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RETRIEVAL OF DIVERGENT LEXICAL DEFINITIONS OF HOMOGRAPHS IN YOUNG, MATURE AND ELDERLY ADULTS

A Thesis

Presented to the

Department of Special Education

and the

Faculty of the Graduate College

University of Nebraska

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

University of Nebraska at Omaha

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by

Barbara J. Gross

July 1985

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THESIS ACCEPTANCE

Accepted for the faculty of the Graduate College, University of Nebraska, in partial fulfillment of the requirements for the degree Master of Arts, University of Nebraska at Omaha.

Thesis Committe

Name	Department
Lawrence M. Hilton	Counseling & Special Ed.
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Lawrence M. Hilton
Chairman

July 11, 1985
Date

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CHAPTER I

Introduction

The ability to communicate one's needs, desires and knowledge is a basic requirement for succeeding in society. It is an ability that is taken for granted by most individuals for whom mastery seemed automatic. The stages of language acquisition and development in young children have been extensively researched and documented. A wide range of semantic abilities of college freshman also have been investigated. Beyond the traditional college age, eighteen to twenty-two years, little normative data concerning functional language ability is available.

Information pertinent to the evolution of language functioning across the adult lifespan would be useful in planning appropriate goals for adults with acquired language disorders and in making decisions regarding the termination of therapy services for clients. In a related area, normative data concerning adult language proficiency would be beneficial in planning educational materials for the normal healthy adult population.

There is, however, a crucial issue which must be addressed at the outset of a study which is proposing to describe and compare individuals of varying ages on a cognitive processing task. One must be cognizant of the fact that individuals of widely varying ages are functioning in response to different foundations of life experiences, educational backgrounds and physical well-being. In recognition of this, Arenberg (1977) suggested calling differences found in cross-sectional studies "age/cohort" differences.

It must not be assumed that apparent age-related deficits have any direct causal relationship with the aging process. Such deficits may, in fact, be more closely related to societal factors (i.e. forced retirement, stereotypes) or health conditions (i.e. circulatory, renal, thyroid disorders) which, while more prevalent among the aged, are not a direct result of the the aging process. (Avorn, 1982; Craik & Byrd, 1982).

The focus of this study was to investigate and compare the ability of adults from three age groups (18-30, 33-56, 65-86) to retrieve divergent lexical definitions for graphically presented homographs. A divergent processing task requires cognitive flexibility as well as the ability to purposefully shift one's attention. Previous research by Guilford (1967) and Chapey, Rigrodsky and Morrison (1975) provided the basis for the design of this study.

Statement of the Problem

Is there a significant difference in the divergent lexical definitions retrieved from long term memory for graphically presented homographs in young, mature, and elderly adults?

Statement of the Subproblems

Subproblem 1. Is there a significant difference between the total weighted scores of fluent responses produced by young, mature, and elderly adults?

Subproblem 2. Is there a significant difference between the total weighted scores of flexible responses produced by young, mature, and elderly adults?

Subproblem 3. Is there a significant difference in the weighted composite correct scores attained by the young, mature, and elderly adults?

Subproblem 4. Is there a significant difference between the weighted incorrect responses produced by young, mature, and elderly adults?

Hypothesis to be Tested

There is no significant difference in the retrieval of divergent lexical definitions from long term memory for homographs between young, mature, and elderly adults.

Subhypotheses to be Tested

Subhypothesis 1. There is no significant difference between the total weighted scores of fluent responses produced by young, mature and elderly adults.

Subhypothesis 2. There is no significant difference between the total weighted scores of flexible responses produced by young, mature, and elderly adults.

Subhypothesis 3. There is no significant difference in the weighted composite correct scores attained by young mature and elderly adults.

Subhypothesis 4. There is no significant difference between the total weighted incorrect responses produced by young, mature, and elderly adults.

Significance of the Problem

It is essential that the intent of a conversation be understood by all participants. In order for communication to be successful, it must be decoded, processed, and encoded clearly and precisely. Exposing three age groups to one type of divergent semantic task may provide some insight into divergent semantic processing as well as identify differences in this processing among age groups.

Assumption and Limitations

There is one assumption related to this study.

Assumption 1. The stimulus homographs will be equally familiar to all subjects based on their high frequency rating according to Thorndike-Lorge (1952) tables.

There are three limitations related to this study.

Limitation 1. All subjects in this study were selected from technical schools, military organizations, the general population, and senior citizens' centers in the Sacramento County, California area.

Limitation 2. All subjects completed a minimum of twelve years of education.

Limitation 3. All subjects have spoken English as their primary language.

Definition of Terms

Group I. Adult males and females, aged 18-30, who were selected from technical colleges and enlisted military personnel in Sacramento County, California.

Group II. Adult males and females, aged 33-56, who were selected

from the general population and enlisted military personnel in Sacramento County, California.

Group III. Adult males and females, aged 65-86, who were selected from senior citizens' centers in Sacramento County, California.

Divergent Behavior. The ability to provide a quantity of varied ideas on a specific topic requiring a broad search of memory storage (Chapey, 1981).

Flexibility Score. The total number of correct different definitions produced for each stimulus word. (Chapey, 1981).

Fluency Score. The total number of fluent correct definitions produced for each stimulus word (Chapey, 1981).

Homographs. Words having identical spelling but different lexical meanings.

Lexical Meaning. The meaning common to all the members of an inflectional paradigm, e.g. eat, eats, eaten, ate, despite their differences in form (Barnhart & Stein, 1962, p. 701).

Retrieval. The act of recalling information from long term memory storage.

CHAPTER II

Review of the Literature

The review of the literature is divided into discussions of sub-topics germane to the research question stated in Chapter I. These topics include (1) crystallized and fluid intelligence, (2) divergent cognitive processing, (3) and long term semantic memory and word retrieval.

Crystallized and Fluid Intelligence

Crystallized intelligence refers to often-used, well known factual information such as world knowledge, personal experience, and vocabulary. Individuals are able to retrieve and utilize such information with minimal effort and attention and without interfering with simultaneous ongoing cognitive functioning. (Hasher and Zacks, 1979). It frequently is referred to as automatic processing requiring minimal mental energy (Schonfield, 1982; Perlmutter and Mitchell, 1982; Howard, McAndrews, and Lasaga, 1980). Schonfield suggests that higher mental processes, which he defines as those processes requiring a "time lapse between problem and solution or input cue and output behavior" (Schonfield, 1982, p. 309), are not required to utilize one's crystallized intelligence. Multiple studies have indicated that crystallized intelligence remains intact and stable across the adult life-span (Craik & Byrd, 1982).

