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AN ANALYSIS OF RESTRICTED WORD ASSOCIATIONS OF ELDERLY PERSONS

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ABSTRACT

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The investigation and rehabilitation of semantic confusions found among elderly aphasic patients has been limited in scope due to the comparatively meager knowledge of restricted word association responses elicited by nonpathological ("normal") elderly persons. In order to distinguish between linguistic changes resulting from neuropathological conditions and those changes (if any) caused by the aging process, it is first necessary to have a thorough understanding of "normal" language usage among the elderly population. Thus, the purpose of this investigation was:

1. to provide data on four restricted word association tasks presented to a group of nonpathological elderly subjects,

2. to investigate the effects of age, sex and years of formal schooling on the restricted word association responses elicited by the elderly subjects.

One hundred thirty-two nonpathological elderly persons, who passed a visual, hearing and mental ability screening procedure, served as subjects. All subjects were white,

native born American English speakers. Subjects were divided into two age groups (65 to 74 years, 75 years and above); two sex groups (males, females); and two educational groups (less than high school education, equal to or greater than high school education).

A synchronized audio-visual presentation of 25 nouns was used to elicit responses for four restricted word association tasks. The four task conditions consisted of two logical tasks (superordination, similarity) and two infralogical tasks (location, part). The same 25 nouns were presented on each task. However, the ordinal presentation of the noun stimuli varied from task to task based on the "easiest" to the "least easiest" stimulus item on each task.

Subjects were seen individually for approximately 40 minutes. Each of the four tasks was presented using the following format:

1. subject read task instructions
2. three practice items were presented
3. questions of clarification were answered
4. noun stimuli (n = 25) were presented

Responses were graphically and electronically recorded.

Data were analyzed employing descriptive and inferential statistics. Descriptive statistical analyses were used to:

1. determine the common responses and corresponding frequencies of occurrence elicited by 85 percent of the elderly population sampled on the four tasks.

2. determine the primary responses and corresponding frequencies of occurrence elicited by the elderly population sampled on the four tasks.

3. determine the diversity scores for each lexical stimulus item on the four tasks.

Results indicate that the infralogical location task had the highest amount of response agreement, whereas the logical similarity task had the highest amount of response variability. This pattern was consistent irrespective of the age, sex or educational level of the elderly subjects.

Interpretation of three two-way, fixed effects analyses of variance yielded the following results:

1. Overall primary response agreement was unaffected by the age of the elderly subject. Results indicate that restricted word associations remain relatively stable for elderly persons aged 65 years and older.

2. Female elderly subjects had significantly higher response agreement than their male counterparts.

3. The number of formal years of schooling influenced the response agreement obtained by elderly subjects. Persons with more years of formal schooling exhibited higher response variability than persons with less years of formal schooling.

To my Grandparents, Dad and Mom: the stems from which I blossom!

To Dr. John W. Black and Dean Frank Hale: for providing the water!

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CHAPTER I

STATEMENT OF THE PROBLEM

Introduction

The 1971 White House Conference on Aging made numerous disciplines of social science cognizant of the paucity of research which examined the biological, social and cognitive behaviors characteristic of the elderly population. For purposes of the present investigation and in keeping with government specifications (U.S. Census, 1974), the elderly population is defined as those individuals who have attained 65 or more years of age.

Among the disciplines recognized as having limited knowledge on behavioral attributes of the elderly was audiology and speech sciences. Consequently, the American Speech and Hearing Association delegated a committee whose primary objective was to conjoin with government officials to develop a conceptual framework which assessed the communication disorders existent among the elderly and to provide intervention strategies that took into account the special needs of geriatric populations. The strategy for assessment and intervention was outlined in the following statement:

> Further investigation is required in the identification, evaluation and treatment of communicative disorders of the aged. Multidisciplined studies of medical, social and psychological aspects of aging are necessary for specifications of the meaning of rehabilitation in geriatrics, and for the development of a philosophy regarding communicative disorders of the aged. (National Institute of Neurological Disease and Stroke, 1968, p. 7).

Past research investigating the speech and language of elderly persons has focused on how neurological diseases affect the communicative process. The disease that has caused extensive linguistic disability among the aged is stroke. Synonymously termed cerebral vascular accident, a stroke results from disruption of the blood supply to the brain due to cerebral thrombosis, hemmorrhage, or embolism (Felton, Perkins and Lewin, 1966).

An epidemiological survey by Stallones et al., (1972) revealed a positive correlation between the occurrence of stroke cases and increasing age. Based on a sample of one million people, Stallones reported an estimated incidence of stroke per 1,000 persons and expected new cases per year (Table 1). A comparison of the incidence figures observed in group D with those observed in groups E and F indicates that a person's chances for having a stroke doubled at age 65 and more than tripled by the age of 75 years. The number of new cases per year followed similar trends. In addition, Stallones stated that 90 out of every 100 persons surviving the initial cerebral vascular accident were affected by post-stroke disabilities which required special assistance.

TABLE 1

ESTIMATED INCIDENCE AND EXPECTED NEW CASES OF STROKE PER 1,000 PERSONS AS REPORTED BY STALLONES, ET AL. (1972, p. 367)

Group	Age Range	Estimated Incidence per 1,000	Expected New Cases per Year
A	0-34	0.00	0
B	35-44	0.25	28
C	45-54	1.00	114
D	55-64	3.50	320
E	65-74	9.00	550
F	75 and up	30.00	1,126

The poststroke disability that is of primary concern to the speech and language pathologist is aphasia. According to Schuell and Jenkins (1961), aphasia is a reduction of language resulting from brain injury. This reduction cuts across all language modalities. Buckman (1971), Spahr (1971) and Sheridan (1976) recognized aphasia as having a high degree of prevalence among older persons. Because of its prevalence, aphasia is considered to be a geriatric communication problem.

An abnormal linguistic behavior resulting from aphasia that has captured the attention of numerous investigators is semantic confusion. According to Schuell and Jenkins (1961), semantic confusions occur when an aphasic individual substitutes a word that is associated in meaning or experience for the target word. Researchers investigating semantic confusion among aphasic patients (e.g., Spinnler and Vignolo, 1966; Spreen, 1968; Rinnert and Whitaker, 1973; Spreen and Wachal, 1973; Zurif, et al., 1974) have found that 1) semantic confusions constitute the most frequently occurring error-type among aphasic patients; and 2) the errors are not random, but appear to be substitutions of closely associated words for the target word intended by the patient. Responses given by aphasic subjects are usually compared to normative data compiled via word association tests. In general, tests of word association are categorized according to the type of response elicited from the subject (Cramer, 1968). In a free association test (Type 1) there are no circumscribed categories designated in which a response must be given. The

subject is allowed to give a response from any semantic or conceptual category. In contrast, a restricted or controlled association test (Type 2) places a limit on the type of response that is acceptable. Information on the type of response required is either presented in the instructions (e.g., "You are to name the opposite of down.") or the subject must select his answer from the response alternatives provided by the experimenter. Current terminology indicative of the two types of responses obtained from tests of word association has been proposed by Wiig and Semel (1976). Divergent semantic production (defined as the process of recalling and producing a variety of words and concepts, word associations, phrases or sentences) is synonymous with responses obtained on free word association tests. On the other hand, convergent semantic production (defined as the process of recalling or producing a specific word, word association, phrase or sentence to fit the meaning of the stimulus) closely resembles responses obtained on restricted association tests.

A substantial amount of data has been compiled on free association responses of elderly persons. Dörken (1956) studied the oral responses of subjects whose ages ranged from 10 to 79 years. Data indicated a progressive increase in the number of common primary responses (i.e., the most frequently occurring responses given to each stimulus by each subject) until age 39. After age 39, however, the frequency of common responses began to decline. The

author attributed the resulting change in primary response strength to the subjects' active participation and involvement in the affairs of society until the late thirties. This was followed by a gradual withdrawal from certain activities accompanied by a decline in the occurrence of common associative responses.

Tresselt and Maynzer (1964) presented the Kent-Rosanoff Word Association Test (1910) to 738 subjects (ages 18 to 87 years). Results indicated a significant decrease in the popularity of the most common responses from the younger adults (ages 18 to 21 years) to the older adults (ages 55 to 87 years). In addition, more response variability (termed heterogenous responses by the authors) was found among the elderly group of subjects when compared to the younger group. Tresselt and Maynzer speculated that "the increase in variability (among the older adults) might be due to the development of rugged individualism in the older group as contrasted with a drive to conform in the younger group". (Tresselt and Mayzner, 1964, p. 66).

In a study of 500 subjects in northern Germany, Riegel and Riegel (1964) verbally presented a 120-item free word association test to each individual subject. Groups of 76 subjects were equally divided by sex into five age levels (55-59, 60-64, 65-69, 70-74, and 75 years and over). Stimuli were divided into four grammatical classes and varied in frequency of occurrence in the German language. A comparison of the older adult group with a young group (consisting

of 120 subjects, ages 16-20 years, who were equally divided by sex) indicated a continuing increase in response variability with age. In a subsequent study, Riegel and Birren (1965) found parallel results of greater response variability among the older subjects (ages 60 to 80 years) when compared to young adults (ages 18 to 33 years).

Sefer and Henrikson (1966) administered a free association test to 50 aphasic and 50 nonaphasic individuals, all of whom were in-patients at a veteran's hospital. Sixty-four percent of the nonaphasic subjects were over age 50. Comparing the nonaphasic subjects with an undergraduate male population used as subjects in a study by Deese (1962), the authors found a decrease in the number of homogenous responses given to certain form classes by the older nonaphasic adults. Sefer and Henrikson concluded that the difference in normal patterns of responses is affected by educational level, by frequency of stimulus words in general usage, and possibly by the subject's age.

Comparatively few investigations of restricted associations have been conducted on nonpathological elderly persons. For purposes of the present investigation, a nonpathological elderly individual is operationally defined as a person, age 65 years and above, who passess the screening procedures of having:

1) no more than two errors on the Mental Status Questionnaire (Kahn et al., 1961),

2) normal hearing,

3) task-appropriate visual ability.

An elaboration of the screening procedures appears in Chapter Three (Research Methodology). The majority of published normative data on restricted association tests have been obtained by using college students as subjects (e.g., The Michigan Restricted Association Test, Riegel, 1965). Yet, tasks of restricted association have been presented to aphasic patients on several occasions in research (e.g., Spinnler and Vignolo, 1966; Lansdell, 1973; Lesser, 1973; Yamadorii and Albert, 1973; and Zurif, et al., 1974) and as subtests on formal diagnostic examinations of aphasia, (e.g., the animal naming subtest of the Boston Diagnostic Aphasia Examination, Goodglass and Kaplan, 1972). Although many of these studies do not report the age of their aphasic subjects, prevalence figures of aphasia among the elderly (Stallones, 1972) allows one to speculate that some of the patients fell within the age range of 65 years and above.

Pragmatic application of word association research has evolved through a therapeutic procedure called "associative cueing." During this intervention strategy, the clinician either presents associated words as cues (based on normative data) or capitalizes on the client's self-generated associative responses. Berman and Peele (no date) hypothesized that self-generated semantic confusions often triggered the response intended by the aphasic patient. Reported case studies indicated that the self-generated responses consisted of synonyms, opposites and homonyms. Analogous categories have been used on restricted word association tasks (e.g., Schuell and

Jenkins, 1961; Riegel, 1965). In addition, Wyke (1962) provided experimental evidence which indicated that correct verbal responses from aphasic patients were facilitated when the possible choice of response words was restricted by the stimulus situation.

A psycholinguistic theory proposed by Schuell and Jenkins (1961) stated that aphasia is characterized by a reduction of language that follows the same principles as normal language usage among adult populations. In support of this theory, Howes (1964) and Taylor (1966) found that the vocabulary of aphasic patients shifted in the direction of reduced variety. The reduction, however, followed the same type of word association patterns elicited from non aphasic ("normal") subjects. Results indicated that associative disturbances were a matter of reduced quantity rather than dissimilarity in the quality of responses given. Subsequent studies by Sefer and Henrikson (1968) and Rinnert and Whittaker (1973) have reported similar findings and conclusions.

The major criticism of these studies is that "normal language" is either not defined or is based on language samples obtained from young educated college students. Noting the accelerated increase in the number of persons attaining age 65 years, Rockstein (1975) stated that there is a need for a complete understanding of the facts of normal aging. In agreement with Rockstein, Hutchinson and Beasley (1976) concluded that future investigations of language and speech functions in the elderly population should be aimed at

defining "normal" functioning. Such research could, perhaps, detect subtle syntactic, semantic and motor programming changes that result from the aging process. Alluding to the specialized instruction necessary for caregivers of poststroke victims, Oyer (1976) stated that knowledge regarding language behavior in the older population is limited and further research is required.

Changes in word meaning from one generation to the next have also been considered in the aging process for language and speech functions. Recognizing word meaning as time and culture bound, Oyer (1976) speculated:

> If generational differences have attributed different meanings to the same words, ideas are not communicated any more than they would be were communicants speaking two foreign languages. Semantic obstacles can impede communication between generations or between social classes or ethnic groups.(Oyer and Oyer, 1976, p. 50).

In summary, then, limited information is presently available on normal speech and language characteristics of elderly people. More specifically, results of restricted association tasks presented to elderly aphasic individuals are limited in scope because of the comparatively meager knowledge of restricted association responses given by nonpathological elderly persons. Considering the fact that educational level and possibly age affected the responses obtained from nonaphasic elderly subjects on a free association test (Sefer and Henrikson, 1968), there is a need to analyze the restricted associative responses of nonpathological elderly

persons within specific age levels and at varying levels of formal education.

Purpose

The purpose of the present investigation was to provide data on restricted word association tasks presented to a sample of nonpathological elderly persons. Before presenting the specific research questions to be investigated, an understanding of related terminology is necessary.

Terminology

For purposes of this study, the terms used are operationally defined as follows:

Lexical Stimulus Items. The 25 nouns selected from the original test of the Michigan Restricted Association Test (Riegel, 1965). The 25 nouns were presented to each of 132 subjects to elicit a set of responses. The list is included in Chapter Three (Table 5).

Logical Tasks. This term implies that the response set given by each subject should have reflected class membership or class relationship to the lexical stimulus item (Flavell, 1963). The two logical tasks under investigation included superordinates and similars.

Infralogical Tasks. This term implies that the response set given by each subject should have reflected a temporal or spatial relationship to the lexical stimulus items (Flavell, 1963). The two infralogical tasks under

investigation included locations and parts.

Superordinate. The name of the general class to which each lexical stimulus item belongs (e.g., the class name for stove is appliance).

Similar. A word that means the same as each lexical stimulus item (e.g., a word that is similar to car is automobile).

Location. The place where each lexical stimulus item can be found (e.g., a lion can be found in the jungle).

Part. An attribute or characteristic of each lexical stimulus item (e.g., part of a zebra are its stripes).

Primary Response. The most frequently occurring single response given by the subjects to each test stimulus item.

Common Response. A response given by two or more subjects to a test stimulus item.

Idiosyncratic Response. A response that is given by only one subject.

Diversity Score. The number of different responses given by subjects to a test stimulus item under a specific task instruction.

Research Questions

Based on the above terminology the following research questions were investigated:

1. In the restricted association task of superordination, what are the frequencies of occurrence of the common responses given by 85 percent of the nonpathological elderly group sampled?

2. In the restricted association task of similarity, what are the frequencies of occurrence of the common responses given by 85 percent of the nonpathological elderly group sampled?

3. In the restricted association task of location, what are the frequencies of occurrence of the common responses given by 85 percent of the nonpathological elderly group sampled?

4. In the restricted association task of part, what are the frequencies of occurrence of the common responses given by 85 percent of the nonpathological elderly group sampled?

5. In the restricted association tasks of superordination, similarity, location and part what primary responses occur for each of the 25 lexical stimulus items?

6. Is there a significant difference between subjects, ages 65 to 74 years, and subjects, ages 75 years and above, on restricted association tasks of superordination similarity, location and part as measured by the number of primary responses given by each subject in each age group?

7. Is there a significant difference between male and female subjects on restricted association tasks of superordination, similarity, location and part as measured

by the number of primary responses given by each subject in each sex group?

8. Is there a significant difference between the subjects having less than high school education and subjects having education equal to or greater than high school on restricted association tasks of superordination similarity, location and part as measured by the number of primary responses given by each subject in each education group?

9. Does the pattern of restricted association responses differ significantly between the logical instruction (superordination, similarity) and infralogical instructions (location, part) as a function of age, sex or education?

Organization of the Dissertation

Chapter One contains a statement of introduction about the limited information available on the linguistic behaviors of nonpathological elderly persons. The exact purpose of the study and its potential importance to the research literature are included. The major terms used in this study are defined, and the research questions are stated. Chapter Two reviews the scientific literature pertinent to this investigation. Theoretical and research papers investigating the cognitive ability of elderly individuals are summarized. Of particular interest is the growing concept of life-span developmental psychology. Previous studies of word association investigating the effects of age,

sex, educational level and stimulus presentation on responses elicited are reviewed.

Chapter Three describes in detail the subjects, the screening tests, the equipment, the materials and the research procedures employed in this study.

Chapter Four presents the data collected from this investigation and a discussion of the results.

Chapter Five incorporates a summary of the problem investigated, the conclusions drawn as a result of this study and the recommendations for further research activity.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

Prior to World War II, the concept of aging in the American society was primitive in scope. Unlike persons living in third world countries of Africa and Asia, who have invariably viewed the aging process as an interaction among equally weighted physiological, psychological and sociocultural forces (Manney, 1975), the perspective of later life that was widespread throughout the United States was one of an irreversible biological process that caused systematic deterioration in the mental and physical abilities of an individual (Baltes and Willis, 1975; Botwinick, 1973; Kimmel, 1974).

The post World War II introduction of life span developmental psychology, however, led to a revamping of the theoretical viewpoint which purported that decrement and deterioration were natural consequences of growing old. Essentially, supporters of life span developmental theory (e.g., Baltes, 1973; Baltes and Willis, 1975; Busse and Pfeiffer, 1969; Goulet and Baltes, 1970; Kimmel, 1974; Labouvie-Vief, 1976; Schaie and Gribbin, 1975) contended

that both maintenance and decline of human abilities across the life span were a function of the interaction of physiological, psychological and sociocultural factors. The perspective purported by life span developmental theorists was summarized in the following statement:

> The conclusion that aging change is change toward slowness, less behavior, less acquisition, less performance and greater dependency may be more a function of the theoretical orientation applied than a representative assessment of the universe of aging change itself. (Baltes and Willis, 1975, p. 14).

The authors suggested that both biological and environmental influences operate and interact in the production of behavior change processes. They concluded that greater empirical research efforts were desirable in strengthening environmental, psychobiological and ecological conceptions of behavior change processes.

The intent of the present literature review is to focus on theories and empirical research which have investigated cognitive functioning among elderly persons and to relate these findings to a particular component of language usage by the elderly. Specifically, the topics to be discussed include the following:

1. Historical and Current Conceptualizations of Adult Cognition
2. The Relationship of Semantics to Word Association
3. Effects of Age, Sex and Educational Level on Responses Obtained on Restricted Word Association Tasks

4. Effects of Mode of Stimulus Presentation on Word Association Responses

Historical and Current Conceptualizations of Adult Cognition

Cognition is defined by Arenberg (1968) as effectiveness in dealing with information. Processes of cognition include registering, storing, retrieving and manipulating information to solve a problem. Formal measures of cognitive abilities within individuals are obtained through the use of intelligence tests.

