AGE DIFFERENCES IN THE PRODUCTION AND PERSISTENCE OF PERCEPTUAL HYPOTHESES

by

Rachelle Dattner

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1969

This manuscript has been read and accepted for the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

June 30 1969
date

Joseph E. Barmack
Chairman of Examining Committee

June 30, 1969
date

Leonard S. Kogan
Executive Officer

Rose E. Pushner

Supervisory Committee

The City University of New York

ACKNOWLEDGMENTS

I take this opportunity to express my deep gratitude to the members of my Doctoral Committee: Dr. Joseph E. Barmack, Chairman of the Committee, who provided invaluable advice and support in the conception and execution of this study; Dr. Rose E. Kushner, who not only served as a member of the Committee, but also filled the role of mentor and teacher for me throughout my years of graduate study; and Dr. William H. Ittelson, who was continuously encouraging and understanding during the preparation of this dissertation.

I would also like to express my appreciation to Dr. Nathan Shock, Director of the Gerontology Research Center in Baltimore, Maryland, without whose support this study would not have been possible, to the staff of the Gerontology Research Center including Dr. Bernard Engel, Dr. David Arenberg, Mr. Arthur Norris, Miss Lee Pisarski and others too numerous to name, all of whom went to great lengths to be of assistance to me in the collection of the data, and to the participants in the Longitudinal Study, who graciously served as subjects for this study.

I am grateful also to Dr. John R. Frederiksen for furnishing the slides used in the visual recognition tests and to Dr. David Lynch for his advice concerning the statistical treatment of data. I would like to thank Miss Ann Sprayragen

and Mrs. Marion Fauross for serving as judges in the scoring of the data.

Finally, I gratefully acknowledge the patience and encouragement of Richard Dattner.

TABLE OF CONTENTS

LIST OF TABLES

Table | Page

Table Page

Table Page

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Historical Background

Gerontological research has supported the view that with advancing age adults are less disposed to modify their behavior in accordance with changes in stimulus conditions. The inability of older subjects to alter their responses has been demonstrated in a variety of situations including visual (Verville and Cameron, 1946; Wallace, 1956; Korchin and Basowitz, 1956) and auditory (Talland, 1958; 1959) perceptual tasks, and learning (Ruch, 1934; Korchin and Basowitz, 1957) and problem solving tasks (Heglin, 1956; Wetherick, 1965).

The term "rigidity" has been used to describe the behavior of interest; namely the fact that normal older adults do not alter their responses as readily as do younger subjects (Botwinick, 1967).

Divergent operational definitions of "rigidity" may be found in the gerontological literature. As examples: Brinley (1963) defined "rigidity" as the additional time required to do an alternation task (alternation of three operations e.g. synonyms, antonyms and rhymes) compared with the time required to do a non-shift task (successive performance

of one of these operations e.g. synonyms). Heglin's (1956) finding that older subjects showed an increasing tendency to be bound by "sets" in their method of solving Einstellung problems (The Luchins Water Jar Problem and The Cowen, Weiner and Hess Alphabet Mazes) has been interpreted as indicative of an increase in "rigidity" with advancing age (Riegel, 1959). Ruch's (1934) data which showed that the aged performed more poorly than the young on a mirror task also has been interpreted as indicative of an increase in "rigidity" (Botwinick, 1967).

The existence of a single factor of "rigidity" has not been supported in the literature (Schaie, 1958). Chown's operational definition of "rigidity" seems to be the most relevant and comprehensive: "lack of change in behavior where change is necessary for success at the task and where the subject knows that a change is likely to be demanded" (p. 353, 1961). She arrived at this conclusion after having administered 18 commonly used tests of "rigidity" including The Raven's Matrices and The Wesley Rigidity Inventory to 200 male subjects ranging in age from 20-82. A factor analysis of the results indicated that "rigidity" was not a unitary psychological dimension which increases with chronological age. In an earlier publication in which she reviewed the literature, Chown (1959) concluded that the "rigidity" measures ordinarily used seem to be measuring different processes.

The diversity of criterion measures for "rigidity" and Chown's findings indicate that a variety of processes are involved. For this reason, unless specifically used by the authors of the studies to be reviewed, the term "rigidity" will be abandoned. The subject of primary interest in the present investigation is the increasing inability to modify behavior with advancing age. Some processes suggested by the literature to account for age differences in the ability to modify behavior will be reviewed.

1) Age differences in the capacity to modify behavior reflect an increase in anxiety regarding performance and an increase in defensive cautiousness with age.

Cautious behavior may be viewed as an attempt to cling to the familiar and a response to anxiety engendered by the threats inherent in new situations.

Using the level of free fatty acid in the blood as an index of anxiety, Eisdorfer (1966) found that "the older person is made more anxious by having to learn and this anxiety and its physiologic correlates result in a tendency to withhold responses, with an apparent decline in verbal learning" (Eisdorfer, 1966, p. 414). Eisdorfer (1967) reports an increased frequency of errors of omission as compared with errors of commission in older subjects in a serial learning task. He also found that the performance differences between the old and young subjects could be reduced by lessening the older subjects anxiety regarding the

total experimental situation. Furthermore, the performance of elderly subjects was found to improve to a greater extent than that of a younger group in a serial learning task as the time available for response increases (Eisdorfer, Axelrod and Wilkie, 1963). On the other hand, with a shorter exposure time, the subjective difficulty of the task increased for the older adult. The consequence of this additional pressure was an increase in anxiety and a decrease in the efficienty of performance (Eisdorfer, 1966).

In their studies of age differences in verbal learning and in perceptual processes, Korchin and Basowitz (1957) and Basowitz and Korchin (1957) also noted that their older subjects withheld more responses than the younger group. They interpreted the cautious behavior of the old group as "a defensive reluctance to venture response for fear of recognizing their inadequacy" (Basowitz and Korchin, 1957, p. 96). More recently, Rabbitt (1968) has indicated that "the generalization that the old compensate by increased caution for real or imagined decrements in performance has been thematic in the literuature for some time" (Rabbitt, 1968, p. 89). Wallach and Kogan (1961) attempted to study age differences in judgement and decision making directly. They used questionnaires in which subjects had to make judgements regarding actions to be taken in everyday situations as well as subjective judgements regarding the probability of success or failure

on a visual and motor task. The findings were consistent with the previous observations that older subjects are less willing than younger subjects to "go out on a limb."

2) The slowness of the aged in modifying their behavior is a reflection of a generalized slowing with age.

One of the few generalizations that can safely be made is that older subjects are slower to respond than younger adults (Welford, 1958; Botwinick, 1967). The role of central changes seems to be critical, and there is unanimity of opinion that with age "slowness of behavior is the principal manifestation of a primary process of aging in the central nervous system" (Birren, 1964, p. 112). A recent study of normal aged males over the age of 65 revealed that psychomotor slowing was not related to any particular sensory modality or muscle group (Birren, Butler, Greenhouse, Sokoloff and Yarrow, 1963).

Slowness with aging is not limited to simple psychomotor response processes, but seems to be implicated in higher intellective processes as well. Studies of age differences in the speed of mental operations have been reviewed by Jones (1959) and studies of perceptual speed have been reviewed by Braun (1959). More recently, Chown (1961) and Brinley (1965) have emphasized the central role of the speed factor in the observed performance decrements on a variety of cognitive tasks with age.

3) The fact that the aged are unable to modify their responses reflects the impoverishment of the associative process with age; that is, there are fewer accessible responses in the repertoire of the older adult for the purpose of encoding.

The evidence regarding impoverishment with advancing age is somewhat contradictory. Deterioration of the associative process with age has been observed in studies of continuous word associations. In investigations by Birren (1955) and Birren, Riegel and Robbin (1962) subjects were instructed to produce as many words beginning with a stated letter as possible in a given period of time. The results showed that older subjects produced fewer associations. Age differences in the speed of behavior were taken into account. In a recent study of age differences in creative responses to sorting tests, Bromley (1967) also found that older subjects had a lower total output than younger subjects.

On the other hand, a study by Singer (1963) suggests that impoverishment is not necessarily a component of aging. She found that the range of available associations on a variety of tests including the Rorschach, T.A.T., Proverbs and Homonyms produced by healthy older men (65-75+) was similar to that of younger subjects.

Investigations of age differences in Rorschach performance seem to yield contradictory conclusions. In a study by Prados and Fried (1947) the performance of the aged

group was interpreted as indicative of a narrowing of the range of interests and associations. However, Eisdorfer (1963) in a more recent study of age differences did not find any age related increase in Rorschach indicators of associational impoverishment.

4) Age differences in the ability to modify behavior reflect an age related change in the ability to adopt the "active attitude."

Two modes of obtaining stimulation may be identified. "Passive" and "active" perception differ in terms of the extent to which the perceiver is active in seeking alternative interpretations of the same stimulus. Passive perception is characterized by a dependence on the sensory qualities of the stimulus itself. In the active attitude, the conceptualizations of the perceiver in addition to the stimulus qualities determine the behavior. Goldstein and Sheerer's (1941) studies of "concrete" and "abstract" behavior provide examples of differences between the two modes of apprehension. For Goldstein (1939) the concrete attitude consists in simple recognition, whereas the abstract attitude implies the selection of essential qualities, and the ability to shift from the abstract to the concrete attitude depending on the requirements of the task. The brain injured subjects studied by Goldstein were characteristically less able to utilize the abstract attitude. Behavioral similarities have been noted between brain injured patients and aged individuals who have not been diagnosed as brain injured.

Thaler (1956) has suggested that the "rigidity" so often attributed to the elderly may be a result of the fact that conceptual limitations preclude the attribution of more than one meaning to a situation. In a large group of normal volunteers observed by Thaler, a definite change toward concrete behavior was exhibited. For example, the predominant mode of response on the Weigel Color-Form Sorting Test in the group, which ranged in age from 60-101, could be classified as "concrete."

5) The increasing inability to modify behavior with advancing age reflects age differences in the effectiveness with which expectancies guide behavior.

Expectancy is the process in the initial stage of perception during which specific relevant aspects of the stimulus situation are given priority in terms of subsequent behavior. In this context, expectancies are future oriented internal activities by means of which the organism is "tuned" for the reception of stimulus information. Adaptive behavior requires the capacity to select and utilize relevant environmental information.

In recent years, age differences in the selection and processing of stimulus information has been a focus of research interest. One important finding is that the inability to ignore irrelevant information characterizes the performance of older adults. This has been demonstrated in simple psychomotor tasks (e.g. reaction time, Rabbitt and

Birren, 1967) and in more complex tasks (e.g. card sorting Rabbitt, 1965). In a recent review, Rabbitt (1968) suggests that with aging there is a diminution in the "information handling capacity" (Rabbitt, 1968, p. 90).

Other authors have suggested a relationship between age differences in the utilization of stimulus information and the modifiability of expectancies (Landahl and Birren, 1959; Birren, 1964). Perseveration seems to occur when an expectancy is maintained beyond its appropriateness to a task thereby precluding the adoption of a different expectancy. Landahl and Birren (1959) have taken cognizance of the relationship between the discriminability of the stimulus and the appearance of perseveration in their study of age differences in the discrimination of lifted weights. They found that while older subjects exhibited perseveration tendencies in judging weights, once their performance was adjusted for the level of weight discrimination, the perseveration effect disappeared. The authors conclude that "some aspects of perseveration may not be independent of the threshold to discriminate" (Landahl and Birren, 1959, p. 54). In interpreting these results Birren (1964) stated that "the tendency toward inflexibility or cautiousness in certain tasks may not be due so much to an anxious, uncertain disposition as to the need for more information; i.e., there is a need for older persons to have more information than younger ones in order to yield an equivalent level of

behavior" (Birren, 1964, p. 190). This was pointed out earlier by Welford (1958) who reviewed studies which indicated that the aged require additional sensory data in order to respond in a manner comparable to that of younger adults.

In another study (Wallace, 1956) the data also suggest a relationship between perseveration and the quality of stimulus information although it was not analyzed from this point of view. It was observed that the older subjects tended to form a "set"; that is, the subject's own response became a barrier to a change of interpretation of the stimulus. Design and pictures were presented to subjects of different ages for identification. These were presented on a band which moved behind an aperture. Both the size of the aperture and the band speed were varied thus varying the amount of structured information available per unit time. Wallace found that the wider the aperture initially, the less likely was the tendency to repeat responses. Clearly, the fact that the older subjects had more difficulty than younger subjects in this task may have been due to a variety of factors such as the decline in the capacity for short term storage with age (Inglis, 1965) and/or age differences in the speed of behavior. In addition, with partial information the task was more ambiguous and required a more active reconstruction process.

Age differences in the interference of a "set" was also observed in a study by Verville and Cameron, 1946).

They found an exacerbation of the tendency to carry over perceptual hypotheses from one stimulus figure to the next in their older group. In this study the Street Figures were used. These are incomplete pictures consisting of disconnected patches which must be conceptually completed by the subject. When the gaps are filled in, the figures are recognized as familiar objects. The authors observed that their older subjects seemed to be unable to respond correctly to fresh stimulus material because the previous response made to a different figure persisted and served as an interfering factor.

Observations made in the foregoing studies suggest that there may be age differences in responses to degraded stimuli. Such a line of inquiry seemed to merit further exploration.

The foregoing survey of the literature indicates a wide range of evidence regarding age related changes in the processes underlying the inability to modify behavior. Contradictory results are commonplace. In many previous gerontological studies, conclusions were based on the performance of inactive, hospitalized patients. Often, these conclusions are presented in the literature as evidence for deterioration in aging without mention of the fact that the subject population was institutionalized. Three widely quoted studies by Korchin and Basowitz (1956; 1957) and Basowitz and Korchin (1957) provide an example of this

problem. In those studies, the elderly subjects were institutionalized in a facility for the aged while the young group were physicians and nurses employed in that institution. These studies are referred to in six different chapters of the standard reference work on aging (Birren, 1959). But the fact that the aged group were institutionalized and the implications of that fact are mentioned in only one of the six chapters.

