed to produce results which can be interpreted to support this hypothesis. The analysis of variance resulted in an F ratio for the interaction of auditory form with number of presentations which was not different from what would be expected by chance.

CHAPTER IV

CONCLUSIONS AND SUMMARY

Conclusions

The experiment, conducted to investigate retention as a function of auditory form, clearly demonstrated that the song was easier to recall than either the poem or the prose. It failed to demonstrate that the poem was easier to recall than the prose, however. And it failed to demonstrate an interaction of auditory form with number of presentations. In the following paragraphs, an attempt is made to account for these findings.

First, the results obtained do not differ greatly from what one would expect from a direct generalization of Bugelski's principle " . . . that Presentation Time multiplied by Trials . . . equals a constant."[45] From an inspection of the data, a close relationship between presentation time and recall-test scores becomes apparent. Three presentations of the poem or the prose required approximately the same duration of exposure as one presentation of the song; and the totals of the recall-test scores for three

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[45]Kausler, loc. cit.

presentations of the poem or the prose did not differ greatly from those for one presentation of the song.

Second, the even rhythm pattern associated with the song and the poem does not appear to have been a potent source of variance since the poem was not recalled any more readily than the prose. Perhaps its effect was confounded by the selection of subjects. All subjects were college students; and college students are practiced at listening to and recalling prose sequences presented as class lectures. As a general rule, they are not so practiced at listening to and recalling poems. Any potentially positive effect of the even rhythm pattern on retention could, as a result, have been offset by a practice effect. Replication of the experiment with subjects of a lower degree of auditory literacy is needed.

Third, the auditory similarity associated with the song and the poem does not appear to have been a potent source of variance either. Auditory similarity occurs in songs and poems through the use of such devices as exact repetition, rhyme, alliteration, and assonance. Since the recall for the poem was not essentially different from that for the prose, auditory similarity cannot be interpreted to have have been a potent source of variance in the over-all recall of the stimuli. Perhaps this accounts for the lack of an interaction effect.

Fourth, the functionally shorter length of the song and the poem might not have been actualized. The last two lines of the song and the poem were formed by repetition of two previous lines from the sequences. If the subject failed to note the repetition of the lines, the sequences would appear to contain more items to recall, not fewer. And the recall task would appear correspondingly more difficult.

Finally, the recall-test instrument itself might have obscured the results somewhat. In the construction of the tests used to measure recall, the last two lines of the song and the poem which were formed by repetition of previous lines were deleted to prevent their "giving away" the items where they occurred previously. In place of the deleted lines, an ellipsis was inserted appropriately on each test. The result was that the recall test for the prose provided a larger number of the words which formed the context for the test items. By providing less of the context, perhaps the recall tests for the song and the poem could have proved more difficult than that for the prose.

The results of the experiment are interpreted, then, to provide further generalization for Bugelski's principle. Length of presentation time appears to have been the most potent source of variance in the experiment. While other sources of variance cannot be ruled out completely, they appear to have played much smaller roles in affecting retention as a function of auditory form than length of presentation

time. However, before final conclusions are drawn and potential sources of variance are relegated to minor positions, further research is needed.

Summary

Three auditory forms used in English are prose, poem, and song. These three auditory forms are distinguished from each other by the uses to which speakers put them, as well as by their characteristics on three basic dimensions. These dimensions are evenness of rhythm pattern, length of presentation time, and extent of acoustic similarity. A rationale was developed to permit the formulation of experimental hypotheses which seemed tenable and deserved further exploration in an experimental investigation of speech retention as a function of auditory form.

An experiment was designed and conducted to test the four hypotheses which were subsequently derived. It was hypothesized that (1) speech in song form is more readily recalled than speech in prose form, (2) speech in song form is more readily recalled than speech in poem form, (3) speech in poem form is more readily recalled than speech in prose form. In addition, it was hypothesized that the differential effects of the three auditory forms are altered by additional presentations beyond the initial presentation of the stimulus sequences.

To test the hypotheses, a 3 X 2 factorial design was generated, statistical procedures to be used in analyzing the data were specified, stimulus sequences were selected, developed, and prepared for auditory presentation, and one-hundred-eighty subjects were selected and assigned to treatment conditions. Appropriate instructions were prepared for each auditory-form-by-number-of-presentations condition. Subjects were individually tested using written recall.

The data collected in the experiment were scored and sorted into the six cells of the 3 X 2 factorial design. They were analyzed using analysis of variance, orthogonal comparisons, and the Newman-Keuls procedure. The results clearly demonstrated that the song was easier to recall than either the poem or the prose. They failed to demonstrate that the poem was easier to recall than the prose, however. They failed, also, to demonstrate an interaction effect.