Numerous studies in experimental psychology have focused on changes in cognitive skills across the life span. In fact, no area of aging research has received greater attention than the assessment of cognitive abilities via intelligence tests (Botwinick, 1967; Eisdorfer, 1969; Riegle, 1973a). Conclusions evidenced in most published research on adult cognitive skills are based on the biomaturational ontogenetic model of cognitive development. According to this model, adult cognitive development is an extension of early childhood development. It is assumed that during childhood and adolescence, an individual acquires stable psychological traits, abilities and competencies (Riegel, 1975). Development is indexed by pre-programmed biomaturational stages which follow a unilinear irreversible progression (Reese, 1962). Furthermore, an individual is said to reach biological maturity during the adolescent years with mental, physical and physiological capacities operating

at a level of peak performance. Labouvie-Vief (1977) points out that research investigating the period of life that remained after peak performance had been reached (the period from young adulthood through old age) addressed two major questions:

> 1) Once adolescence is reached, how long is peak performance maintained? and 2) When does performance become disrupted by presumptive biological deterioration?

Both cross-sectional studies (one observation on multiple cohorts) and longitudinal studies (multiple observations on one cohort) have attempted to answer these two questions. Within the realms of the two research strategies, quantitative and qualitative characteristics of adult intelligence have been reported. Depending upon the research design employed (cross-sectional or longitudinal), a difference exists in the results obtained.

In a classic cross-sectional study of adult learning, Thorndike (1928) determined that peak learning performance occurred at age 22 years and declined about one percent per year until age 40. Similar results were reported by Weschler (1958). During an attempt to standardize the Bellevue Intelligence Scale (which was later renamed the Weschler Adult Intelligence Scale), Weschler reported a high peak of performance for his subjects at 22 years followed by a gradual decline. Subsequent cross-sectional studies (e.g., Balinsky, 1941; Lienert and Crott, 1964; Schaie, 1962)

confirmed Thorndike's and Weschler's findings and extended the decline into the sixth and seventh decades of life.

Investigations employing longitudinal research strategies have failed to substantiate the conventional view of decline in intelligence during adulthood and old age. Data indicated that increments existed in some subjects until at least the mid-fifties (e.g., Owens, 1953; Bayley and Oden, 1955). Other longitudinal research (e.g., Miles, 1934; Jarvik, et al., 1962; Kallman and Jarvik, 1959; Tuddenham, et al., 1968) supported the trends found in cross-sectional studies but concluded that the rate and magnitude of decline was less than was indicated by cross-sectional data.

Thus, the conclusion purported by most investigators was that cognitive performance among the elderly was characterized by irreversible regression and decrement. Furthermore, the decline in cognitive function was attributable to normal universal biological breakdown (Labouvie-Vief, 1976).

The study of differential patterns of cognitive changes associated with adulthood and old age provided qualitative data on specific areas of maintenance and decrement in intellectual capacities. Research centered around a model conceptualized by Cattell and Horn (Cattell, 1963; 1967; Horn, 1968; 1970). Two differential patterns of cognitive functions were distinguished: fluid intelligence and crystallized intelligence. Fluid intelligence referred to abilities which reflected neurological and physiological capacities and incidental learning (Hooper, Fitzgerald and Papalia, 1971). According to Cattell (1968), cumulative

effects of aging as well as environmental insults, loss of sensation in the sensory modalities, and insults to the brain were reflected in decreased fluid intellectual capacities.

In comparison, crystallized intelligence was recognized as the product of acculturation and experience. This form of intelligence included individual differences in factors such as personal adjustment and motivation (Hooper, Fitzgerald and Papalia, 1971). According to Hooper and his colleagues, crystallized abilities were superimposed upon the basic (fluid) intellectual capacities, which, according to Horn (1968), operate to some extent in all intellectual performances. Cattell considered crystallized intelligence to be "the collection of skilled judgments a person has acquired by applying his fluid intelligence to his school opportunities" (Cattell, 1965, p. 304).

According to Labouvie-Vief (1976), the fluid-crystallized model of intellectual ability has been substantiated across literally "hundreds" of research studies. Every major cross-sectional study conducted has consistently demonstrated that tests measuring stored information exhibit the least differences between young and old subjects. Conversely, the earliest and most dramatic losses have been consistently shown to occur on tests of memory, space and abstract reasoning abilities (Baltes and Labouvie, 1973; Botwinick, 1973).

Labouvie-Vief (1976) summarizes the distinct polarity between maintenance and improvement of crystallized intelligence

and deterioration of fluid intelligence in adulthood and old age. Speaking of fluid intelligence, she states:

> ...tests relating to the perception of abstract relationships among symbols of low meaningfulness (such as, for instance, geometric shapes) to the integration of new and complex materials and to the effective use of information under conditions of time restrictions and in highly abstract contexts are those on which the older adults tend to do much poorer than their younger counterparts. (Labouvie-Vief, 1976, p. 7).

In comparison, crystallized intelligence is viewed in the following manner:

> ...cognitive tests which assess an individual's accumulation of verbal skills and general information on tasks of learning, memory and problem solving are those typically found to improve throughout adulthood and well into old age. (Labouvie-Vief, ibid).

Thus, as shown by Botwinick (1967), the classic pattern of cognitive ability among the elderly on, for example, the Weschler Adult Intelligence Scale (WAIS) shows high scores on subtests which assess crystallized or verbal skills (Information, Comprehension, Arithmetic, Similarities, Digit Span and Vocabulary subtests) and low scores on subtests which assess fluid or performance skills (Digit, Symbol, Picture Completion, Block Design, Picture Arrangement and Object Assembly subtests).

Theories which purport that the biomaturational process provides the best explanation for regressive decremental changes in adult cognitive behavior are currently

being challenged by equally possible theoretical positions and associated research evidence. Although physiological conditions are considered to have some effects on the cognitive abilities of adults and elderly persons, these effects appear to be minimal, especially in healthy elderly individuals. This notion is supported by the "Discontinuity Hypothesis" proposed by Birren (1964). According to Birren, physiological factors account for variability in cognitive behavior only if the factors reach critical abnormal ranges as is evidenced in persons suffering pathologies and/or approaching death. Thus, Birren's hypothesis argues that physiological indices are considered to be determining and sufficient causes of cognitive deficit only when health limits are exceeded.

Cognitive decline has been found to occur within a period ranging from a few weeks to five years prior to death (Palmore and Cleveland, 1976; Riegel and Riegel, 1972). This phenomenon, known as "terminal decline", has been investigated by several researchers either conducting or having access to data from longitudinal studies.

Jarvik and Falek (1963) tested 39 twin pairs, aged 60 years and older, who were part of a large sample of subjects first examined between 1946 and 1949. The 78 twins were tested on two subsequent occasions. Each person was given four subtests of the Weschler-Bellevue Scale of Adult Intelligence, the Standford-Binet vocabulary test and a speed-of-tapping test. An annual rate of decline of each person

was computed for each of the tests. The authors reported that an annual decrement of at least two percent on the digit symbol subtest, 10 percent on the similarities subtest, or any decline on the vocabulary subtest was indicative of approaching death. Subjects showing two or three of these decrements had high mortality rates (e.g., of eight people, seven died within the next five years).

In an analysis of data from the Duke Longitudinal Study (Palmore, 1970), Eisdorfer and Wilkie (1974) found that terminal decline occurred primarily in the ninth decade of life, and the major portion of decline occurred on those subtests involving time limitations (psychomotor speed tests). The Duke Longitudinal Study began in 1955 with a total population of 271 persons (aged 60 to 90 years) whose survivors had been periodically examined nine times.

A subsequent report by Palmore and Cleveland (1976) analyzed 21 social, physical and psychological variables of 178 subjects from the original Duke Longitudinal Study. Data were analyzed on these subjects because they had all died from natural causes (nonaccidental). A cross-sectional multiple regression analysis was performed to measure the separate effects of aging decline and terminal decline (defined as a steady linear decline prior to death). In addition, a longitudinal multiple regression analysis was performed to measure the separate effects of aging decline and terminal drop (defined as a curvilinear or accelerating drop before death).

Intelligence (as measured by the Weschler Adult Intelligence Scale) was found to have a moderate aging decline (R = .31), a small but significant terminal decline and no substantial terminal drop effects.

The conclusion drawn from the longitudinal research cited is that cognitive decline is evidenced in adult and elderly persons as a function of distance from death rather than from birth. Hence, the curve showing continuous decrement found in most research studies is the result of chronological age being confounded with mortality and age-related increases in pathological conditions that are associated with, and eventually lead to, natural death. Other investigators of intellectual changes across the life span (e.g., Riegel and Riegel, 1972; Baltes and Labouvie, 1973) support the hypothesis of terminal decline.

Palmore and Cleveland (1976) were careful to point out the limitations of studies supporting the terminal decline hypothesis. The first major problem was that age differences were not taken into account, thereby creating a confounding interaction of age with generational and sociocultural differences. Second, the majority of previous studies had small samples of 28 or less persons. A third criticism proposed by Botwinick (1973) and Jarvik and Falek (1963) is that reported data are based on postmortem observations. Therefore, predictions of approaching death may be invalid. Jarvik and Falek emphasized that postmortem analyses were only first steps to the

prediction of survival.

In sum, recent studies investigating changes in adult and elderly cognitive abilities as a function of bio-physiological factors have strongly contended that these physical alterations are not normally distributed among the elderly but rather are manifestations of a subpopulation of elderly persons whose lives are characterized by pathology, poor health and nearness to death. Cognitive impairment, therefore, is not so much a universal concomitant condition of advancing age as it is of impending death.

Another group of researchers have focused their efforts on gathering evidence that dramatizes the impact of environmental conditions on the intellectual performance of adult and elderly persons. An extensive review of current research addressing this issue has been published by Labouvie-Vief (1977). According to this hypothesis, decrements in cognitive skills may often reflect lifestyles, attitudes, task approaches and psychological defenses that are disadvantageous to the adult and elderly individual within a testing situation. Factors such as lack of physical exercise, poor nutritional and dietary habits, poor self concepts, experimental fatigue, increased anxiety level during test situations and lower formal education levels have been considered as explanatory variables that possibly account for the decremental cognitive abilities observed in adult and elderly individuals. Through intervention strategies, many researchers have reported improvement in cognitive

skills, especially on tasks of fluid intelligence. Once model performance behaviors are demonstrated for, and acquired by the adults, optimal cognitive performance has been found to be generalized to other intellectual tasks and are usually retained by subjects for long periods of time.

Summary

The first part of the literature review has summarized the historical and current theories of adult cognitive abilities. Included in this first section was information on the ontogenetic developmental model of cognitive abilities and more current theory of life span developmental psychology. In addition, two types of intelligence (crystallized and fluid) were defined and investigations supporting these two distinct intellectual abilities were summarized. Although, for purposes of clarity, both fluid and crystallized intelligence were discussed, the present investigation focused exclusively on an aspect of crystallized intelligence - the semantic relationships that exist for a given set of words.

Thus, in section two of the literature review, a brief discussion of the concept of semantics is provided, the relationship of semantics to tests of word association is discussed, and research focusing on changes in word association responses as a function of age, sex and educational level is reviewed.

The Relationship of Semantics to Word Association

Theories of modern linguistics conceptualize language as a form of structuralism (Fillebaum and Rapoport, 1971). Linguistic structuralism implies that each language is regarded as a set of interrelated systems characterized by linguistic elements (e.g., phonemes, morphemes, grammar) and the relations that exist among these elements (Lyons, 1968). The relationships between phonological and grammatical systems of the English language have been formally documented by such linguists as Chomsky. In his book, Syntactic Structures, Chomsky (1957) substantiates the notion that phonological and grammatical structures of a language can be studied objectively because of the finite and concise rule system implicit to these two linguistic elements.

In contrast to the objectivity and finite character of phonology and grammar, the semantic element of a language is composed of subjective lexicons (Fillenbaum and Rapoport, 1971). According to these two psycholinguists, a lexicon (or word) is considered to be subjective because its meaning is intricately woven into the perceptions and understanding of the external world by human observers. Subjective lexicons are not isolated independent features of a language. Instead, the words are combined to form interrelated associative structures which constitute the semantic domain of a language and represent the "world picture presupposed by those who speak that language" (Miller, 1968, p. 68).

Associative networks, defined as a relationship among more than two elements, are composed of lexical fields consisting of a given lexicon and other words which are closely or remotely related to the lexicon conceptually (Miller and Johnson-Laird, 1976). According to Miller and Johnson-Laird, a lexical field is composed of two processes. First is the process of shared conditions that determine denotations of the words within the field. Second, there exists a conceptual core which is an organized representation of general knowledge and beliefs about what objects or events the word denotes.

The internalized configuration of the relationships comprising the sematic domain has been of interest to experimental psychologists for many years. Empirical investigations of the semantic domain have mainly been conducted through the use of word association tests. Introductory comments about word association was included in Chapter One. Thus, the remaining portion of the literature review will summarize studies that investigate changes in word association responses as a function of the subject's age, sex and educational level. Studies which investigate the effects of sensory modalities used for presenting the stimulus items on the responses obtained are also reviewed. Lastly, the procedures employed by investigators to analyze data obtained from tests of word association are discussed.

Effects of Age on Responses Obtained on Word Association Tasks

The increasing popularity of life span developmental psychology has motivated researchers to explore associative networks in middle and late life. Extending Piagetian theory into adulthood, Riegel (1973 b & c) proposed that the semantic domain in adulthood and old age is controlled by "dialectic operations". As defined by Riegel, dialectic operations represented simultaneous usage of the skills existing at all four of the cognitive stages originally proposed by Piaget. These stages include the sensori-motor, preoperational, concrete operational and formal operational stages of cognitive development. Piagetian theory (Flavell, 1970) states that an individual who experiences disequilibrium strives toward equilibrium by utilizing formal operational thought processes and, thereby, moves away from contradictions and concrete thought processes. In contrast, Riegel's theory of dialectic operations proposes that a mature individual accepts disequilibrium and tolerates contradiction. Therefore, the individual can transcend different levels of cognition simultaneously. Riegel purports that such "multilevel synchronicity is desirable for appropriate performance in different situations" (Riegel, 1973c, p. 482). Previously dormant as a consequence of physical restrictions, normative social pressure and formal education, this newly acquired flexibility in cognitive skills enhances creative thought. According to Riegel the creativity and flexibility of thought processes in later life perhaps accounts for the extensive response variability on tasks of

word association reported in the literature.

Studies of free associative responses characteristic of nonpathological elderly subjects have been summarized in Chapter One. The review which follows discusses results obtained on restricted association tasks that were administered to older subjects.

In a reverse procedure, Riegel and Riegel (1964) asked 12 subjects (age 64 and over) to identify the original stimuli (called target words) that had produced the responses obtained on the Michigan Restricted Association Norms (Riegel, 1965). The experimenters used responses collected on the norms as stimuli (called clue words). The eldery subjects' responses were compared with 96 young subjects. For both young and old subjects, double clues were found to produce more correct identification of the target word than single clues. "Similars" were found to be the most efficient single clue. In addition, simultaneous usage of similars with any of the other clues (location, superordinates, and parts) was found to increase correct identification of the target word. In comparison, locations and superordinates were very poor as single clues but were only slightly below the average score when used in combination with other clue words. Parts gave average correct responses regardless of their being used as a single clue or in a combination with another word.

Grouping the clues into logical (superordinate and similars) and infralogical (locations and parts) components, Riegel found that double logical clues showed large age

deficits, whereas both double and single infralogical clues produced less marked declines. These findings are in direct opposition to the results obtained by Zivian (1966) and Wigg and Globus (1971). Both studies reported that a greater number of target words were correctly identified from logical clues than from infralogical clues. Mixed clues (e.g., parts and similars) showed average decline. Riegel (1964) concluded that the findings implied a specific lack of capacity on the part of elderly subjects to deal with more abstract (logical) relations. The elderly were said to prefer a concrete (infralogical) focus of conceptualization.

Wigg and Globus (1971) performed a similar association task using 11 aphasic subjects and 11 college students. The two groups were matched for sex and educational level. Ages were not reported.

Twenty nouns, selected for their picturability, were chosen from the list of the original stimuli used in the Michigan Restricted Association Norms. The clue words were classified into two categories: logical clues and infralogical clues. Logical clues were selected from the superordinate, subordinate and similar response categories. Infralogical clues were selected from the location, parts and preceding response categories. No overall quantitative difference in responses was found. However, qualitative analysis of aphasic and non-aphasic performance suggested that facilitation of target word identification was similar. For both subject groups, the largest number of correct target words was given in response to high logical clues (high implying

associated strength based on tabulated frequency of response occurrence). Both subject groups identified the smallest number of target words when given low logical clues as stimuli. Although associative strength of logical clues was not reported by Riegel (1964), the discrepancy in the results obtained from these two studies may be a result of associative strength being confounded with the logical clues selected.

Effects of Sex on Responses Obtained on Word Association Tasks

Sex differences on responses to word association tasks have been given limited attention. The subjects who participate in studies are usually equally divided by sex, but data are reported with no consideration of sex as an independent variable.

A few studies of free word association investigated sex differences in the 1960's. Palermo (1963) and Palermo and Jenkins (1965), investigating several age levels from grade one through college, found that females have a greater number of primary responses than males. A primary response is the most frequently occurring response to a given stimulus. The authors also found that a significantly greater percentage of females gave the first three most popular responses in the sequential order found in previously collected response hierarchies. Additional findings in studies by Palermo (1963) and Palermo and Jenkins (1965) showed that males give

more supraordinate (class) responses than females, irrespective of grade level.

Effects of Educational Level on Responses Obtained on Word Association Tasks

Relatively few studies have investigated response variability as a function of formal educational level. The difficulty with investigating this variable is that age and educational level are confounded. However, in a related study of classification using shape, size and color, Denny (1974) suggested that the effects of the highest level of education reached on classification abilities should be investigated.

Herr (1957) gave 1600 adults an association test with instructions which asked the subjects to give the response most people would give. The investigator found a small but significant positive correlation between response commonality and educational level.

Becher (1960) found greater response commonality among female college freshmen than among college seniors. When the freshmen were tested four years later, the females were found to have a lesser number of common responses.

Comparing 50 adult aphasic patients with 50 subjects who were admitted to a hospital for reasons other than neurological disorders, Sefer and Henrikson (1966) stated that differences in normal patterns of word association responses were, perhaps, affected by the educational level of the subjects as well as several other factors.

Rosenzweig (1964) investigated the primary responses of 115 French workmen. He speculated that perhaps the educational and socioeconomic levels of the workmen resulted in systematically different associative responses. Previously collected data on college French students were used for purposes of comparison.

Effects of Mode of Stimulus Presentation on Word Association Responses

Two modes of stimulus presentation, aural and visual, have been used extensively by experimenters investigating word association. Aural presentation is generally conducted by the experimenter's pronouncing the stimulus item aloud. Visually presented stimuli are either printed on a page or projected on a screen (Cramer, 1968).

Two dependent variables have been investigated in studies that exclusively looked at effects of mode of stimulus presentation: 1) the number of responses obtained and 2) the type of responses obtained when input modes varied.

Reynolds et al., (1971) compared differences in single word responses of orally- versus visually-presented stimuli at four different age levels. Forty subjects were randomly drawn from grades 3, 5 and 7 and an adult group ranging in age from 21 to 92 years. Groups were balanced for sex. All subjects were described as educationally deprived. During oral presentation, subjects were presented the stimuli aloud by the experimenter. Stimulus items were presented visually by using an overhead projector with the

words printed on transparencies. The third grade children were found to have more single word responses when the oral mode of presentation was used. For each successively older group, response differences between oral and visual presentation of the stimuli were negligible.