There is growing evidence that deterioration in cognitive functioning should not necessarily be considered characteristic of advancing age (Birren et. al, 1963). It has been demonstrated that the level of intellectual functioning throughout the life span is of primary importance in the extent to which age related cognitive deficits develop. Bayley and Oden (1955) showed that Concept Mastery scores of a group of gifted adults increased over a period of 12 years. The Concept Mastery Test, which includes Synonyms and Antonyms and Analogies, requires the ability to utilize symbols and abstractions. In a study by Eisdorfer (1963) in the case of every Rorschach variable (e.g. R, F+%, M etc.) I.Q. was more closely correlated with the mode of response than was age. For example, in his lowest I.Q. group, Eisdorfer noted an almost linear decline in the total number of responses with age, while the high I.Q. group did not show any age related decline.

These findings indicate that the status of the aged population studied is a major determinant in the degree of

cognitive deterioration observable. One should not anticipate that a bright, active, non-institutionalized old group would exhibit the same performance deficits as a group of aged hospitalized patients. But neither group can be considered representative of "the aged." Since an increasing proportion of the population over the age of 65 live in institutions of all sorts, a probability sample of all persons over 65 would contain institutionalized patients as well as active community residents. In practice, gerontological investigations are limited to the study of readily accessible institutionalized patients or to samples of non-institutionalized volunteers. The point to be stressed here is that the characteristics of the population studied must always be clearly stated so that generalizations may be appropriately restricted.

For the purposes of the present investigation, a group of bright, active aged volunteers were compared with a similar group of active middle aged and young volunteers on a visual recognition test. The background of the methodology is given in the following section.

Background of the Methodology

The handicapping influence of experience with blurred pictures has been demonstrated by Galloway (1946), Wyatt and Campbell (1951), Bruner and Potter (1964), Potter (1966) and Frederiksen (1965; 1966). In an unpublished study by

Galloway (1948, cited by Wyatt and Campbell, 1951) slides of common objects were presented to subjects under two conditions. Some subjects saw slides which were initially very blurred and which came into focus in 8 levels of blurredness while others saw the slides at an isolated only moderately blurred presentation. The incorrect identification made by the first group revealed repetition of earlier responses; early hypotheses seemed to interfere with subsequent recognition. On the other hand, subjects who saw a single moderately blurred slide did better.

More recently, Frederiksen (1966) attempted to predict performance on visual and auditory recognition tests similar to the one described above. The predictions regarding performance on the recognition tests were based on a set of cognitive factors. Twenty-nine tests representing the cognitive factors were administered to a large group of subjects. These cognitive factors included "cognitive flexibility-rigidity" (defined as the ability to overcome sets) and "flexibility of closure" (identified with Witkin's "field dependence-independence," "the ability to perceive objects apart from . . . context" Witkin, 1964, p. 176, cited by Frederiksen, 1966).

In Frederiksen's study one group of subjects was presented with pictures which were arranged from totally blurred to perfectly clear in 15 trials. (In Frederiksen's terms, the stimulus was arranged in levels of decreasing

ambiguity. Operationally, each series was produced by photographically blurring a clear image, and later reproducing a set of 15 slides designated each as differing from the adjoining one by "psychologically equal intervals of focus" by a group of judges.) This group, which saw the complete series, was referred to as the WRA (Wide Range of Ambiguity) group. A second group began seeing the picture at a later point in the series, and although the image was clearer, it was still quite blurred. This group was referred to as the NRA (Narrow Range of Ambiguity) group. The subjects who were tested in large groups, wrote down their hypotheses at each stage of blurredness.

Frederiksen found that the NRA group recognized the slide significantly earlier in the sequence than did the WRA group despite the fact that less overall time was provided for subjects in the NRA group to view the ambiguous stimuli.

Individual differences in ability in this recognition task were noted, "Cognitive-flexibility" was associated with early recognition in the WRA group only, whereas the prediction was that the ability to overcome sets would facilitate recognition in both groups. "Flexibility of closure" was related to late recognition in the WRA group presumably because the tendency to perceive embedded figures precluded the utilization of a more appropriate "global" interpretation of the blurred field. In the NRA group "flexibility of closure" was related to recognition in a negative way; that is, the capacity to produce a more analytic interpretation

of the more articulated stimulus was more appropriate in this case.

In addition to individual differences in the interfering effect of early hypothesizing, there may be developmental differences. With one recent exception however, the technique of decreasingly blurred slides has not been used in developmentally oriented studies. Galloway's (1946) subjects were all school children, while college aged adults served as subjects in the studies by Wyatt and Campbell (1951), Bruner and Potter (1964) and Frederiksen (1965; 1966). In a recent study by Potter (1966), developmental differences in the appearance of set persistence were noted. Potter observed that younger children were less encumbered by prior commitments to early erroneous hypotheses. Older children seemed to benefit more from the omission of early blurred stages.

In the present investigation a modification of Frederiksen's visual recognition test was employed with two objectives. The first of these was the verification of the data regarding differences in the recognition points attained in the Wide and Narrow Range of Ambiguity series. The consistent differences previously reported seem to indicate that this task is a sensitive measure of set persistence. As such, this task was seen as an appropriate vehicle for the execution of the second objective. That was the observation of age differences in the processes underlying set persistence in a bright and active group of men.

If as suggested by the literature, the interfering effect of incorrect responses is more damaging to older people, then the aged should perform even more poorly in the WRA condition compared with younger subjects. The oral reports should provide some insights into age related cognitive processes. Among the issues that could be examined is whether the increased set persistence of the aged is related to a paucity of accessible responses. On the basis of earlier studies, one may expect that the aged will produce fewer hypotheses regarding the blurred pictures. A further question to be explored is the role of cautiousness in the performance of subjects of different ages. It is also anticipated that an analysis of spontaneously occurring hypotheses produced by subjects of different ages will provide some clue as to age differences in the quality of responses. For example, do the aged produce a higher frequency of emotionally regressive responses than younger adults.

Statement of Hypotheses

On the basis of the foregoing discussion, the following hypotheses were examined in this study.

1. Hypothesis regarding the conditions of stimulus presentation.
    a. The repetition of an incorrect perceptual hypothesis and response enhances the persistence of the hypothesis and interferes with the reorganization of the percept when new cues are made available by increasing

the clarity of the stimulus. The mean recognition point in the Narrow Range condition should occur significantly earlier in the sequence of increasing clarity than the recognition point in the Wide Range condition.

2. Hypotheses regarding age differences in cognitive processes.

   a. Persistence of early erroneous responses is more characteristic of the performance of the aged than of the young. Accordingly, old subjects will be even more handicapped than young subjects with a wider range of blurred images (Wide Range condition) than when the opportunity to form incorrect hypotheses is decreased (Narrow Range condition).

   b. One process underlying the repetition of perceptual hypotheses in the aged is a paucity of available responses. Therefore, providing the subject with plausible alternative responses rather than requiring him to spontaneously produce them, should serve to minimize age differences in performance.

   c. If age related deficits in performance are due to greater cautiousness, it is anticipated that old subjects should withhold more responses than young subjects. It is also expected that greater uncertainty regarding performance should be verbalized by old subjects.

d. If the thinking of the aged subjects is more concrete they should produce a greater frequency of descriptive responses in the place of hypotheses regarding the subject of the picture than younger subjects.

e. In addition, the old group should produce more hypotheses which are vague and general than the young groups.

CHAPTER II

SUBJECTS AND PROCEDURE

Description of Subjects

In the present investigation the subjects selected were homogeneous with respect to sex, race, and intellectual and educational level. They ranged in age from 24 to 80.

Sixty white male subjects were selected from among the participants in the longitudinal study of the Gerontology Research Center, National Institute of Child Health and Human Development located at the Baltimore City Hospitals, Baltimore, Maryland, and from among volunteers recruited from the staffs of the Gerontology Research Center and the Baltimore City Hospital. This population was selected because it provided a unique opportunity to study the performance of matched groups of adults all of whom function at high levels of competence in the community. With few exceptions, subjects were professional personnel in scientific and technical areas employed by the Federal Government. Among the exceptions were educators, pharmacists and attorneys. All subjects were residents of the Baltimore-Washington area. Stone and Norris (1966) present additional data regarding the characteristics of the population from which this sample was drawn.

Three age groups (24-40, 42-59, 60+) were matched for educational achievement and intellectual level as estimated from the Vocabulary subtest of the WAIS. The characteristics of each age group have been summarized in Table 1.

All subjects fell within the normal range of color vision and visual acuity on standard tests. Those subjects whose vision was corrected wore their glasses during the Recognition Test.

TABLE 1

MEANS AND STANDARD DEVIATIONS OF AGE IN YEARS, YEARS OF EDUCATION, AND WAIS VOCABULARY SCALED SCORE* FOR SUBJECT POPULATION

		N	Age (Years)	Years of Education	Vocab. Score
Young	Mean	20	29.80	17.45	15.00
	S.D.		4.551	1.849	1.590
Middle	Mean	20	50.48	17.60	15.45
	S.D.		4.877	2.326	1.210
Old	Mean	20	70.12	18.20	15.40
	S.D.		5.893	1.765	1.789

*A scaled score of 15, the mean of the group, was assigned to ten college graduates for whom the WAIS data were unavailable.

Procedures

Two separate tests were used: The Free Response Recognition Test and The Checklist Recognition Test. Each of these will be described in turn.

The Free Response Recognition Test

Experimental design.--All subjects were shown the slides in two types of sequences. These sequences differed in the extent to which they provided an opportunity to misinterpret the slide. Following Frederiksen's (1966) procedure, each Wide Range sequence began with the presentation of a maximally blurred picture (stage 1) and continued through intermediate stages to a perfectly clear picture (stage 15). In the Narrow Range sequence, the presentation began with a picture of medium blurredness (stages 4-9 depending on the particular slide) and continued through the intermediate stages to a perfectly clear picture (stage 15).[1]

---

[1]It will be recalled that Frederiksen referred to the complete series of 15 slides as the Wide Range of Ambiguity and the shorter series as the Narrow Range of Ambiguity. The present investigator believes that Frederiksen's equation of ambiguity and blurredness may be misleading. Accordingly, in the present study, the complete series was referred to as the Wide Range sequence and the shorter series as the Narrow Range sequence. The word "ambiguity" was dropped from the description. A perceptual object is ambiguous if it lends itself to a set of alternate interpretations. Blurredness, as it is used in the present context, is a property of the stimulus. A blurred picture may be ambiguous but is not necessarily so. In addition, it is possible for a perfectly clear picture to be ambiguous. Boring's wife-mother-in-law figure serves as an example of a focused picture which is ambiguous because it lends itself to at least two distinct interpretations. By throwing a clear picture out of focus, Frederiksen (1966) destroyed its formal structure. The blurred picture may therefore be appropriately referred to as destructured but not necessarily ambiguous. The technique of defocusing is more effective in degrading form and probably less effective in degrading other stimulus properties such as color and shading. It is recognized that the form of distortion of the stimulus properties may be differentially effective in the aged and the young. In this study, the dominant property degraded was structure.

All subjects saw a total of eight different slide series. Half of the subjects in each one of the three age groups saw the first four slide series in the Wide Range and the second four in the Narrow Range. This order was reversed for the remaining half of the subjects in each age group. For five of the ten subjects, who saw the first four slide series in the Wide Range and the second four in the Narrow Range, the initial presentation was in the Wide Range. The other five subjects had the initial presentation in the Narrow Range. For each subject Wide Range and Narrow Range conditions were alternated. This procedure was carried out for the other ten subjects in each age group and was designed to eliminate the development of an expectancy based on the difficulty of the task.

The experimental design is outlined in Table 2.

TABLE 2

DISTRIBUTION OF SUBJECTS IN EACH AGE GROUP AND EACH ORDER OF STIMULUS PRESENTATION

		Age Groups					
		24-40		42-59		60+	
Slide Series*	Series No.	Order	N	Order	N	Order	N
I							
Cupboard	I	W R	5	W R	5	W R	5
Trashcans	II	N R		N R		N R	
Lifeboat Drill	I	N R	5	N R	5	N R	5
Child with Toys	II	W R		W R		W R	
II							
Cow and Person	II	W R	5	W R	5	W R	5
Leaves and House	I	N R		N R		N R	
Silverware	II	N R	5	N R	5	N R	5
Bicycles	I	W R		W R		W R	
TOTAL			20		20		20

*Slide Series were presented in random order within each range, Wide (W R) and Narrow (N R).

Materials.--For the purpose of the Free Response Recognition Test eight of Frederiksen's (1966) fourteen slide series were used. These were duplicates of those used in Frederiksen's study. The selection of the eight series was made on the basis of a preliminary investigation using a different population. The slides included color pictures of the following: an open cupboard containing dishes, a row of metal trashcans on a sidewalk, sailors participating in a lifeboat drill, a child playing with toys, a person and a cow, a house seen through the leaves of a tree, silverware scattered on a rug, and a row of bicycles in a bicycle rack.

The eight slide series were divided into two equivalent groups based on the trial (level of blurredness) at which they were recognized by subjects in the preliminary study. In Table 3 the points at which each slide series began in the Wide Range and Narrow Range sequences are given. As a reminder, for each of these pictures there were 15 levels of

TABLE 3

STARTING POINT IN EACH SLIDE SERIES FOR WIDE RANGE AND NARROW RANGE SEQUENCES

Description	Starting Point	
	WR	NR
Cupboard with Dishes	1	4
Trashcans	1	6
Child with Toys	1	8
Lifeboat Drill	1	9
Bicycles	1	4
Sky and Leaves	1	6
Cow and Person	1	8
Silverware	1	9

blurredness. In the Wide Range sequence, the complete range of 15 slides was presented. In the Narrow Range, several early blurred stages were deleted at different points according to Frederiksen's rationale described below.

According to Frederiksen (1966) the reduction in the number of levels of blurredness should be sufficient to produce a reduction in the number of "interference creating" hypotheses. At the same time he attempted to avoid a

restriction in the range of scores possible. Such a restriction would have been caused by the elimination of trials on which subjects might have recognized an item. The number of stages deleted for each item was determined from the distribution of recognition points on that item. For each item, all trials (levels of blurredness) were eliminated on which the cumulative percentage of subjects who recognized it was less than four percent. Where fewer than a third of the trials were eliminated using this rule, a criterion of eight percent was applied.

Procedure for the Free Response Recognition Test.--Subjects were comfortably seated at a distance of nine feet from a standard grainless 30" x 40" white screen. Slides were shown with a Kodak Carousel projector which had an automatic timing device. The projected image size was 32" x 21 1/2".

At each stage of clarity the slide was exposed for eight seconds. Each exposure was followed by an eight second blank interval during which the subject verbalized his hypotheses regarding the picture. Responses were tape recorded for transcription.

