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THE EFFECT OF LEVELS OF PROCESSING ON RETENTION OF WORD MEANINGS

BY

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Running head: EFFECT OF LEVELS OF PROCESSING

Abstract

The purpose of the study was to investigate the effects of the three encoding techniques of rote memory, semantic, and self-reference, on short-term and long-term retention levels of unfamiliar vocabulary words and their meanings. Seventy-two college students participated in the experiment, with 24 students in each encoding group. All participants viewed 20 target words and their definitions, and were exposed to each word for 30 seconds. Each group was given instructions designed to promote a type of encoding specific to their group. After a five-minute distractor task, subjects were given a list of the target words and were tested on the recall of the definitions of those words. A retest was administered after one week. As hypothesized, encoding by self-reference produced significantly higher scores than encoding by semantic strategies or by rote memory. It was concluded that encoding by self-reference may lead to higher short-term and long-term retention levels of the meanings of unfamiliar nouns and adjectives.

The Effect of Levels of Processing on Retention of Word Meanings

Much contemporary research has been concerned with exploring the idea that the cognitions of an individual, and the manner in which they are organized, are important determinants of information processing. Beginning with Kelly's (1955) ideas concerning personal constructs, researchers have studied the individual's cognitive network and its effect on analysis and memory of information.

Broadbent (1958) was one of the first to view humans as processors of information. The essential concept of his multistore model is that information is transformed from one store to another. Supporters of the multistore model (Waugh & Norman, 1965; Murdock, 1967; Atkinson & Shiffrin, 1968; Shulman, 1971) are in agreement concerning the existence of three separate stages of verbal memory and the relative capacity and features of each. The proponents of the multistore model also agree that information must pass through sensory registers to short-term storage (STS) in order to reach long-term storage (LTS).

On the other hand, Craik and Lockhart (1972) stated that while the multistore methods that explain information processing are specific and concrete, there

are weaknesses in the models. Tulving and Patterson (1968) argued against the idea that information passes from one store to another, and Shallice and Warrington (1970) presented evidence against the idea that information must always pass through STS to enter LTS.

Craik and Lockhart (1972) rejected the multistore model as the explanation for information processing, arguing that aspects not recognized by the multistore model are important in attaining retention in LTS. While proponents of the multistore model state that the amount and mode of information presented, as well as the time given to study it are important variables in effecting LTS, they hypothesized that familiarity, compatibility, and meaningfulness of material presented to an individual were also important determinants of information processing and retention. More specifically, they suggest that memory trace persistence is a function of depth of analysis, with deeper levels of processing resulting in stronger and longer-lasting traces.

Craik and Lockhart's (1972) framework for levels of processing is strengthened by prior research results. Tresselt and Mayzner (1960) used three different encoding strategies in order to induce incidental learning; they found that subjects who were

induced to use semantic encoding by categorizing words recalled four times as many words as those who were given the structural encoding task of crossing out all vowels in the presented words and twice as many words as did subjects who were instructed to copy the words. Results of experiments by Hyde and Jenkins (1969) and Johnston and Jenkins (1971) showed that incidental free recall and organization of lists of highly associated word pairs which were semantically encoded by subjects was equivalent to the rate of recall of a control group, who had been instructed to learn the word pairs. The rate of recall of both of these groups was found to be much higher than that of an incidental group which had been given a structural encoding task. Mandler (1967) found that the amount of incidental learning obtained by categorizing words, a semantic encoding task, was similar to the amount of intentional learning (subjects were told that their recall of the words would be tested) by subjects who performed the same encoding task. Bobrow and Bower (1969) studied levels of processing as related to encoding of sentences, and found that tasks that induced semantic processing of sentences yielded a higher level of recall of words than did tasks including shallower levels of processing. Research by Schulman (1971) confirmed

previous findings; he instructed subjects to scan a list for target words described either by physical characteristics, such as containing a specific letter, or by category, such as the word representing a living thing. Scanning time for words was not significantly different between groups, but recall of words was much higher for the semantic-oriented group than for the group who had engaged in structural orienting tasks.