Ohnmacht and Pacheo (1972) administered a word association test to 114 literate adults to determine the effects of mode of presentation (aural vs. visual). Half of the subjects were presented 12 concepts aurally; the remaining half were given the same 12 concepts visually. Results showed that the quality of associative response was unaffected by the mode of presentation for literate adults. Subjects were found to respond with a single word regardless of modality. A significant difference in the number of associations generated by the subjects was found to be in favor of the aurally presented stimuli. However, the authors speculated that the specific stimulus items used may have been a confounding variable.

Timnermaus and Kumin (1974) used 10 adult male aphasics and 10 normal males, matched for age and education, to investigate free association responses of adult aphasics to auditory and pictorial stimuli. The stimulus items consisted of 40 nouns and verbs from the Palermo-Jenkins list (1964). All stimulus words had a high frequency of occurrence. Aphasics and normals were found to emit significantly more single word responses on auditory than on visual modes of stimulus presentation. Normal subjects gave significantly

more single word responses than the aphasic subjects and more syntagmatic responses for the visual and the combined mode of stimulus presentation. The authors concluded that perhaps the auditory association and visual association tasks were not comparable. According to Timnermaus and Kumin (1974), when the visual association modality was used, the subjects appeared to label the stimuli orally first and then to give an associated response. In contrast, when stimuli were presented aurally, the subjects rarely imitated the word before emitting an associative response.

The effects of mode of presentation on responses obtained from elderly subjects have not been investigated. However, McClusky (1970) states that the most effective learning environment for the elderly appears to be one which combines auditory and visual information.

Procedures Employed to Analyze Data From Word Association Tests

Associative responses which are elicited by a word association test must eventually be categorized in some manner. A large variety of measures have been used to describe the findings of word association studies. However, only those analytical procedures employed in the present investigation will be discussed.

The measure that is used most often in analyzing word association data is the primary response (Cramer, 1968). The primary response is the most frequently occurring response given by a group of subjects to any one stimulus. The

criteria for what constitutes a primary response may be based either on previously gathered normative data or on the sample currently being tested.

In addition to analysis of word association data via primary responses, other quantitative measures also reflect upon the organization of the associative network. In general, these measures indicate the size of the associative network. One scoring procedure that is used to measure the size of the network is the number of different responses obtained across subjects on a given stimulus item. The score obtained is known as the diversity score and is symbolized by the letter "D". In contrast to primary response analysis, which determines response commonality or homogeneity, the diversity score indicates response variability or heterogeneity.

Response entropy (calculated by the formula $H = - p_i \log_2 p_i$ where p_i is the probability of occurrence of a given response) has also been used to describe the heterogeneity of responses to a stimulus word (Cramer, 1968). However, Laffal (1955) demonstrated that response entropy and diversity measures were highly correlated. Thus, the diversity score is the more preferable measure for determining the size of the associative network because it is easier to calculate than response entropy and is as reliable as the latter measure in calculating the variability of responses in an associative domain (Laffal, 1955).

Summary

The second section of the literature review covered information on the concept of semantics and its relation to tests of word association. Studies investigating changes in the type of responses given on word association tests when subjects were grouped by age, sex and educational level were reported. Investigations which reported on how experimenter manipulation of the sensory modality used to present the stimuli to subjects (usually aurally, visually or a combination of aural and visual presentation) affected the responses elicited, were summarized. Because of the limited number of investigations which concentrated on these four variables (age, sex, education, mode of stimulus presentation), evidence is somewhat inconclusive at this time.

Finally, analytical procedures pertinent to the present investigation were discussed.

The experimental procedures employed in the present study are reported in Chapter Three.

CHAPTER III

RESEARCH METHODOLOGY

Subjects

One hundred thirty-two elderly adults served as subjects in the present investigation. All subjects were white, native born American English speakers. The age range of these 132 persons (61 men and 71 women) was 65 to 89 years. Subjects were divided into two age groups: Young-Old (Y-O) composed of persons whose ages ranged from 65 to 74 years ($\bar{x}$ = 70.21 years, standard deviation = 3.81 years) and Old-Old (O-O) composed of individuals aged 75 and above ($\bar{x}$ = 79.84 years, standard deviation = 7.10 years). Placement of the elderly subjects into two separate age groups was based on the classficiation system proposed by Busse and Pfeiffer (1969), who assigned the terms "young-old" and "old-old", respectively, to the age ranges indicated. Although Neugarten (1975) expanded the age range of the young-old group from 55 years to 75 years, she supported the age range designated by Busse and Pfeiffer as old-old.

Subjects were noninstitutionalized community residents who participated in a senior citizens' community program or recreational facility. The majority of the

elderly subjects resided in two government supported housing projects in Inkster, Michigan. The remaining subjects (most of whom were retired state employees or retired university professors) lived in East Lansing, Michigan. Subjects were classified by educational level on the basis of two criteria: less than high school completion ($\langle$HS) and high school completion or above ($\overline{\rangle}$HS).

Screening Procedures Used

The selection of the elderly individuals who were used as subjects in the present investigation was based on three screening procedures administered and evaluated by the investigator prior to the subjects' involvement in any formal research tasks. All subjects were tested for 1) the condition of mental functioning as operationally determined by the score obtained on the Mental Status Questionnaire (Kahn, et. al., 1960); 2) task appropriate visual ability; and 3) normal hearing with intensity levels adjusted for presbycusis.

The Mental Status Questionnaire is a quantifiable index of mental functioning. The index consists of ten questions (Appendix A) which quickly and accurately assesses an individual's mental abilities on tasks of memory, orientation, calculation and retrieval of current information. A quantitative measure of cerebral functioning can be determined on the basis of the number of errors obtained. Kahn

and his associates (1960) developed a chart which indicated the number of errors associated with the degree of organic brain syndrome found in individuals (Table 2).

TABLE 2

NUMBER OF ERRORS ASSOCIATED WITH THE DEGREE OF ORGANIC BRAIN DYSFUNCTIONS AS DETERMINED BY THE MENTAL STATUS QUESTIONNAIRE

Number of Errors	Degree of Organic Brain Dysfunction
0 - 2	none or minimal
3 - 8	moderate
9 - 10	severe

Wilson and Brass (1973) have found the Mental Status Questionnaire to be a powerful single measure for detecting and roughly quantifying intellectual impairment. Included in their study are references that show the test to be a valid and reliable measure for use with geriatric populations. Citing the advantages of the test, Wilson and Brass stated that the Mental Status Questionnaire 1) provided an objective basis for the uniformity of observation and evaluation by different examiners; 2) required little time for administration, making it a desirable procedure for rapid clinical screening and for research purposes; and 3) included five questions that relate to personal information and can, therefore, be asked without the patient's knowing

s/he is being tested.

Although the Mental Status Questionnaire is a useful instrument for examining mental change associated with chronic brain syndrome, it is limited in detecting other types of psychiatric disorders (e.g., depression, schizophrenia, paranoia). A second disadvantage is that the test measures the mental faculties at the time of testing only. Thus, the Mental Status Questionnaire may fail to show impairment in persons with fluctuating mental ability. However, since the present investigation is concerned only with the mental status of the subject during the period of testing, a fluctuating mental ability pattern was not considered.

Criterion for acceptance as a subject in the present investigation was designated by a score of zero to two errors on the Mental Status Questionnaire, indicating no or minimal cerebral dysfunction.

To satisfy the criterion for normal hearing, each participant passed a bilateral pure tone audiometric screening test given at the octave frequencies 1000Hz, 2000Hz, and 4000Hz via Telephonics TDH 39 earphones mounted in MX 41/AR cushions. Criterion for passing the hearing test was based on data cited in a study by Milne and Lauder (1975), who calculated loss of hearing acuity as a function of aging. This phenomenon, termed presbycusis, is defined as the hearing loss that occurs with age unconfounded by extraneous factors such as disease and noise exposure (Corso, 1971). Selection of the three test frequencies was based on

guidelines for identification audiometry approved by the American Speech and Hearing Association Legislative Council in 1974 (Asha, 1975). The hearing threshold level (HTL) of each subject was tested in a quiet room with acceptable ambient noise levels. The allowable ambient noise level for each test frequency and the actual ambient noise levels observed in the three test environments are shown in Table 3.

TABLE 3

COMPARISON BETWEEN THE ALLOWABLE AMBIENT NOISE LEVELS FOR 1000Hz, 2000Hz AND 4000Hz AND THE ACTUAL AMBIENT NOISE LEVELS OBSERVED IN THE THREE TEST ENVIRONMENTS

Frequency	Allowable Ambient Noise Level
1000Hz	50 dB
2000	58
4000	76

Test Environment	Observed Ambient Noise Level
Board Room (Inkster)	48 dB
$Chapel_1$ (Inkster)	43
$Chapel_2$ (E. Lansing)	47

A General Radio Sound Level Meter (Type 1551-C) was used to determine the relative ambient noise levels of the test environments. Dials were set on "Weight A" and "Slow Sweep"

to obtain average intensity peaks across all frequencies. A calibrated Maico Portable Audiometer (Model MA-2B) was used to conduct the pure tone screening.

To determine whether the elderly subject had adequate visual ability to participate in the research tasks, each elderly individual was asked to read aloud the general instructions which provided procedural information on the four tasks (Appendix B). The instructions appeared on an 8 1/2" x 11" piece of typing paper. The orator typing element of an IBM Selectric II typewriter was used to write out the instructions. The orator element types boldface upper and lower case letters (5mm and 3mm in height, respectively). Criterion for passing the vision test was the ability to read the instructions accurately with or without corrective lenses when the paper was held eight to twelve inches away from the subject's face at a 45 degree angle.

Stimuli

Twenty-five nouns were selected from a core of 200 words (120 nouns, 40 verbs and 40 adjectives) which comprised the original stimuli used by Riegel (1965) on the Michigan Restricted Association Norms. Nouns were exclusively chosen as stimuli becasue they represented the largest number of stimuli observed in an individual form class in Riegel's study. Prior to selecting the 25 nouns, it was first necessary to determine the form

class (part of speech) and the frequency of occurrence of the 200 stimuli in the English language.

Riegel reported cumulative data on the number of nouns, verbs and adjectives included in the list of the original stimuli. The number of words that appeared at each frequency of occurrence was also reported. However, Riegel did not specify the words that were assigned to the frequency levels or to the form classes.

Adapting the same procedure used by Riegel, the form class of each of the 200 stimuli was determined by using the first part-of-speech entry listed in the Random House Dictionary of the English Language, Unabridged Edition (1973). The initial part-of-speech entry represents the most common usage of the word in English sentence constructs. A comparison of the number of stimuli listed in each form class by Riegel versus the figures obtained by the investigator showed a slight discrepancy in the number of words assigned to each form class. Table 4 shows that there was a slightly higher number of words classified as nouns when the first entry was based on the Random House Unabridged Dictionary (1973). Perhaps the discrepancy may be accounted for by the fact that Riegel used Webster's Collegiate Dictionary to determine the first entry for each word. The particular words that shifted form class cannot be determined since the information about individual word classifications was not included in the final report of Riegel's study.

TABLE 4

DIFFERENCE IN THE NUMBER OF WORDS CLASSIFIED UNDER THREE FORM CLASSES BASED ON THE FIRST PART-OF-SPEECH ENTRY OF TWO AMERICAN ENGLISH DICTIONARIES

Form Class	Webster Collegiate (Riegel, 1965)	Unabridged Random House (1973)
noun	120	125
verb	40	39
adjective	40	36

The selection of the stimuli from the 125 words classified as nouns by the Random House Unabridged Dictionary was based on the following rules:

1. Independence- the 25 stimulus items could only minimally elicit each other as responses to stimulus presentations. To determine independence, the three most common responses of each noun in each of the four tasks under present investigation (superordinate, location, similar and part) were analyzed using the original responses from the Michigan Restricted Association Norms (Riegel, 1965).

2. Concept Representation- the 25 stimulus nouns were to represent a variety of concepts. Included in the 25 nouns were common objects, bodily functions, professions, family relationships, bodily structures, foods and animals. Based on the two rules, the investigator selected 25 words as lexical stimulus items. The 25 stimuli appear in Table 5.

TABLE 5
LIST OF THE TWENTY-FIVE TEST STIMULUS ITEMS SELECTED
FROM THE ORIGINAL TWO HUNDRED TEST STIMULI
OF THE MICHIGAN RESTRICTED ASSOCIATION
NORMS (RIEGEL, 1965)

anger
bread
cabbage
candle
city
eagle
girl
house
knife
memory
moth
music
nurse
rug
soldier
stomach
street
sun
table
thief
tiger
tobacco
water
whiskey
wool

Generation of Task Stimuli

Each of the 25 lexical stimulus items was centered on a 9" x 12" sheet of paper using Chartpak Velvet Touch lowercase lettering (Style 60 PT/M1160L). A sample of the lettering appears in Appendix C. The large size letters were used to assist the elderly individual in visual recognition of the stimuli.

A photograph of each stimulus item was taken by the investigator under the direction of a professional photographer. The film was processed into 35 millimeter slides (black figure, white background). Four slides per noun were developed. Although the 25 lexical stimulus items were the same on each of the four tasks, ordinal presentation of the stimuli was arranged from the "easiest" to the "least easiest". Determination of the easiest to least easiest ordinal listing was based on the frequency of occurrence of the most common response of each of the 25 test stimulus items obtained from the 100 college educated subjects in Riegel's study.

In the event that two or more words received the same frequency of common responses, the items were listed alphabetically. Thus, the number of presentations of the 25 test stimulus items totaled one hundred.

A master recording of the 25 stimuli was made using a white male talker (f_o = 125 Hz) who spoke with a General American Dialect. The talker was seated in a sound treated recording booth. An Electrovoice Dynamic Omnidirectional

Microphone (Model 635 A, frequency response = 60Hz - 15,000Hz) was placed eight inches from the talker on an insulated tabletop. An Ampex full track tape recorder (Model AG 600), located in an adjacent sound treated booth, was connected to the microphone. The recording intensity level of the talker was monitored by the volume control and a VU meter. Each test stimulus item was spoken thrice (using natural intonation and stress) at an average intensity level of -2dB VU to avoid distortion and peak clipping of the spoken signal. If, for any given item, the three productions did not satisfy the investigator, the item was repeated following completion of the entire stimuli list.

The selection of the highest quality recording of each stimulus item was performed by dubbing from the original tape recording of the 25 nouns onto a second Ampex AG 600 tape recorder. Using the VU meter of the tape recorder and TDH 39 earphones, the three productions of each stimulus were monitored both visually and aurally by the investigator and a student of speech science. An intensity level of average peaks was the primary concern when choosing the recorded version to be used as the test stimuli. Arbitrary volume levels were set to provide a constant intensity level (-2dB VU meter) of the stimulus signals. If all three recordings peaked at the appropriate intensity level, the decision for selection was made on the basis of interjudge agreement by the investigator and the speech science student on the best sounding production.

Following location of the best production, the sequence was dubbed onto the Ampex AG 600 tape recorder four times.

A unit designed for editing the dubbed audio tape was used to cut and splice seven seconds of silent interval space between each of the test items. Each second was represented by seven and a half inches of blank lead tape. Instrumentation for editing included a playback head connected to a preamplifier (Claricon, 36-195) routed to a speaker (Bogen, Model MTA-10). With this unit, the beginning and end of each test stimulus could be located. The first and last second of each silent interval was marked with the name of the stimulus and the letters A, B, C or D (representing the four tasks under investigation). Based on the ordinal listing of easiest to least easiest stimuli in each of the four tasks, the tape pieces were spliced together. A copy of the tape with the inserted silent intervals was produced using an Ampex AG-600 tape recorder.

The final master copy of the stimuli (presented to the elderly subjects) was produced on two 15 minute Memorex cassette tapes using the Montage Audio-Mate 600 cassette tape recorder (frequency response = 80Hz to 10,000Hz). The ordinal listings for the superordinate and location tasks were recorded on one cassette tape and the ordinal listings for the similar and part tasks were recorded on the second cassette tape.

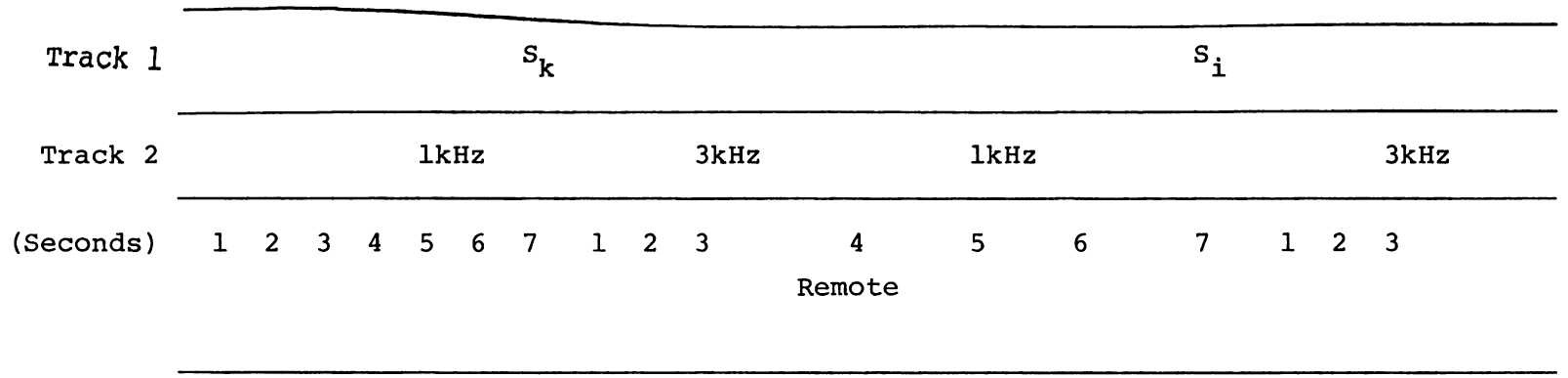
The Montage Audio-Mate recorder has two built in pulse signals: a 1000Hz pulse signal called the projector command and a 3000Hz pulse signal known as the tape-stop

command. Synchronization of an audio signal (cassette tape recordings of the 25 stimuli) with a visual presentation (slides of the 25 test stimuli) is accomplished by recording the inaudible advance tone signal (1000Hz) and the tape-stop signal (3000Hz) on the lower half of the tape (track two). The 1000Hz signal advances a slide projector, whereas the 3000Hz tape-stop command signal halts tape and projector motion until it is re-initiated by a remote control button. The position of the tape-stop command is based on a pre-selected point in the recording.

Using a stop watch for temporal monitoring, the two inaudible pulse cues were programmed onto the cassette tape inbetween the stimulus items. Figure 1 indicates the sequence in which the silent pulse signals were inserted.

Test Environments

Three testing sites were chosen to conduct the investigation. The first two sites, located in Inkster, Michigan, consisted of the board of directors meeting room (23'L x 11 1/2'W) and the L - shaped chapel (16'L x 11 1/2'W x 28'W) of two government sponsored housing projects for the elderly. The third site, located in East Lansing, Michigan, was a chapel (17'L x 17'W) in a local university affiliated church. The selection of the test environments was based on 1) permission of the administrators of the facility to use the site for testing, 2) convenience of the site for a substantial number of elderly persons (e.g., free parking, easy



Explanation:

1k Hz = 1000 Hz projector command pulse signal which advances the slide projector. Pulse was inserted on the fifth second of every seven second sequence.