Subjects were instructed as follows:

> This is a Test to determine how people identify pictures which are out of focus. The slides you will see are all ordinary color slides of things which you would immediately recognize if you saw them in full focus.

> When you first see each of these pictures it will be blurred. It will gradually come into focus in a number of steps. The picture will go on and then will go off. Each time the picture goes on it will be slightly less blurred. I would like you to tell me at each step what you think the picture is even if you are not sure. If it looks the same, say, "Same." Identify all the things that you see in the picture.
>
> Try and determine what each picture is as soon as you can. The projector will continue automatically until the clearest slide has been presented.
>
> We will begin with a sample. Then if you have any questions you may ask them.

A sample item was then shown at Level 1, the most blurred stage, and the subject was asked, "What does that look like to you now?" If he did not respond or said he didn't know, he was told, "Even if you are not sure, I'd like you to guess each time." This was repeated whenever the subject did not respond. The subject was encouraged to identify both foreground and background details in the sample item. For example, if he responded with one detail, he was asked what else he saw in the picture.

Each series was preceded with an instruction to guess at each step. The series was terminated after the 15th (clearest) slide had been exposed. The subject had a 45 second rest period between series. The Free Response Recognition Test took 45 minutes. The subject was then given a five minute rest period.

Scoring.--Two advanced graduate students in clinical psychology served as independent judges in scoring the responses.

Protocols were coded so that no information was available regarding the age of the subject although the Wide Range or Narrow Range sequence was known by virtue of the number of trials.

Responses were classified as partially correct, complete or incorrect. The trial (level of blurredness) at which the partial and totally correct response was given was noted. If recognition did not occur, a score of 16 was assigned. The criteria for correctness for each slide is given in Appendix I. Incorrect pre-recognition responses were classified as follows:

1. No hypothesis
2. Attributive remarks
3. Erroneous hypotheses
4. Repetitions

Erroneous hypotheses were further classified as to content. The criteria for each of the response categories is given in Appendix I. The correlation between the judges scores ranged from 0.79 for the measure of verbalized uncertainty regarding performance to 0.96 for the trial at which correct recognition was attained. Seventy-two correlations between judges scores were computed; the modal correlation coefficient was +0.91. Correlation coefficients of this magnitude indicate a high degree of reliability of the measures. Accordingly, the scores of one of the judges was selected for use in the description of the data by flipping a coin.

The Checklist Recognition Test

Experimental design.--The purpose of using a Checklist was to determine whether the paucity of responses observed in older subjects is due to a lack of available ideas. It was anticipated that if older subjects have greater difficulty than younger subjects in the production of alternative hypotheses, then relieving them of the requirement for evoking reasonable alternative hypotheses by providing such hypotheses in the Checklist should result in an improvement in performance. Clearly, other factors contaminate the issue of the availability of ideas in the Checklist Recognition Test. For example, the presentation of alternative hypotheses may also reduce the uncertainty inherent in a free response situation. The finding that the performance of the aged in the Checklist Recognition Test is more like that of younger subjects as compared with their relative performance in the Free Response Recognition Test may therefore be due to age differences in the capacity to deal effectively with uncertainty. Nevertheless, it was anticipated that the results of the Checklist Recognition Test would shed some light on the nature of age differences in recognition performance.

All subjects who had participated in the earlier part of the study received the Checklist Recognition Test.

Materials.--Four slide series, different from the eight used in the Free Response Recognition Test, were used in the Checklist. Two of these, Shoes and Ashtrays were among those

used by Frederiksen in his 1966 study. The other two series, Barge with Crates and Cat were used by Frederiksen (1965) in an earlier investigation. In Table 4, the four series and the eight alternatives are presented.

TABLE 4

FOUR SERIES AND EIGHT ALTERNATIVES* OFFERED IN THE CHECKLIST RECOGNITION TEST

Series	Alternatives Offered
Barge with Crates	Food on a table, Pile of IBM cards, Barge with Crates, House, Voltmeter, Model of a city, Bricks, None of these
Shoes	People dancing, Chairs, Pocketbook, Saddle, Shoes, Machine, Musical Instrument, None of these
Ashtrays	Glass Ashtrays, Sunset, Magazines, Finger Painting, Record Albums, Playing Cards, Boxes, None of these
Cat	Looking through a spider web, Snow scene, Sheets, Rocks, Reflection in Water, Cat, Dog, None of these

*Successive pages of the checklist differed with respect to the order in which the alternatives were presented. There were five random orders.

Procedure for the Checklist Recognition Test.--Before each series, the subject was given a packet of 15 unattached pages. On each page of this Checklist, the eight alternative hypotheses appeared on the left hand side of the page. These consisted of a) the six most frequently occurring incorrect hypotheses produced by 38 preliminary subjects in the Free

Response Recognition Test, b) the correct response, c) "none of these." On the right hand side of the page, alongside each of the alternatives, space was provided so that the subject could check any or all of them. After the subject made his choice, he handed the completed page to the experimenter who was seated behind him. A small desk lamp provided illumination for the checklist.

Subjects were instructed as follows:

> Now I am going to show you some more slides which gradually come into focus in a number of steps as before. This time, I will give you a list containing several possible descriptions of the slide.
>
> Each time the slide goes off you will have time to check off all the things the picture could be. After you have checked off as many of these as might describe the picture, hand me the top page and use the page under that at the next step.
>
> If you feel that none of the choices describes the picture at a particular step, you can check, "none of these."
>
> Do you have any questions?
>
> Take a minute to look at the choices.

The subject was then given 60 seconds in which to study the alternatives. As in the Wide Range condition of the Free Response Recognition Test, the presentation of each series began at stage 1 (most blurred picture) and continued automatically to stage 15 (clearest picture). Each slide was exposed for 8 seconds and was followed by a 16 second blank interval during which the responses were checked off.

Scoring.--Responses to the Checklist Recognition Test were scored as follows:

1. The trial at which the correct response was the exclusive response and was not changed subsequently.
2. The number of incorrect alternatives checked off prior to the final attainment of the correct response.

CHAPTER III

RESULTS

In order to determine age differences in the role of set persistence in recognition performance, young, middle aged and old subjects were compared on three categories of response measures. The mean recognition point of the four slides shown in the Wide Range was compared with the mean recognition point of the four shown in the Narrow Range. The dependent variable was analyzed by means of a 3 x 2 x 2 Latin Square Analysis of Variance (Edwards, 1960). There were three levels of age, two ranges of stimulus presentation (Wide and Narrow) and two slide sets (See Table 2). This analysis permitted the partialling out of variables which were not of primary interest but which may have affected the variance. For example, the variance contributed by the difference between the two slide sets used was assumed to be negligible since they had been pre-tested and found to be equivalent with respect to recognizability. In fact however, as may be seen in Table 5, the failure to consider the variance contributed by slide set would have resulted in the confounding of slide set and sequence of presentation (Wide or Narrow Range). The two slide sets, were not equivalent in their recognizability; that is, the mean trials at which recognition occurred differed significantly.

In terms of the experimental hypotheses, the following were of primary interest; age, range (Wide/Narrow) and the interaction of age by range. Results relevant to the trial at which recognition occurred are presented in Tables 5, 6, 7, 8 and Figures 1, 2, 3 and 4.

The second category of response measure by which the three age groups were compared, dealt with the processes involved in recognition performance. The three measures in this group include: a measure of productivity of different incorrect pre-recognition hypotheses; a measure of repetitiveness of incorrect hypotheses; and a measure of the tendency not to respond. An Index was derived for every subject for each of the measures described. Each Index took into account the number of trials prior to correct recognition. This was done in order to compare subjects who had had different numbers of trials in which to produce the response in question. As an example, three different subjects may each have produced two erroneous, pre-recognition hypotheses in the Wide Range sequence. Clearly if the first of these subjects recognized the slide at trial 6, the second subject at trial 9 and the third subject at trial 12, the three subjects differed with respect to the number of opportunities they had to produce the two hypotheses. The subject who recognized early had fewer chances to hypothesize incorrectly than the subject who recognized later. The fact that all three produced two incorrect hypotheses does not adequately describe the situation.

Accordingly, an Hypothesis Production Index was derived and defined as the total number of different incorrect pre-recognition hypotheses produced divided by the total number of trials preceding recognition. Hypotheses Production Indexes were derived in this manner for each subject in the Wide Range and in the Narrow Range conditions. Analagous measures derived for repetitiveness and the tendency not to respond are referred to as the Repetition Index and the Response Omission Index respectively. The significance of all differences relevant to the three indexes were evaluated by 3 x 2 x 2 Latin Square Design Analyses of Variance. Results relevant to the three measures are presented in Tables 9-12, 16-18 and 22-23 respectively. For the sake of completeness, the total number of responses relevant to the three measures of interest are also given. In addition, the significance of the mean age difference for each of the totals was tested in the Wide Range and Narrow Range conditions. This was accomplished by the Randomized Groups Design Analyses of Variance (Edwards, 1960). These results are shown in Tables 13-15, 19-21, and 24-26.

The third category of response measure used to compare the performance of the three age groups involved the form and content of the responses. Included in this category were a measure of verbalized uncertainty, a measure of the concreteness of the response and three measures involving specific content categories. A 3 x 2 x 2 Latin Square Design Analysis of Variance was performed to test the significance

of the mean differences for the measure of uncertainty. Randomized Groups Design Analyses of Variance were used for the other measures. Results may be found in Tables 27-44.

In order to determine age differences in recognition performance in the Checklist Recognition Test, the significance of the differences among the mean trials at which recognition occurred was tested by a Randomized Groups Design Analysis of Variance (Tables 45-47).

Age differences in the number of incorrect, prerecognition hypotheses checked were also analyzed by the Randomized Groups Design Analysis of Variance (Tables 48-53).

A Mixed Factorial Design, Type 1 Analysis of Variance (Lindquist, 1953) was performed to compare the three age groups with respect to the number of incorrect pre-recognition hypotheses checked in the Free Response Recognition Test and the Checklist Recognition Test. A summary of that analysis is presented in Table 54. All multiple comparisons among means were made with Duncan's New Multiple Range Test when the F ratio was significant at the .05 level (Edwards, 1960).

Free Response Recognition Test

Point of Recognition

Difference between Wide and Narrow Range conditions.--The first hypothesis predicted that the mean trial at which correct recognition was attained in the Wide Range sequence would occur later for all subjects than the mean trial at which correct recognition was attained in the Narrow Range. This hypothesis was not supported by the results (Table 5).

TABLE 5

SUMMARY OF THE ANALYSIS OF VARIANCE
MEAN TRIAL AT WHICH TOTAL RECOGNITION OCCURRED

Source	df	MS	F	P
Age	2	25.227	26.686	.001
Order of Slide Set	1	0.033		
Order of Range (Wide/Narrow)	1	0.008		
Age x Order of Slide Set	2	1.789		
Age x Order of Range	2	1.653		
Order of Range x Order of Slide Set	1	0.003		
Age x Order of Range x Order of Slide Set	2	0.309		
Error 1	48	1.112		
Trials	1	2.002		
Trials x Age	2	2.130		
Slide Set	1	8.009	4.152	.05
Range (Wide/Narrow)	1	4.034	2.091	n.s.
Slide Set x Age	2	0.014		
Range x Age	2	1.308		
Slide Set x Order of Range	1	1.302		
Trials x Age x O. S.S. x Order of Range	2	2.151		
Error 2	48	1.929		

Age differences.--The hypothesis that with advancing age the mean trial at which recognition was attained would occur later in both the Wide Range and Narrow Range sequences was confirmed (Tables 5, 6). The mean trials at which recognition was attained by young, middle aged and old subjects (11.825, 12.575 and 13.413 respectively) differed significantly each from the other ($p < .01$).

TABLE 6

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO THE DIFFERENCES IN THE MEAN TRIALS AT WHICH TOTAL RECOGNITION WAS ATTAINED BY THREE AGE GROUPS

Age Group	Means	11.825	12.575	13.413
Young	11.825		0.750*	1.588**
Middle-Aged	12.575			0.838**
Old	13.413			

*Difference is significant at .01 level.
**Difference is significant at .001 level.

Interaction.--The results did not support the hypothesis that the difference between the mean trials at which recognition was attained in the Wide and Narrow Ranges would be greater in the old group than the corresponding difference in the young and middle aged groups. The age by range interaction was not significant (Table 5). The mean trial at which total recognition was attained by the three age groups under the Wide and Narrow Range conditions is given in Table 7.

TABLE 7

MEAN TRIAL AT WHICH TOTAL RECOGNITION WAS ATTAINED BY THREE AGE GROUPS IN THE WIDE AND NARROW RANGE CONDITIONS

	Wide Range		Narrow Range	
Age Group	Mean	S.D.	Mean	S.D.
Young	11.800	1.123	11.850	1.250
Middle-Aged	12.850	1.645	12.300	1.092
Old	13.713	1.080	13.113	1.062

Recognition Score.--Table 8 describes the recognition performance of each of the three age groups in the Wide and Narrow Range, and of the three age groups combined. A mean recognition score was calculated for each level of blurredness (trial) by assigning a score of zero for non-recognition, one for partial recognition and two for total recognition to subjects in each age group and then dividing by the total number of observations made (see criteria Appendix I). For each age group in the Wide Range, there were 80 observations at each level of blurredness; four observations (the performance on four slides) for twenty subjects. There were fewer observations in the early trials of the Narrow Range sequence. The Narrow Range sequence began at some intermediate level of blurredness--a different level for each of the four slides in the set. At trial 4 there were only 20 observations, one observation on one slide for twenty subjects. There were 40 observations at trial 6; 60 observations at trial 8; and 80 observations at trial 9. The number of observations at each level of blurredness is given in Table 8. The results are portrayed graphically in Figures 1, 2, 3 and 4.