One's vocabulary store is considered to be a part of crystallized intelligence. That word meanings are activated automatically was demonstrated in studies using the Stroop procedure which required

subjects to hold the ink color of printed words in memory. It was found that the word meanings were activated automatically and interfered with retention of the color name. Active inhibition of the word meanings was only partially successful (Stroop, 1938, cited in Howard et al., 1980).

Howard et al. devised a variation of this procedure in which each of three age groups (21-39, 40-59, 61-75) was presented with a series of three words followed by a base word printed in colored ink. The subjects were then instructed to say aloud the color of the ink followed by the first three words. The latency of color naming response time was monitored from the presentation of the base word. No significant differences were found between the three age groups either in response latency or accuracy of color and word naming. It was proposed that automatic activation of word meanings interfered with color naming equally in all subjects which supports the notion of vocabulary stability across the adult life-span.

A unique category of English words is homographs for which only one correct spelling represents multiple distinct meanings. There appears to be a hierarchy of meanings (dominance) for these words (Kausler, 1974). Simpson (1981) found that when context strongly biased one meaning, only that meaning was retrieved; however when context was weakly biased more than one meaning was activated. When the context was unbiased, the dominant meaning was retrieved first. Furthermore, Hogaboam and Perfetti (1975) found that when undergraduate college students were asked to determine whether or not the last word of a sentence was ambiguous they responded more rapidly to contexts biased toward a secondary meaning rather than the primary or dominant

definition. This may indicate that retrieving secondary meanings from contextual material is a more restricted recall task requiring less effort than accessing the dominant meaning.

Fluid intelligence, by contrast, requires higher mental processes. It is the component of one's knowledge which is retrieved through effortful processes demanding the intentional focusing of attention and utilization of mental energy. Studies requiring effortful processing have shown that this ability declines as individuals become older (primarily beyond the age of 65) in comparison to young adults (Hasher & Zacks, 1979; Horn, 1982; Craik & Byrd, 1982). It has been hypothesized that effortful processing requires the translation of previously acquired information, numerous attention changes, and comparisons with information held in working memory. It also requires an organizational process, or an operating strategy, to follow through from the inception of the effortful cognitive task to its conclusion (Rabbitt, 1982; Schonfield, 1982).

Horn (1982) suggests that cognitive processing may involve an interaction between crystallized and fluid intelligence. Schonfield (1982) also indicated an inter-relationship between these two categories of intelligence. He hypothesized that a given cognitive processing task may be resolved by one individual using crystallized intelligence and by another person utilizing fluid intelligence (Horn, 1982).

Petros, Zehr and Chabot (1983) investigated the processing capacity required for accessing categorical information compared to that required for accessing information about the name or physical features of a word. They hypothesized that retrieval speed would become slower with age if

accessing categorical information about words limits the available processing capacity in elderly individuals. The purpose of this study was to compare young (mean age 24 years) and old (mean age 68 years) adults on the speed and accuracy of encoding the physical features of a word and accessing semantic information about a word. The results of this study indicated that the older adults were disproportionately slower than the younger adults in retrieving categorical information about words as compared with the retrieval of lexical or physical features. These findings are compatible with the theory that vocabulary is accessed automatically whereas the retrieval of semantic information is effortful requiring more processing time. The data obtained from research strongly supports the hypothesis that effortful processes are more difficult for older adults compared to younger adults. While evidence also supports the notion that the retrieval of word meanings is an automatic process, there are indications that accessing categorical information about words requires some effort.

Divergent Cognitive Processing

Divergent cognitive processing is characterized by a broad search of one's long term memory in order to retrieve a variety of information concerning a specific topic (Chapey, 1981). The proliferation of novel ideas concerning a subject is the goal of this type of processing. It is concerned with the generation of logical possibilities, the ready flow of ideas, and with the readiness to change the direction of one's response (Chapey, 1981). Guilford (1967) devised a variety of tasks requiring association responses, such as naming members of a

category, to investigate divergent processing. Other tasks required creative problem solving such as suggesting the possible consequences if clouds had strings attached to them that hung down to earth or describing many possible uses for bricks (Guilford, 1967). These tasks explored the subject's creativity and ability to change from one mental set to another in response to a single stimulus. Guilford then analyzed these responses for inclusion in one of two categories: flexible responses or fluent responses. A flexible response represented a novel thought or change of mental set; whereas, each fluent response was merely a reiteration, with some variation, of a flexible response. A greater number of flexible responses resulted from a broader memory search.

This type of cognitive processing contrasts sharply with the concept of convergent cognitive processing in which a limited number of ideas are produced in response to a restricted problem. These two types of cognitive processing are typified by the difference between inductive reasoning (divergent), which may result in the production of multiple logical possibilities, and deductive (convergent) reasoning, which results in a paucity of logical probabilities (Guilford, 1967).

Chapey et al. (1975) utilized divergent processing tasks to investigate the differences between normal and aphasic adults aged 50-70. Two types of association tasks were presented: (1) a controlled association task which required one antonym response to each presented stimulus word, and (2) a free association task in which the first verbal response of any type was accepted for each of the stimulus words. Both stimulus and response words were given a communality rating based on the

Palermo and Jenkins study (1964) in which college freshmen were asked to produce word associations in response to numerous stimulus words. The communality value of a response was defined as being equal to the percentage of subjects producing that response. For example, if 50% of the 1,000 subjects said man in response to the stimulus word woman, the communality value for man would be 50. An interesting result of this study revealed that the normal subjects aged 50 to 70 produced responses to the free association test which were significantly different from the communality ratings of the responses produced by the college freshmen.

Howard (1980) conducted a study in which word association tests were given to subjects aged 20-39 years, 40-59 years, and 60-79 years. They were first asked to write the name of as many members of a category as they could recall. The categories were selected from those used by Battig and Montague (1969) who established response norms for these categories for young adults. Next, two kinds of restricted word associations (category-member and descriptive-property) were elicited from the subjects. The results revealed that the oldest subjects (60-79 years) produced fewer responses per person per category than the other two groups. Additionally, analyses of between-subject variability indicated that the oldest subjects produced fewer unique responses (responses occurring only one time) and significantly fewer different types of responses (flexible responses) per stimulus word than the other two groups.