S_k and S_i = Stimuli recorded on track one of the cassette tape. Stimuli were presented aurally to each subject through a high quality speaker.

3k Hz = 3000 Hz tape stop command pulse signal which inactivated the tape recorder and slide projector. Pulse was inserted on the third second of every seven second sequence.

Remote = Remote switch that was pressed by the subject to reactivate the tape recorder and slide projector.

Figure 1. Demonstration of the Insertion of the Projector Command and the Tape Stop Command Signals for Obtaining a Synchronized Audio/Visual Presentation of the Test Stimulus Items.

accessibility, knowledge of the site's location by the elderly), and 3) site was relatively quiet and uninterrupted by other scheduled activities.

The ambient noise levels of each test site were reported in Table 3.

Equipment

Below is a description of the equipment which was employed in the present investigation, along with the arrangement of the equipment in the test environments.

Two carrousel slide trays, each having a load capacity of 80 slides, were used to load the 100 35 millimeter slides. Slides for Task A (superordinate) and Task B (location) were placed in one tray, whereas slides for Task C (similar) and Task D (part) were loaded into the second tray.

Two 15 minute high quality low noise cassette tapes (Memorex) contained the serially ordered audio portion of the test stimuli. The presentation of the stimuli on tape coincided directly with the slide presentations. Depending on the task being presented, one of the cassette tapes was loaded onto an Audio Mate 600 Cassette Tape Recorder that lead to a high quality speaker. The volume and tone levels of the cassette tape were held constant (five and nine, respectively) throughout the presentation of the 100 test stimulus items to each subject. An Ektographic Slide Projector (Model AF-2) was also connected to the cassette

tape recorder. Both the slide projector and the cassette tape recorder were advanced in synchrony via a remote control switch, leading from the recorder. The subject was seated in a comfortable chair facing a rearview plexiglass screen (22.5cmL x 28.5cmW) and within easy reach of the remote control switch.

The cassette tape recorder, slide projector, speaker and rearview plexiglass screen were placed on a long table (6'L x 2'W). To control for response reliabilty, a second casette tape recorder (Sony, Model TC 60A) and microphone were located on the table. The microphone, leading to the Sony cassette tape recorder, was placed directly in front of the subject ten inches away at a 45 degree angle. A schematic diagram of the physical arrangement of the equipment in the test environment and the position of the subject is depicted in Figure 2.

Test Procedure

Each subject was seen individually for approximately 40 minutes. Subjects were given a printed copy of five pages of instructions faced down. The subject was asked to pick up the first page (General Instructions) and read aloud the contents of the page. Questions about general procedures were answered by the investigator following the reading. The subject was then allowed to read the instructions for Task A (superordination) and three practice items for Task A were presented. After the practice session was

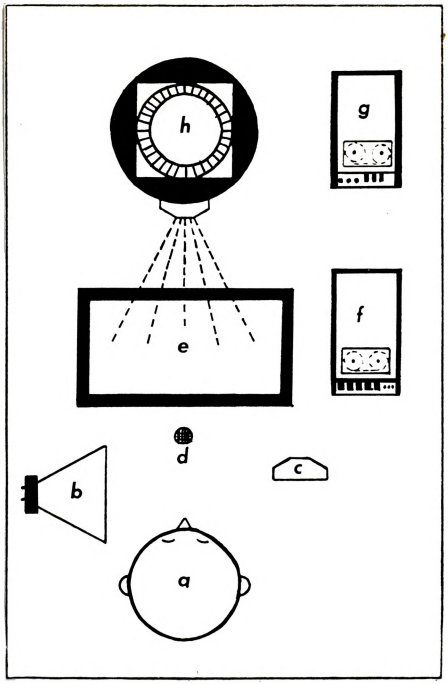


Figure 2. Arrangement of Subject and Equipment in the Test Environment.

a = subject; b = loudspeaker; c = remote control; d = microphone; e = plexiglass rearview screen; f = Sony cassette tape racorder; g = Audio Mate 500 cassette tape recorder; h = Ektographic carrousel slide projector

completed, the subject was allowed a brief period to ask questions of clarification. The format of presentation of the test stimuli was the same for the remaining three tasks (instructions, three practice items, questions of clarification, presentation of 25 test stimulus items).

Once the subject appeared to have an understanding of the test procedures and the linguistic responses requested, the first 50 test items (Slide Tray One) were presented, followed by a three minute rest period. The rest period provided a moment of relaxation to the subject to minimize fatigue. The first slide tray was replaced by the second tray (containing Tasks C and D) during the rest period along with the corresponding cassette tape. At the end of the short break, the remaining practice items and the last 50 test stimuli were presented to the subject.

The 100 oral responses of each subject were recorded on an answer sheet (Appendix D) by the investigator. In addition, the subjects' responses were recorded onto one side of a 60 minute Ampex cassette tape using the Sony cassette tape recorder.

Subjects were given 30 seconds to respond to each item. If no response was elicited during the alloted time period, the subject was instructed to advance the tape and slide to the next test item. After all 25 items were presented, the items missed within the task were presented a second time by the investigator acting as the talker. If

the subject could not provide the investigator with an associative response after the second presentation of the test stimulus items, a "NR_2" (indicating no response after two presentations) was recorded for the missed item.

Summary

Chapter Three has presented an overview of the research procedures employed in the present investigation. One hundred thirty-two nonpathological elderly persons (ages 65 to 89 years) served as subjects. All subjects were white, native born American English speakers. Each subject had passed three screening procedures which assessed the subject's hearing, visual and mental abilities. Subjects were seen individually for approximately 40 minutes.

Three testing sites were chosen to conduct the investigation. The first two sites were located in two government sponsored housing projects for the elderly in Inkster, Michigan. The third site was located in East Lansing, Michigan, at a local university affiliated church. The three sites were selected on the basis of convenience for the elderly subjects.

Using a synchronized audio-visual procedure, 25 nouns were presented four times under two logical task conditions (superordination and similarity) and under two infralogical task conditions (location and part). Presentation of the 25 noun stimuli varied from task to task as a function of the "easiest" to the "least easiest" stimulus item under each task condition.

Written instructions were given for each task. Subjects were asked to elicit a one-word response for each noun under each task condition. The subjects were given 30 seconds to respond. Stimulus items receiving no response during the alloted time interval were repeated a second time by the investigator. If no response was given after the second presentation, an "NR_2" was recorded indicating no response after two stimulus presentations. Responses elicited from each subject were graphically recorded onto an answer sheet and auditorily recorded onto a cassette tape.

Chapter Four will discuss the statistical analysis and results of the investigation.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter is divided into two main sections, results and discussion. The section on results includes the descriptive and inferential statistical analyses to which the data were subjected along with an explanantion of what these analyses revealed. Data are represented graphically where appropriate. Finally, a discussion of the results as they relate to other relevant research is provided.

Results

Descriptive Analyses

The descriptive analyses employed in this investigation provided both qualitiative and quantitative interpretation of the data. The first descriptive analysis to which the raw data were subjected was Crosstabulation Analysis, a subprogram of the Statistical Package for the Social Sciences (Nie, et al., 1975). In general, crosstabulation analysis computes and displays the frequency distribution of the number of cases that occurred for two or more discrete variables. Data are displayed in a contigency table.

A 4 x 8 design (four tasks by eight groups) was programmed for crosstabulation analysis. The four tasks consisted of the following codes:

1. ATASK 1 to ATASK 25 -- representing the task of superordination.
2. BTASK 1 to BTASK 25 -- representing the task of location.
3. CTASK 1 to CTASK 25 -- representing the task of similarity.
4. DTASK 1 to DTASK 25 -- representing the task of part.

The numbers one to 25 corresponded to the 25 lexical stimulus items that were subjected to each task condition.

The eight groups represented all possible combinations of the three fixed independent variables (age, sex and education) investigated in the present study. Each variable consisted of two levels. Table 6 lists the eight groups included in the crosstabulation analysis. The contingency tables obtained from the crosstabulation analysis provided the within cell (individual group) frequencies and the row marginal frequencies. Of major importance to the present investigation were the row marginal frequencies because these values represented the combined frequency of occurrence scores across all groups. The primary and common response measures were taken directly from the marginal row counts.

TABLE 6

LIST OF THE EIGHT GROUPS INCLUDED IN THE CROSSTABULATION ANALYSIS AS A FUNCTION OF THE SUBJECT'S AGE, SEX AND EDUCATION

Group	Age[a]	Sex[b]	Education[c]	N[d]
1	Y-O	F	< HS	18
2	Y-O	M	< HS	15
3	O-O	F	< HS	20
4	O-O	M	< HS	16
5	Y-O	F	≥ HS	18
6	Y-O	M	≥ HS	15
7	O-O	F	≥ HS	15
8	O-O	M	≥ HS	15

Notes: [a] = Age levels consisted of Young-Old (Y-O) and Old-Old (O-O).

[b] = Sex levels consisted of Females (F) and Males (M).

[c] = Educational levels consisted of subjects with less than high school completion (< HS) and subjects with equal to or greater than high school completion (≥ HS).

[d] = The letter "N" represents the number of subjects within each group.

The primary responses of each stimulus item and the corresponding frequencies of occurrence are listed in Tables 7, 8, 9 and 10. The table numbers correspond to the four experimental tasks of superordination, similarity, location and part, respectively. The 25 lexical stimulus items are listed alphabetically in each table to provide for easier comparison across tasks. As was alluded to in Chapter Three (Research Methodology), the actual ordinal presentation of

TABLE 7

PRIMARY RESPONSES AND CORRESPONDING FREQUENCIES OF OCCURRENCE (f) FOR SUPERORDINATION TASK

Lexical Stimulus Item	Primary Response	f
anger	mad	39
bread	food	75
cabbage	vegetable	126
candle	light	102
city	town	52
eagle	bird	129
girl	female; feminine; femininity	74
house	home	35
knife	tool	36
memory	mind	25
moth	insect	89
music	sound	30
nurse	helper	20
rug	cover; covering; floor covering	51
soldier	fighter	26
stomach	organ	31
street	road; roadway	36
sun	light	28
table	furniture	113
tiger	animal	118
thief	robber	37
tobacco	smoke; smoking	59
water	drink; drinking	46
whiskey	drink	48
wool	material	28

TABLE 8

PRIMARY RESPONSES AND CORRESPONDING FREQUENCIES OF OCCURRENCE (f) FOR SIMILARITY TASK

Lexical Stimulus Item	Primary Response	f
anger	mad	40
bread	cake	33
cabbage	lettuce	46
candle	light	43
city	town	96
eagle	bird	55
girl	woman	47
house	barn	28
knife	sword	27
memory	remember; remembering; remembrance	27
moth	butterfly	52
music	sing; singing	29
nurse	doctor	57
rug	carpet; carpeting	83
soldier	sailor	42
stomach	belly[a]	22
street	road	57
sun	moon	80
table	stand	37
tiger	lion	78
thief	robber	61
tobacco	cigarette	41
water	milk	21
whiskey	gin	25
wool	cotton	41

Note: [a] = Belly and intestines were equal in frequency of occurrence (f = 22). The decision for selecting belly as the primary response was based on flipping a coin.

TABLE 9

PRIMARY RESPONSES AND CORRESPONDING FREQUENCIES OF OCCURRENCE (f) FOR LOCATION TASK

Lexical Stimulus Item	Primary Response	f
anger	mind	42
bread	bakery	28
cabbage	garden	100
candle	holder	28
city	state	67
eagle	sky	68
girl	school	46
house	street	38
knife	kitchen	51
memory	mind	62
moth	clothes; clothing	50
music	church	16
nurse	hospital	131
rug	floor	105
soldier	army	99
stomach	body	91
street	city	80
sun	sky	127
table	kitchen	61
tiger	jungle	48
thief	jail	33
tobacco	pipe[a]	28
water	lake	35
whiskey	bottle	38
wool	sheep	94

Note: [a] = Pipe and store were equal in frequency of occurrence (f = 28). The decision for selecting pipe as the primary response was based on flipping a coin.

TABLE 10

PRIMARY RESPONSESAND CORRESPONDING FREQUENCIES OF OCCURRENCE (f) FOR PART TASK

Lexical Stimulus Item	Primary Response	f
anger	mad	30
bread	flour	53
cabbage	leaf	101
candle	wick	53
city	people	25
eagle	wings; wing	74
girl	hair	36
house	room	30
knife	blade	61
memory	mind	24
moth	wings	91
music	notes	42
nurse	uniform	57
rug	wool	40
soldier	uniform	48
stomach	lining	30
street	pavement	24
sun	rays	41
table	legs	106
tiger	stripes	41
thief	hands[a]	24
tobacco	leaf	96
water	liquid	32
whiskey	alcohol	49
wool	fiber	23

Note: [a] = Hands and gun were equal in frequency of occurrence (f = 24). The decision for selecting hands as the primary response was based on flipping a coin.

the 25 stimulus items varied from task to task. Pages three and four of the answer form (Appendix D) show the actual order used to present the stimulus items to the elderly subjects on a specific task.

Incorporating the rules established by Laffal (1955), response words differing in form but coming under the following rules were combined as one type of response:

1. Singular and plural responses of the same word.

2. Responses containing the same root but differing only in terms of a suffix, prefix or infix that did not essentially alter the basic word.

The frequency count of the primary responses, as elicited by the 132 elderly subjects, ranged from 16 to 131 on a specific stimulus item. The mean frequencies of the primary responses under each task condition appear in Table 11. The mean scores indicate that, on the average, the greatest amount of primary response agreement among the subjects was given when subjects were asked to name the location of the stimuli. The task having the next highest primary response agreement was superordination followed by part and similarity tasks, respectively.

The second group of measures obtained from the row marginal counts were the frequencies of occurrence of the common responses elicited by the 132 elderly subjects. As was defined in the terminology section (Chapter One), a common response is obtained when two or more subjects give the same response to a lexical stimulus item. An arbitrary

TABLE 11

MEAN FREQUENCIES OF OCCURRENCE OF THE PRIMARY RESPONSES UNDER FOUR TASK CONDITIONS

Task Condition	Mean Frequency of Occurrence
Superordination	58.12
Similarity	46.72
Location	62.64
Part	49.24

cut-off level of 85 percent of the total population (n = 112) was established for purposes of reporting the common responses obtained under the four experimental tasks. The common responses were selected on the basis of their corresponding frequencies of occurrence. Selection consisted of ordinally choosing the highest to the lowest frequencies of occurrence until at least 85 percent of the population was represented. The common responses and the associated frequency distributions for each task are reported in Appendices E, F, G and H. For purposes of comparison across tasks, the stimulus items and the common responses are listed alphabetically. The primary responses appearing in Tables 7 through 10 are included in the four Appendices. The primary responses are listed with the common responses for easier accessibility.

A third descriptive measure obtained from the cross-tabulation analysis was the diversity score for each lexical stimulus item on each of the four experimental tasks. The

diversity score represents response variability or heterogeneity.

Diversity scores were calculated by counting the number of different responses given to a lexical stimulus item under a specific task condition. The diversity scores for each of the stimuli appear in Table 12. Each "NR_2" (indicating no response on a particular item after two attempts) was counted as an idiosyncratic response and was included in the diversity scores. Row means (indicating the average diversity score for each lexical stimulus item across tasks) and column means (indicating the average diversity for each task condition) are also provided. Results of the column means showed that the elderly subjects had the least amount of response diversity on the restricted association task of location and the greatest amount of diversity when responses were restricted to naming a part of the stimuli. Stated differently, the size of the associative networks for the stimulus items used in the present investigation appeared to be smallest for the task condition of location and largest for the task condition of part. The remaining two conditions (similarity and superordination) obtained diversity scores that fell between the above task conditions.

To analyze the effects of age, sex and education on the diversity scores obtained, three two-level split group comparisons were constructed. The analyses consisted of comparing the mean diversity scores between the young-old (Y-O)

TABLE 12

DIVERSITY SCORES FOR EACH LEXICAL STIMULUS ITEM UNDER THE FOUR TASK CONDITIONS

Lexical Stimulus Item	Task Condition				Item Mean
	Superordination	Similarity	Location	Part	
anger	30	30	27	55	35.50
bread	18	22	22	11	18.25
cabbage	6	16	15	11	12.00
candle	7	14	23	11	13.75
city	28	14	23	39	26.00
eagle	2	23	16	12	13.25
girl	12	24	23	38	24.25
house	18	27	18	28	22.75
knife	18	31	6	8	15.75
memory	29	24	9	29	22.75
moth	10	25	21	19	18.75
music	37	34	36	34	35.25
nurse	40	26	2	33	25.25
rug	12	15	4	35	16.50
soldier	28	30	8	32	24.50
stomach	19	33	13	37	25.50
street	27	12	15	37	22.75
sun	31	15	4	22	18.00
table	10	33	11	8	15.50
tiger	6	15	12	22	13.75
thief	26	24	20	36	26.50
tobacco	16	26	18	15	18.75
water	18	29	22	31	25.00
whiskey	15	20	15	24	18.50
wool	21	31	21	43	29.00
Task Mean	19.36	23.72	16.16	26.80	21.51 (Grand Mean)

and the Old-Old (O-O), between the females (F) and males (M) and between those subjects who did not complete high school ($<$ HS) and those subjects with equal to or greater than high school completion ($\geq$ HS). Table 13 lists the mean diversity scores for each group on each of the four experimental tasks. The row means and column means represent the group mean combined across tasks and the mean diversity score for each task across all subjects, respectively. The numerical value beside each group represents the number of subjects within the group. As was exemplified by the overall combined group mean diversity scores (Table 13), on the average the diversity score for the task of location was lowest, whereas the highest number of different responses was obtained under the part task condition.

Figures 3, 4, 5, and 6 graphically represent the mean diversity scores for each of the two-level groups of age, sex and education under the four task conditions. The following trends were observed in the graphic analyses:

1. The old-old group had less diversity among the responses given for the superordination and similarity tasks. However, the trend was reversed for the location and part tasks. The young-old scored lower on the diversity measures for the latter two tasks.

2. The diversity scores for females were essentially the same as the male subjects on three of the four tasks (similarity, location and part). Males scored slightly higher than females on the superordination task.

TABLE 13

SUMMARY OF MEAN DIVERSITY SCORES AS A FUNCTION OF AGE, EDUCATION AND SEX

	Split Group	Task Condition: Superordination	Similarity	Location	Part	Row Mean
Age[a]	$Y\text{-}O_{66}$	14.28	16.76	11.36	17.52	14.98
	$O\text{-}O_{66}$	13.28	14.84	12.36	18.00	14.62
Education[b]	$<HS_{69}$	14.44	16.40	12.44	18.32	15.40
	$\geq HS_{63}$	13.04	16.32	10.92	16.48	14.19
Sex[c]	F_{71}	12.48	15.92	11.92	18.24	14.64
	M_{61}	13.48	15.72	11.72	17.92	14.71
Column Mean		13.50	15.99	11.79	17.75	14.75 (Grand Mean)

Notes: [a] = Age Groups; Y-O = young-old (n = 66); O-O = old-old (n = 66); [b] = Education Groups; HS = less than high school completion (n = 69); HS = equal to or greater than high school completion (n = 63); [c] = Sex Groups; F = female (n = 71); M = male (n = 61).