TABLE 8

MEAN RECOGNITION SCORE AT EACH LEVEL OF BLURREDNESS OF EACH OF THREE GROUPS IN THE WIDE RANGE AND NARROW RANGE CONDITIONS AND THE MEAN RECOGNITION SCORE OF THE THREE AGE GROUPS COMBINED

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Young	WR	0	0	.01	.13	.21	.35	.46	.62	.81	.95	1.01	1.39	1.61	1.83	1.89
	NR				.20	.50	.58	.80	.93	.86	.99	1.15	1.43	1.56	1.74	1.85
	Number of Observations in the Narrow Range				20	20	40	40	60	80	80	80	80	80	80	80
	Difference				-.07	-.29	-.23	-.34	-.31	-.05	-.04	-.14	-.04	+.05	+.09	-.04
Middle Aged	WR	.01	.01	.03	.05	.15	.30	.43	.53	.69	.81	.99	1.20	1.43	1.71	1.89
	NR				.05	.15	.40	.55	.73	.76	.93	1.04	1.24	1.51	1.78	1.85
	Number of Observations in the Narrow Range				20	20	40	40	60	80	80	80	80	80	80	80
	Difference				0	0	-.10	-.12	-.20	-.07	-.12	-.05	-.04	-.08	.07	+.04
Old	WR	0	0	0	.09	.11	.18	.24	.29	.36	.59	.79	.96	1.24	1.48	1.64
	NR				0	.05	.30	.48	.59	.65	.80	.93	1.14	1.21	1.55	1.71
	Number of Observations in the Narrow Range				20	20	40	40	60	80	80	80	80	80	80	80
	Difference				+.09	+.06	-.12	-.24	-.30	-.29	-.21	-.14	-.18	+.03	-.08	-.08

CONTINUED.....

Table 8--continued

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	WR	0	0	.01	.09	.16	.28	.38	.48	.62	.78	.93	1.18	1.43	1.67	1.80
	NR				.08	.23	.43	.61	.75	.76	.90	1.04	1.27	1.47	1.69	1.80
Total	Number of Observations in the Narrow Range				60	60	120	120	180	240	240	240	240	240	240	240
	Difference				+.01	+.06	-.15	-.23	-.27	-.14	-.12	-.11	-.09	-.04	-.02	0

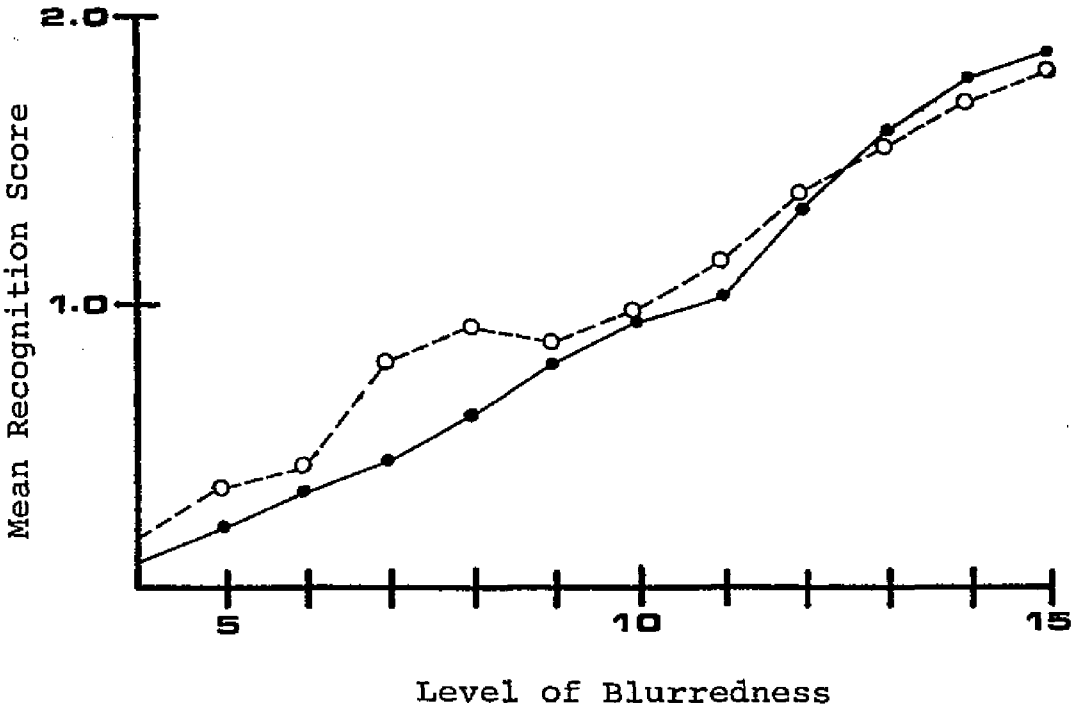

Figure 1. Mean Recognition Score at each Level of Blurredness for the Young Group

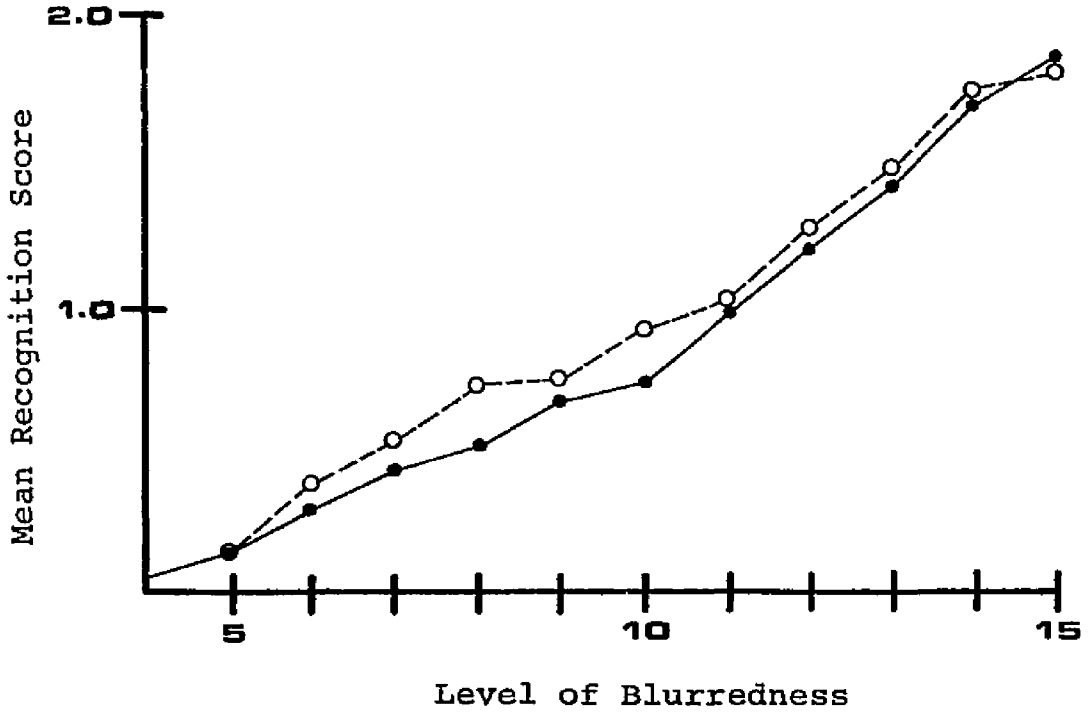

Figure 2. Mean Recognition Score at each Level of Blurredness for the Middle Aged Group

Narrow Range

Wide Range

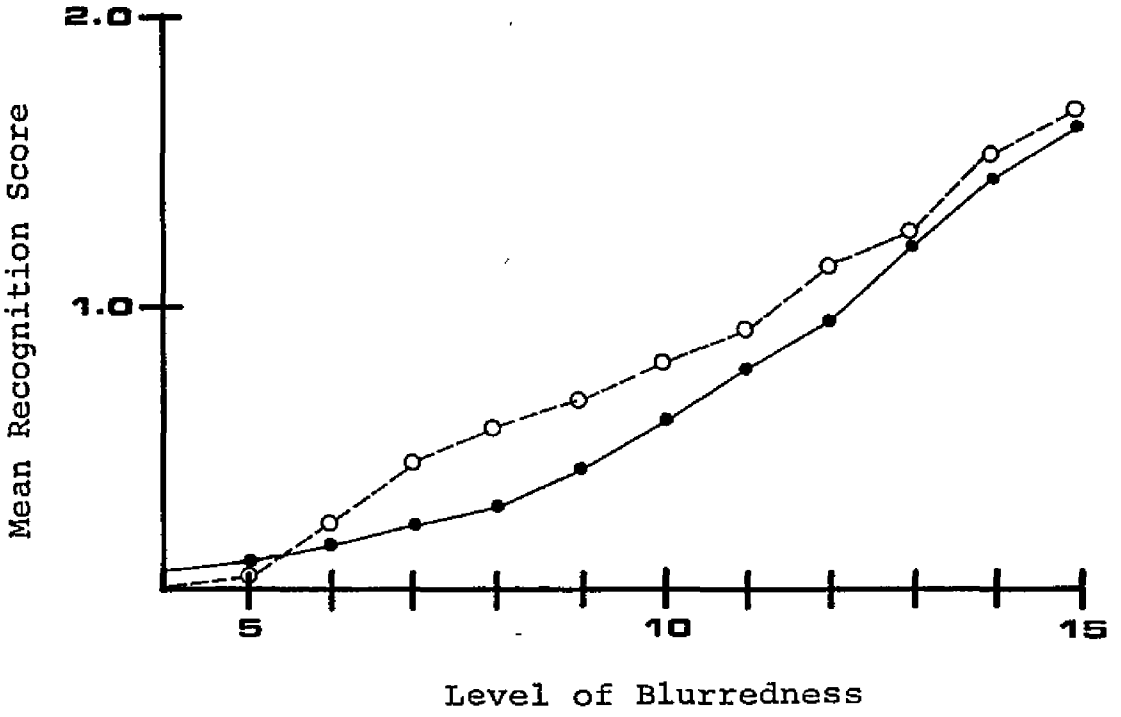

Figure 3. Mean Recognition Score at each Level of Blurredness for the Old Group

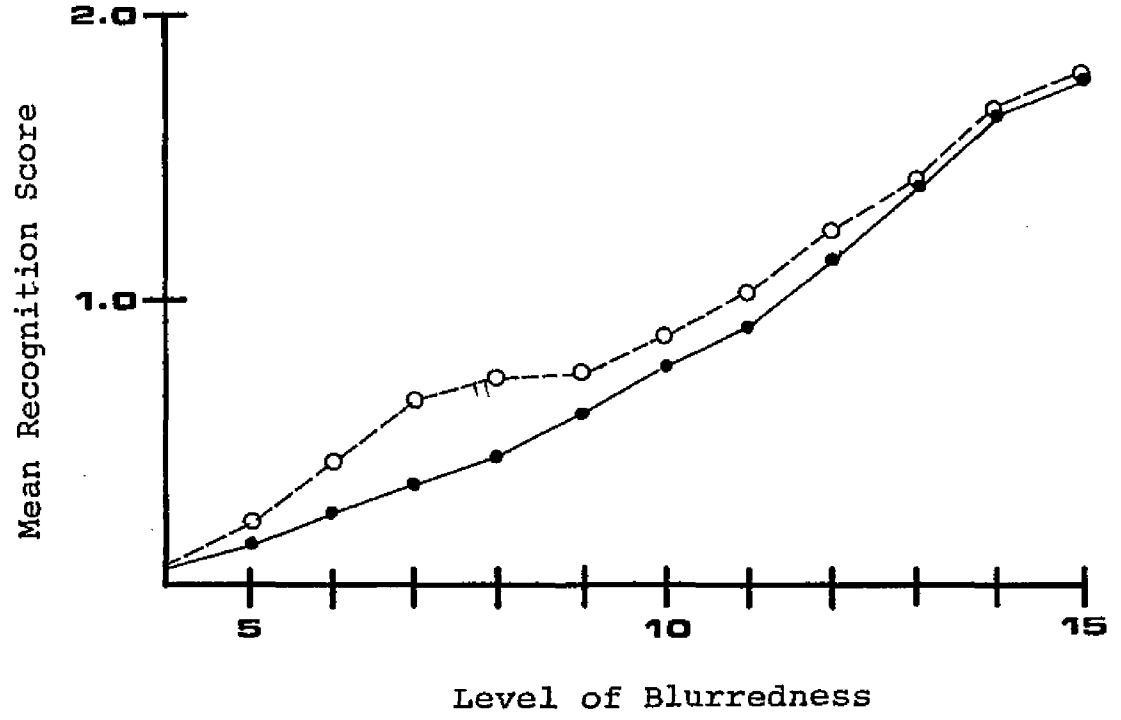

Figure 4. Mean Recognition Score at each Level of Blurredness for the Three Aged Groups Combined.

Narrow Range

Wide Range

Productivity

It was predicted that in the older group, fewer false hypotheses regarding the blurred pictures would be produced. As a reminder, subjects in the three age groups attained recognition at different levels of blurredness (trials). The mean trial at which total recognition was attained by each age group in the Wide and Narrow Range conditions is presented in Table 7. Older subjects, who recognized the slide later in the sequence, had more trials and therefore more opportunity to construct different incorrect hypotheses. Younger subjects, who recognized the slide earlier, had fewer trials in which to produce erroneous pre-recognition hypotheses. For this reason, the simple measure of the mean number of incorrect pre-recognition hypotheses produced by the three age groups did not adequately describe the situation, and an Hypothesis Production Index was derived for each subject. This Index was defined as the total number of different, erroneous pre-recognition hypotheses divided by the total number of trials preceding the recognition of all or part of the slide.

The mean Hypothesis Production Indexes for the three age groups in the Wide and Narrow Range conditions are given in Table 9.

TABLE 9

MEAN HYPOTHESIS PRODUCTION INDEX OF THREE AGE GROUPS IN THE WIDE AND NARROW RANGE CONDITIONS

Age Group	Wide Range Mean	Wide Range S.D.	Narrow Range Mean	Narrow Range S.D.
Young	0.346	0.148	0.588	0.252
Middle-Aged	0.411	0.126	0.564	0.194
Old	0.324	0.129	0.412	0.136

The results of the analysis of variance summarized in Table 10 indicate a significant difference in the mean Hypothesis Production Indexes as a function of age ($p < .05$).

TABLE 10

SUMMARY OF THE ANALYSIS OF VARIANCE MEAN HYPOTHESIS PRODUCTION INDEX

Source	df	MS	F	P
Age	2	0.163	3.543	.05
Slide Set	1	0.055		
Age x Slide Set	2	0.029		
Error 1	54	0.046		
Range	1	0.772	64.333	.001
Slide Set x Range	1	0.086	7.167	.01
Age x Range	2	0.059	4.917	.05
Age x Slide Set x Range	2	0.002		
Error 2	54	0.012		

As indicated in Table 11 the mean Hypothesis Production Index of the Old group is significantly smaller than that of both the Young and the Middle-aged group ($p < .05$).