Craik and Tulving (1975) designed ten experiments to explore the levels of processing framework proposed by Craik and Lockhart (1972). Words were encoded by methods designed to obtain three levels of processing. Shallow levels of processing were obtained by asking questions about the physical characteristics of the words, such as "is the word typed in capital letters?" or "write the consonant/vowel combination of the word.". Intermediate levels of processing were obtained by asking about the rhyming characteristics of target words, such as, "does this word rhyme with _____?". Deeper levels of processing were achieved by asking if a word would fit into a particular category or sentence frame, such as "does this word represent a living thing?". Since intention and effort to learn, task difficulty, and amount of rehearsal time were held constant, the results of these

experiments confirmed previous findings by Craik and Lockhart (1972) and Craik and Watkins (1973) that the elaborateness of encoding improves retention. That is, if encoding is more elaborate, the information should be processed more deeply, thus yielding better memory performance.

While the majority of research concerned with levels of processing has been conducted using college students as subjects and has been short-term in duration, the research that has been concerned with finding successful strategies for learning the meaning of vocabulary words has been long-term and has used, for the most part, elementary school children as subjects. A long-term study by Gipe (1978) attempted to teach word meanings to 113 third-graders and 108 fifth-graders. The control group used the method of looking in the dictionary in order to find the meaning of the target words. The association group paired the unknown (target) words with a familiar synonym or brief definition, such as "colossal (target word) = large". The category group added the target word to a list of three familiar words, for example, "huge, large, gigantic, colossal". The context group utilized the target word in meaningful sentences. The target word was used in a three-sentence passage where each

sentence used the target word in a defining context. Evaluation tasks were given at the end of each of the eight weeks of the study. The context method was consistently found to be the most effective method in every analysis made, regardless of age, sex, or reading proficiency (all subjects were categorized as a good or poor reader prior to the experiment) of the subject.

Beck, Perfetti and McKeown (1982) conducted a five-month research project, using forth-grade students as subjects, designed to study the relationship between knowledge of word meanings and semantic processes. Experimental subjects were exposed to various semantic encoding methods, such as being presented with target words both within categories and in the context of sentences. Post-tests compared performances of the experimental subjects and control subjects who had been matched with the experimental subjects in pre-instruction vocabulary knowledge and comprehension, and the results indicated that experimental subjects had made significant gains in both areas. These results led Beck et al. (1982) to conclude that processing vocabulary words and their definitions at a semantic level leads to an easier understanding of word meanings that can improve reading comprehension.

A study by Rash, Johnson and Gleadow (1984) provided evidence to support previous findings concerning the effectiveness of semantic processing. They presented eight target words to two groups of kindergarten children, where one group was shown each target word alone and the other group was shown each target word in the context of two meaningful sentences. While both groups learned the words and their meanings, the group that had been presented with the words in context learned in significantly less time. Results of these studies imply that deeper levels of processing are effective in promoting better short-term and long-term vocabulary knowledge as well as improving reading comprehension.

The previous findings have stimulated further research concerning levels of processing. Rogers, Kuiper and Kirker (1977) investigated the role of self-reference in encoding hypothesizing that while past studies had found that semantic encoding did lead to deeper processing and to a higher level of retention of information, self-reference would lead to even deeper processing. Citing previous research by Cantor and Mischel (1977), who found evidence for the existence of a memory bias for new items that are conceptually related to self, and by Markus (1977), who

suggested that personal data are processed using schemata or prototypes, Rogers et al. (1977) hypothesized that encoding by self-reference involves the self-schema that contains the individual's past experiences and personal data, and that it will lead to an even deeper level of processing than semantic encoding. Results of their research indicate that self-reference is a very effective encoding device. Using an experimental design modelled after those used in experiments by Craik and Tulving (1975), Rogers et al. (1977) tested recall of adjectives and found that those encoded by self-reference tasks were recalled with significantly higher frequency. From these results they concluded that processing information by self-reference produces the most elaborate and integrated memory trace. Bower and Gilligan (1977) and Ferguson, Rule and Carlson (1983) expanded this theory with research results showing that encoding by reference to a close family member or friend is as effective as encoding by self-reference when applied to depth of processing and memory retention.