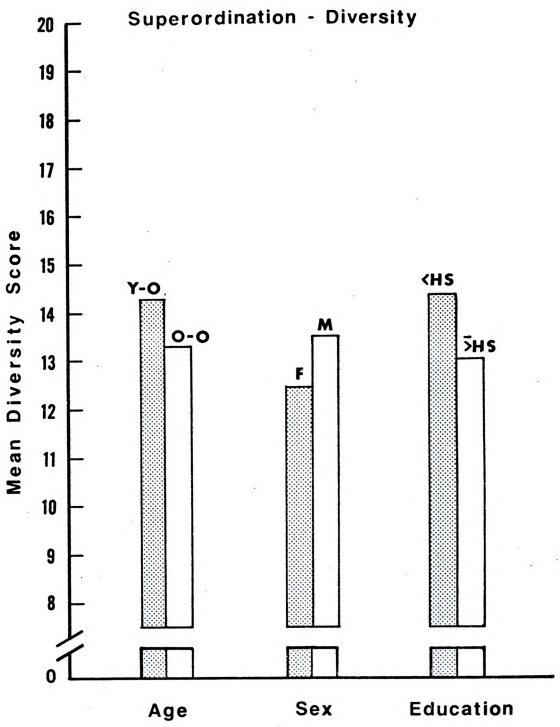


Figure 3. Mean Diversity Scores for Superordination Task as a Function of Age, Sex and Education.

Notes: [a] = Age Groups: Y-O = Young-Old; O-O = Old-Old

[b] = Sex Groups: F = Female; M = Male

[c] = Education Groups; < HS = less than high school completion; ≥ HS = Equal to or greater than high school completion

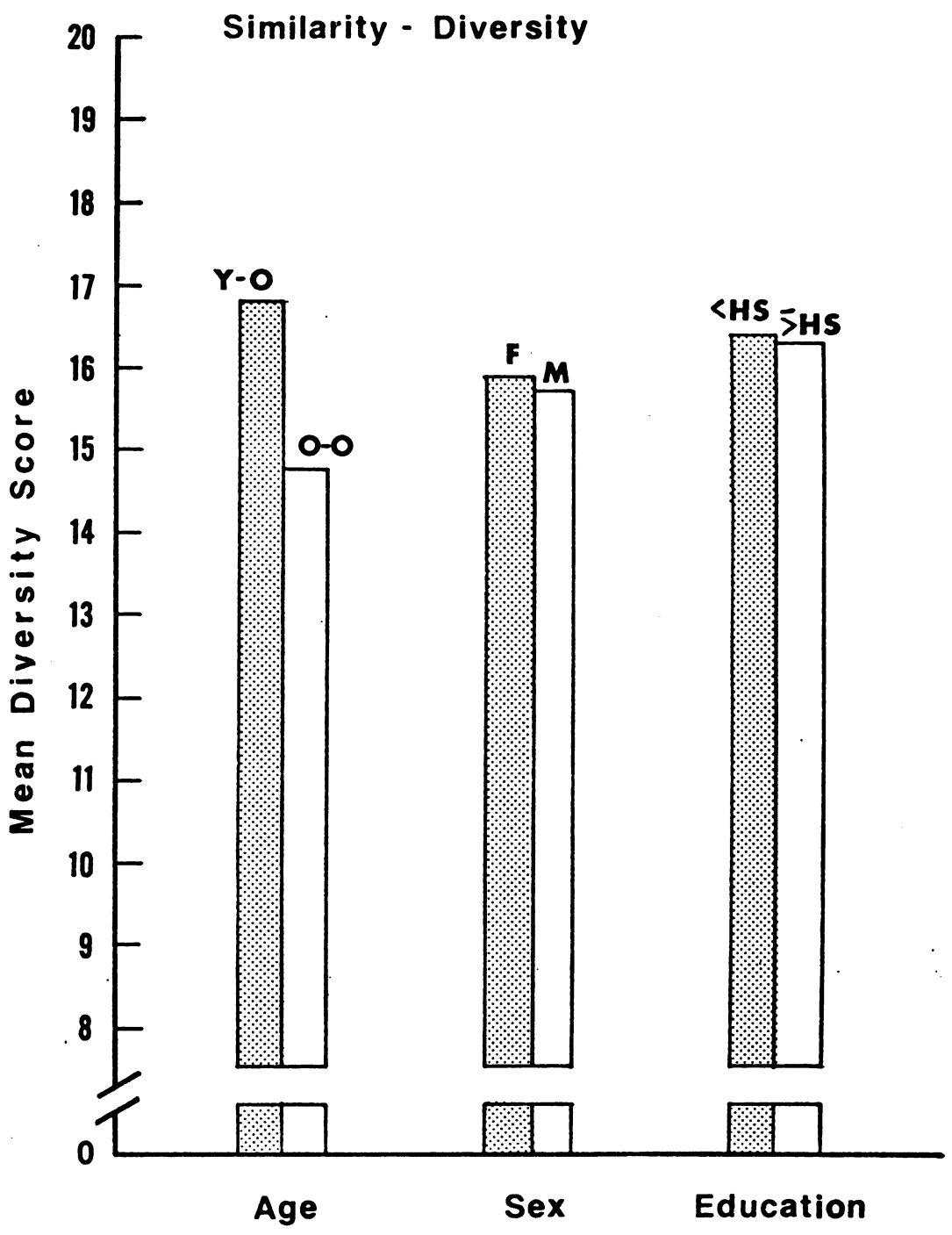


Figure 4. Mean Diversity Scores for Similarity Task as a Function of Age, Sex and Education.

Notes: [a] = Age Groups: Y-O = Young-Old; O-O = Old-Old

[b] = Sex Groups: F = Female; M = Male

[c] = Education Groups; < HS = less than high school completion; ≥ HS = equal to or greater than high school completion

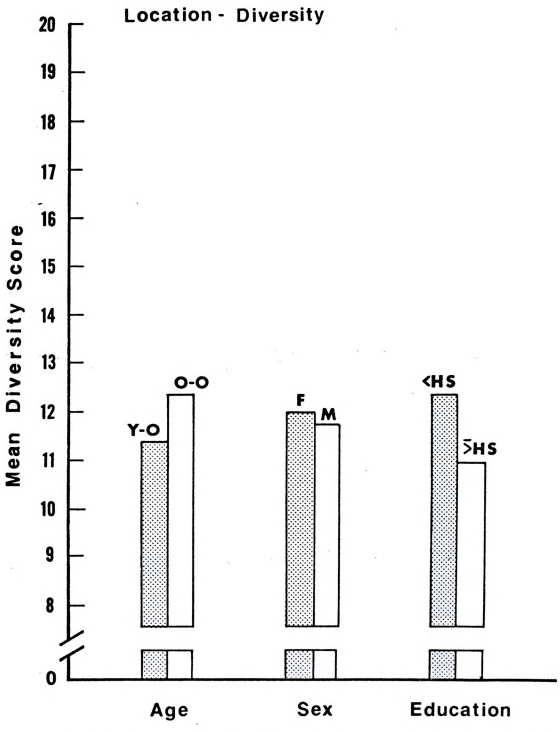


Figure 5. Mean Diversity Scores for Location Task as a Function of Age, Sex and Education.

Notes: [a] = Age Groups: Y-O = Young-Old; O-O = Old-Old

[b] = Sex Groups: F = Female; M = Male

[c] = Education Groups; < HS = less than high school completion; ≥ HS = equal to or greater than high school completion

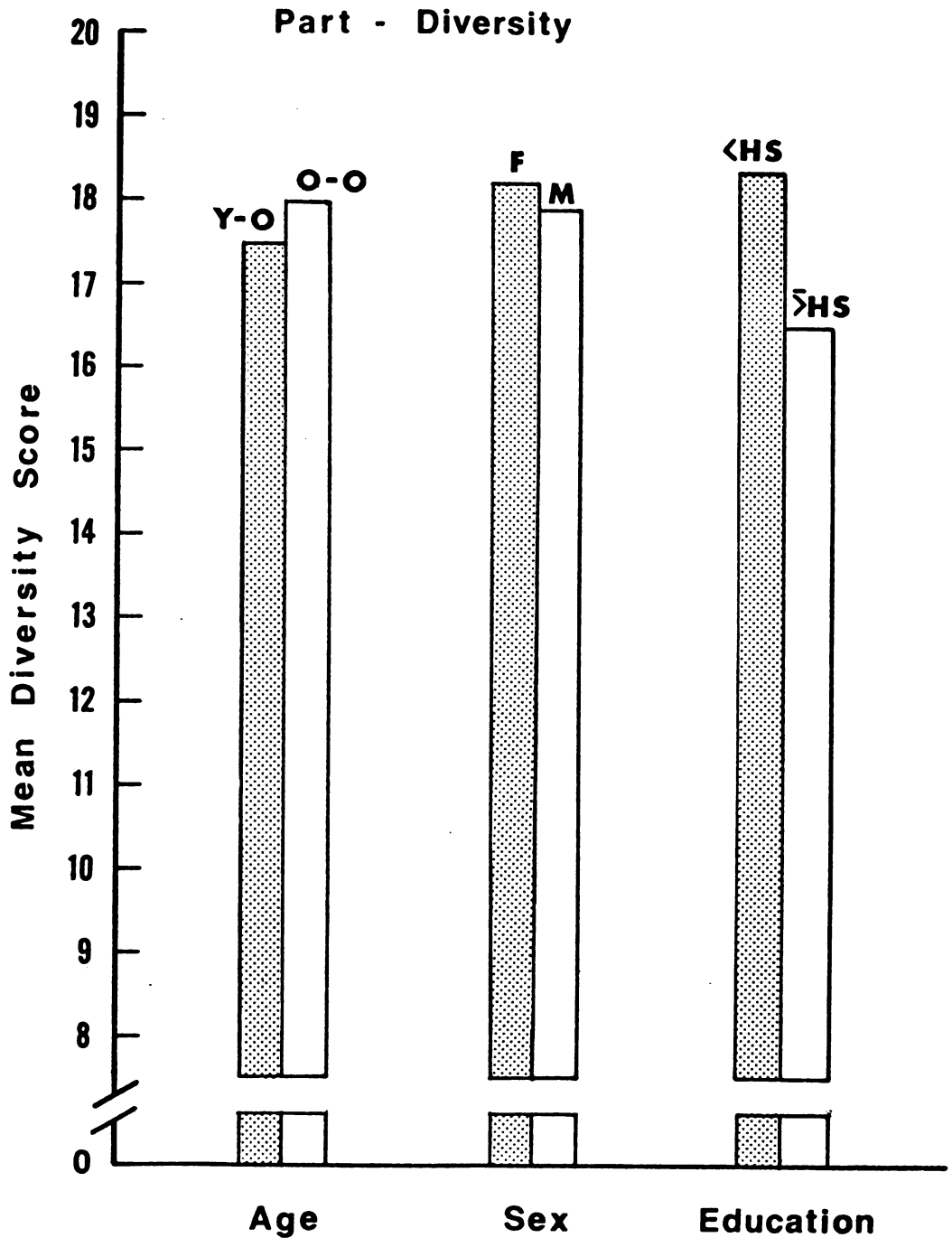


Figure 6. Mean Diversity Scores for Part Task as a Function of Age, Sex and Education.

Notes: [a] = Age Groups: Y-O = Young-Old; O-O = Old-Old

[b] = Sex Groups: F = Female; M= Male

[c] = Education Groups; < HS = less than high school completion; ≥ HS = equal to or greater than high school completion

3. On the average, the elderly subjects with equal to or greater than high school education had lower diversity scores on all four of the experimental tasks, although the gap between the two groups narrowed considerably on the similarity task.

Correlational Measures of Diversity Scores as a Function of Age, Sex and Education

To determine whether the pattern of scores for a set of stimulus words under a given task condition was influenced by the subjects' age, sex, or education, correlational analyses were calculated. Employing an item-by-item analysis of the diversity scores obtained on each stimulus item across tasks, the Pearson product moment correlational procedure was used to find the relationship between the diversity scores of the Y-O and O-O age groups, the F and M sex groups, and the $<$ HS and $>$ HS education groups for all tasks. The results of the correlational calculations appear in Table 14. The comparatively high correlational scores depicted in Table 14 indicate that the lexical stimuli formed a relatively consistent scale of agreement or disagreement across the tasks regardless of the subject group comparison. Subject variation changed the mean diversity scores obtained on each of the items but had no effect on the relative ease or difficulty of each item. In summary, in the sample of stimulus items used, the tendency to agree was far more closely related to the nature of the stimulus item than to differences in subject groups.

TABLE 14

SUMMARY OF CORRELATION VALUES OF THE DIVERSITY SCORES OF 25 LEXICAL STIMULI AS A FUNCTION OF AGE, SEX AND EDUCATION

Group	Task Condition			
	Superordination	Similarity	Location	Part
Y-O: O-O[a]	r = .98	r = .97	r = .95	r = .97
F: M[b]	.97	.98	.98	.98
<HS: >HS[c]	.97	.98	.97	.96

Notes: [a] Y-O = Young-Old; O-O = Old-Old
[b] F = Females; M = Males
[c] <HS = Less than high school completion; >HS = Equal to or greater than high school completion

Frequency Distribution of Primary Response Scores

The number of primary responses elicited by each of the 132 elderly subjects was determined by counting those responses that were identical to the primary responses obtained from the entire population samples (Tables 7, 8, 9 and 10). Since 25 primary responses were possible under each task condition a subject's primary response score could range from zero to 25. Thus, each subject had four scores (range = zero to 25) which represented the number of primary responses elicited by the subject under each of the four task conditions.

To obtain a frequency distribution of primary response scores, the scores were subjected to percentile rank analysis. The rank order analysis was based on charting the distribution

of the lowest to the highest primary response scores obtained on each task. Tables 15, 16, 17 and 18 provide information on the frequency of occurrence of a given primary response score. The cumulative frequency distribution and cumulative percentage distribution of the scores are also included.

TABLE 15

CUMULATIVE FREQUENCY
SUPERORDINATE

Raw Score	Frequency	Cumulative Frequency	Cumulative Percentage
6	1	1	<1 %
7	7	8	6
8	12	20	15
9	18	38	29
10	21	59	45
11	21	80	61
12	19	99	75
13	10	109	83
14	11	120	91
15	7	127	96
16	3	130	99
17	2	132	100

TABLE 16

CUMULATIVE FREQUENCY
SIMILARITY

Raw Score	Frequency	Cumulative Frequency	Cumulative Percentage
4	6	6	5 %
5	8	14	11
6	12	26	20
7	15	41	31
8	18	59	45
9	19	78	59
10	21	99	75
11	14	113	86
12	8	121	92
13	6	127	96
14	1	128	97
15	4	132	100

TABLE 17

CUMULATIVE FREQUENCY
LOCATION

Raw Score	Frequency	Cumulative Frequency	Cumulative Percentage
7	2	2	2 %
8	7	9	7
9	15	24	18
10	15	39	30
11	20	59	45
12	27	86	65
13	14	100	76
14	14	114	87
15	7	121	92
16	6	127	96
17	2	129	98
18	3	132	100

TABLE 18

CUMULATIVE FREQUENCY
PART

Raw Score	Frequency	Cumulative Frequency	Cumulative Percentage
4	3	3	2 %
5	6	9	7
6	9	18	14
7	13	31	24
8	14	45	34
9	24	69	52
10	21	90	68
11	15	105	80
12	14	119	90
13	6	125	95
14	3	128	97
15	3	131	99
18	1	132	100

Analyses of Variance of Primary Response Scores as a Function of Age, Sex and Education

The purpose of the analyses of variance was to determine whether for any given task, a difference existed in the number of primary responses elicited by the subjects as a function of age, sex or education. The mean primary response scores for each split group analysis appear in Table 19. Row means and column means are included.

The statistical analyses employed in the investigation were three two-way, fixed effects analyses of variances (2 x 4) with repeated observations. The first analysis of variance was calculated to analyze the primary response scores obtained by the subjects as a function of age (young-old, old-old)

TABLE 19

SUMMARY OF MEAN VALUES FOR PRIMARY RESPONSES GIVEN AS A FUNCTION OF AGE, SEX AND EDUCATION

	Task Condition				Row Mean
	Logical[a]		Infralogical[b]		
Split Group	Superordination	Similarity	Location	Part	
Age					
Young-Old	11.36	8.92	11.94	9.03	10.25
Old-Old	10.65	8.77	11.79	9.62	10.21
Column Mean	11.00	8.84	11.86	9.52	
Sex					
Female	11.23	9.20	11.92	9.92	10.57
Male	10.75	8.44	11.80	8.64	9.90
Column Mean	10.99	8.82	11.86	9.28	
Education					
< HS	11.20	9.16	11.43	9.69	10.37
> HS	10.79	8.51	12.33	8.92	10.14
Column Mean	10.99	8.83	11.88	9.30	

Table 19 (cont'd.)

Notes: [a]Grand Means: Logical Tasks

Age = 9.92

Sex = 9.90

Education = 9.91

[b]Grand Means: Infralogical Tasks

Age = 10.64

Sex = 10.57

Education = 10.59

TABLE 20

TWO WAY FIXED EFFECTS (AGE x TASK) ANALYSIS OF VARIANCE WITH REPEATED MEASURES AND EQUAL GROUP SIZE FOR THE NUMBER OF PRIMARY RESPONSES ELICITED BY SUBJECTS

Source of Variation	Degrees of Freedom	Mean Square	F[a] Value	Probability of Statistic
A (Age)	1	0.61	0.07	0.7856
Error (Age)	130	8.26		
B (Task)	3	219.78	39.96	0.0001*
AB (Age x Task)	3	12.34	2.24	0.0864
Error (Within)	390	5.50		

* Significant at .01 level of confidence.

Notes: [a] = Critical F values at .01 level:

Factor	Critical F Value
Age	6.63
Task	3.78
Age by Task	3.78

and task condition (superordination, similarity, location and part). The second analysis of variance was calculated to analyze the primary response scores as a function of sex (male, female) and task condition. The third analysis of variance was calculated to test statistically the primary response scores as a function of education (less than high school completion, equal to or greater than high school completion) and task condition.

Primary Responses as a Function of Age and Task Condition

Table 20 represents a two-way, fixed effects (age by task) analysis of variance with repeated observations and equal group size (Young-Old = 66; Old-Old = 66). The results indicate that there is no significant main effect for age (factor A) and no significant age by task interaction (factor AB). However, the task main effect (factor B) was statistically significant at the .05 level.

Three post hoc planned comparisons for the task main effect were developed to test for the following paired contrasts:

Contrast One. To determine whether a significant difference existed between the two logical tasks (superordination and similarity) on the primary response scores obtained by the subjects.

Contrast Two. To determine whether a significant difference existed between the two infralogical tasks (location and part) on the primary response scores obtained.

Contrast Three. To determine whether a significant difference existed between the combined primary response scores for the two logical tasks and the combined primary response scores for the two infralogical tasks. The planned comparison post hoc procedure was used to eliminate the problem of redundancy that is inherent to repeated measures designs.

Table 21 represents the results of the three post hoc planned comparisons. When task conditions were statistically analyzed for the pooled age groups, all three contrasts were found to be significant at the .01 level. Specifically:

a) When age groups are combined, a statistically significant difference exists between the primary response scores obtained on the superordination task and the similarity task. The group mean for superordination was 11.00 versus 8.84 on the similarity task.

b) A statistically significant difference exists between the primary response scores obtained on the location task and the part task for the combined age groups. The group mean for location was 11.86 versus 9.32 on the part task.

c) A statistically significant difference exists between primary response scores obtained on the logical tasks and the infralogical tasks. The group grand mean for the logical tasks was 9.92 versus a grand mean of 10.64 for the infralogical tasks. All mean values appear in Table 19.