TABLE 11

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO DIFFERENCES IN THE MEAN HYPOTHESIS PRODUCTION INDEXES OF THREE AGE GROUPS

Age Group	Means	0.368	0.467	0.487
Old	0.368		0.099*	0.119*
Young	0.467			
Middle-Aged	0.487			

*Difference is significant at .05 level.

The interaction between age and range is also significant as indicated in Table 10. Within each of the three age groups, the mean Hypothesis Production Index in the Narrow Range is significantly larger than it is in the Wide Range. For the Middle-aged and Young groups this difference is significant at the .001 level, while for the old group, it is significant at the .05 level (see Table 12).

TABLE 12

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO DIFFERENCES IN THE MEAN HYPOTHESIS PRODUCTION INDEXES OF THREE AGE GROUPS IN THE WIDE AND NARROW RANGES

Age Group	Means	0.324	0.346	0.411	0.412	0.564	0.588
Wide Range							
Old	0.324				0.088*		
Young	0.346						0.242**
Middle-Aged	0.411					0.153**	
Narrow Range							
Old	0.412						
Middle-Aged	0.564						
Young	0.588						

*Difference is significant at .05 level.
**Difference is significant at .001 level.

In Table 13 the mean of the total number of incorrect hypotheses per slide produced prior to correct recognition by the three age groups in the Wide and Narrow Range conditions is given.

TABLE 13

MEAN NUMBER OF DIFFERENT INCORRECT HYPOTHESES PRODUCED PER SLIDE BY THREE AGE GROUPS IN THE WIDE AND NARROW RANGE CONDITIONS

Age Group	Wide Range Mean	Wide Range S.D.	Narrow Range Mean	Narrow Range S.D.
Young	2.550	1.117	0.963	0.592
Middle-Aged	3.200	0.978	1.450	0.672
Old	2.938	1.164	1.300	0.577

The analyses of variance summarized in Table 14 show that no age differences were found among the mean number of hypotheses produced in the Wide Range condition, while in the Narrow Range condition, the differences among the means was significant ($p < .05$).[1]

TABLE 14

SUMMARY OF THE ANALYSES OF VARIANCE
MEAN NUMBER OF DIFFERENT INCORRECT HYPOTHESES PER SLIDE
PRODUCED BY THREE AGE GROUPS IN THE WIDE AND
NARROW RANGE CONDITIONS

	Wide Range				Narrow Range			
Source	df	MS	F	P	df	MS	F	P
Between Age Groups	2	2.139	1.802	n.s.	2	1.247	3.299	.05
Within Age Groups	57	1.187			57	0.378		

The Middle-aged group produced significantly more incorrect pre-recognition hypotheses per slide in the Narrow Range than did the Young group ($p < .05$). There was a tendency

[1]In evaluating the results of performance in the Narrow Range sequence on all measures, the following should be kept in mind. In the Narrow Range, the old subjects had an approximate average of three exposures prior to the correct identification of the slide (the recognition of the slide occurred at about trial 13 and the mean trial at which the Narrow Range sequence began was trial 9), the middle aged group had two exposures and the young group had one exposure. Therefore, the old group had three times as many exposures as the young group, while the middle aged group had twice as many. In the Wide Range the approximate average number of exposures before correct recognition were as follows: 12 for the old group, 11 for the middle aged group and 10 for the young group. Therefore the old group had only 1.2 times as many exposures as the young group and the middle aged group had only 1.1 times as many. The increase in the opportunity for the older subjects to view the slides and respond was therefore many times greater in the Narrow Range than in the Wide Range (3:1 versus 1:1.2). This may account for the increased number of hypotheses, repetitions and non-responses exhibited by the old group in the Narrow Range.

($p < .10$) for the Old group to differ from the Young group in terms of the total number of pre-recognition hypotheses produced (Table 15).

TABLE 15

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO DIFFERENCES IN THE MEAN NUMBER OF INCORRECT HYPOTHESES PER SLIDE PRODUCED BY THREE AGE GROUPS IN THE NARROW RANGE CONDITION

Age Group	Means	0.963	1.300	1.450
Young	0.963		0.337*	0.487**
Old	1.300			0.150
Middle-Aged	1.450			

*Difference is significant at .01 level.
**Difference is significant at .05 level.

Repetitiveness

It was anticipated that older subjects would tend to repeat early erroneous hypotheses to a greater extent than younger subjects. Because the mean number of repetitions alone does not adequately describe the performance of the three age groups as indicated in the preceding section, a Repetition Index was derived for each subject. The Repetition Index was found by dividing the total number of times any incorrect hypothesis was repeated by the total number of trials prior to correct recognition of all or part of the slide. The mean Repetition Indexes for each age group in the Wide Range and Narrow Range conditions are given in Table 16.

TABLE 16

MEAN REPETITION INDEX OF THREE AGE GROUPS IN THE WIDE AND NARROW RANGE CONDITIONS

Age Group	Wide Range Mean	Wide Range S.D.	Narrow Range Mean	Narrow Range S.D.
Young	0.463	0.189	0.347	0.220
Middle	0.486	0.148	0.382	0.200
Old	0.495	0.166	0.451	0.144

The analysis of variance summarized in Table 17 indicates that there was no overall age difference in the mean Repetition Index. As indicated in Table 17 however, the interaction between age and range was significant ($p < .001$).

TABLE 17

SUMMARY OF THE ANALYSIS OF VARIANCE MEAN REPETITION INDEX

Source	df	MS	F	P
Age	2	0.047	1.119	n.s.
Slide Set	1	0.003		
Age x Slide Set	2	0.018		
Error 1	54	0.042		
Range (Wide/Narrow)	1	0.231	21.00	.001
Slide Set x Range	1	0.091	8.273	.01
Age x Range	2	0.311	28.273	.001
Age x Slide Set x Range	2	0.029		
Error 2	54	0.011		

Both Young and Middle Aged groups produced significantly more repetitions per trial in the Wide Range than they did in the Narrow Range ($p < .05$). Within the Old group however,

there was no difference in the mean Repetition Indexes as a function of range (Table 18).

TABLE 18

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO THE DIFFERENCES IN THE MEAN REPETITION INDEXES OF THREE AGE GROUPS IN THE WIDE AND NARROW RANGE

Age Group	Means	0.495	0.486	0.463	0.451	0.382	0.347
Wide Range							
Old	0.495				0.044		
Middle-Aged	0.486					0.104*	
Young	0.463						0.116*
Narrow Range							
Old	0.451						
Middle-Aged	0.382						
Young	0.347						

*Difference is significant at the .05 level.

The mean of the total number of times an incorrect hypothesis per slide was repeated in the Wide Range and Narrow Range Conditions is shown in Table 19.

TABLE 19

MEAN NUMBER OF REPETITIONS OF INCORRECT HYPOTHESES PER SLIDE PRODUCED BY THREE AGE GROUPS IN THE WIDE AND NARROW RANGE CONDITIONS

Age Group	Wide Range Mean	Wide Range S.D.	Narrow Range Mean	Narrow Range S.D.
Young	3.538	1.449	0.862	0.691
Middle-Aged	3.950	1.572	1.062	0.790
Old	4.125	1.468	1.462	0.744

The analyses of variance summarized in Table 20 indicate no age differences among the mean number of repetitions produced in the Wide Range condition while in the Narrow Range condition, the differences among the means is significant ($p < .05$).

TABLE 20

SUMMARY OF THE ANALYSES OF VARIANCE
MEAN NUMBER OF REPETITIONS OF INCORRECT HYPOTHESES PER SLIDE
PRODUCED BY THREE AGE GROUPS IN THE
WIDE AND NARROW RANGE CONDITIONS

Source	Wide Range df	MS	F	P	Narrow Range df	MS	F	P
Between Age Groups	2	1.820	0.812	n.s.	2	1.866	3.380	.05
Within Age Groups	57	2.242			57	0.552		

The old group repeated a significantly greater number of incorrect hypotheses in the Narrow Range condition than did the Young group. The difference between the mean number of repetitions produced by the Middle-aged and Young group was not significant, while there was some tendency ($p < .10$) for the Middle and the Old groups to differ with respect to the mean number of repetitions (Table 21).

TABLE 21

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO THE DIFFERENCES IN THE MEAN NUMBER OF REPETITIONS OF INCORRECT HYPOTHESES PER SLIDE PRODUCED BY THREE AGE GROUPS IN THE NARROW RANGE CONDITION

Age Group	Means	0.862	1.062	1.462
Young	0.862		0.200	0.600**
Middle	1.062			0.400*
Old	1.462			

*Difference is significant at .01 level.
**Difference is significant at .05 level.

Response Omission

Another expectation regarding age differences in the processes by which recognition occurs was that Old subjects would exhibit a greater tendency than Young subjects to withhold responses.

A Response Omission Index was derived for each subject by dividing the total number of non-responses by the total number of trials prior to correct recognition. The mean Response Omission Indexes for each age group in the Wide and Narrow Range conditions are given in Table 22.

TABLE 22

MEAN RESPONSE OMISSION INDEX OF THREE AGE GROUPS IN THE WIDE AND NARROW RANGE CONDITIONS

Age Group	Wide Range		Narrow Range	
	Mean	S.D.	Mean	S.D.
Young	0.146	0.247	0.072	0.115
Middle Aged	0.073	0.095	0.088	0.168
Old	0.200	0.162	0.122	0.154

There was no age difference in the mean Response Omission Indexes (Table 23).

TABLE 23

SUMMARY OF THE ANALYSIS OF VARIANCE
MEAN RESPONSE OMISSION INDEX

Source	df	MS	F	P
Age	2	0.066	1.941	n.s.
Slide Set	1	0.152	4.470	.05
Age x Slide Set	2	0.004		
Error 1	54	0.034		
Range (Wide/Narrow)	1	0.063	3.316	.05
Slide Set x Range	1	0.003		
Age x Range	2	0.041	2.157	n.s.
Age x Slide Set x Range	2	0.004		
Error 2	54	0.019		

The mean of the total number of non-responses per slide in the Wide and Narrow Range conditions is shown in Table 24.

TABLE 24

MEAN NUMBER OF NON-RESPONSES PER SLIDE FOR THREE AGE GROUPS IN THE WIDE AND NARROW RANGE CONDITIONS

Age Group	Wide Range Mean	Wide Range S.D.	Narrow Range Mean	Narrow Range S.D.
Young	1.225	2.193	0.138	0.206
Middle Aged	0.625	0.916	0.138	0.189
Old	1.875	1.647	0.475	0.628

The analyses of variance summarized in Table 25 show no age difference in the mean number of non-responses in the Wide Range condition, while in the Narrow Range condition, the difference in the mean is significant ($p < .05$).

TABLE 25

SUMMARY OF THE ANALYSES OF VARIANCE
MEAN NUMBER OF NON-RESPONSES PER SLIDE FOR THREE AGE GROUPS
IN THE WIDE AND NARROW RANGE CONDITIONS

	Wide Range				Narrow Range			
Source	df	MS	F	P	df	MS	F	P
Between Age Groups	2	7.816	2.804	n.s.	2	0.759	4.834	.05
Within Age Groups	57	2.787			57	0.157		

In the Narrow Range condition, the Old group withheld a significantly greater number of responses than the Young and Middle aged groups (Table 26).

TABLE 26

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO DIFFERENCES IN
THE MEAN NUMBER OF NON-RESPONSES PER SLIDE FOR
THREE AGE GROUPS IN THE NARROW RANGE CONDITION

Age Group	Means	0.138	0.138	0.475
Young	0.138			0.337*
Middle Aged	0.138			0.337*
Old	0.475			

*Difference is significant at .05 level.

Uncertainty

It was anticipated that older subjects would show a greater degree of uncertainty regarding their performance than younger subjects and that this would be expressed in more frequent verbalizations of uncertainty. The mean number of uncertainty remarks produced by the three age groups in the Wide and Narrow Range conditions is given in Table 27. Examples of remarks judged to indicate uncertainty are qualified hypotheses e.g., "It could be a tree" and all "I don't know" responses. All responses and non-responses were scored for uncertainty at every level of blurredness, regardless of whether or not recognition had been attained. Since the same number of trials was being considered for each of the three age groups no index was required.

TABLE 27

MEAN NUMBER OF UNCERTAINTY REMARKS PER SLIDE PRODUCED BY THREE AGE GROUPS IN THE WIDE AND NARROW RANGE CONDITIONS

Age Group	Wide Range		Narrow Range	
	Mean	S.D.	Mean	S.D.
Young	6.600	2.617	3.925	1.795
Middle	6.650	2.595	3.250	1.726
Old	6.813	2.919	3.763	1.284

No age difference in the mean number of uncertainty remarks produced was found (Table 28).

TABLE 28

SUMMARY OF THE ANALYSIS OF VARIANCE
MEAN NUMBER OF UNCERTAINTY REMARKS

Source	df	MS	F	P
Age	2	0.012		
Slide Set	1	0.029		
Age x Slide Set	2	0.004		
Error 1	54	0.044		
Range	1	0.645	129.00	.001
Slide Set x Range	1	0.004		
Age x Range	2	0.009		
Age x Slide Set x Range	2	0.000		
Error 2	54	0.005		

For the purposes of the remaining analyses of the form and content of the responses produced by the three age groups, the Wide and Narrow Range conditions have been combined. The following measures will be considered in the remainder of the present section; the number of descriptive responses, the number of incorrect vague hypotheses, the number of incorrect hypotheses dealing with movement in space, and the number of incorrect hypotheses dealing with food or food related objects. As previously indicated, because subjects in the three age groups had unequal opportunities to produce incorrect responses a special measure was derived. This measure, in which the relevant response is divided by the total number of trials preceding correct recognition for each subject, will be presented for each relevant response category. The significance of the age

difference in each of these measures will also be presented. In addition, the mean of the total number of these responses produced by each age group will be given. These means will be tested for the significance of the differences among them.

Concreteness

It was predicted that the older subjects would approach the Recognition Test with a more "concrete" attitude and the younger subjects would have a more "abstract" attitude. Accordingly, it was anticipated that older subjects would produce more "concrete" responses. An example is a purely descriptive response such as "it is red." Another kind of concrete response is in the form of an hypothesis which is a vague generalization such as "modern art" or "clouds."