In summary, research concerning levels of processing has found that the encoding strategy used to process information is an important variable in determining retention and recall of information.

Specifically, there is evidence to support the theory that a greater depth of processing implies a greater degree of analysis and thus better storage in LTS. There is also evidence which suggests that while semantic encoding results in a deeper level of processing than either structural or phonemic encoding, self-reference, or reference to highly familiar others, leads to an even deeper level of processing than any of the other known strategies.

In this study, the effect of encoding new vocabulary words and their meanings by techniques that promote different levels of processing were examined. The encoding technique used was the independent variable, and scores on tests taken after the encoding process was completed was the dependent variable. This study compared the encoding techniques of rote memory, semantic processing, and processing by self-reference, and how each effected retention. A rote memory group was included in this study because encoding by this method requires no analysis of word meaning, and has been shown in previous research (Johnston & Jenkins, 1971; Gipe, 1978) to produce greatly reduced recall compared to different levels of processing. Thus, inclusion of a rote memory group allowed one to compare the effectiveness of the self-reference encoding method

with that of the semantic encoding method in the retention of vocabulary words and their meanings, and to compare both with an encoding method that has consistently been shown to be less effective than semantic processing.

Prior research investigating the effectiveness of self-reference as an encoding device has studied the recall of words, but not of their meanings, while research concerned with finding successful strategies for encoding meanings of vocabulary words has not used self-reference as an encoding device. Although this study differed from previous ones, results of research in these areas led to the hypothesis that both semantic and self-reference encoding techniques would lead to higher retention levels than encoding by rote memory, and that encoding by self-reference would result in the highest level of retention. In order to insure that retention was not merely temporary, there was a follow-up session to study long-term retention.

Previous research involving self-reference as an encoding device has used only adjectives as target words. In this study, the target words consisted of ten adjectives and ten nouns, in order to determine if the effectiveness of encoding by self-reference could be generalized to other vocabulary words.

Method

Subjects

Seventy-eight students in the introductory psychology classes at the University of Richmond volunteered for this study. In order to achieve an equal number of subjects in each of the three groups, three subjects from both the rote memory group and the semantic processing group were randomly eliminated, leaving a total of 24 subjects in each group. Prior to participation, each student signed an informed consent form, which can be found in Appendix A. This consent form contained statements concerning the willingness of each student to participate and their freedom to withdraw from the study at any time without penalty, as well as the information that all research results pertaining to individual subjects would be kept confidential and that they would be debriefed at the end of the experiment. Subjects were told that the experiment would take place in two sessions and that they should participate in both. All participants received 1½ hours of credit towards their participation in the University's research participation pool.

Apparatus and Procedure

A pretest was given to 28 undergraduates enrolled in an upper level course in Cognitive Psychology. None of these students were participants in any other phase of the study. They were given a list of forty words, twenty nouns and twenty adjectives, listed in alphabetical order, that were selected from Webster's Ninth New Collegiate Dictionary (Mish, 1983) and from Complete Preparation for the Graduate Record Examination General (Aptitude) Test (GRE), (Crocetti, 1983), and that had been determined to have a frequency of 0 or 1 by Francis and Kucera (1967). Students were instructed to write the definitions of any of the forty words whose meanings they knew, and were given fifteen minutes to complete this task. The 40 words that were presented to these students, and the frequency with which they were correctly defined, are listed in Appendix B. Of the 25 words that were not correctly defined, two adjectives and three nouns were randomly eliminated, and the 10 remaining adjectives and the 10 remaining nouns which were determined to be least familiar to students participating in this task were the twenty target words used in this study.

At the beginning of each session, the participants in the experiment proper were given a three-page booklet. The first page contained an informed consent sheet, which was signed by each participant after the experimenter read its contents aloud. Using the experiments by Craik and Tulving (1975) as a model, subjects were informed that the experiment was concerned with perception and speed of reaction. Subjects were then asked to turn to page two of the booklet, which contained directions, and to follow along while the experimenter read these directions aloud. The directions for each of the three groups differed, as they were designed to enhance one of the three types of encoding that was attempted in this study. Directions for all groups began with this sentence: "Each word and its dictionary definition will be shown on the screen for 30 seconds.". Further instructions for the rote memory group were as follows: "Write each word and its definition as often as you can in the time allowed.". Directions for the semantic group were: "Use each word in as many sentences as you can during the allotted time.". The self-reference group was given the following instructions: "Spend the time allotted for each word writing how it might or might not describe you, or how it might or might not

pertain to you.". All participants were told that page three of their booklet was identical to page two, and that it had been provided in order to allow ample writing space.