TABLE 21

PLANNED COMPARISON POST HOC ANALYSIS OF THE TASK MAIN EFFECT FOR ALL SUBJECTS

Source of Variation	Degrees of Freedom	Mean Square	F[d] Value	Probability of Statistic
Sup - Sim[a]	1	307.58	59.29	0.0001*
Error (Sup - Sim)	130	5.19		
Loc - Prt[b]	1	399.97	65.08	0.0001*
Error (Loc - Prt)	130	6.15		
Log - Inf[c]	1	65.52	12.68	0.0006*
Error (Log - Inf)	130	5.17		

* Significant at .01 level.

Notes: [a] (Sup - Sim) = Contrast between superordination and Similarity.

[b] (Loc - Prt) = Contrast between location and part.

[c] (Log - Inf) = Contrast between logical tasks (superordination and similarity) and infralogical tasks (location and part).

[d] Critical F value at .01 level for all three contrasts = 6.63.

Primary Responses as a Function of Sex and Task Condition

Table 22 represents a two-way fixed effects analysis of variance (sex by task condition) with repeated measures and unequal group size (males = 61; females = 71). Factor A, the sex main effect, was found to be significant. Results indicate that, on the average, there is a significant difference between males and females on the number of primary responses elicited across task conditions. The task main effect (factor B) was also found to be significant. Sex by task interaction (factor AB), however, was not significant.

The mean data for the primary response scores tabulated by sex and task condition appear in Table 19. The row mean for women (across all task conditions) was 10.57 primary responses; the row mean for men was 9.90. Results indicate that the female subjects had more primary responses than did their male counterparts. The analysis of variance found this difference to be significant. Figure 7 graphically traces the mean scores for primary responses as a function of sex across all task conditions.

The planned comparisons contrasts for post hoc analysis of the significant task main effect (factor B) appear in Table 23. When task conditions were statistically analyzed for the combined sex groups, all three contrasts were also found to be significant at the .01 level. Specifically:

a) When sex groups were pooled, a statistically significant difference was found between primary response scores obtained on superordination task and the similarity task. The group mean for superordination was 10.99 versus 8.82 on the similarity task.

TABLE 22

TWO-WAY FIXED EFFECT (SEX BY TASK) ANALYSIS OF VARIANCE WITH REPEATED MEASURES AND UNEQUAL GROUP SIZE FOR THE NUMBER OF PRIMARY RESPONSES ELICITED BY SUBJECTS

Source of Variation	Degrees of Freedom	Mean Square	F[a] Value	Probability of Statistic
A(Sex)	1	62.90	8.12	0.0051*
Error (Sex)	130	7.74		
B(Task)	3	223.23	40.44	0.0001*
AB(Sex by Task)	3	8.90	1.61	0.1899
Error (Within)	390	5.52		

* Significant at the .01 level.

Note: [a] Critical F values at .01 level:

Factor	Critical F Value
Sex	6.63
Task	3.78
Sex by Task	3.78

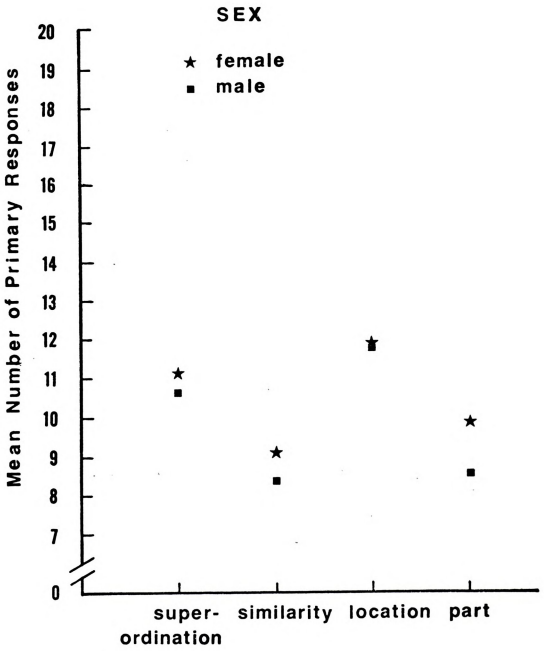


Figure 7. Mean Primary Response Scores for Male and Female Subjects Under the Four Task Conditions.

TABLE 23

PLANNED COMPARISON POST HOC ANALYSIS OF THE TASK MAIN EFFECT FOR ALL SUBJECTS

Source of Variation	Degrees of Freedom	Mean Square	F[d] Value	Probability of Statistic
Sup - Sim[a]	1	309.74	59.23	0.0001*
Error (Sup - Sim)	130	5.23		
Loc - Prt[b]	1	399.97	66.30	0.0001*
Error (Loc - Prt)	130	6.03		
Log - Inf[c]	1	64.82	12.21	0.0007*
Error (Log - Inf)	130	5.31		

* Significant at .01 level.

Notes: [a] (Sup - Sim) = Contrast between superordination and similarity.

[b] (Loc - Prt) = Contrast between location and part.

[c] (Log - Inf) = Contrast between logical tasks (superordination, similarity) and infralogical tasks (location and part).

[d] Critical F value at .01 level for all three contrasts = 6.63.

b) A statistically significant difference was found between the primary response scores obtained on the location task and the part task for the combined sexes. Group means for the location and part tasks were 11.86 and 9.28, respectively.

c) A statistically significant difference exists between primary response scores obtained on the logical tasks and the infralogical tasks. The group grand mean for the logical task was 9.90 versus a grand mean of 10.57 for the infralogical tasks.

Primary Responses as a Function of Education and Task Condition

The summary of the third two-way fixed effects (education by task) analysis of variance with repeated measures and unequal group size (less than high school completion = 63; equal to or greater than high school completion = 69) appears in Table 24. The education by task interaction (factor AB) was significant at the .05 level. The task main effect (factor B) was significant at the .01 level. The group main effect (factor A) was not significant. Results shown in Table 24 indicate that, on the average, education does not have a significant effect on the number of primary responses elicited by the subjects across the four task conditions. However, when a specific task condition is subjected to the two levels of education, a significant difference exists in the performance of the two groups in terms of the number of primary responses elicited.

TABLE 24

TWO-WAY FIXED EFFECTS (EDUCATION BY TASK) ANALYSIS OF VARIANCE WITH REPEATED MEASURES AND UNEQUAL GROUP SIZE FOR THE NUMBER OF PRIMARY RESPONSES ELICITED BY SUBJECTS

Source of Variation	Degrees of Freedom	Mean Square	F[a] Value	Probability of Statistic
A (Education)	1	4.99	0.61	0.4375
Error (Education)	130	8.22		
B(Task)	3	225.58	41.36	0.0001*
AB(Education by Task)	3	16.61	3.05	0.0313**
Error (Within)	390	5.45		

* Significant at .01 level
** Significant at .05 level.

Note: [a] Critical F value at .01 and .05 level.

Factor	Critical F Value .01 level	Critical F Value .05 level
Education	6.63	3.84
Task	3.78	2.60
Education by Task	3.78	2.60

Using the mean primary response scores for education (Table 19), a graphic representation of the education by task interaction was plotted (Figure 8). Noting the distance between mean points on a specific task, post-hoc t-test analyses with pooled variances were calculated. The first t-test contrast consisted of statistically testing the difference between the mean score of the < HS group and the mean score of the > HS group on the task of location. The results of the post-hoc analysis indicated that there was no significant difference between the two education groups at the .05 level. Since the numerical difference between the means of the remaining task conditions (superordination, similarity and part) was smaller than the contrast between the two means obtained on the location task and since the pooled variance was the same across tasks, it was assumed that the t-test contrasts of the other task conditions would not be statistically significant. Therefore, additional t-test analyses were not performed.

One possible explanation for the significant interaction effect was that the subjects with less than high school education had more primary response agreement than subjects with equal to or greater than high school education on three of the four tasks (superordination, similarity and part). On the task of location, those subjects with equal to or greater than high school education scored almost one point higher (.090)than the subjects not completing high school.

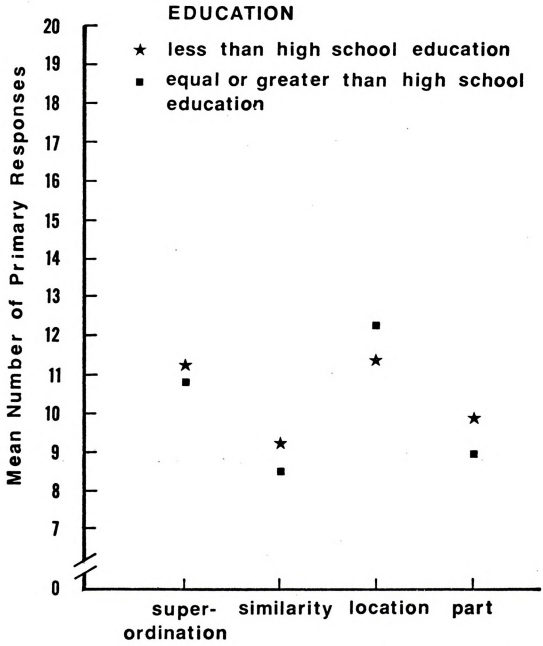


Figure 8. Interaction Between Education and Task Condition.

Discussion

In this section, the results as decribed above are compared and contrasted to the findings of previous investigations. For purposes of clarity, the research questions are restated. Following the discussion of each question, clinical implications are delineated.

Common Responses Elicited by the Elderly Subjects

Research Question One. In the restricted association task of superordination, what are the frequencies of occurrence of the common responses given by 85 percent of the nonpathological elderly group sampled?

A common response was defined as a response given by two or more subjects to a stimulus item. The common responses and corresponding frequencies of occurrence elicited by 85 percent of the elderly subjects (n = 112) on the superordination task appear in Appendix E (pp. 135-146). The frequency distribution of the common responses ranged from 129 to two with a mean frequency of 17.17. The mean diversity score was 19.36.

Research Question Two. In the restricted association task of similarity, what are the frequencies of occurrence of the common responses given by 85 percent of the nonpathological elderly group sampled?

The common responses and corresponding frequencies of occurrence elicited by at least 112 elderly subjects on the similarity task appear in Appendix F (pp. 147-161). The frequency distribution of the common responses ranged from 96 to two with a mean frequency of 12.13. The mean diversity score was 23.72.

Research Question Three. In the restricted association task of location, what are the frequencies of occurrence of the common responses given by 85 percent of the non-pathological elderly group sampled?

Appendix G (pp. 162-171) denoted the common responses and corresponding frequencies of occurrence for the location task. The frequency distribution of the common responses ranged from 131 to two with a mean frequency of 18.50. The mean diversity score was 16.16.

Research Question Four. In the restricted association task of part, what are the frequencies of occurrence of the common responses given by 85 percent of the non-pathological elderly group sampled?

Appendix H (pp. 172-189) denotes the common responses and corresponding frequencies of occurrence for the part task. The frequency distribution ranged from 106 to two with a mean frequency of 10.29. The mean diversity score was 26.80.

An overview of the common responses and associated frequency distributions indicates that the greatest amount of response agreement occurred on the location task. The part task had the least amount of response agreement.

Clinically, the data provided in Appendices E, F, G, and H could be useful when comparing "normal" elderly persons with elderly individuals whose language abilities have been disrupted by a neuropathology. With normative data available, reductions in response agreement and changes in normally elicited responses could be more easily detected.

Primary Responses Elicited by the Elderly Subjects

Research Question Five. In the restricted association tasks of superordination, similarity, location and part, what primary responses occur for each of the 25 lexical stimulus items?

A primary response was defined as the most frequently occurring single response given by the subjects to each test stimulus item. The primary responses and corresponding frequencies of occurrence for the four tasks appear in Tables 7, 8, 9, and 10 (pp. 63 - 66).

A comparison of the primary responses elicited by the 100 college students used as subjects to obtain the Michigan Restricted Association Norms (Riegel, 1965) with the primary responses elicited by the 132 elderly subjects of the present investigation showed the following results:

1. Twelve of the 25 primary responses elicited by the college sample were identical to the primary responses elicited by the elderly subjects on the superordination task. The mean frequency of occurrence was 50.24 for the college subjects versus 58.12 for the elderly sample.

2. Fourteen of the 25 primary responses elicited by the college sample were identical to the primary responses elicited by the elderly subjects on the similarity task. The mean frequency of occurrence was 37.16 for the college group versus 46.72 for the elderly subjects.

3. Twenty of the 25 primary responses elicited by the college sample were identical to the primary responses elicited by the elderly group on the location task. The

mean frequency of occurrence was 42.04 for the college group versus 62.64 for the elderly subjects.

4. Fifteen of the 25 primary responses elicited by the college sample were identical to the primary responses elicited by the elderly group on the part task. The mean frequency of occurrence was 33.16 for the college students versus 49.24 for the elderly subjects. The primary responses that were identical to those elicited by subjects used to obtain the Michigan Restricted Association Norms (Riegel, 1965) appear in Table 25. Four of the stimulus items (cabbage, rug, tiger, and wool) had matching primary responses on all four tasks. Six stimulus items (candle, eagle, moth, table, tobacco, and whiskey) had matching primary responses on three of the tasks. The location task obtained the highest number of identical primary responses for both groups of subjects.

Clinically, the identical primary responses elicited by the college sample and the elderly sample indicate that a certain amount of consistency is maintained across generations on the four restricted association tasks investigated in the study. The consistency of primary responses supports the theory that tests measuring crystallized intelligence (which includes stored verbal information) exhibit the least differences between young and old subjects (Labouvie-Vief, 1976).

TABLE 25

PRIMARY RESPONSES IDENTICAL TO THOSE APPEARING IN THE MICHIGAN RESTRICTED ASSOCIATION NORMS (RIEGEL, 1965)

Stimulus Item	Task Condition			
	Superordination	Similarity	Location	Part
anger		mad	mind	
bread	food			flour
cabbage	vegetable	lettuce	garden	leaf
candle	light	light	holder	
city		town	state	
eagle	bird		sky	wings
girl		woman		
house				room
knife			kitchen	blade
memory			mind	
moth	insect	butterfly		wing
music	sound			note
nurse		doctor	hospital	
rug	covering	carpet	floor	wool
soldier			army	uniform
stomach	organ	intestine[a]	body	
street		road	city	pavement
sun			sky	
table	furniture		kitchen	leg
thief		robber	jail	
tiger	animal	lion	jungle	stripe
tobacco		cigarette	pipe	leaf
water			lake	
whiskey	drink		bottle	alcohol
wool	material	cotton	sheep	fiber
TOTAL	12	14	20	15

Table 25 (cont'd.)

Note: [a] = Intestines and belly were equal in frequency distibution in the present investigation. Belly was selected as the primary response on the basis of flipping a coin.

The Effects of Age on Primary Response Groups

Research Question Six. Is there a significant difference between subjects, ages 65 to 74 years and subjects, ages 75 years and above, on restricted association tasks of superordination, similarity, location and part as measured by the number of primary responses given by each subject in each age group?

Results of the data indicated that there was no statistically significant difference between the young-old and old-old subjects on the primary response scores obtained across the four tasks. To date, only one investigation (Riegel and Riegel, 1964) has attempted to find differences among elderly subjects as a function of age. The investigation divided 76 elderly subjects into five age categories (55-59, 60-64, 70-74, and 75 years and over). Comparing the five elderly groups with 120 young subjects (ages 16-20 years), Riegel and Riegel found that as age continued to increase, primary response scores decreased but the decrease was not significant. The results of the present study are somewhat in agreement with the findings of the Riegels' investigation. Statistically, both age groups appeared to perform the same across tasks. However, the results depicted in Figure 3 showed that primary response agreement between the two age groups changed as a function of task condition. The young-old group had less agreement than the old-old subjects on the logical tasks (superordination, similarity) but tended to have

more response agreement than the old-old on the infra-logical tasks. Although the results of two studies are comparable, a caution must be made with respect to the manner in which data were collected. The Riegel study consisted of five grammatical categories (concrete nouns, abstract nouns, verbs, adjectives and adverbs). Only nouns were used as stimuli in this investigation. In addition, stimulus items in the Riegel study were presented orally instead of in a standard audio-visual procedure.

Clinically, the results of this investigation imply that age will have no significant effect on the amount of response agreement or response variability that occurs between, for example, two groups of elderly aphasic patients. However, a fluctuating pattern of agreement may occur depending upon the specific task conditions being investigated.

Future research should compare other age groups (e.g., young adult, middle age) with nonpathological elderly groups of subjects. Perhaps a sequential research design will be desirable, whereby the various age groups are investigated at designated intervals across a given time span. With this type of design, changes in response agreement or disagreement (diversity) across groups and within individuals can be detected simultaneously. In

addition, perhaps a five to ten year gap between the age groups (e.g., 25-35, 45-55, 65-75, etc.) should be included in the design. Leaving spans of time between age groups could possibly make any age differences in response agreement or response diversity more pronounced.

The Effects of Sex on Primary Response Scores

Research Question Seven. Is there a significant difference between male and female subjects on restricted association tasks of superordination, similarity, location and part as measured by the number of primary responses given by each subject in each sex group?

The sex main effect was found to be significant at the .01 level of confidence. The results indicate that women achieved higher primary response scores than men across all task conditions. Studies by Palermo (1963) and Palermo and Jenkins (1965) showed similar findings, although in the latter two investigations male subjects obtained higher scores than females on the superordination task.

When these results are applied to a rehabilitation situation one can only speculate that primary response scores of aphasic men and women should tend to be different with any variance usually favoring the women. The reason for this difference is as yet unexplained. Hopefully, future studies will investigate differences between male and female aphasic

patients to see if the statistically significant sex main effect found in nonpathological elderly subjects is upheld in pathological (i.e., aphasic) groups of elderly subjects.

The Effects of Education on Primary Response Scores

Research Question Eight. Is there a significant difference between the subjects having less than high school education and subjects having equal to or greater than high school education on restricted association tasks of superordination, similarity, location and part as measured by the number of primary responses given by each subject in each education group?

A significant interaction was found between education and the four task conditions. However, post-hoc t-test analyses, which contrasted the difference between the mean primary response scores of the two education groups on each task condition, revealed differences that were nonsignificant at the .05 level. An extrapolation of the t-test value obtained on the location task ($t = 1.58$ with 130 degrees of freedom) found the value to be statistically significant at the .062 level. The critical value of t at the .05 level was 1.64. Subjects with $\geq$ HS education had higher response agreement than subjects with $<$ HS education on the location task. However, more response agreement was found among subjects with less than high school education on the remaining three tasks (superordination, similarity and part).

Evidence of educational differences as reported in previous investigations is inconclusive. Herr (1950)

stated that an increase in education yielded an increase in response agreement. In contrast, Becher (1960) found that an increase in education led to a decrease in common responses. Sefer and Henrikson (1966) and Rosenzweig (1964) merely speculated that differences in response agreement existed as a function of years of formal education. No formal testing was conducted by the latter three investigators.

When applied to a rehabilitative setting, the results of this study indicate that primary responses and common responses may vary as a function of the subject's years of formal education and the specific task condition being investigated.