These findings contrasted with those found earlier by Perlmutter (1978, 1979) and Riegel and Riegel (cited in Riegel, 1968) who

reported that more variable associations were produced by elderly subjects than the young ones.

Perlmutter found that older subjects (aged 60-65) generated less common associations for stimulus words than did the young subjects (aged 20-25). The older subjects were, however, less consistent in the associations they produced over repeated trials of the task than the younger subjects.

Riegel and Riegel (cited in Riegel, 1968) also found that elderly subjects produced more varied word association responses. In addition, this study revealed a difference in the type of association generated by the elder group of subjects. They produced more syntagmatic (descriptive-property) responses, i.e. cat-furry, than younger subjects who produced a majority of paradigmatic (category-member) responses, i.e. cat-dog, which is more typical of adults of all ages. (Howard, 1983).

Semantic Memory and Free and Restricted Recall

It is generally accepted that memory is divided into two classifications, (1) primary memory and (2) secondary memory. Primary memory has a limited capacity characterized by the rapid decay of memory tracks. Secondary memory provides long term storage and a larger capacity. In secondary storage, coding is considered to be complex involving acoustic and semantic attributes. Retrieval from the primary store is immediate and direct; whereas, retrieval from the secondary store involves a search process. An additional postulate is that age differences in short term memory are minimal; however, significant age

related differences exist in both storage and retrieval from long term memory (Craik, 1968).

One component of secondary memory is semantic memory. It refers to an individual's stored knowledge of words, word meanings, and referents as well as the relationships between words and the rules governing them (Eysenck, 1977). Lachman and Lachman (1980) postulated a semantic memory network which contains an "object's properties, its class affiliation, subordinates, superordinates, and coordinates; its various uses and relationships to other objects and events; and even its familiarity and frequency of use" (Lachman & Lachman, 1980, pp. 321-322). World knowledge may also be stored within this network.

Lachman and Lachman further stated that phonological and graphemic representation of a word does not reside in this network but rather in a separate lexical network. Studies investigating the tip-of-the-tongue state, in which an individual is unable to recall a word but is cognizant of various attributes of the word, support the notion of separate semantic and lexical storage networks (Eysenck, 1977).

In view of the proposed study, a review of the literature pertaining to free and restricted recall from semantic memory is particularly pertinent.

Free recall from semantic memory requires effortful, deep cognitive processing aided by rehearsal and organizational strategies. Research repeatedly has demonstrated that elder adults display a significant decrement in free recall in comparison with young adults (Hasher & Zacks, 1979; Perlmutter, 1979; Perlmutter & Mitchell, 1982; Camp, 1981; Craik & Byrd, 1982).

Howard, McAndrews, and Lasaga (1981) also found that deeper, more complex processes change with aging; whereas, automatic processes do not. These investigators compared the effects of the semantic priming of lexical decisions in young (20-39 years) and old (65-78 years) adults. Semantic priming is the facilitation of processing a target word due to the prior processing of a semantically related word. The subjects were shown paired letter strings and were instructed to respond yes only if both letter strings were words. Of the letter strings that were related word pairs, half were category-member associates (rain-snow), and half were descriptive-property associates (rain-wet). Results demonstrated that the semantic priming of lexical decisions occurred in both age groups, indicating that an age related decrement does not occur. The subjects were also asked to respond to a free-recall task in which word lists consisting of frequently associated words (high dominance) and less frequently associated words (low dominance) were presented to the participants. They were then asked to recall as many words as possible from each list. The elderly group recalled significantly fewer words (both high and low dominance) than the younger group. Howard et al. concluded that there is a large automatic component underlying semantic priming; whereas, the free recall of word associates requires an effortful process. This supports the hypothesis that effortful processes are more age sensitive than automatic processes.

Restricted recall is a less effortful task in which expectations of a convergent response are greater (Chapey, 1976). When asked to produce an antonym for a stimulus word, older subjects (aged 50-70) produced

responses comparable to the normative communalities obtained for college students by Palermo and Jenkins (1964) (Chapey, 1976).

Horn (1972) obtained similar results comparing younger and older adults in a synonym retrieval task.

In summary, the review of the literature supports the following conclusions: (1) vocabulary stability, an automatic process, is maintained across the adult life-span, (2) retrieval cues such as semantic priming and restricted recall facilitate response retrieval and reduce differences between young and old adults, (3) effortful processes such as those requiring deep cognitive processing or switching attention result in significant differences in the responses of young and old adults revealing declining performances among the elderly.

Eysenck (1977) noted that the sheer size and complexity of semantic memory renders experimentation difficult. He stated that one problem in the study of semantic memory has been the tendency for investigators to concentrate on the most dominant semantic attribute of the stimulus words. Very little attention has been directed at the non-dominant semantic information held in one's semantic memory store. By its emphasis upon the retrieval of multiple responses for each stimulus word, the study undertaken in this thesis has attempted to elicit non-dominant information stored in the subjects semantic memory utilizing a divergent semantic cognitive processing task.

CHAPTER III

Testing Procedures and Analysis of Data

This was a descriptive research project which attempted to identify possible age related differences in divergent semantic cognitive processing in adults. The responses of three adult age groups to a word definiton retrieval task were compared.

Subjects

Group I contained 15 young adults aged 18-30 years who were selected from technical colleges and enlisted military personnel in Sacramento County, California.

Group II included 13 mature adults aged 33-56 who were selected from the general population and enlisted military personnel in the same geographical areas as group one.

Group III was composed of 15 senior citizens aged 66-86 years old. They were selected from senior citizen centers in the same area as group one and two.

All of the subjects have spoken English as their primary language, and have had a minimum of twelve years of formal education. (See table 1). Each subject received a $5.00 stipend for participating in this study, or this amount was donated to a specified designee.

Materials

Ten stimulus words (see Appendix A) were randomly selected from lists of homographs (Bush, 1979; Paivio, Yuille, & Madigan, 1968). The

Table 1

Subject Characteristics

	Sex			Age			Years of Education		
	N	M	F	Range	Mean	SD	Range	Mean	SD
Group I	15	5	10	18-30	22.9	3.74	12-17	14.1	1.68
Group II	13	7	6	33-58	44.6	8.84	12-18	15.2	1.92
Group III	15	6	9	66-86	73	5.55	12-18	15.1	2.02

words available for random selection had to meet the following criteria: (1) have a minimum of three lexical definitions verifiable in three standard English dictionaries; (2) have at least one definition in the verb form; and (3) have an AA rating (at least 100 occurrences per one million words) as determined by Thorndike and Lorge (1952) for a minimum of one definition. Each stimulus word was presented graphically in one-inch Arabic letters on a 4" x 6" card.