After reading the directions, each participant was exposed to each target word and its definition for 30 seconds. Each appeared in typed form on a transparency which was then shown on a screen by using an overhead projector. The 20 target words and their definitions are listed in Appendix C in the random order in which they were shown to the participants in each of the three groups.

After the subjects were presented with each of the target words and their definitions, and they had participated in tasks designed to encourage a certain level of processing, they engaged in a nonverbal distractor task for five minutes. This task consisted of looking at 20 slides of advertisements that were mainly nonverbal in content. At the end of five minutes, all subjects were presented with a list of the 20 target words, ordered randomly, and instructed to write the definition of each to the best of their knowledge. Each group was given 20 minutes to complete this task. After a delay of one week, subjects returned for a second session. They were given a

second list of the 20 target words, ordered randomly, and again asked to write their definitions to the best of their ability. Twenty minutes was also allowed to complete this task. The purpose of the second test administration was to examine the retention level of the previously encoded information over time. After administration of the second retention test, all subjects were debriefed, told the purpose of the study, and were invited to contact the experimenter if they desired further information concerning their individual test scores.

After all groups had taken both the short-term and long-term retention tests, an independent party wrote a code letter on the back of each test. The purpose of coding the tests was to eliminate experimenter bias. All five-minute retention tests taken by the rote memory group were coded "Y", while one-week retention tests for this group were coded "B". Five-minute retention tests for the semantic group were coded "R" and their one-week retention tests were coded "G". Five-minute retention tests taken by the self-reference group were coded "O" while their one-week retention tests were coded "P". After tests were coded, they were mixed together and given to the experimenter, who had no knowledge of the meaning of the codes, to score.

Tests were scored by placing a check beside any word that was correctly defined. Each correct response counted one point, incorrect responses were worth zero points, thus it was possible to earn a maximum of 20 points on each test. After all tests were scored, they were separated by code by the same individual who had originally coded them, and a key to the code was given to the experimenter so that group results could be analyzed.

Results

A 3 X 2 multivariate analysis of variance was performed on the effects of the three encoding methods on the noun and adjective retention scores over the five-minute and the one-week retention intervals. The means and standard deviations for all conditions are shown in Table 1.

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insert Table 1 about here

Significant skewness occurred for noun and adjective scores at the one-week condition, otherwise the assumption of normality was supported. F_{max} was not significant for either the five-minute condition (F_{max} (2,69) = 1.22, *p.* > .05), or the one-week

condition (F_{max} (2,69) = 1.03 *p.* > .05), indicating that homogeneity of variance within groups at both conditions was satisfied. Since the standard deviations for the 12 cells were within the same limits, it was assumed that there was no significant difference in group variabilities across the two retention intervals.

The mean noun scores and adjective scores were analyzed for each of the three groups, and interaction was found. The Wilkes-Lambda F was significant for the effect of Group X Time (F (4,136) - 5.16, *p.* < .05). Obtained F ratios for each of the four effects are found in Appendix D.

A univariate analysis was performed for the noun scores and the adjective scores at each condition in order to compare the short-term and long-term effects of each of the encoding strategies. A significant difference was found for each dependent variable, and the F ratios obtained are found in Appendix E.

Pearson product-moment correlations were obtained for the noun scores and the adjective scores for all encoding groups at both retention intervals. Correlations for the five-minute condition (*r* = .77, *p.* <.05) and the one-week condition (*r* = .68, *p.* <.05) were both significantly different from zero. Results

of the correlational analysis indicate that approximately one-half of the variance in adjective scores can be accounted for by the variance in noun scores. It was concluded that the two dependent variables, noun scores and adjective scores, could be treated as one dependent variable; thus, all further analyses treated these as one dependent variable, called word scores, at each of the two conditions.