The mean number of descriptive responses per trial and the mean number of vague hypotheses per trial produced by the three age groups per slide is presented in Table 29.

TABLE 29

MEAN NUMBER OF DESCRIPTIVE RESPONSES PER TRIAL AND MEAN NUMBER OF VAGUE HYPOTHESES PER TRIAL PRODUCED BY THREE AGE GROUPS

Age Group	Descriptive Responses Per Trial		Vague Hypotheses Per Trial	
	Mean	S.D.	Mean	S.D.
Young	0.046	0.053	0.081	0.082
Middle-Aged	0.045	0.062	0.095	0.057
Old	0.062	0.071	0.088	0.072

No significant age difference was found in the mean number of descriptive responses per trial. In addition there was no significant age difference in the mean number of vague hypotheses per trial (Table 30).

TABLE 30

SUMMARY OF THE ANALYSES OF VARIANCE
MEAN NUMBER OF DESCRIPTIVE RESPONSES PER TRIAL AND MEAN NUMBER OF VAGUE HYPOTHESES PER TRIAL
PRODUCED BY THREE AGE GROUPS

	Descriptive Responses Per Trial				Vague Hypotheses Per Trial			
Source	df	MS	F	P	df	MS	F	P
Between age groups	2	0.001	0.333	n.s.	2	0.002	0.667	n.s.
Within age groups	57	0.003			57	0.003		

The mean of the total number of descriptive responses and the mean of the total number of hypotheses judged to be "vague" are given in Table 31.

TABLE 31

MEAN NUMBER OF DESCRIPTIVE RESPONSES AND VAGUE HYPOTHESES PER SLIDE PRODUCED BY THREE AGE GROUPS

	Descriptive Responses		Vague Hypotheses	
Age Group	Mean	S.D.	Mean	S.D.
Young	0.350	0.409	0.463	0.408
Middle Aged	0.337	0.439	0.650	0.576
Old	0.425	0.481	0.588	0.515

No age difference was found in the mean number of descriptive responses or in the mean number of vague hypotheses produced (Table 32).

TABLE 32

SUMMARY OF THE ANALYSES OF VARIANCE MEAN NUMBER OF DESCRIPTIVE RESPONSES AND VAGUE HYPOTHESES PER SLIDE PRODUCED BY THREE AGE GROUPS

Source	DESCRIPTIVE RESPONSES df	MS	F	P	VAGUE HYPOTHESES df	MS	F	P
Between Age Groups	2	0.049	0.025	n.s.	2	0.182	0.072	n.s.
Within Age Groups	57	0.197			57	0.254		

Other Content

A post hoc examination of the responses produced by subjects in the three age groups seemed to indicate that there were differences in the frequency with which two categories of incorrect hypotheses appeared. These were hypotheses dealing with food and food related objects (e.g., "spare ribs," "bottles of milk") and hypotheses dealing with movement. In Table 33 the mean number of food related hypotheses per trial produced by the three age groups is given.

TABLE 33

MEAN NUMBER OF FOOD RELATED HYPOTHESES PER TRIAL PRODUCED BY SUBJECTS IN THREE AGE GROUPS

	Young	Middle-Aged	Old
Mean	0.032	0.076	0.089
S.D.	0.037	0.049	0.053

The mean number of food related hypotheses per trial produced by the three age groups differ significantly (Table 34).

TABLE 34

SUMMARY OF THE ANALYSIS OF VARIANCE MEAN NUMBER OF FOOD RELATED HYPOTHESES PER TRIAL PRODUCED BY THREE AGE GROUPS

Source	df	MS	F	P
Between Age Groups	2	0.018	9.00	.001
Within Age Groups	57	0.002		

Both Old and Middle Aged groups produced significantly more food related hypotheses per trial than did the Young group; there were no differences between the Old and Middle Aged group (Table 35).

TABLE 35

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO THE DIFFERENCES IN THE MEAN NUMBER OF FOOD RELATED HYPOTHESES PER TRIAL PRODUCED BY THREE AGE GROUPS

Age Group	Means	0.032	0.076	0.089
Young	0.032		0.044*	0.057**
Middle Aged	0.076			0.013
Old	0.089			

*Difference is significant at .005 level.
**Difference is significant at .001 level.

The mean of the total number of incorrect food related hypotheses per slide produced by the three age groups is given in Table 36.

TABLE 36

MEAN NUMBER OF FOOD RELATED HYPOTHESES PER SLIDE PRODUCED BY THREE AGE GROUPS

	Young	Middle-Aged	Old
Mean	0.225	0.437	0.487
S.D.	0.242	0.227	0.483

In Table 37 the analysis of variance for the mean number of food responses produced by three age groups is given. The results indicate a significant difference ($p < .05$) among the means.

TABLE 37

SUMMARY OF THE ANALYSIS OF VARIANCE
MEAN NUMBER OF FOOD RELATED HYPOTHESES PER SLIDE PRODUCED BY THREE AGE GROUPS

SOURCE	df	MS	F	P
Between Age Groups	2	0.389	3.412	.05
Within Age Groups	57	0.114		

The Young age group produced significantly fewer food related hypotheses than did either the Middle Aged or the Old group. There was no significant difference between the mean number of food related hypotheses produced by the Middle Aged and Old groups (Table 38).

TABLE 38

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO THE DIFFERENCE IN THE MEAN NUMBER OF FOOD RELATED HYPOTHESES PER SLIDE PRODUCED BY THREE AGE GROUPS

Age Group	Means	0.225	0.437	0.487
Young	0.225		0.212*	0.262*
Middle Aged	0.437			0.050
Old	0.487			

*Difference is significant at .05 level.

In Table 39 the mean number of movement hypotheses per trial produced by the three age groups is given. An example of an hypotheses scored m (inanimate movement) is "a bomb exploding"; while an example of an hypotheses scored M (animate movement) is "a man being tackled and falling."

For the purpose of the present analysis animate and inanimate movement responses were combined.

TABLE 39

MEAN NUMBER OF MOVEMENT HYPOTHESES PER TRIAL PRODUCED BY THREE AGE GROUPS

	Young	Middle Aged	Old
Mean	0.201	0.049	0.026
S.D.	0.328	0.043	0.050

The results of the Analysis of Variance summarized in Table 40 indicate that the difference in the mean number of movement hypotheses produced by the three age groups is significant ($p < .025$).

TABLE 40

SUMMARY OF THE ANALYSIS OF VARIANCE
MEAN NUMBER OF MOVEMENT HYPOTHESES PER TRIAL PRODUCED BY THREE AGE GROUPS

Source	df	MS	F	P
Between Age Groups	2	0.182	4.919	0.025
Within Age Groups	57	0.037		

The Young group produced significantly more movement hypotheses than the Middle Aged and Old Groups. There was no difference between the Middle Aged and Old groups (Table 41).

TABLE 41

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO THE DIFFERENCE IN THE MEAN NUMBER OF MOVEMENT HYPOTHESES PER TRIAL PRODUCED BY THREE AGE GROUPS

Age Group	Means	0.026	0.049	0.201
Old	0.026		0.023	0.175*
Middle Aged	0.049			0.152**
Young	0.201			

*Difference is significant at .05 level.
**Difference is significant at .001 level.

The mean of the total number of incorrect hypotheses per slide dealing with movement produced by the three age groups is shown in Table 42.

TABLE 42

MEAN NUMBER OF MOVEMENT HYPOTHESES PER SLIDE PRODUCED BY THREE AGE GROUPS

	Young	Middle-Aged	Old
Mean	0.437	0.262	0.088
S.D.	0.479	0.275	0.271

The analysis of variance summarized in Table 43 indicates a significant age difference ($p < .01$) in the mean number of movement hypotheses.

TABLE 43

SUMMARY OF THE ANALYSIS OF VARIANCE
MEAN NUMBER OF MOVEMENT HYPOTHESES PER SLIDE
PRODUCED BY THREE AGE GROUPS

Source	df	MS	F	P
Between Age Groups	2	0.612	5.415	.01
Within Age Groups	57	0.113		

The Old group produced significantly fewer movement hypotheses than the Young group. The Middle Aged group did not differ significantly from either the Young or Old group in terms of the number of movement hypotheses produced (Table 44).

TABLE 44

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO THE DIFFERENCE
IN THE MEAN NUMBER OF MOVEMENT HYPOTHESES PER SLIDE
PRODUCED BY THREE AGE GROUPS

Age Group	Means	0.087	0.262	0.437
Old	0.087		0.175	0.350*
Middle Aged	0.262			0.175
Young	0.437			

*Difference is significant at .01 level.

Checklist Recognition Test

Point of Recognition

It was hypothesized that age differences in recognition performance observable in the Free Response Recognition Test would disappear in the Checklist Recognition Test. In

the Checklist Recognition Test the subject was provided with plausible alternative hypotheses regarding the blurred picture and it was required that he choose among them. This may be contrasted with the task demand in the Free Response Recognition Test in which the subject was required to spontaneously produce alternate hypotheses. It was anticipated that the presentation of the Checklist would relieve the aged of the requirement for an active, spontaneous production of alternate ideas and thereby eliminate possible age differences in recognition of the blurred picture. The results did not support the hypothesis since significant age differences in the trial at which recognition occurred were observed (Table 45).

TABLE 45

SUMMARY OF THE ANALYSIS OF VARIANCE
MEAN TRIAL AT WHICH RECOGNITION WAS ATTAINED BY THREE AGE GROUPS IN THE CHECKLIST RECOGNITION TEST

Source	df	MS	F	P
Between Age Groups	2	9.989	3.189	.05
Within Age Groups	57	3.132		

The mean trial (level of blurredness) at which recognition was attained by three age groups is given in Table 46.

TABLE 46

MEAN TRIAL AT WHICH RECOGNITION WAS ATTAINED BY THREE AGE GROUPS IN THE CHECKLIST RECOGNITION TEST

	Young	Middle-Aged	Old
Mean	10.400	11.438	11.750
S.D.	2.007	1.310	1.911

The results of the analysis of variance summarized in Table 45 indicate that the mean trial at which recognition was attained by the three age groups differ significantly ($p < .05$).

The Young subjects recognized the slides significantly earlier in the sequence than did either the Middle Aged or the Old subjects ($p < .05$). There was no difference in the mean trial at which recognition was attained by the Middle Aged and Old groups (Table 47).

TABLE 47

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO THE DIFFERENCE IN THE MEAN TRIALS AT WHICH RECOGNITION WAS ATTAINED BY THREE AGE GROUPS IN THE CHECKLIST RECOGNITION TEST

Age Group	Means	10.400	11.438	11.750
Young	10.400		1.308*	1.350*
Middle Aged	11.438			0.312
Old	11.750			

*Difference is significant at .05 level.

Productivity

If the inaccessibility of alternate ideas was responsible for the failure of older subjects to produce as many divergent pre-recognition hypotheses as younger subjects in the Free Response Recognition Test, providing "ready-made" hypotheses in a checklist should have obliterated the discrepancy in the productivity among the three age groups.

Since the three age groups recognized the slides at different levels of blurredness, subjects had different numbers of trials in which to check off the alternative hypotheses. Therefore the measure of hypotheses checked per trial which is necessary for the comparison of the performances of the three age groups is given (Table 48).

TABLE 48

MEAN NUMBER OF INCORRECT PRE-RECOGNITION HYPOTHESES CHECKED PER TRIAL BY THREE AGE GROUPS IN THE CHECKLIST RECOGNITION TEST

	Young	Middle Aged	Old
Mean	0.413	0.400	0.305
S.D.	0.139	0.093	0.123

The results of the analysis of variance summarized in Table 49 indicate that the mean number of hypotheses checked per trial by the three age groups differ significantly ($p < .01$).

TABLE 49

SUMMARY OF THE ANALYSIS OF VARIANCE
MEAN NUMBER OF INCORRECT PRE-RECOGNITION HYPOTHESES PER TRIAL CHECKED BY THREE AGE GROUPS IN THE CHECKLIST RECOGNITION TEST

Source	df	MS	F	P
Between Age Groups	2	0.087	7.909	.01
Within Age Groups	57	0.011		

The Old group checked significantly fewer hypotheses than did the Young and Middle Aged groups ($p < .01$). There was no difference in the means of the Young and Middle Aged group (Table 50).

TABLE 50

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO THE DIFFERENCE IN THE MEAN NUMBER OF INCORRECT PRE-RECOGNITION HYPOTHESES PER TRIAL CHECKED BY THREE AGE GROUPS IN THE CHECKLIST RECOGNITION TEST

Age Group	Means	0.305	0.400	0.413
Old	0.305		0.095*	0.126*
Middle-Aged	0.400			0.013
Young	0.413			

*Difference is significant at .01 level.

The mean of the total number of incorrect prerecognition hypotheses per slide checked by the three age groups is given in Table 51.

TABLE 51

MEAN NUMBER OF INCORRECT PRE-RECOGNITION HYPOTHESES CHECKED BY THREE AGE GROUPS IN THE CHECKLIST RECOGNITION TEST

	Young	Middle Aged	Old
Mean	4.000	4.163	3.225
S.D.	1.272	0.926	0.738

The analysis of variance summarized in Table 52 indicates a significant age difference among the mean number of incorrect hypotheses checked ($p < .05$).

TABLE 52

SUMMARY OF THE ANALYSIS OF VARIANCE
MEAN NUMBER OF INCORRECT PRE-RECOGNITION HYPOTHESES CHECKED BY THREE AGE GROUPS IN THE CHECKLIST RECOGNITION TEST

Source	df	MS	F	P
Between Age Groups	2	5.021	4.975	.05
Within Age Groups	57	1.009		

The Old group checked significantly fewer hypotheses than either the Middle Aged or the Young groups. There was no difference between the Middle-Aged and Young Groups (Table 53).

TABLE 53

DUNCAN'S NEW MULTIPLE RANGE TEST APPLIED TO THE DIFFERENCE IN THE MEAN NUMBER OF INCORRECT PRE-RECOGNITION HYPOTHESES CHECKED BY THREE AGE GROUPS IN THE CHECKLIST RECOGNITION TEST

Age Group	Means	3.225	4.000	4.163
Old	3.225		0.775*	0.938*
Young	4.000			0.163
Middle Aged	4.163			

*Difference is significant at .05 level.