Procedure

The subjects were tested individually. Testing took place at their respective senior citizen centers, colleges, or homes. The subjects were asked to produce as many definitions as possible for each homograph, taking as much time as they desired. Prior to initiating the test, each subject was given specific information, instructions, and examples relating to the test stimuli and procedures (see Appendix B).

Data Analysis

The subject's responses were analyzed for the total number and the total weighted scores of (1) flexible responses (i.e. those responses representing a unique lexical definition), (2) fluent responses (i.e. all correct responses), and (3) error responses which were limited to ambiguous and/or unrelated responses. The first correct response was designated a fluent response. Thereafter all distinct different responses were assigned to the flexible category. Partially correct responses, defined as (1) incomplete lexical definitions, or (2) descriptive associations which did not fulfill the requirements of complete definitions, were analyzed for their relationship to a lexical definition and subsequently classified as flexible or fluent. This decision was made by the investigator and two objective assistants.

Flexible responses were assigned a weight of three, fluent responses two, and errors one. The weighted scores for each category were tabulated, and means and standard deviations were compared for each group. The means and standard deviations were computed for the composite scores of each group as well.

Analyses of variance (ANOVA) were computed for (1) weighted flexible responses, (2) weighted fluent responses, (3) weighted incorrect responses and (4) weighted composite correct responses.

T-tests of significance of between group mean differences were applied to the weighted scores of the three groups of subjects, comparing Group I versus Group II, Group I versus Group III, and Group

II versus Group III on the following variables:

1. Total weighted scores of flexible responses.
2. Total weighted scores of fluent responses.
3. Total weighted composite correct scores.
4. Total weighted incorrect responses.

CHAPTER IV

Presentation and Analysis of Data

Analysis of the taped responses of the subjects produced three categories of raw scores (1) total number of flexible responses, (2) total number of fluent responses, and (3) total number of incorrect responses. The resulting scores in each category were then multiplied by a weight of three, two, and one respectively. Means and standard deviations were computed for the weighted scores in each of the following categories: (1) flexible response, (2) fluent responses, (3) incorrect responses, and (4) composite correct responses. The weighted flexible scores yielded means (M) and standard deviations (S) for each group of subjects as follows: Group I, $\underline{M}$ = 69.6, $\underline{S}$ = 36.34; Group II, $\underline{M}$ = 93.231, $\underline{S}$ = 37.72; Group III, $\underline{M}$ = 71.0, $\underline{S}$ = 24.15. The weighted fluent scores produced means and standard deviations of $\underline{M}$ = 32.4, $\underline{S}$ = 11.98 for Group I; $\underline{M}$ = 34.308, $\underline{S}$ = 13.49 for Group II; and $\underline{M}$ = 45.867, $\underline{S}$ = 27.58 for Group III. The means and standard deviations computed for each group's weighted incorrect scores were: Group I, $\underline{M}$ = 2.2, $\underline{S}$ = 1.6; Group II, $\underline{M}$ = 2.846, $\underline{S}$ = 2.41; Group III, $\underline{M}$ = 1.867, $\underline{S}$ = 1.5. Weighted composite correct scores yielded means and standard deviations of: Group I, $\underline{M}$ = 51.0, $\underline{S}$ = 32.63; Group II, $\underline{M}$ = 63.77, $\underline{S}$ = 40.90; Group III, $\underline{M}$ = 58.433, $\underline{S}$ = 28.50. The results of these computations are shown in Table 2. A comparison of the mean scores for each group across the five categories is graphically displayed in Figure 1. It is apparent that the mean weighted flexible scores produced by Groups I ($\underline{M}$ = 69.6) and III ($\underline{M}$ = 71.0) are quite similar; whereas, the

Table 2

Descriptive Statistics for Weighted Flexible, Weighted Fluent, Weighted Incorrect, and Weighted Composite Correct Responses for Three Groups

	Group I	Group II	Group III
Weighted Flexible			
M	69.6	93.231	71.0
S	36.34	37.72	24.15
Range Min/Max	15/168	48/162	30/117
Weighted Fluent			
M	32.4	34.308	45.867
S	11.98	13.49	27.58
Range Min/Max	20/56	22/74	24/126
Weighted Incorrect			
M	2.2	2.846	1.867
S	1.6	2.41	1.5
Range Min/Max	0/5	0/8	0/5
Weighted Composite Correct			
M	51.0	63.77	58.433
S	32.63	40.90	28.50
Range Min/Max	15/168	22/162	24/126

Note: Descriptive statistics include Mean (M), Standard Deviations (S), and Range Minimum (Min)/Maximum (Max).