A Two-Factor, repeated on 1 ANOVA design, with the three encoding methods as the independent factor, and the two retention tests as the repeated measure, was performed. Skewness and kurtosis were examined in order to verify the assumption of normality. The means and standard deviations for these measures appear in Table 2. Skewness for the rote

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insert Table 2 about here

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memory group scores were significant, otherwise, the assumption of normality was supported. F_{max} was not significant for either the five-minute condition (F_{max} (2,69) = 1.12, p. > .05) or the one-week condition (F_{max} (2,69) = 1.30, p. > .05), indicating that there were no significant differences in the variances within groups on either of the days that they were tested.

Since the standard deviations for each of the six cells were within the same limits, it was assumed that there were no significant differences across the two retention intervals.

Mean scores for the six cells are plotted in Figure 1.

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insert Figure 1 about here

There was significant interaction ($F(2,69) = 10.66$, $p. \leq .05$), and the results of all tests of significance are presented in Appendix F. As interaction was found to be significant, all simple effects were performed.

Simple effects were performed to examine the differences between the three groups at each retention level. Results indicated that there existed significant differences between the groups at both the five-minute condition ($F(2,29) = 22.06$, $p. < .05$), and the one-week condition ($F\ 2,69) = 12.52$, $p. < .05$). A Student Neuman Keuls (SNK) Test was performed in order to locate where the significant differences occurred. Results of the SNK tests revealed that significant differences occurred between each of the three retention conditions, with semantic encoding scores being significantly higher than rote memory scores at

both conditions, and with self-reference encoding scores being significantly higher than either the semantic or rote memory scores at both conditions.

Simple effects were conducted to determine if there were significant differences between the mean scores of each group across retention intervals. For the rote memory group (F (1,69) = 17.81 $p. < .05$), the semantic group (F (1,69) = 36.22, $p. < .05$), and the self-reference group (F (1,69) = 111.35, $p. < .05$), test scores at the one-week interval were found to be significantly lower than test scores at the five-minute interval.

Discussion

The overall results support previous research concerned with levels of processing (Hyde & Jenkins, 1969; Johnston & Jenkins, 1971; Craik & Lockhart, 1972; Craik & Tulving, 1975), and with finding successful strategies for the teaching of vocabulary words and their meanings (Gipe, 1978; Beck et al., 1983; Rash et al., 1984). Also, the results support the theory that level of retention of information is not determined by intention or by the amount of rehearsal time that information receives, but rather by the kind of operations that are carried out on the information

(Craik & Watkins, 1973). In the present experiment, frequency, recency, instructions to "learn" the information, and the amount and duration of exposure to information were held constant for each group. Only the mental strategies used to encode the information were manipulated, and the results show a significant difference in the retention levels of each group at both retention intervals.

Prior research that investigated the effectiveness of self-reference as an encoding device (Rogers et al., 1977; Bower & Gilligan, 1979; Ferguson, et al., 1983), received support from the present data which shows that encoding by self-reference induces a significantly higher retention level than semantic encoding, and that self-reference as an encoding unit can function effectively during information processing (Markus, 1977; Rogers et al., 1977). The major difference between semantic and self-reference encoding is the involvement of the self, which has access to an individual's memories derived from a lifetime of experience with personal data (Rogers et al., 1977). The present results imply that access to this personal data while processing information results in higher levels of retention.

Prior studies have found that encoding by semantic strategies can lead to higher short-term and long-term retention of previously unfamiliar vocabulary words and their meanings (Gipe, 1978), and subsequently to significantly higher levels of reading comprehension (Beck et al., 1983). In the present study, encoding by self-reference was found to be a more successful strategy for retaining vocabulary words and their meanings than was encoding by either rote memory or by semantic methods. If future studies confirm the superiority of self-reference encoding techniques in both short-term and long-term retention of information, the present finding could benefit educational research concerned with finding effective strategies for presenting new information.