Comparison Between the Free Response Recognition Test and the Checklist Recognition Test

Since different slides were used for the Checklist Recognition Test and the Free Response Recognition Test, any comparison of the performance on the two tasks by the three age groups must be made with caution, and conclusions must be based largely on inference. Nevertheless, it seems reasonable to compare the mean Hypothesis Production Index in the Wide Range of the Free Response Recognition Test and the mean number of hypotheses per trial checked by the three age groups. Such a comparison would assist in determining whether subjects of different ages performed similarly on the two tasks. It was anticipated that the aged would benefit disproportionately, as compared with the other age groups, from having hypotheses among which to choose. Specifically, in the Free Response Recognition Test, the requirement that subjects generate their own hypotheses regarding the blurred picture

would reflect itself in the paucity of different incorrect hypotheses produced by the aged. On the other hand, in the Checklist Recognition Test, where subjects were relieved of that requirement, no age differences in the number of pre-recognition hypotheses checked were expected.

Table 54 presents an analysis of variance performed to test the differences between the age groups, the two tasks, and the interaction between them. For the purposes of this analysis, the half of each age group for whom the second group of four slides were shown in the Wide Range were randomly selected. Their mean Hypotheses Production Indexes in the Wide Range of the Free Response Recognition Test were compared with the mean number of incorrect pre-recognition hypotheses per trial they checked in the Checklist Recognition Test. The selection was made randomly because there was no reason to believe that one or the other of the slide sets used in the Free Response Recognition Test was more comparable to the four slides used in the Checklist Recognition Test.

TABLE 54

SUMMARY OF THE ANALYSIS OF VARIANCE
MEAN NUMBER OF HYPOTHESES PER TRIAL PRODUCED IN THE FREE RESPONSE RECOGNITION TEST (WIDE RANGE) AND IN THE CHECKLIST RECOGNITION TEST BY THREE AGE GROUPS

Source	df	MS	F	P
Age	2	0.066	2.444	n.s.
Error 1	27	0.027		
Tests	1	0.002		
Tests x Age	2	0.075	2.885	n.s.
Error 2	27	0.026		

The results of the analysis of variance indicate that there were no age differences or differences between the two Recognition Tests in the number of pre-recognition hypotheses produced. Neither task provoked the consideration of more hypotheses per trial than did the other. The non-significant Age by Task interaction indicates that the two tasks operated in a similar manner across age groups in terms of the number of pre-recognition hypotheses considered.

CHAPTER IV

DISCUSSION

Introduction

The Visual Recognition Test used in the present investigation was chosen in order that age differences in the processes underlying set persistence might be observed. It was expected that the test would serve as a vehicle with which to gain insight into some cognitive processes of the aged which might be different from younger subjects.

In this study, highly destructured slides exposed in the early trials of the Wide Range sequence provided subjects with an opportunity to misconstrue the picture. This opportunity to misinterpret the picture was limited in the Narrow Range by deleting the most blurred versions of the slide and beginning the sequence at a later, clearer trial. A greater tendency for the misperception to become stereotyped was expected to delay recognition in the Wide Range sequence. This hypothesis was not confirmed. While small differences in the predicted direction did appear, the Wide and Narrow Range sequences did not differ significantly in the mean trial at which recognition was attained.

Comparison With the Results of Previous Studies

The finding that exposure to an out of focus picture which was misinterpreted interfered with its subsequent recognition as it was slowly brought into focus has been reported by Galloway (1946), Wyatt and Campbell (1951), Bruner and Potter (1964) and Frederiksen (1965; 1966). School children and college students served as subjects in these studies. Our failure to confirm that finding in a group of young, middle aged and old adults indicates that the effects previously observed are subtle enough to be obscured by variations in the procedure.

Several methodological differences between the present and previous studies may have contributed to the lack of congruence in the results. For example, in earlier procedures, subjects were instructed to write consecutive hypotheses on an answer sheet. This sheet remained in view for the duration of the test. In the present investigation, subjects were instructed to freely verbalize their hypotheses and tape recordings were made. Subjects had no written record of their earlier responses. The extent to which the interference of early, unverified hypotheses was exacerbated by the subject's visual access to earlier responses cannot be evaluated without further study.

In Frederiksen's studies (1965; 1966), one group of subjects viewed all the slides in the Wide Range sequence while another group of subjects viewed the same slides in

the Narrow Range sequence. In the present study subjects within each age group saw half the slides in the Wide Range and half in the Narrow Range sequences. Conditions of presentation were alternated so that following the exposure of a slide in the Wide Range, the subject saw the next slide in the Narrow Range and vice-versa. The development of cumulative effects by exposure of the slides in one or the other range only was precluded by our experimental design but seems not to have been precluded by Frederiksen's design.

One might speculate that based on a realistic evaluation of the impossibility of an early identification of the picture, Frederiksen's Wide Range subjects developed a different, perhaps more relaxed, attitude towards the recognition task than Narrow Range subjects. A more active search process may have been developed by Narrow Range subjects, who were aware of the possibility of correctly recognizing the picture when first exposed. The Wide Range-Narrow Range difference in recognition point observed by Frederiksen may have been the product of some cumulative effect of the sequence of stimulus presentation.

Results of a study by Wyatt and Campbell (1951) in which a counterbalanced design was used, support the hypothesis that recognition will be delayed by the persistence of early, unverified hypotheses. But again, there are procedural issues which call the results into question. First, the dependent variable in that study was the proportion of

correct responses made in a Wide Range sequence compared with the proportion of correct responses made to an isolated blurred presentation of the slide. No direct comparison of results can be made with the relevant parts of this study, in which the dependent variable was the mean trial at which recognition occurred in Wide and Narrow ranges. Secondly, in the study by Wyatt and Campbell, the focus of the picture was continuously sharpened while in the present study the picture was presented statically at increasing stages of focus. The interruption of the exposure of the blurred slide by a blank interval may have interrupted the tendency to form strong pre-recognition hypotheses by providing the subject with a "fresh look" at the picture. The results of an unpublished study by Potter (1966) do not support such a view. In her procedure, the blurred picture was interrupted at frequent intervals. The picture was turned off and the subjects looked at a blank screen for 20 seconds before the showing of the picture was resumed. There was no measureable improvement in recognition speed.

Another explanation for our failure to demonstrate a difference in recognition point in the Wide and Narrow Ranges may be a function of time. In the present study, all subjects spent forty-five minutes in the Free Response Recognition Test. In Frederiksen's most recent study (1966), Wide Range subjects spent close to twice the amount of time in the Recognition test than Narrow Range subjects. The

additional boredom and fatigue generated in the Wide Range subjects may have contributed to the delay in recognition.

Finally, in this study, subjects were tested individually while in earlier studies subjects were tested in groups of at least 12 individuals. The effect on recognition performance by the presence or absence of a direct interaction between Experimenter and Subject is unknown.

Since the Wide Range-Narrow Range difference in recognition point was not observed for the population as a whole, the failure to observe an increased involvement of set persistence in the Wide Range sequence for the old group may represent a deficiency in the task. If procedural variations of the kind enumerated can obliterate Wide Range-Narrow Range difference in recognition point, this Visual Recognition Test would appear to be too procedurally dependent a technique to be meaningfully used for age comparisons.

The hypothesis that the aged would be even more handicapped in the Wide Range sequence when compared with younger subjects than they would be in the Narrow Range was not confirmed. But in view of the unreliability of the Visual Recognition Test, the failure to confirm the experimental hypothesis does not disconfirm the general hypothesis that the aged are more susceptible to the influence of set persistence than younger adults.

Age Differences in Recognition Point in the Free Response Recognition Test

The results regarding the recognition point averaged across the Wide and Narrow Range sequence indicate that in the aged group there is an increased involvement of some process which serves to delay recognition. Highly significant age differences were found in the mean trial at which correct recognition occurred. Old subjects correctly identified the picture later in the sequence than middle aged subjects. Young subjects recognized earlier than both older groups.

All subjects were pretested for visual acuity and those who did not fall within the normal range of corrected vision were excluded from the sample. Therefore explanations of the observed performance decrement which involve age related, modality specific disabilities such as cataracts, myopia and other visual disorders related with aging were ruled out.

Age Differences in Productivity

In the present investigation, a central finding was that older subjects generated fewer hypotheses per trial than the young and middle aged groups. The Hypothesis Production Index, a measure of the productivity of different prerecognition hypotheses was smaller for the aged than for the other groups. There were no age differences in the total

number of hypotheses produced prior to recognition. This indicates that given the additional exposures of the pictures, the performance of the older subjects did approximate that of the younger groups.

These results suggest that the older group was less active than the younger groups in constructing pre-recognition hypotheses. Perceptual recognition has been conceptualized as an active constructive process (Selfridge and Neisser, 1960; Neisser, 1967). In the initial stage, the field is organized into a set of primitive features by global, holistic processes. These "preattentive processes" provide the objects for subsequent interpretation. In the second stage, active synthetic processes operate on the features to construct the appropriate visual objects. Neisser (1967) suggests that the processes of this stage, which he has called "focal attention" are under the control of developmental factors.

The present study provides some support for the view that with advancing age there is an increase in cognitive passivity. However, in contrast to studies in which unselected populations were used as subjects, the age differences observed here are modest. For example, no age differences were found in the measures of repetitiveness, response omission, verbalized uncertainty regarding performance and the frequency of "concrete" hypotheses. These findings will be discussed in greater detail later in the present chapter.

The Role of the Sample in the Observation of Age Differences

Undoubtedly, our failure to demonstrate gross decrements in our aged group has to do with the characteristics of the sample. The subject population consisted of bright, highly educated men whose level of cognitive functioning could not be considered representative of the general population. A conservative estimate is that the group represents the top 10% of the general population with respect to intellectual level. Earlier studies have shown that conceptual ability does not deteriorate with advancing age in gifted adults (Bayley and Oden, 1955; Owens, 1953). Our subjects functioned at high levels of competence in the community despite advancing age. The majority of subjects in the old group continued to participate in professional life, if not in full time positions, then in some consultative capacity. Our study adds to the growing evidence that gross cognitive deterioration with aging is less likely to be demonstrable when dealing with a bright and active population (Birren et. al, 1963).

Based on the results of previous studies (Bruner and Potter, 1964; Frederiksen, 1966) our expectation was that the differential involvement of perseverative tendencies in the Wide Range sequence of the Free Response Recognition Test would reflect itself in the interference of early, erroneous hypotheses and would delay correct recognition. Based on previous studies of age differences in visual

recognition (Verville and Cameron, 1946; Wallace, 1956), it was anticipated that the old subjects would persist in incorrect responses more than younger subjects. The results of the present study fail to provide support for either of these expectations.

It has already been shown that no delay in recognition occurred in the Wide Range compared with the Narrow Range sequence. There was however, a significant difference between the Wide Range and Narrow Range sequences in the mean Repetition Indexes for the population as a whole. There was more repetitiveness in the Wide Range sequence. The tendency to repeat erroneous hypotheses was observed in the Wide Range sequence, but it did not serve to delay recognition. Rather, once a minimal degree of clarity in the picture was attained, recognition occurred whether or not repetitive behavior preceded it.

There were no age differences in the Repetition Index. Older subjects did not repeat early hypotheses to any greater extent than subjects in early or middle adulthood. The nature of the visual recognition test may be responsible for the failure to observe the predicted age differences in behavior. On the other hand, the high intellectual level of the subject population may be the more critical factor in the lack of age differences in the Repetition Index. Further work is needed in order to determine whether our failure to observe age differences in the interference effect represents a deficiency in the task or a special characteristic of the population.

Age Differences in the Content of Pre-recognition Hypotheses

Our finding that the old group produced fewer hypotheses per trial than the younger age group suggested an increase in cognitive passivity with advancing age. On the basis of earlier reports ([Comalli, Wapner and Werner, 1959] Wapner, Werner and Comalli, 1960), it was expected that the responses of the old group would reveal greater globality than those of the younger subjects. Accordingly, it was predicted that the oldest group would produce a greater frequency of verbalizations made in response to the attributive features of the stimulus. In a developmental study of children, Potter (1966) found a decrease in the number of attributive remarks regarding the blurred picture with advancing age. Responses in which color and form are identified preclude the formation of an hypothesis regarding the subject of the picture and may be regarded as indicative of a more passive orientation to the task.

The results revealed no age difference in the mean number of descriptive responses per trial. Pursuing a similar line of thought, it was expected that if greater passivity did exist, it would reflect itself in an age related increase in the frequency of general and vague hypotheses. In the study cited above (Werner, Wapner and Comalli, 1960) the results were interpreted as indicative of greater globality and less articulation of the perceptual

field with advancing age. It seemed reasonable to expect that hypotheses categorized by the judges as "vague" might point to an age difference in the orientation to the task. There were no significant age differences in the mean number of "vague" hypotheses produced and our hypothesis was not confirmed.

These negative results do not provide sufficient evidence against the finding that there is an age related increase in passivity. The validity of the verbal responses we have categorized as "descriptive" and "vague" as measures of passivity have not been determined. On the other hand, positive results would have had certain "face validity" and more importantly may have provided the impetus for further research.

An analysis of incorrect prerecognition hypotheses revealed age differences in the activity implied in the content of the hypotheses constructed. Old subjects produced fewer hypotheses dealing with movement than younger subjects but produced more hypotheses concerned with food and related objects. This is reminiscent of the findings of an early Rorschach study of age differences (Prados and Fried, 1947). In that study, the decrease in M was interpreted as a regression to greater primitiveness and to the activation of instinctual promptings which demand immediate gratification. There are several elements of interest in our results. First, the increase in food responses in combination with the decrease

in movement responses produced by the old group again suggests an increase in passivity with advancing age. Earlier it was suggested that the age differences observed in the processes underlying recognition indicated an increase in cognitive passivity. In the present context, the results may imply that aging is also associated with an increase in passivity in the "dynamic sphere." Secondly, in the present study, the increase in instinctual preoccupation with age was observed in the context of relatively adequate cognitive functioning and in this respect may represent a successful adaptation to increased inner demands for gratification.

Age Differences in Performance on the Checklist Recognition Test

The results of the Checklist Recognition Test provide additional data regarding age differences. The purpose of using the Checklist was to investigate whether the paucity of responses typically observed in older adults could be ascribed to a lack of alternate ideas, in this case alternate hypotheses regarding blurred pictures. It was anticipated that when subjects were provided with plausible alternative hypotheses and required to choose among them rather than having to generate their own hypotheses, age differences in performance would decrease. Our results did not support that hypothesis. The Checklist did not provide any advantage to the aged group as had been predicted. In the Checklist Test, as in the Free Response Recognition Test, the old group

correctly identified the blurred slides significantly later in the sequence than the middle aged and young groups. In addition, in the Checklist Recognition Test, the aged did not check more erroneous hypotheses relative to the young and middle aged groups than they did in the Free Response Recognition Test.