The results were interpreted as providing further generalization for Bugelski's principle. Other sources of variance were suggested to have played lesser roles in producing the results. Finally, the need for further research was indicated.

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APPENDIX A

EXPERIMENTAL INSTRUCTIONS

Purpose

This experiment was designed to measure the effects which three forms of oral communication have on the retention of the contents of the communication. Shortly, you will hear a tape-recorded communication in one of the three forms under investigation. It will be in the form of a speech.

In no way do the procedures used attempt to measure aspects of your personality, character, or intelligence. They simply determine in which of the three forms the communication is most easily remembered.

Thank you for your participation in this experiment.

Purpose

This experiment was designed to measure the effects which three forms of oral communication have on the retention of the contents of the communication. Shortly, you will hear a tape-recorded communication in one of the three forms under investigation. It will be in the form of a poem.

In no way do the procedures used attempt to measure aspects of your personality, character, or intelligence. They simply determine in which of the three forms the communication is most easily remembered.

Thank you for your participation in this experiment.

Purpose

This experiment was designed to measure the effects which three forms of oral communication have on the retention of the contents of the communication. Shortly, you will hear a tape-recorded communication in one of the three forms under investigation. It will be in the form of a song.

In no way do the procedures used attempt to measure aspects of your personality, character, or intelligence. They simply determine in which of the three forms the communication is most easily remembered.

Thank you for your participation in this experiment.

Procedure

1. A tape-recorded communication will be presented.
2. At the conclusion of the communication, the experimenter will stop the equipment.
3. Use the stopping of the equipment as a cue to count backward from the number two hundred (200). Pace yourself so that you say approximately one number per second.
4. At the end of two minutes, the experimenter will stop you and give you a test on the contents of the tape-recorded communication.
5. Read the test instructions and complete the test.

Procedure

1. A tape-recorded communication will be presented.
2. At the conclusion of the communication, the experimenter will stop the equipment.
3. Use the stopping of the equipment as a cue to count backward from the number two hundred (200). Pace yourself so that you say approximately one number per second.
4. At the end of two minutes, the experimenter will stop you and play the recorded communication a second time.
5. At the conclusion of the communication, the experimenter will stop the equipment.
6. Use the stopping of the equipment as a cue to count backward from the number two hundred (200) as you did before. Pace yourself so that you say approximately one number per second.
7. At the end of two minutes, the experimenter will stop you and play the recorded communication a third time.

8. At the conclusion of the communication, the experimenter will stop the equipment.

9. Use the stopping of the equipment as a cue to count backward from the number two hundred (200) as you did twice before. Pace yourself so that you say approximately one number per second.

10. At the end of two minutes, the experimenter will stop you and give you a test on the contents of the tape-recorded communication.

11. Read the test instructions and complete the test.

APPENDIX B

EXPERIMENTAL STIMULI

Prose

Who's the child with no complaint? Maybe he's the son of a thief, or perhaps he's the son of a clerk? In the final analysis, all children are really like yours--even those who are sons of the great or sons unknown. After all, they share the same smiles, the same tears, and cries at night.

Poem and Song[46]

Sons of the thief, sons of the saint,
Who is the child with no complaint?
Sons of the great, or sons unknown,
All were children like your own.
The same sweet smiles, the same sad tears,
The cries at night, the nightmare fears;
Sons of the great or sons unknown,
All were children like your own.

---

[46]Brel, loc. cit. Copyright © 1968 by Hill and Range Songs, Inc. Used by Permission.

APPENDIX C

RECALL TESTS

Prose

Instructions: Write the words missing from the speech in the appropriate blanks below.

Who's the _____ with no _____? Maybe he's the son of a _____, or perhaps he's the son of a _____? In the final analysis, all _____ are really like _____--even those who are sons of the _____ or sons _____. After all, they share the same _____, the same _____, and _____ at _____.

Poem

Instructions: Write the words missing from the poem in the appropriate blanks below.

Sons of the _____, sons of the _____,
Who is the _____ with no _____?
Sons of the _____ or sons _____,
All were _____ like _____ own.
The same sweet _____, the same sad _____,
The _____ at _____, the nightmare fears. . . .

Song

Instructions: Write the words missing from the song in the appropriate blanks below.

Sons of the _____, sons of the _____,

Who is the _____ with no _____?

Sons of the _____ or sons _____,

All were _____ like _____ own.

The same sweet _____, the same sad _____,

The _____ at _____, the nightmare fears. . . .

APPENDIX D

PERSONAL DATA QUESTIONNAIRE

Name (optional): _____

Age: _____

Sex: _____

Classification: _____

Major: _____

Grade Point Average: _____

Have you ever seen the play *Jacques Brel Is Alive and Well and Living in Paris*?

_____ Yes

_____ No