Although future studies may find that self-reference encoding strategies may enhance information processing and retention, possible threats to both internal and external validity of the present study must be addressed before interpreting the significance of the results. As concerns internal validity, the target words used in this study were chosen on the basis of their frequency in print (Kucera & Francis, 1967), and on results of a pretest. In order to avoid exposing the subjects to the target

words before the experiment, it was assumed that all target words were unfamiliar to all subjects on the basis of these criteria. Future research could pair nonsense words with definitions created solely for the experiment. While participants in each of the three groups were given different instructions designed to enhance three levels of encoding, the members of the semantic group were not prohibited in any way from using the pronouns "I" or "me" in the sentences they were instructed to write. As a matter of fact, 13.21 percent of the sentences produced by the semantic group contained "I" or "me". The use of personal pronouns in sentences that include a target word should enhance encoding of that information by self-reference, and according to the theory (Rogers et al., 1977), should lead to deeper levels of processing and a higher level of retention. Future research comparing semantic and self-reference encoding devices might examine the sentences used and separate those that contain personal pronouns from those that do not when analyzing the data.

Threats to external validity appear to come from two sources. First, while research concerned with finding successful strategies for the teaching of vocabulary words and their meanings have been conducted

using elementary school aged children as subjects, the participants here were college students. As college students are often in classroom situations where they are exposed to large amounts of information in a short period of time, they may typically have learning strategies that differ from those of children, or of the general population. There is a need to research the effectiveness of the self-reference encoding device using different populations as subjects. Second, while encoding the target words by self-reference strategies produced significantly higher short-term and long-term retention levels, the data show that the rate of forgetting is higher for the self-reference group than for either the rote memory group or the semantic group (see Figure 1). The retention loss over the one-week period was 2.25, 3.20, and 4.73 words for the rote, semantic, and self-reference conditions, respectively. Further research needs to investigate the retention level produced by self-reference over a longer period of time in order to determine that it is effective in producing higher levels of retention.

The hypothesis of this study was based on the following two research findings: semantic encoding leads to the highest levels of retention of unfamiliar vocabulary words and their meanings, and encoding by

self-reference leads to higher retention of personally relevant information than does semantic encoding. Both of these findings were supported, and in addition, new information relevant to these areas was produced. Self-reference may be an effective encoding device for the processing and the retention of more than just adjectives. The results of the Pearson product-moment correlation between nouns and adjectives at both the five-minute and one-week intervals revealed that the two types of words were highly correlated at each retention point. While previous research results have found that encoding by self-reference appears to facilitate the processing and the retrieval of trait adjectives, (Rogers et al., 1977; Bower & Gilligan, 1979), results of the present study indicate that using self-reference as an encoding device may facilitate processing and retention of different parts of speech, such as verbs and adverbs.

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Appendix A

INFORMED CONSENT FORM:

I _____, agree to participate in this study. I understand that I will be taking two paper and pencil tests concerning a series of vocabulary words and their definitions that I will be viewing. Neither of these tests will pose any physical or psychological risk for me. The entire experiment will be divided into two parts, and I understand that I must participate in both parts to receive credit. The whole experiment will take about 1½ hours and for my participation I will receive 1½ hours of credit toward fulfillment of my research requirement in Introductory Psychology.

I understand that Dorothy Flannagan, a graduate student in the Psychology Department at the University of Richmond, will be administrating the tests. I know that I am volunteering for her study and that I may exit at any time. My participation or lack of participation will in no way affect my status in school. I further understand that the results of the study will be kept confidential. My name will not be

used in any report of this study. Debriefing will follow the last phase of this experiment.

_____

(signature)

_____

(date)

Appendix B

Vocabulary Words Given in Pretest

	Vocabulary Word		Frequency of Correct Definitions
1.	Aleatoric	(adj.)	-
2.	Andragony	(noun)	-
3.	Asperity	(noun)	2
4.	Arrant	(adj.)	-
5.	Blandishment	(noun)	2
6.	Bouleversement	(noun)	-
7.	Canard	(noun)	-
8.	Celerity	(adj.)	3
9.	Chemerical	(adj.)	-
10.	Cicatrization	(noun)	-
11.	Defalcation	(noun)	-
12.	Desuetude	(noun)	-
13.	Drupaceous	(adj.)	-
14.	Encaustic	(adj.)	1
15.	Endemic	(noun)	2
16.	Enmity	(noun)	-
17.	Fecund	(adj.)	1
18.	Haptic	(adj.)	1
19.	Invective	(noun)	-
20.	Laconic	(adj.)	-
21.	Lagniappe	(noun)	-