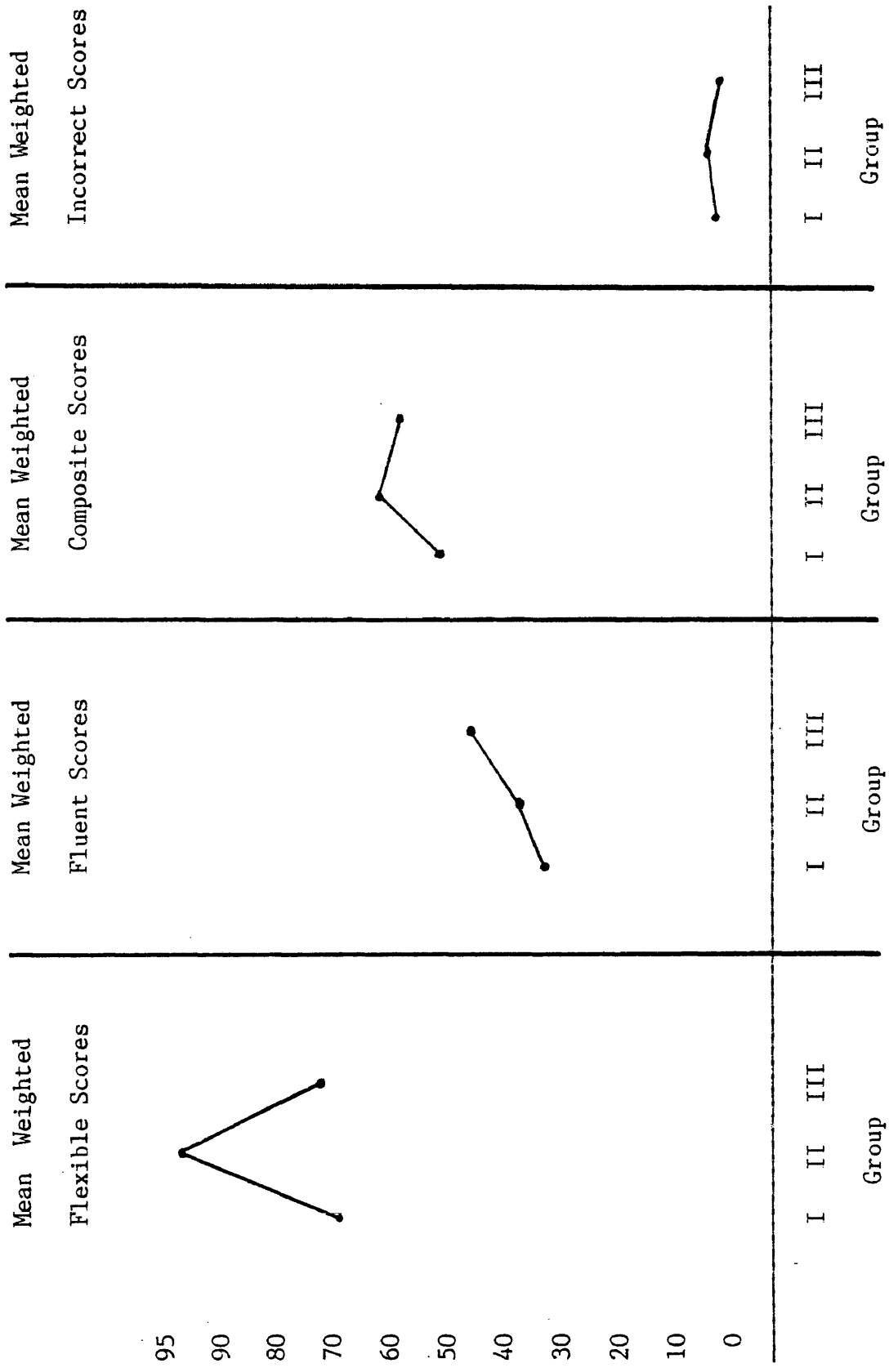

Figure 1. Comparison of Mean Scores for Young, Mature, and Elderly Adults in Four Categories.

mean weighted fluent scores for Groups I (M = 32.4) and II (M = 34.308) are similar. The means of the weighted composite scores and incorrect scores are clustered closely together.

An analysis of variance, ANOVA, was also computed utilizing the F-test to determine any significant differences between the scores for the three groups of subjects. A response category x age interaction analysis was carried out for: (1) weighted flexible responses, (2) weighted fluent responses, (3) weighted incorrect responses, and (4) weighted composite correct responses. No significant interactions were obtained for any of the four computations. The four categories yielded the following values of F: (1) weighted flexible responses, $F(2, 40) = 2.188$, $p > .05$; (2) weighted fluent responses, $F(2, 40) = 2.075$, $p > .05$; (3) weighted incorrect responses, $F(2, 40) = .4032$, $p > .05$; (4) weighted composite correct responses $F(2, 83) = .7186$, $p > .05$.

T-scores to determine the level of significance were computed for each of the four categories comparing Group I with Group II, Group I with Group III, and Group II with Group III. This analysis revealed that no group comparisons yielded a difference at the $p < .05$ level of significance (see Table 3).

The t-scores were computed for the weighted fluent responses in an identical manner as for the flexible responses. These analyses also revealed that no inter-group differences were significant at the $p < .05$ level (see Table 4).

Table 3

T-scores (t) and Level of Significance (p) for Inter-Group Comparisons of Weighted Flexible Scores

	t	p
Group I/Group II	1.746	$p < .10$
Group I/Group III	.1286	$p < .20$
Group II/GroupIII	1.897	$p < .10$

Table 4

T-Scores (t) and Level of Significance (p) for Inter-Group Comparisons of Weighted Fluent Scores

	t	p
Group I/Group II	.4056	$p > .20$
Group I/Group III	1.791	$p < .10$
Group II/Group III	1.516	$p < .10$

The same statistical procedures were applied to the weighted composite correct scores and the weighted incorrect scores. Again, no statistically significant results were obtained. These results of the t-tests were consistent with the ANOVA computations; consequently, the null hypothesis could not be rejected.

It should be noted that *t*-tests of significance comparing Groups I and II and Groups II and III from the flexible category resulted in a $p < .10$ level of confidence. Similarly, *t*-tests applied to Groups I and III and to Groups II and III from the fluent category attained the $p < .10$ level of significance.

Re-examination of the raw data revealed a dramatic overlap in the total number of responses produced by all of the subjects for each response category (see Figures 2 and 3). Figure 2 reveals that the majority of all subjects related a total of 10 to 35 flexible responses. It also demonstrates that approximately 30% of the subjects in Group II produced a total of 45 to 55 responses which may have accounted for the $p < .10$ level of significance.

Figure 3 reveals a similar situation with the majority of total responses falling between 10 and 20 responses. A small proportion of subjects from Group III (particularly one subject) deviated greatly from the majority which may have accounted for the obtained $p < .10$ level of confidence for this category.