Future research should investigate the effects of years of formal education on response agreement or response variability among a larger sample of nonpathological elderly individuals. Persons with grade school-, high school- and college-education should be included as subjects. In addition, since aphasia was defined as a reduction in language (Schuell and Jenkins, 1961), a comparison between response agreement among elderly aphasics with less than high school completion and response agreement among elderly aphasics with equal to or greater than high school completion would provide information on whether a neuropathological condition reduced the vocabulary of both education groups to the same level, irrespective of formal schooling.

Closely related to years of formal schooling are life-long occupations held by elderly subjects. Occasionally,

occupational jargon influenced the responses elicited by some elderly subjects. For example, the life-long occupation of one male subject was an oil well driller. When asked to give a word that was similar to water, he responded with oil because, according to him, "both are natural resources that are deep in the ground."

When asked to give a synonym for stomach, a retired agriculturist whose area of concentration was animal husbandry, responded with "crop". He stated that "It's the name we use for a chicken's stomach."

Clinically, occupational jargon may be useful stimuli for prompting aphasic patients to elicit a target word. Future investigations should employ occupational jargon as stimuli and have subjects respond with "a word that would be given by most people in your profession."

The Effects of Task Condition on Primary Response Scores

Research Question Nine. Does the pattern of restricted association responses differ significantly between the logical instructions (superordination, similarity) and infralogical instructions (location, part) as a function of age, sex or education?

Two types of tasks were investigated, logical tasks (superordination, similarity) and infralogical tasks (location, part). Post-hoc comparisons were calculated to test significant task main effects across age, sex and education. Three contrasts were constructed to a) compare differences within the task-type (superordination minus similarity; location minus part) and b) compare differences

between the task-type (combined logical tasks minus combined infralogical tasks). When the three contrasts were analyzed across age and sex, all three post-hoc analyses were statistically significant at the .01 level. Although the task main effect was statistically significant at the .01 level across education, the significant interaction between education and task condition warranted no further discussion of the task main effect. Based on the column means appearing in Table 19, the rank order of the four task conditions for primary response agreement is as follows:

1. Infralogical task of location
2. Logical task of superordination
3. Infralogical task of part
4. Logical task of similarity

Stated differently, for the elderly population sampled, the highest amount of primary response agreement occurred on the infralogical task of location, whereas the greatest amount of response diversity occurred on the logical task of similarity. This pattern was consistent across age, sex and education.

Comparing the results of this study to those obtained by Riegel and Riegel (1964), it would appear that using location responses as clue words would increase a subject's chances for correctly identifying a target word. Riegel and Riegel found similars to be the most efficient single clue but, in this study, similars had the least amount of response agreement among the elderly subjects. In addition, the rank order analyses implies that mixed clues

(e.g., location and superordination) would produce more correct identification of the target words than double logical (e.g., superordination and similarity) and double infralogical (e.g., location and part) clues.

Clinically, the results indicate that determining the location of an object may, perhaps, be the easiest task for the aphasic patient to perform. Rehabilitation specialists should begin with the location task and present more difficult levels of association in the order indicated.

Future studies should investigate other logical and infralogical tasks that were used to collect the Michigan Restricted Association Norms (Riegel, 1965). Meanwhile, responses appearing in Appendices E, F, G and H can be used as clue words to investigate whether the highest amount of correct identification of the original stimulus items can be attributed to single-, double-, logical-, infralogical-, or mixed clues.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The major objectives of this investigation were (1) to provide data on the responses elicited by non-pathological elderly individuals on four tasks of restricted word association and (2) to determine whether or not differences in the responses elicited could be attributed to the age, sex or education of the elderly persons.

The research procedure consisted of (1) an assessment of the subject's hearing, vision and mental ability and (2) a test session. One hundred thirty-two elderly individuals, who passed the screening requirements, served as subjects. Each subject was seen individually for approximately 40 minutes.

A synchronized audio-visual presentation of 25 words was used to elicit responses to four restricted word association tasks. The task conditions consisted of two logical tasks (superordination, similarity) and two infralogical tasks (location, part). The same set of 25 words

as presented on each task. The order of stimuli presentation varied from task to task depending on the rank order of the "easiest" to "least easiest" stimulus item on each task.

Data from the test procedure were analyzed employing descriptive and inferential statistics. Descriptive statistical analyses were used to:

1. determine the common responses and corresponding frequencies of occurrence elicited by 85 percent of the total population sampled on the four tasks;

2. determine the primary responses and corresponding frequencies of occurrence elicited by the total population sampled on the four tasks;

3. determine the diversity scores for each lexical stimulus item on the four tasks.

Results indicated that the location task had the greatest amount of response agreement, whereas the similarity task had the greatest amount of response diversity.

Three two-way, fixed effects analyses of variance were employed. The first analysis of variance was used to investigate the difference in primary response scores as a function of age and task condition. A non-significant difference was found between the two age groups. The interaction between age and task was also non-significant. The differences between the three planned comparison contrasts for post hoc analyses of the statistically significant task main effect were all significant at the .05 level.

The second analysis of variance investigated the difference in primary response scores as a function of sex and task condition. Females were found to have significantly more response agreement than their male counterparts. Post-hoc analysis of the significant task main effect showed all three contrasts to be significant.

The final analysis of variance explored differences in primary response scores as a function of education and task condition. A significant interaction between education and task condition was found. Post-hoc t-test analyses yielded non-significant results, although the difference between the two education groups on the task of location was significant at the .062 level.

Conclusions

The results and statistical interpretation of the word association data elicited by the 132 elderly subjects suggest the following conclusions:

1. The use of a remotely controlled, synchronized audio-visual procedure is advantageous in minimizing misinterpretation of the stimulus signals by the elderly subjects.

2. Data have been obtained on restricted word associations of elderly subjects on the tasks of superordination, similarity, location and part. The collected data will be useful for comparison with future investigations of language patterns of the elderly. In addition, the data

can be used as a rehabilitative tool with elderly aphasic patients exhibiting semantic confusions.

3. The infralogical location task is the "easiest" task for the elderly as determined by overall response agreement. The logical similarity task is the "least easiest" for the elderly as determined by the diversity scores. This pattern is consistent regardless of the age, sex or educational level of the subject. The fact that the location task proved to be the "easiest" task for the elderly subjects may be influenced by the specific nouns selected as stimuli which may have a commonly recognized place in the environment. In view of the present findings, however, habilitation of neuropathological geriatric patients exhibiting semantic confusions should begin with a location task followed by a superordination task. Part and similarity tasks should be introduced last.

4. The fact that overall primary response agreement was unaffected by the age of the elderly subjects indicates that restricted word association responses remain relatively unchanged for elderly persons aged 65 years and above.

5. Female elderly subjects have significantly more response agreement than male subjects. In speculation, the majority of the females were housewives whereas the males occupied a variety of employment positions. Perhaps the "occupational uniformity" of the females and the "occupational diversity" of the males influenced the results obtained. In addition, the sex of the investigator (female) may have been

a contributing factor to the higher response agreement elicited by the elderly females.

6. The number of formal years of schooling influences the response agreement obtained by elderly subjects. Results suggest that persons with more years of formal schooling are exposed to more words in the language and thus, have a larger semantic domain. The larger semantic domain allows the person to have a variety of word association options from which to select. Therefore, less response agreement occurs. The fact that elderly subjects with a greater number of years of formal schooling obtained a higher common response score on the location task than subjects with less years of formal schooling may have been a factor of the words used as stimuli.

Recommendations

The following are suggestions for continued research exploration:

1. Future studies should employ equal cell sizes for the age, sex and education variables. A concomitant suggestion would be to enlarge cell size well beyond the 15 subjects. Both of the above changes would increase the power of the test statistic and allow for easier calculations.

2. Other investigations may subject additional form classes to the four task conditions or extend the number of task conditions investigated. A change in test stimuli might include adjectives and verbs. Additional task conditions may include antonyms and homonyms.

3. There should be a thorough analysis of the primary and common responses elicited as a function of the race of the subject. Differences in primary and common responses elicited by Black and Latino populations would have profound implications for the standardized testing procedures and clinical rehabilitative techniques currently being used to assess and habilitate aphasic patients.

4. Investigation of restricted word association responses over a greater age range is desirable. A comparison of other age groups (e.g., young and middle-aged adults) with nonpathological elderly groups of subjects would provide information on changes in response agreement and response diversity across age groups.

5. A comparative study of elderly male and female aphasic patients is important to see if the female aphasic patients have more response agreement than male aphasic patients as was evidenced in the nonpathological sex groups.

6. The effect of years of formal schooling on response agreement and response variability needs further exploration. Closely related to the educational process is the resulting occupational jargon that influences word association responses. The use of occupational jargon as cues for eliciting target words from aphasic patients should be investigated.

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APPENDICES

APPENDIX A

QUESTIONS USED ON MENTAL STATUS QUESTIONNAIRE

The Mental Status Questionnaire

1. Where are we now?
2. Where is this place located?
3. What is today's date? (day of the month)
4. What month is it?
5. What year is it?
6. How old are you?
7. What is your birthdate?
8. What year were you born?
9. Who is the president of the United States?
10. Who was president before him?

Source: Goldfarb, Alvin: "Memory and Aging" in The Physiology and Pathology of Human Aging, R. Goldman and M. Rockstein (Eds.) Academic Press, Inc., New York, 1975.

APPENDIX B

GENERAL AND INDIVIDUAL TASK INSTRUCTIONS

GENERAL INSTRUCTIONS

I AM TRYING TO COLLECT INFORMATION ON THE LANGUAGE USED BY SENIOR CITIZENS WHEN THEY ARE ASKED TO SUBSTITUTE ONE WORD FOR ANOTHER. YOU WILL HEAR AND SEE 25 WORDS IN FOUR DIFFERENT TASKS. AN EXPLANATION OF EACH TASK WILL BE GIVEN JUST BEFORE THE 25 WORDS ARE PRESENTED TO YOU. YOU WILL HAVE A CHANCE TO PRACTICE EACH TASK.

USE ONLY ONE WORD WHEN ANSWERING. TRY TO RESPOND AS QUICKLY AS POSSIBLE WITH THE FIRST WORD THAT COMES TO YOUR MIND.

THERE ARE NO RIGHT OR WRONG ANSWERS.

DO YOU HAVE ANY QUESTIONS?

LET US BEGIN WITH TASK 1.

TASK 1 - SUPERORDINATE

YOU ARE TO GIVE A GENERAL CLASS NAME FOR EACH OF THE 25 THINGS PRESENTED ON SLIDE. FOR EXAMPLE, THE CLASS NAME FOR A ROSE IS FLOWER. THE CLASS NAMES FOR BASEBALL ARE SPORT OR GAME. THREE MORE EXAMPLES ARE INCLUDED ON THE SLIDE PROJECTOR. WHEN YOU SEE AND HEAR EACH ITEM, YOU WILL RESPOND WITH A SINGLE WORD AS QUICKLY AS POSSIBLE. REMEMBER, YOUR RESPONSE MUST BE A GENERAL CLASS NAME.

YOU CAN ADVANCE THE TAPE AND THE SLIDE PROJECTOR BY PRESSING THE WHITE BUTTON ON THE RED BLOCK.

TASK 2 - LOCATION

YOU ARE TO NAME THE PLACE WHERE YOU MIGHT FIND EACH OF THE 25 THINGS PRESENTED ON SLIDE. IN OTHER WORDS, NAME THE LOCATION OF EACH ITEM. FOR EXAMPLE, A CAR CAN BE FOUND IN A GARAGE OR ON A STREET. A HAT CAN BE FOUND ON A RACK OR ON A HEAD. THREE MORE EXAMPLES ARE PRESENTED ON THE SLIDE PROJECTOR. REMEMBER, YOUR RESPONSE MUST BE A SINGLE WORD WHICH NAMES THE LOCATION.

TASK 3 - SIMILAR

YOU ARE TO GIVE ME A WORD THAT PRETTY MUCH MEANS THE SAME AS THE THINGS PRESENTED ON SLIDE. IN OTHER WORDS, NAME A WORD THAT ESSENTIALLY HAS THE SAME MEANING. FOR EXAMPLE, A CUP IS SIMILAR TO A GLASS OR A MUG. A HAT IS SIMILAR TO A CAP OR HELMET. THREE MORE EXAMPLES ARE PRESENTED ON THE SLIDE PROJECTOR. REMEMBER, YOUR RESPONSE MUST BE A SINGLE WORD WHICH ESSENTIALLY MEANS THE SAME.

TASK 4 - PART

YOU ARE TO NAME A WORD THAT REPRESENTS ONLY A PART OF THE THING PRESENTED ON SLIDE. FOR EXAMPLE, A TOE IS A PART OF THE FOOT. AN ERASER IS PART OF A PENCIL. THREE MORE EXAMPLES ARE PRESENTED ON THE SLIDE PROJECTOR. REMEMBER, YOUR RESPONSE MUST BE A SINGLE WORD WHICH REPRESENTS A PART OF EACH THING PRESENTED.

APPENDIX C

SAMPLE OF LETTERING USED TO CREATE STIMULI SLIDES

Lettering Used For Lexical Stimulus Items

APPENDIX D

ANSWER FORM SHOWING ORDER OF STIMULI PRESENTATION ON THE FOUR EXPERIMENTAL TASKS

ANSWER FORM

RESTRICTED WORD ASSOCIATION TASKS
PRESENTED TO ELDERLY SUBJECTS

Name:_____ Birthdate:_____

Chronological Age: _____yrs. _____mos. Sex:_____

Educational Level: _____ HS _____ HS

Highest Grade Completed:_____

PRE-EXPERIMENTAL DATA

MSQ Score:_____

Visual/Reading Screening: Pass _____ Fail _____

Hearing Screening(HTL): dB levels: 500 Hz:____ 1KHz:____

2KHz:____ 4KHz:____

Residence Elsewhere: ____No ____Yes Place_____

GENERAL COMMENTS:

Occupation(s):

Other:

Subject_____

Mental Status Questionnaire

1. Where are we now?_____
2. Where is this place located?_____
3. What is today's date?_____
4. What month is it?_____
5. What year is it?_____
6. How old are you?_____
7. What is your birthdate?_____
8. What year were you born?_____
9. Who is the president of the United States?_____
10. Who was president before him?_____

Score_____ (8 or above indicates passing score)

Degree of Dysfunction: none_____ mild_____

TASK 1: SUPERORDINATE	TASK 2: LOCATION
eagle	nurse
table	tiger
cabbage	stomach
bread	street
moth	sun
candle	rug
anger	cabbage
stomach	wool
tiger	memory
rug	table
tobacco	thief
water	eagle
knife	city
thief	whiskey
sun	water
house	knife
music	tobacco
wool	house
whiskey	soldier
girl	moth
memory	bread
street	girl
city	candle
nurse	anger
soldier	music

TASK 3: SIMILAR

moth_____

rug_____

sun_____

city_____

street_____

house_____

eagle_____

table_____

thief_____

tiger_____

cabbage_____

girl_____

bread_____

water_____

candle_____

nurse_____

anger_____

knife_____

memory_____

stomach_____

wool_____

music_____

soldier_____

whiskey_____

tobacco_____

TASK 4: PART

moth_____

table_____

cabbage_____

whiskey_____

eagle_____

tobacco_____

candle_____

knife_____

water_____

music_____

bread_____

tiger_____

street_____

city_____

nurse_____

soldier_____

wool_____

stomach_____

sun_____

house_____

memory_____

anger_____

thief_____

girl_____

rug_____

APPENDIX E

ALPHABETIZED PRIMARY AND COMMON RESPONSES AND ASSOCIATED FREQUENCY DISTRIBUTION FOR SUPERORDINATION TASK

Common Responses for Task of Superordination

Lexical Stimuli	Common Response	f	Total
1. anger	disposition	5	
	emotion	26	
	feeling	4	
	frustration	5	
	hate	2	
	mad[a]	39	
	mood	3	
	rage	2	
	temper; temperament	22	
	wrath	5	113
2. bread	bakery	9	
	dough	14	
	flour	9	
	food[a]	75	
	grain	4	
	wheat	4	115
3. cabbage	vegetable[a]	126	126

Lexical Stimuli	Common Response	f	Total
4. candle	light[a]	102	
	wax	18	120
5. city	area	7	
	community	5	
	country	4	
	location	2	
	metropolis	14	
	municipality	2	
	organization	2	
	people	8	
	place	14	
	population	6	
	town[a]	52	
	village	2	118
	NR_2[b]	4	
6. eagle	bird[a]	129	129

Lexical Stimuli	Common Response	f	Total
7. girl	child	8	
	female; feminine; femininity[a]	74	
	gender	7	
	human	6	
	lady	6	
	person; people	9	
	sex	6	
	woman	10	126
8. house	abode	12	
	building	30	
	dwelling	19	
	home[a]	35	
	live; living	5	
	residence	5	
	shelter	6	112
9. knife	cutter	8	
	cutlery	19	
	instrument	8	
	silverware	15	
	tool[a]	36	
	utensil	24	
	weapon	5	115

Lexical Stimuli	Common Response	f	Total
10. memory	ability	3	
	brain	11	
	faculty	5	
	forget; forgetful	3	
	function	4	
	intelligence	2	
	knowledge	2	
	mind[a]	25	
	past	2	
	recall	6	
	remember; remembering; remembrance	20	
	reminder	4	
	retainment	2	
	sense	2	
	think; thinking	18	
	thought	9	118
11. moth	bug	24	
	insect[a]	89	113

Lexical Stimuli	Common Response	f	Total
12. music	amusement	3	
	art	16	
	enjoyment	2	
	entertainment	24	
	instrument	4	
	rhythm	3	
	sing; singing	18	
	sound[a]	30	
	tone	4	104[c]
	NR_2[b]	11	

Lexical Stimuli	Common Response	f	Total
13. nurse	aide	18	
	assistant	9	
	attendant	7	
	carer	3	
	female	2	
	girl	2	
	health	3	
	helper[a]	20	
	hospital	2	
	humanitarian	2	
	medical	13	
	occupation	6	
	person	4	
	profession; professional	9	
	service	2	
	technician	3	
	woman	2	113
	NR_2[b]	10	

Lexical Stimuli	Common Response	f	Total
14. rug	carpet; carpeting	33	
	cover; covering; floor covering[a]	51	
	floor; flooring	9	
	furniture; furnishing	26	119
15. soldier	army	25	
	defender	9	
	fighter[a]	26	
	GI	2	
	male	2	
	man	8	
	military	11	
	person	2	
	profession; professional	3	
	protector; protection	10	
	serviceman	5	
	veteran	2	
	warrior	12	117
	NR_2[b]	2	

Lexical Stimuli	Common Response	f	Total
16. stomach	abdomen	11	
	anatomy	19	
	body	26	
	digestion	10	
	insides	6	
	intestines	9	
	organ[a]	31	112
17. street	address	2	
	avenue	22	
	boulevard	2	
	byway	2	
	city	4	
	direction	3	
	highway	4	
	passage; passageway	2	
	path; pathway	4	
	pavement	6	
	place	3	
	road; roadway[a]	36	
	sidewalk	14	
	thoroughfare	14	
	transportation	2	118

Lexical Stimuli	Common Response	f	Total
18. sun	body	3	
	bright; brightness	4	
	element	6	
	energy	4	
	heat	15	
	heavens	2	
	light[a]	28	
	planet	18	
	satellite	2	
	shine	11	
	sol	3	
	solar	5	
	sphere	2	
	star	7	
	universe	6	
	weather	2	118
	NR_2[b]	6	
19. table	furniture[a]	113	113
20. tiger	animal[a]	118	118

Lexical Stimuli	Common Response	f	Total
21. thief	burglar	16	
	criminal	21	
	crook	11	
	man	2	
	outlaw	3	
	person; people	4	
	robber[a]	37	
	scoundrel	2	
	stealer	16	
	thug	2	
	villain	2	116
22. tobacco	drug	5	
	habit	7	
	leaf; leafage	7	
	plant	20	
	smoke; smoking[a]	59	
	weed	16	114

Lexical Stimuli	Common Response	f	Total
23. water	drink; drinking[a]	46	
	element	4	
	fluid	18	
	liquid	37	
	rain	4	
	wet	6	115
24. whiskey	alcohol	32	
	beverage	12	
	booze	6	
	drink[a]	48	
	liquor	16	114
25. wool	cloth	15	
	clothes; clothing	23	
	fabric	15	
	fiber	8	
	material[a]	28	
	sheep	17	
	warmth	4	
	yarn	5	115

Notes: [a] = Words marked are the primary responses given by the elderly population sampled.