22.	Lamentation	(noun)	6
23.	Madrilene	(noun)	-
24.	Neoteric	(adj.)	-
25.	Obdurate	(adj.)	-
26.	Patristic	(adj.)	2
27.	Perspicuity	(noun)	-
28.	Prolix	(adj.)	-
29.	Protean	(adj.)	-
30.	Querulous	(adj.)	-
31.	Ramification	(noun)	10
32.	Rapacious	(adj.)	1
33.	Slivowitz	(noun)	-
34.	Sonsy	(adj.)	-
35.	Temerity	(noun)	-
36.	Trenchant	(adj.)	-
37.	Trichologist	(noun)	1
38.	Tyro	(noun)	3
39.	Uxorious	(adj.)	1
40.	Vacuous	(adj.)	7

Appendix C

Target Words

CHEMERICAL: existing only as the product of unrestrained imagination

TEMERITY: unreasonable or foolhardy contempt of danger or opposition; rashness or recklessness

DRUPACEOUS: bearing overripe fruit

CICATRIZATION: scar formation at the site of a healing wound

NEOTERIC: youthful, comparatively new, modern

DESUETUDE: discontinuance from use or exercise; disuse

OBDURATE: hardened in feelings

PERSPICUITY: plainness of understanding because of clarity and precision of argument

LACONIC: using or involving the use of a minimum of words; concise to the point of seeming rude

BOULEVERSEMENT: a violent disturbance, disorder

PROLIX: unduly long or drawn out; too long

CANARD: a false or unfounded report or story, especially a fabricated report

PROTEAN: displaying great diversity or variety; versatile

ENMITY: positive, active and typically mutual hatred or ill will

QUERULOUS: habitually complaining

INVECTIVE: insulting or abusive language

ARRANT: being notoriously without moderation

LAGNIAPPE: a small gift given a customer by a merchant at the time of purchase

TRENCHANT: sharply perceptive

DEFALCATION: failure to meet a promise or an expectation

Table 1

Means and Standard Deviations for the Effect of Encoding Method on Noun and Adjective Scores

Rote Memory

	5-minute	1-week	
nouns	m = 2.54 sd = 2.15	m = 1.33 sd = 1.56	m = 3.87
adjectives	m = 2.17 sd = 2.04	m = 1.13 sd = 1.23	m = 3.30
	m = 4.71	m - 2.46	

Semantic

	5-minute	1-week	
nouns	m = 3.58 sd = 2.02	m = 2.17 sd = 1.49	m = 5.75
adjectives	m = 3.75 sd = 2.15	m = 1.96 sd = 1.43	m = 5.71
	m = 7.33	m - 4.13	

Self-reference

	5-minute	1-week	
nouns	m = 6.08 sd = 2.17	m = 3.29 sd = 1.94	m = 9.37
adjectives	m = 5.88 sd = 2.11	m = 3.04 sd = 1.37	m = 8.92
	m =11.96	m = 6.33	

Appendix D

Multivariate Analysis of Variance

Variables Used	Effect Measure	df	F	Significance
Noun 1, Adjective 1	Group	4,136	9.28	.05
Noun 1, Adjective 1	Constant	2,68	145.96	.05
Noun 2, Adjective 2	Group X Time	4,136	5.16	.05
Noun 2, Adjective 2	Time	2,68	1.10	.05

Appendix E

Results of Univariate Analysis of Variance

Variables Used	Effect Measure	df	F	Significance
Noun 1	Group	2,69	15.74	.05
Adjective 1	Group	2,69	19.57	.05
Noun 1	Constant	1,69	242.20	.05
Adjective 1	Constant	1,69	263.00	.05
Noun 2	Group X Time	2,69	6.82	.05
Adjective 2	Group X Time	2,69	7.28	.05
Noun 2	Time	1,69	90.10	.05
Adjective 2	Time	1,69	96.20	.05