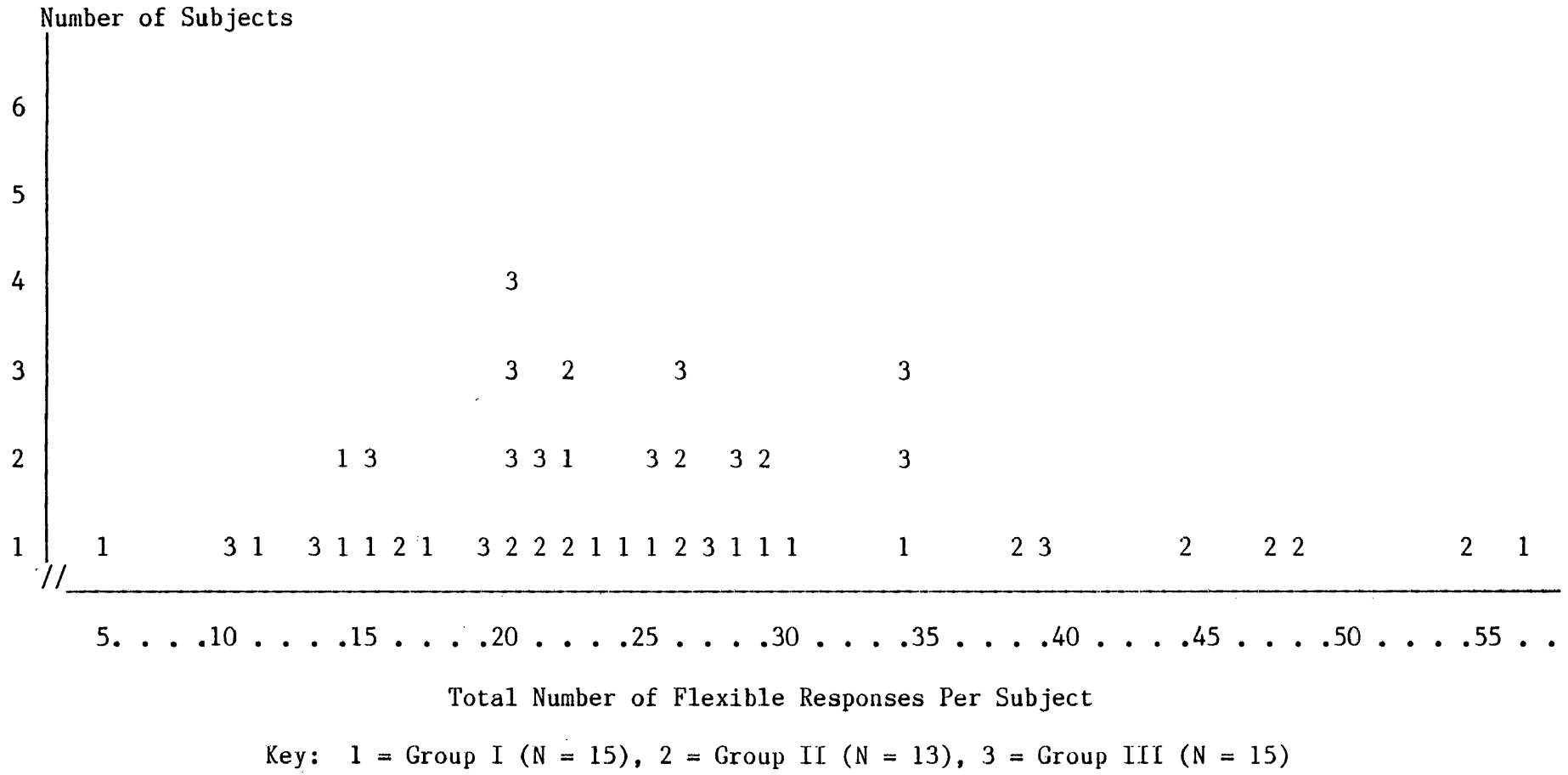

Figure 2. Dispersion of the Total Number of Flexible Responses Per Subject in Groups I, II, and III. (Each subject (N=43) is represented in the figure according to age-group membership).

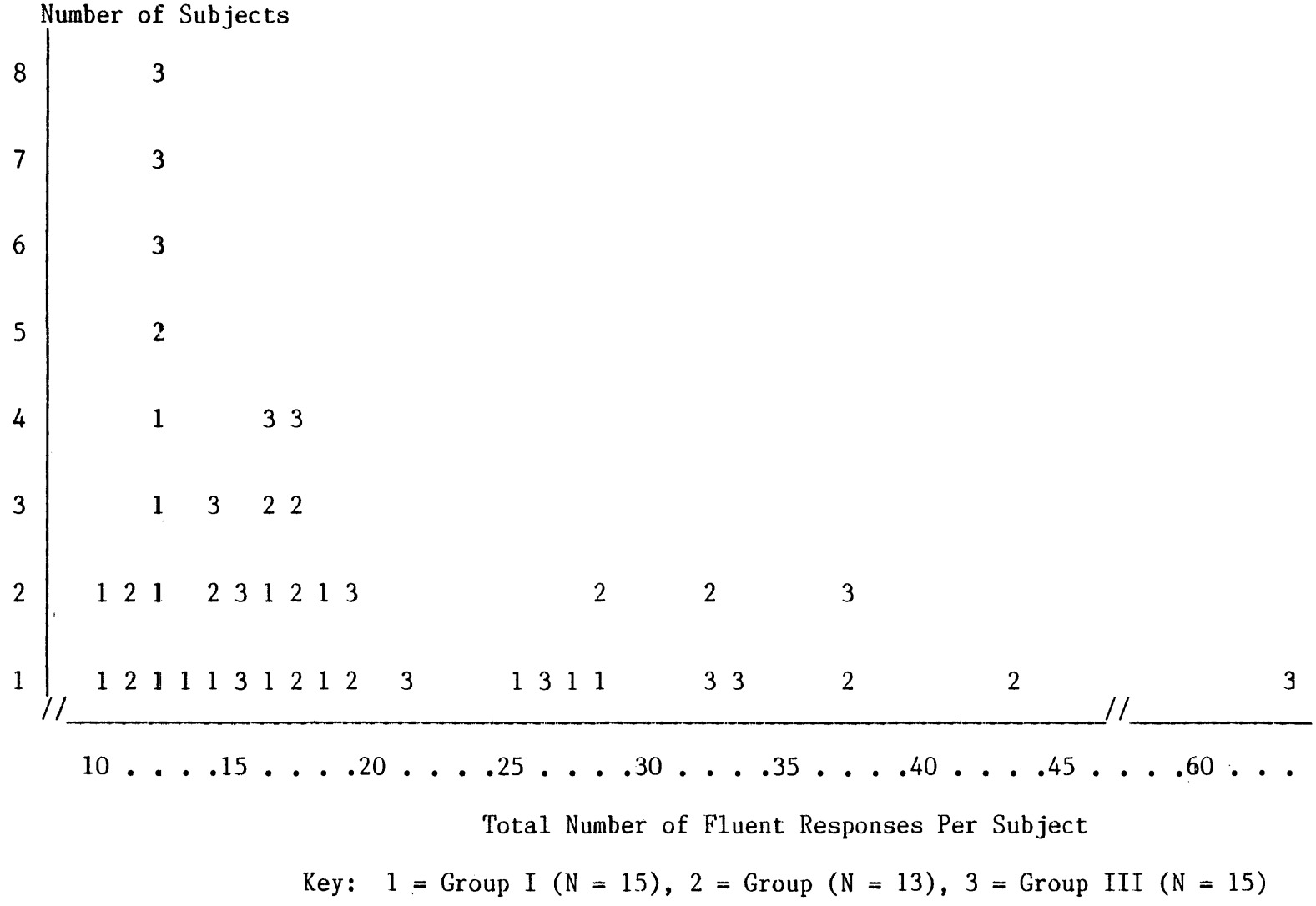

Figure 3. Dispersion of the Total Number of Fluent Responses Per Subject in Groups I, II, and III. (Each subject (N=43) is represented in the figure according to age-group membership).