[b] = The number of no response answers (NR_2) are indicated where the score fell within the range of the numeric values of the common response frequencies. However, the no response measures were not counted when the common responses for 85 percent (n = 112) of the population was determined.

[c] = Cases where the 85 percent criterion level could not be reached without using idiosyncratic responses.

APPENDIX F

ALPHABETIZED PRIMARY AND COMMON RESPONSES AND ASSOCIATED FREQUENCY DISTRIBUTION FOR SIMILARITY TASK

Common Responses for Task of Similarity

Lexical Stimuli	Common Response	f	Total
1. anger	annoyed	2	
	emotion	3	
	fear	3	
	fright	2	
	frustration	11	
	grouchy	2	
	hate; hatred	10	
	ire	13	
	irritability	3	
	mad[a]	40	
	rage	5	
	tantrum	2	
	temper	16	
	violence	2	
	wrath	3	117

Lexical Stimuli	Common Response	f	Total
2. bread	biscuits	23	
	buns	16	
	cake[a]	33	
	muffin	6	
	rolls	23	
	toast	6	117
3. cabbage	broccoli	10	
	cauliflower	28	
	kale	3	
	lettuce[a]	46	
	ruddebaker	10	
	sauerkraut	4	
	slaw	13	114
4. candle	bulb	13	
	lamp	33	
	lantern	6	
	light[a]	43	
	taper	9	
	wax	10	114

Lexical Stimuli	Common Response	f	Total
5. city	town[a]	96	
	village	18	114
6. eagle	bird[a]	55	
	buzzard	5	
	crow	7	
	falcon	8	
	hawk	21	
	owl	5	
	pigeon	4	
	robin	9	114
7. girl	child	2	
	female	24	
	gal	2	
	lady	24	
	lassie	4	
	maiden	9	
	Miss	3	
	mother	2	
	woman[a]	47	117

Lexical Stimuli	Common Response	f	Total
8. house	abode	3	
	apartment	14	
	barn[a]	28	
	bungalow	2	
	cabin	9	
	cottage	12	
	church	2	
	domicile	3	
	dwelling	10	
	garage	7	
	home	20	
	hut	2	
	shed	2	
	tent	5	
	trailer	2	117

Lexical Stimuli	Common Response	f	Total
9. knife	blade	7	
	chisel	3	
	cleaver	2	
	cutter	5	
	dagger	9	
	fork	23	
	implement	2	
	machete	2	
	pick	2	
	razor	8	
	saber	2	
	saw	11	
	scissors	5	
	spatula	7	
	spear	2	
	sword[a]	27	114

Lexical Stimuli	Common Response	f	Total
10. memory	brain	9	
	diary	2	
	forget; forgetfulness	9	
	mind	22	
	recalls; recalling	10	
	remember; remembering; remembrance[a]	27	
	reminder	2	
	reminiscence	3	
	retainment	2	
	think; thinking	11	
	thought	20	117
11. moth	ant	3	
	bee	5	
	beetle	3	
	bug	11	
	butterfly[a]	52	
	caterpillar	5	
	fly	22	
	insect	3	
	miller	3	
	mosquito	7	
	roach	3	
	worm	3	120

Lexical Stimuli	Common Response	f	Total
12. music	art	2	
	band	7	
	classics	2	
	entertainment	2	
	happiness	2	
	harmony	4	
	instrument	2	
	melody	4	
	noise	12	
	note	2	
	orchestra	2	
	painting	5	
	piano	8	
	racket	2	
	radio	2	
	sing; singing[a]	29	
	sound	25	
	tone	2	
	tune	2	
	violin	2	
	voice	2	120

Lexical Stimuli	Common Response	f	Total
13. nurse	aide	26	
	assistant	6	
	attendant	6	
	doctor[a]	57	
	girl	2	
	helper	6	
	maid	2	
	midwife	2	
	mother	2	
	orderly	6	
	technician	2	117
	NR_2[b]	4	
14. rug	carpet; carpeting[a]	83	
	covering	7	
	linoleum	8	
	mat	19	117

Lexical Stimuli	Common Response	f	Total
15. soldier	army	9	
	cadet	4	
	fighter	10	
	guard	4	
	man	6	
	marine	9	
	navy	4	
	police; policeman	5	
	private	3	
	protector	5	
	sailor[a]	42	
	sergeant	3	
	warrior	8	

Lexical Stimuli	Common Response	f	Total
16. stomach	abdomen	15	
	bag	4	
	belly[a]	22	
	bladder	4	
	bowel	10	
	container	2	
	crop	2	
	digestion; digester	8	
	heart	2	
	intestines	22	
	liver	4	
	lungs	2	
	organ	5	
	pouch	8	
	sack	3	
	tummy	3	116
	NR_2[b]	3	
17. street	alley	8	
	avenue	37	
	boulevard	6	
	highway	6	
	road[a]	57	
	sidewalk	9	123

Lexical Stimuli	Common Response	f	Total
18. sun	bright	4	
	heat	5	
	light	15	
	moon[a]	80	
	star	9	
19. table	bar	2	
	bench	25	
	box	2	
	buffet	2	
	counter	5	
	cupboard	2	
	desk	23	
	pedestal	2	
	shelf	3	
	stand[a]	37	
	stool	7	110[c]
	NR_2[b]	12	
20. tiger	cat	21	
	leopard	13	
	lion[a]	78	112

Lexical Stimuli	Common Response	f	Total
21. thief	bum	2	
	burglar	18	
	criminal	4	
	crook	19	
	hijacker	2	
	liar	2	
	purloiner	2	
	robber[a]	61	
	stealer	7	117
	NR_2[b]	3	
22. tobacco	cigar	8	
	cigarette[a]	41	
	gum	4	
	leaf; leaves	5	
	marijuana	12	
	smoke	17	
	snuff	17	
	weed	8	112

Lexical Stimuli	Common Response	f	Total
23. water	alcohol	3	
	beer	4	
	coffee	6	
	drink	4	
	fluid	5	
	H_2O	3	
	ice	5	
	juice	5	
	lemonade	6	
	liquid	20	
	liquor	3	
	milk[a]	21	
	pop	8	
	rain	5	
	tea	7	
	wine	8	113

Lexical Stimuli	Common Response	f	Total
24. whiskey	alcohol	13	
	beer	20	
	booze	4	
	brandy	6	
	drink	6	
	gin[a]	25	
	liquor	9	
	scotch	4	
	vodka	6	
	wine	22	115

Lexical Stimuli	Common Response	f	Total
25. wool	blanket	3	
	cloth	11	
	clothing	3	
	cotton[a]	41	
	fiber	3	
	flannel	3	
	fleece	4	
	fur	4	
	hair	11	
	linen	3	
	material	3	
	nylon	4	
	sheep	8	
	yarn	12	113

Notes: [a] = Words marked are the primary responses given by the elderly population sampled.

[b] = The number of no response answers (NR_2) are indicated where the score fell within the range of the numeric values of the common response frequencies. However, the no response measures were not counted when the common responses for 85 percent (n = 112) of the population was determined.

[c] = Cases where the 85 percent criterion level could not be reached without using idiosyncratic responses.

APPENDIX G

ALPHABETIZED PRIMARY AND COMMON RESPONSES AND ASSOCIATED FREQUENCY DISTRIBUTION FOR LOCATION TASK

Common Responses for Task of Location

Lexical Stimuli	Common Response	f	Total
1. anger	argument	3	
	body	3	
	brain	5	
	court	2	
	crowds	2	
	fight	2	
	head	6	
	heart	4	
	home	7	
	man	3	
	mind[a]	42	
	person; people	29	
	quarrel	3	
	room	2	
	self	5	118

Lexical Stimuli	Common Response	f	Total
2. bread	bakery[a]	28	
	box	6	
	breadbox	14	
	cupboard	4	
	house	7	
	kitchen	10	
	sandwich	4	
	store	19	
	table	20	112
3. cabbage	field	4	
	garden[a]	100	
	ground	4	
	store	6	114
4. candle	candelabra	5	
	candlestick	5	
	church	24	
	holder[a]	28	
	home	5	
	house	11	
	mantle	5	
	store	12	
	table	17	112

Lexical Stimuli	Common Response	f	Total
5. city	area	2	
	community	2	
	country	9	
	county	13	
	land	3	
	map	8	
	metropolis	2	
	outside; outdoors	2	
	state[a]	67	
	town	11	119
	NR_2[b]	3	
6. eagle	aerie	7	
	air	6	
	mountain	11	
	sky[a]	68	
	tree	12	
	woods	8	112

Lexical Stimuli	Common Response	f	Total
7. girl	college	3	
	dance	4	
	family	3	
	home	37	
	house	12	
	office	4	
	school[a]	46	
	street	3	113
8. house	city	29	
	country	7	
	foundation	5	
	land	5	
	lot	26	
	street[a]	38	
	town	5	115
9. knife	drawer	32	
	kitchen[a]	51	
	pocket	25	
	table	18	126

Lexical Stimuli	Common Response	f	Total
10. memory	brain	29	
	head	26	
	mind[a]	62	117
11. moth	air	11	
	closet	28	
	clothes; clothing[a]	50	
	house	10	
	rug	3	
	wool; woolens	10	112

Lexical Stimuli	Common Response	f	Total
12. music	air	6	
	auditorium	3	
	band	5	
	church[a]	16	
	concert	4	
	conservatory	4	
	hall	10	
	home	5	
	house	3	
	instrument	4	
	opera	3	
	orchestra	8	
	piano	12	
	radio	5	
	record	3	
	store	7	
	television	5	
	theatre	10	113
13. nurse	hospital[a]	131	131
14. rug	floor[a]	105	
	house	13	118

Lexical Stimuli	Common Response	f	Total
15. soldier	army[a]	99	
	barracks	11	
	war	7	118
16. stomach	body[a]	91	
	bowel	4	
	human	4	
	person; people	14	113
17. street	city[a]	80	
	country	7	
	outside; outdoors	8	
	town	20	115
18. sun	sky[a]	127	127
19. table	home	11	
	house	30	
	kitchen[a]	61	
	room	15	117

Lexical Stimuli	Common Response	f	Total
20. tiger	Africa	11	
	forest	15	
	jungle[a]	48	
	woods	15	
	zoo	24	113
21. thief	bank	8	
	garage	8	
	home	6	
	house	11	
	jail[a]	33	
	prison	7	
	store	12	
	street	27	112
22. tobacco	cigarette	15	
	field	19	
	mouth	5	
	pipe[a]	28	
	pouch	19	
	store	28	114

Lexical Stimuli	Common Response	f	Total
23. water	faucet	6	
	ground	6	
	home	3	
	lake[a]	35	
	ocean	23	
	pipe	3	
	river	16	
	sea	7	
	tap	3	
	well	15	117
24. whiskey	bar	23	
	bottle[a]	38	
	brewery	4	
	distillery	9	
	saloon	10	
	store	31	115

Lexical Stimuli	Common Response	f	Total
25. wool	clothes; clothing	7	
	lamb	4	
	sheep[a]	94	
	store	4	
	sweater	5	114

Notes: [a] = Words marked are the primary responses given by the elderly population sampled.

[b] = The number of no response answers (NR_2) are indicated where the score fell within the range of the numeric values of the common response frequencies. However, the no response measures were not counted when the common responses for 85 percent (n = 112) of the population was determined.

[c] = Cases where the 85 percent criterion level could not be reached without using idiosyncratic responses.

APPENDIX H

ALPHABETIZED PRIMARY AND COMMON RESPONSES AND ASSOCIATED FREQUENCY DISTRIBUTION FOR PART TASK

Common Responses for Task of Part

Lexical Stimuli	Common Response	f	Total
1. anger	annoyance	2	
	control	2	
	disgust	2	
	disposition	2	
	emotion	3	
	feeling	5	
	fight	6	
	frustration	9	
	hate	4	
	hit	2	
	ire	3	
	irritation	2	
	mad[a]	30	
	mean	2	
	rage	4	
	reaction	2	
	stubborn	2	
	temper	17	
	tension	2	101[c]

Lexical Stimuli	Common Response	f	Total
2. bread	crust	16	
	dough	23	
	flour[a]	53	
	slice	10	
	wheat	13	115
3. cabbage	heart	9	
	leaf[a]	101	
	root	5	115
4. candle	flame	7	
	light	7	
	wax	49	
	wick[a]	53	116

Lexical Stimuli	Common Response	f	Total
5. city	building	22	
	district	3	
	hall	2	
	house; houses	12	
	mayor	3	
	metropolis	2	
	neighborhood	3	
	noise	2	
	people[a]	25	
	population	3	
	road	3	
	slums	2	
	stores	4	
	streets	14	
	suburb	5	
	tower	2	
	township	2	
	wards	3	112
6. eagle	beak	16	
	claw	10	
	feather	15	
	wing; wings[a]	74	115

Lexical Stimuli	Common Response	f	Total
7. girl	arm	5	
	beauty	2	
	body	6	
	breast	8	
	child	3	
	clothes; clothing	4	
	curls	3	
	dress	12	
	eyes	5	
	face	8	
	female	6	
	figure	2	
	gender	2	
	hair[a]	36	
	hands	2	
	head	3	
	heart	2	
	legs	2	
	Miss	2	
	nose	2	
	skirts	2	117

Lexical Stimuli	Common Response	f	Total
8. house	chimney	3	
	door	16	
	family	3	
	furniture; furnishing	6	
	home	3	
	kitchen	12	
	porch	4	
	roof	20	
	room[a]	30	
	windows	3	
	wood	9	115
9. knife	blade[a]	61	
	handle	44	
	steel	13	118

Lexical Stimuli	Common Response	f	Total
10. memory	brain	16	
	concentration	2	
	forget; forgetful	7	
	image	2	
	mind[a]	24	
	past	3	
	recall	8	
	remember; remembering; remembrance	19	
	think; thinking	13	
	thought	17	111[c]
11. moth	feelers	6	
	legs	10	
	mouth	8	
	wings[a]	91	115

Lexical Stimuli	Common Response	f	Total
12. music	band	2	
	bass	2	
	dance; dancing	2	
	entertainment	2	
	harmony	2	
	instrument	5	
	keys	2	
	melody	2	
	noise	3	
	notes[a]	42	
	piano	4	
	rhythm	2	
	scale	2	
	score	2	
	sheet	5	
	sing; singing	8	
	sound	25	
	strings	2	
	tone	2	
	voice	2	119

Lexical Stimuli	Common Response	f	Total
13. nurse	arms	2	
	cap	21	
	cloths; clothing	3	
	education	2	
	female	3	
	gown	2	
	hands	5	
	helper	2	
	medicine	6	
	patience	2	
	person	2	
	personality	2	
	thermometer	4	
	uniform[a]	57	
	woman	2	115

Lexical Stimuli	Common Response	f	Total
14. rug	base	2	
	border	2	
	carpet	3	
	color	6	
	covering	2	
	design	2	
	fabric	2	
	fiber	5	
	fringe	5	
	mat	3	
	material	5	
	nap	14	
	pattern	4	
	rag	2	
	thread	6	
	top	2	
	warp	4	
	weave; weaving	3	
	wool[a]	40	
	yarn	6	118

Lexical Stimuli	Common Response	f	Total
15. soldier	body	2	
	clothes; clothing	5	
	dress	2	
	guard	2	
	gun	33	
	head	2	
	legs	2	
	man	4	
	medal	2	
	regiment	2	
	rifle	6	
	training	3	
	uniform[a]	48	
	weapon	3	116

Lexical Stimuli	Common Response	f	Total
16. stomach	abdomen	2	
	ache	4	
	acid	4	
	bowel	9	
	digestion	8	
	esophagus	5	
	food	10	
	intestines	25	
	lining[a]	30	
	pyloris	2	
	skin	2	
	ulcer	6	107[c]
	NR_2[b]	4	

Lexical Stimuli	Common Response	f	Total
17. street	alley	3	
	asphalt	5	
	cement	15	
	concrete	7	
	curb	10	
	direction	3	
	ground	2	
	houses	4	
	intersection	2	
	lamps	2	
	lights	3	
	name	3	
	number	5	
	pavement[a]	24	
	sidewalk	22	110[c]
18. sun	bright; brightness	6	
	energy	3	
	fire	4	
	heat	23	
	light	24	
	rays[a]	41	
	shine	12	
	warmth	3	116

Lexical Stimuli	Common Response	f	Total
19. table	legs[a]	106	
	top	15	121
20. tiger	body	3	
	claws	15	
	foot; feet	3	
	fur	5	
	head	8	
	legs	7	
	mouth	3	
	paw; paws	5	
	skin	3	
	stripes[a]	41	
	tail	20	
	teeth	8	121

Lexical Stimuli	Common Response	f	Total
21. thief	character	2	
	crook	2	
	gun	24	
	hands[a]	24	
	head	2	
	legs	3	
	loot	3	
	man	8	
	mask	4	
	person	4	
	robbery	3	
	stealing	21	
	tools	10	110[c]
22. tobacco	leaf[a]	96	
	nicotine	4	
	smoke	10	
	stem	5	115

Lexical Stimuli	Common Response	f	Total
23. water	bubble	3	
	drink	3	
	drop	2	
	fluid	2	
	fluoride	2	
	H_2O	6	
	hydrogen	13	
	liquid[a]	32	
	mineral	5	
	moisture	2	
	oxygen	15	
	rain	5	
	steam	2	
	taste	2	
	waves	2	
	wet	21	117

Lexical Stimuli	Common Response	f	Total
24. whiskey	alcohol[a]	49	
	bottle	3	
	corn	13	
	grain	14	
	liquid	7	
	malt	3	
	rye	10	
	shot	3	
	smell	3	
	water	8	
	wheat	3	116

Lexical Stimuli	Common Response	f	Total
25. wool	cloth	3	
	fabric	2	
	fiber[a]	23	
	fleece	2	
	grease	2	
	itchiness	2	
	lamb	11	
	lanolin	5	
	nap	2	
	oil	7	
	sheep	6	
	skein	2	
	strands	5	
	threads	18	
	warmth	4	
	yarn	12	106[c]
	NR_2[b]	15	

Notes: [a] = Words marked are the primary responses given by the elderly population sampled.

[b] = The number of no response answers (NR_2) are indicated where the score fell within the range of the numeric values of the common response frequencies. However, the no response measures were not counted when the common responses for 85 percent (n = 112) of the population was determined.

[c] = Cases where the 85 percent criterion level could not be reached without using idiosyncratic responses.