Table 2

Means and Standard Deviations for the Effect of Encoding Method on Word Scores

Rote Memory

5-minute	1-week
m = 4.71	m = 2.46
sd = 3.86	sd = 2.55

Semantic

5-minute	1-week
m = 7.33	m = 4.13
sd = 3.92	sd = 2.59

Self-reference

5-minute	1-week
m =11.06	m = 6.33
sd = 3.70	sd = 2.91

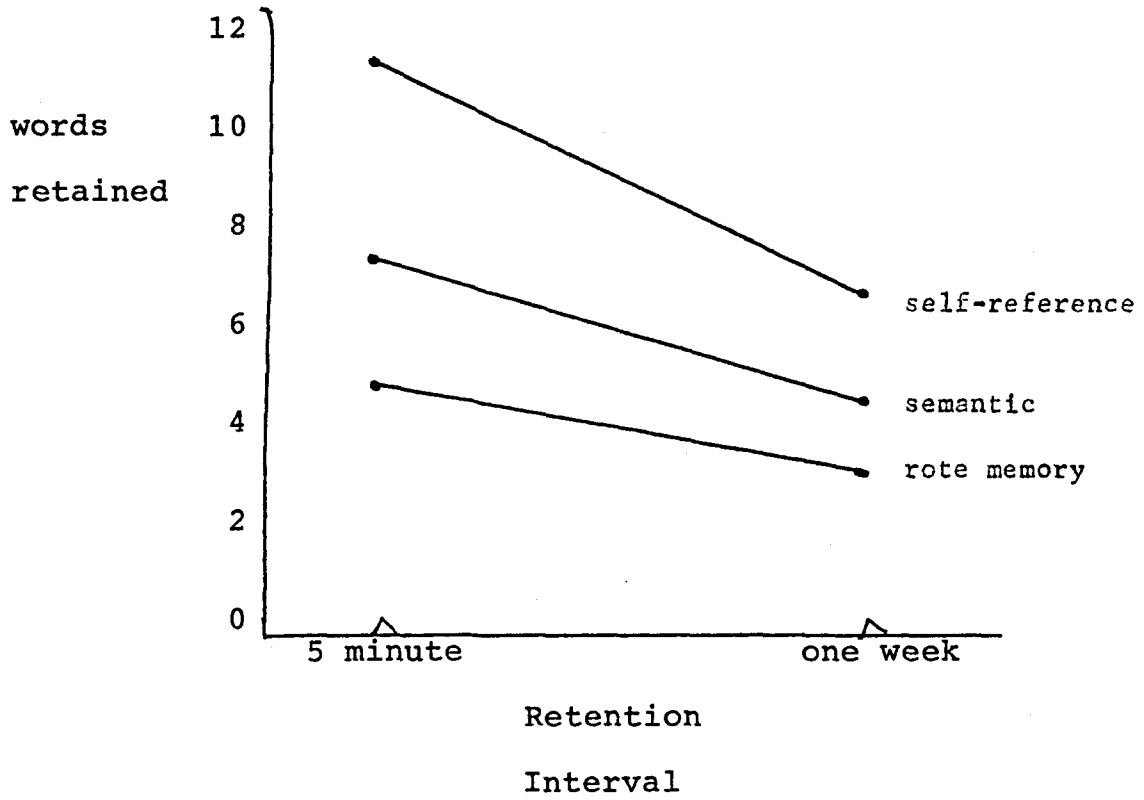
words
retained
12
10
8
6
4
2
0
self-reference
semantic
rote memory
5 minute
one week
Retention
Interval

Figure 1. Mean word scores for each encoding group at five-minute and one-week retention intervals.

Appendix F

Results of Tests of Significance

Variables Used	Effect Measure	df	F	Significance
Score 1	Constant	1,69	294.75	.05
Score 1	Group	2,69	20.43	.05
Score 2	Time	1,69	144.25	.05
Score 2	Group X Time	2,69	10.66	.05

The author, a native Virginian, received a B.A. degree from the University of South Carolina in 1973. She presently resides in Richmond with her son, Michael.