CHAPTER V

Summary, Discussion, and Recommendations

The purpose of this study was to compare the ability to retrieve divergent lexical definitions from long term semantic memory across three age groups; 18-30, 33-56, and 66-86 years old. The task required retrieval of multiple unique definitions appropriate to ten randomly selected homographs for which one correct spelling represents a variety of definitions. Verbal responses to the graphically presented stimulus words were recorded on an audio-tape cassette. Responses were analyzed and assigned to three categories: (1) flexible, defined as distinctly unique definitions; (2) fluent, defined as repetitions or minor variations of flexible responses; (3) incorrect, defined, as ambiguous or unrelated responses. Both t-scores and an ANOVA revealed no differences at the $p < .05$ level of significance between the three groups' responses in any category. The findings support the hypothesis that no significant difference in retrieval of divergent lexical definitions for homographs exists across the adult lifespan.

Restatement of the Problem

Is there a significant difference in the divergent lexical definitions retrieved from long term memory for graphically presented homographs in young, mature, and elderly adults?

Restatement of the Hypothesis

There is no significant difference in the retrieval of divergent lexical definitions from long term memory for homographs between young,

mature, and elderly adults.

Description of Procedures Used

The three groups of subjects consisted of forty-three volunteers who live in Sacramento County, California. All participants had completed a minimum of twelve years of education and spoke English as their primary language.

After listening to the instructions for the research task, each participant was asked to relate as many definitions as he or she could recall for each of ten graphically presented homographs. The responses were taped on a Panasonic, model RX-F4, audiocassette tape recorder.

The taped responses were transcribed and analyzed for assignment to one of three categories: (1) flexible responses (those representing distinctly unique definitions for the stimulus words), (2) fluent responses (all correct responses representing a repetition or minor variation of a flexible response), and (3) incorrect responses (comprised of ambiguous and/or unrelated responses). Because a minimum of two distinctly different response definitions are required to demonstrate divergent semantic processing, the first correct response produced for each stimulus word was assigned to the fluent category. The responses were then weighted such that each flexible response was assigned a value of three, each fluent response received a value of two, and each incorrect response was given a value of one. Means and standard deviations were computed for each category for the three respective groups. Additionally, means and standard deviations were computed for the weighted composite correct scores. Finally, an ANOVA

and a t-test of significance were computed for each subhypothesis outlined in Chapter I. The statistical analyses revealed that no intergroup comparisons in any of the four categories reached the critical $p < .05$ level of confidence. The null hypothesis was not rejected.

Interpretation of the Findings and Discussion

The null hypothesis was clearly supported by the results of the statistical computations in this study. This seems to indicate that the research task primarily tapped the automatic processing that characterizes crystallized intelligence rather than the more effortful searching associated with fluid intelligence. The results also indicate that the task involved restricted recall rather than free recall. This supports previous studies cited in the Review of Related Research which demonstrated no significant differences between young and elderly adults in tasks investigating crystallized intelligence and/or restricted recall from semantic memory.

A review of the subjects' Personal Data Inventories revealed no significant differences between the three age groups on the factors of years of education and the number of books and periodicals read per week. The three groups also reported similar frequencies of opportunities for socialization and conversation per week. These factors did not appear to confound the results of the study.

While statistical analyses of the results of this study did not approach the critical level of significance ($p < .05$), the confidence

levels of $p < .10$ which were obtained from the t-tests invite closer inspection. The mean for Group II on weighted flexible response scores was 93.231 compared to means of 69.6 and 71.0 for Groups I and III respectively. Compared to both remaining groups, this demonstrably higher mean score for Group II was significant at the .10 level of confidence when subjected to t-tests. Given the small sample size and broad distribution of responses within groups, this .10 confidence level could be interpreted as a weak rejection of the null hypothesis warranting follow-up research with a larger subject pool.

The same may be said for the higher weighted fluent mean score of 45.87 obtained by Group III adults as compared to means of 32.4 and 34.3 for Groups I and II respectively. Again, t-tests of mean difference showed Group III's higher mean score to be significant at only the .10 level of confidence.

The clustering of the total number of responses per subject displayed in Figures 2 and 3 demonstrated the homogeneity of the three groups; however, it also was apparent that a broader variety of responses were produced by Groups II and III. This dispersion of the three groups of participants' total response scores in Figures 2 and 3 lend support to Arenberg's (1978) contention that differences in cross-sectional studies of widely varying age groups be called "age/cohort differences". "The study of aging is, inescapably, the study of widening individual differences in performance" (Rabbitt, 1982, p. 81).

Recommendations

Future research in the area of semantic retrieval might include a

comparison of a generic (long term) memory semantic retrieval task with an episodic (short term) memory semantic retrieval task. The task utilized in the present study required retrieval from generic semantic memory. Adding an episodic task such as the recall of associated word lists, a task that has been previously documented in other semantic memory research studies, would provide a basis for both inter- and intra-group comparisons of the three age-groups of subjects as well as a comparison of the episodic task results with those of previous studies. It also would be interesting to compare the results of a research task similar to that presented in this study with an episodic task requiring the recall of a list of graphically presented definitions for several homographs. This would allow a comparison of the ability to retrieve information from both generic and episodic semantic memory. Furthermore it would allow observation of the occurrence of interference in the episodic task in the form of response definitions retrieved from generic memory rather than from the list presented during the episodic memory task.

Replication of this study with more subjects within each group also is recommended in order to explore the potential significance of the group mean differences resulting from this study.

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APPENDIX A

Stimulus Words

light

head

plant

check

wave

hand

pound

point

bank

face

APPENDIX B

Instructions to Subjects

You are participating in an experiment investigating the abilility of individuals of different ages to recall definitions for homographs. I am going to ask you to tell me as many definitions as you can recall for each of ten words which are printed on cards. These words are called homographs.

A homograph is a word that has several definitions and can be used in different ways, however, a homograph has only one correct spelling.

This is an example of the task you will be doing. I will say, "Tell me as many different definitions, as many meanings, as you can for the word rock." Your response might be similar to this:

1. A rock is a heavy stone that is found in nature.
2. Mount Rushmore is made of granite rock.
3. Rock is a type of popular music.
4. Rock means moving back and forth as in a rocking chair or a row boat.
5. Rock is a word to describe someone who is strong and reliable.
6. Teens dance to rock music.
7. Rock is a man's name.
8. Rock(y) describes rough or uneven terrain.
9. Rock is a slang word for ice cube as in "on the rocks."
10. Rock is a slang word for jeopardy as in "A marriage is on the rocks."

Another example is the word pipe. Help me think of as many definitions for the word pipe as we can.

There is no time limit for this task. When you feel that you have stated as many definitions as you can, proceed to the next printed word card.

I am going to tape record your responses. They will remain confidential as outlined in the Informed Consent Statement that you read and signed. Do you have any questions?

APPENDIX C

PERSONAL DATA INVENTORY

NAME: _____

SEX: Male _____ Female _____ AGE: _____ PHONE: _____

Is English your primary language? Yes _____ No _____

Do you speak any other language(s)? Please list. _____

_____

What is your ethnic/racial background? _____

Number of years of education completed: _____

Degrees earned including high school: _____

_____

Occupation (if retired state occupation before retirement):_____

_____

How would you rate your general health?

	excellent				poor
(circle one)	5	4	3	2	1

Please list any medications you are taking: _____

What type of reading material do you enjoy?
Books _____ Newspapers _____ Magazines _____

How many books/magazines do you read each week? _____

How often do you get together with friends or relatives for conversation and socializing? _____

Do you have a history of:

1) ear infection: right ear _____ left ear _____

   How long ago was the last ear infection? _____

2) ringing in your ears? yes _____ no _____

3) hearing loss: right ear _____ left ear _____

4) do you wear a hearing aid? yes _____ no _____

APPENDIX D

University of Nebraska at Omaha

College of Education
Department of Counseling (402) 554-2727
and Special Education (402) 554-2201
Omaha, Nebraska 68182-0167

INFORMED CONSENT STATEMENT

You are invited to participate in a study which examines the ability to recall information about the meaning of words from memory across the adult life-span. You will be asked to participate in a 45 minute session at _____. You will be asked to tell as many definitions for a set of words as you can recall. Each word will have several different possible definitions. Your responses will be recorded on an audiotape cassette which willl be retained in the investigator's possession. Any future use of this tape by the investigator will be for continuing research. The standards of privacy printed in this statement will be maintained.

You will be requested to complete a short biographical questionnaire concerning your age, sex, occupation, and years of education completed. You will also be asked to participate in an audiometric pure-tone screening of your hearing acuity.

This audiometric exam will be conducted using a Beltone portable pure-tone audiometer, model 10D. You will hear a series of quiet tones (similar to those you hear when using a push button telephone) presented first in the right and then in the left ears through earphones. You will notify the examiner that you hear the tone by saying "Yes." There is no discomfort connected with this procedure. It will last no longer than ten minutes. The results will be for your private information and for the examiner's use while conducting the study. This information will not be kept by the examiner.

Participation is voluntary. You are free to withdraw your consent and discontinue participation at any time. Please do not hesitate to ask any questions about this study. You may call me at 363-8878 any evening. A copy of this form will be given to you.

YOU ARE MAKING A DECISION AS TO WHETHER OR NOT YOU WISH TO PARTICIPATE IN THE ABOVE STUDY. YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO PARTICIPATE HAVING READ THE INFORMATION PROVIDED ABOVE.

Thank you for your cooperation.

Barbara J. Gross
Investigator

_____
DATE

_____
Signature of Participant

_____
Signature of Investigator

APPENDIX E

Quantitative Raw Data

Total Raw and Weighted Responses

Per Subject for Three Categories

Group I (Age 18-30)	flexible (n x 3)	fluent (n x 2)	incorrect (n x 1)
1	23 (69)	10 (20)	3
2	25 (75)	12 (24)	1
3	14 (42)	10 (20)	1
4	17 (51)	13 (26)	1
5	5 (15)	12 (24)	0
6	56 (168)	27 (54)	0
7	23 (69)	18 (36)	5
8	15 (45)	16 (32)	0
9	14 (42)	18 (36)	3
10	29 (87)	25 (50)	4
11	11 (33)	12 (24)	2
12	30 (90)	28 (56)	4
13	28 (84)	12 (24)	2
14	24 (72)	14 (28)	3
15	34 (102)	16 (32)	4

Note: Weighted responses are shown in parentheses.

Group II (Age 33-56)	flexible (n x 3)	fluent (n x 2)	incorrect (n x 1)
1	54 (162)	16 (32)	1
2	26 (78)	14 (28)	3
3	31 (63)	17 (34)	0
4	38 (84)	37 (74)	7
5	20 (60)	12 (24)	4
6	29 (87)	19 (38)	2
7	26 (78)	17 (34)	0
8	16 (48)	11 (22)	2
9	48 (144)	17 (34)	3
10	23 (69)	11 (22)	1
11	22 (66)	22 (44)	3
12	44 (132)	14 (28)	8
13	47 (141)	16 (32)	3
Group III (age 66-86)			
1	15 (45)	32 (64)	3
2	25 (75)	17 (34)	1
3	34 (102)	21 (42)	3
4	26 (78)	33 (66)	1
5	34 (102)	37 (74)	4

Group III (age 66-86)	flexible (n x 3)	fluent (n x 2)	incorrect (n x 1)
6	19 (57)	14 (28)	0
7	28 (84)	15 (30)	1
8	21 (63)	12 (24)	0
9	21 (63)	12 (24)	5
10	22 (66)	16 (32)	2
11	27 (81)	12 (24)	1
12	13 (39)	19 (38)	0
13	39 (117)	63 (126)	3
14	21 (63)	15 (30)	3
15	10 (30)	26 (52)	1