These findings seem to suggest that the aged have a more limited capacity than younger adults to simultaneously deal with a variety of hypotheses even when relieved of the responsibility for generating such hypotheses. However, several features of the Checklist Recognition Test must be taken into account in the evaluation of the results. The Checklist and Free Response Recognition tests differed in a variety of ways. First, they differed with respect to the amount of cognitive activity required; the selection among alternatives is a more passive process that the construction of appropriate hypotheses. Secondly, they differed with respect to the amount of visual and motor activity required. In the Checklist Test, the subject performed a series of tasks; he attended to the blurred picture on the screen, hypothesized regarding its identity, turned to look at the checklist in front of him (the successive pages of which differed in the order of presentation of alternatives so that if he had already made a decision regarding the picture, he had to scan the page in order to locate the correct word or phrase), checked off one or more of the alternative

hypotheses and finally handed the completed page to the examiner. That cycle was repeated at each level of blurredness. It is conceivable that the complexity of the procedure affected the three age groups differently.

The Checklist and the Free Response Recognition Tests differed with respect to their complexity. For this reason one cannot exclude the possibility that the presentation of alternative hypotheses did afford the aged group with some advantage as had been predicted. However, any such advantage was obliterated by age differences in the ability to deal effectively with the increased complexity of the Checklist Test. An investigation in which the two tests are made more comparable is therefore indicated.

Compensatory Mechanisms Frequently Used by the Old Group

The Checklist Recognition Test required that subjects sustain a number of different performance sets simultaneously. Of great interest was the tendency of the older subjects to react prematurely. Older subjects checked the items almost immediately, where younger subjects seemed to take advantage of the long time period available.[3] It seemed as if in order to compensate for their diminished reaction time to situations in general, older subjects were attempting to "jump the gun."

Two sets of facts are of interest here; the perceived complexity of the task and the tendency of the aged to respond prematurely. This raises the question whether in this

---

[3]This conclusion is based on observational data, no formal measures of reaction time were planned for initially and therefore were not gathered. Future study along these lines is indicated.

case the performance of the aged represents a defense against what the older subject experiences as his own deficit or is indicative of cautiousness.[4] Clearly, he did have additonal time, yet he did not utilize it in the selection of alternate hypotheses. One possibility may be that the older adult by responding prematurely is reacting to what he perceives as a deficit in his short term memory. That is, by getting the response over with, he no longer has to rely on his memory of the blurred slide. Whether in fact he is correct in his assumption might be determined in a study in which he is prevented from making the response until some specified time period has elapsed following the exposure of the picture. The question to be answered here is, does this defensive maneuver function to compensate for an actual deficit or is it based on the anticipation that such a deficit exists.

Implicit in such an interpretation of the observation that the aged responded more quickly than the young and middle aged groups is the view that there are age differences in the intrusion of anxiety. In other gerontological studies, anxiety was thought to result in behavior which is the direct opposite of the early responding observed among the old group in the present investigation. Results reported by Eisdorfer (1965) have suggested that the response to heightened anxiety in older groups is withdrawal. The "anxiety-withdrawal hypothesis" is based on the common

[4]Strictly speaking this study demonstrated differences rather than deficits. The concept of deficits is only one of a range of hypotheses that could be advanced to account for the differences. Another hypothesis would be that there are changes in decision strategies with age. Such an hypothesis would be difficult to test even with a longitudinal study. The Checklist data are not inconsistent with the concept of deficit.

observation that older subjects tend to make more "errors of omission" (non-responses) rather than "errors of commission" (responding incorrectly). This has been reported by Arenberg (1965), Eisdorfer (1965) and Eisdorfer, Axelrod and Wilkie (1963). In general, our findings do not conform to the "anxiety-withdrawal hypothesis." In the Free Response Recognition Test, there was no age difference in the Response Omission Index, our measure of the tendency not to respond. In addition, there was no age difference in the frequency of verbalized expressions of uncertainty.

Another observation of age differences in the performance on the Checklist Recognition Test is also of interest. Older subjects, more often than young and middle aged ones tended to read the alternatives aloud during the time provided for studying the checklist. Subsequently, they seemed more prone than the other subjects to enunciate the alternative chosen at each level of blurredness. The instructions did not mention the verbalization of the response; the subject was simply instructed to check off the plausible items.

There are at least two interpretations of the observed behavior. First, there may be age differences in the efficiency with which information is processed and stored. For example, the aged may rely on auditory memory to a greater extent than younger adults. The more active use of overt speech observed in our older group may facilitate the recoding

observation that older subjects tend to make more "errors of omission" (non-responses) rather than "errors of commission" (responding incorrectly). This has been reported by Arenberg (1965), Eisdorfer (1965) and Eisdorfer, Axelrod and Wilkie (1963). In general, our findings do not conform to the "anxiety-withdrawal hypothesis." In the Free Response Recognition Test, there was no age difference in the Response Omission Index, our measure of the tendency not to respond. In addition, there was no age difference in the frequency of verbalized expressions of uncertainty.

Another observation of age differences in the performance on the Checklist Recognition Test is also of interest. Older subjects, more often than young and middle aged ones tended to read the alternatives aloud during the time provided for studying the checklist. Subsequently, they seemed more prone than the other subjects to enunciate the alternative chosen at each level of blurredness. The instructions did not mention the verbalization of the response; the subject was simply instructed to check off the plausible items.

There are at least two interpretations of the observed behavior. First, there may be age differences in the efficiency with which information is processed and stored. For example, the aged may rely on auditory memory to a greater extent than younger adults. The more active use of overt speech observed in our older group may facilitate the recoding

of visually presented information into auditory storage. Arenberg's (1967) observation that auditory input facilitates short term retention in older subjects is relevant here. He suggests that the effectiveness of the internal subvocal conversion from visual to auditory storage is reduced in the aged. Since the aged have greater difficulty in converting visual input to auditory storage "any aspect of the learning situation which facilitates this conversion to auditory storage, such as active responding or auditory presentation, should be particularly beneficial to the older person's learning and retention" (Arenberg, 1967, p. 13).

The compensatory use of speech has been reported in a somewhat different context. Luria (1966) reports that preventing brain injured patients from making speech movements resulted in the deterioration of cognitive performance. The verbal repetition of the response which was observed in the older group in the present study may represent an attempt to compensate for a deficiency in the functioning of some internal process.

The second interpretation of the observation that the aged verbalized the alternatives in the Checklist is that the demands of the previous task, in which a verbal response was required, were carried over to the new situation. The Checklist Test always followed the Free Response Recognition Test which required a verbal response. It has often been observed that the aged have greater difficulty in relinquishing

response sets than younger subjects (Talland, 1959; Griew, 1962). Our observation that the older subject verbalized the alternatives may represent his failure to inhibit a style of response which had been previously established.

To summarize, the foregoing observations imply that in a group of highly educated, professionally active men, old age is associated with some diminution in the activity of the constructive process involved in perceptual recognition. This was most clearly shown in the finding that old subjects generated or recognized as relevant fewer alternative hypotheses regarding the blurred pictures than younger subjects. In addition, age differences in performance suggest that a variety of compensatory mechanisms were developed by the old group. Some examples are the tendency to respond prematurely, the self reinforcement of visual input by overt verbalization and the construction of well articulated incorrect prerecognition hypotheses in response to increased inner demands for instinctual gratification.

CHAPTER V

SUMMARY

Two forms of a visual recognition test were given to sixty bright and active male subjects ranging in age from 24 to 80. Three groups consisting of twenty subjects each had mean ages of 30, 50 and 70 years.

In the first test, the Free Response Recognition Test, subjects were required to generate different hypotheses regarding blurred color slides of common objects and scenes. Slides were shown in two different ranges of increasing clarity; a Wide Range, which offered an opportunity to misinterpret the picture; and a Narrow Range, in which the opportunity to construct false impressions of the picture was limited by the deletion of the early highly blurred versions of the picture.

The hypothesis that correct recognition would occur later in the Wide Range was not confirmed for the population as a whole. The hypothesis that the old group would be even more handicapped in the Wide Range than the younger groups was also not confirmed. Several methodological differences between the present study and previous studies, which have observed the Wide Range-Narrow Range difference in recognition point, were evaluated and it was suggested that this

technique is too procedurally dependent and insensitive to be used for age comparisons. Highly significant age differences in the recognition point were observed averaged across the Wide and Narrow Ranges thus confirming the hypothesis that older subjects would attain recognition later than young and middle aged subjects. The old group required more stimulus clarity before correctly recognizing the blurred picture.

Significant age differences in the point at which recognition occurred were also found in the second visual recognition test. In that test, the Checklist Recognition Test, eight alternative hypotheses regarding another set of blurred slides were presented and the subject was simply required to check off as many of the items as seemed plausible.

The central finding of the study was that the aged did not produce as many hypotheses as younger subjects. This was true when subjects had to spontaneously generate hypotheses and when they had to choose among several possible alternative hypotheses. These findings were interpreted as indicative of a decrease in the activity of the constructive process involved in perception. In addition, the results suggested that in response to changes in the efficiency of the cognitive processes, a variety of compensatory mechanisms were developed by the old group.

Generally, age differences in the present study were modest compared with differences observed in studies in which less active populations were used. The findings of previous

gerontological studies, in which the aged showed a greater susceptibility to the persistence of responses made earlier in a series, were not supported. The results of the present investigation did not indicate that the aged verbalized more uncertainty regarding performance than younger groups. Nor did they indicate that the elderly produced more "errors of omission" than younger subjects as had been widely reported. There was no indication that the aged were more concrete in their thinking than the other groups.

A variety of mechanisms which may serve to compensate for the limited deficits of this aged population were observed. These included the tendency for the old group to respond prematurely in the Checklist Recognition Test, the verbalization of the alternatives in the checklist and the greater frequency of hypotheses indicative of instinctual preoccupations in the Free Response Recognition Test.

APPENDIX I

SCORING CRITERIA

Incorrect Responses

Pre-recognition responses were classified as follows:

1. No hypothesis

   this included all trials at which the subject remained silent prior to having made some hypothesis; as will be indicated shortly, silences following incorrect hypotheses were considered repetitions, unless the previous response was negated. Also included "don't know" etc.

2. Attributive remarks

   this category included all responses which were purely descriptive, but in which no identification of the meaning of the stimulus configuration was attempted; e.g. "it's getting clearer" "a brown and white blur." As in the case of 1 above, attributive remarks occurring after an hypothesis as to the identity of the picture were considered repetitions unless the previous hypothesis had been negated, e.g. "it's not a bottle, it is white" was scored as an attributive remark.

3. Erroneous hypothesis

   these were further classified as follows:

Content Categories for Erroneous pre-Recognition Hypotheses

Anatomy (At)	included x-rays, bones, teeth
Animal (An)	
Architecture (Arch)	included exterior and interior features, e.g. walls, doors, fences
Food (Fd)	included any food or food related response e.g. responses re: food processing, storage ("milk bottle" scored Fd) fruits, vegetables

Human (H)	included responses scorable as H on Rorschach
Human Movement (M)	included responses scorable as M on Rorschach
Inanimate movement (m)	included responses scorable as m on Rorschach
Landscape (L)	
Man made object (Obj)	included, furniture, cars, machinery
Plant (Pl)	included all flower and tree responses not already classified as Fd
Vague response (V)	includes highly general percepts, e.g. shadows, ink blots, modern art, clouds
Other	All other hypotheses

4. Repetitions

this category included all repetitions of previous hypotheses or other responses such as attributive remarks, and the response "same" and all silences following incorrect responses. In other words, silences were scored in one of two ways: appearing initially, prior to the identification of any object they were scored NR (no response), while if a silence occurred following the enunciation of an erroneous response was considered a repetition. EXCEPTION: When the silence followed the negation of the previous response e.g. "This is not a house but I don't know what it is" was considered NR

Correct Responses

Correct responses may be more or less comprehensive. Accordingly, two levels of completeness of a correct response were considered: RP 1 minimal recognition of any aspect of the picture and RP 2 foreground and background details correctly integrated. Recognition Points (RP 1 and 2) 1 and 2 were identified at the level of blurredness (trial) at which they first appear. The specific criteria for each slide follow:

Slide 1 Cupboard with Dishes

RP 1 identification of any of the following:

a. cabinet, cupboard, shelf, kitchen scene, pantry, etc.
b. plates, dishes stacked, saucers
c. cups, cups hanging, teacups
d. mugs, standing cups, cups in the foreground, steins etc.

RP 2

enumeration of all 3 types of dishes shown (b., c. & d.) in the enclosure (a.)

examples: "cups hanging in a kitchen cabinet" received a designation of RP 1. "plates, mugs and cups in a closet" received a designation of RP 2. The generalization "dishes in a kitchen cupboard" was RP 1.

Slide 2 Trash Cans

RP 1

a. a response indicating the correct perception of the form of the objects even when the specific response is incorrect e.g. glasses was to be considered RP 1

b. street

RP 2

had to include concept of the size of the containers as well as their location on the street

examples: "some objects out on the street" = RP 1
"glass tumblers" = RP 1
"large metal drums on the corner of a street" = RP 2

Slide 3 Lifeboat Drill

RP 1 identification of either of the following:

a. people in any circumstance
b. ship, ship-board scene boat etc.

RP 2

must have included men in lifevests on the ship, or more generally lifeboat drill

examples: "commuters on a platform" = RP 1
"a lifeboat with water in the background" = RP 1
"sailors with Mae Wests on a ship" = RP 2

Slide 4 Child with Toys

RP 1 identification of any of the following:

a. person in the background
b. chair in the background
c. doll
d. clothing or doll's clothing
e. lemon
f. red bench, little red stool, rack with objects
g. stuffed animal, lamb
h. striped rug, carpet or bedspread
i. toys or playthings

RP 2

must have included the child in the background in relation to the objects in the foreground

example: "a bedspread with objects on it" = RP 1
"a plastic lemon" = RP 1
"a child's hand on a red bench" = RP 2
"playthings with a child in the background" = RP 2

Slide 5 Cow and Person

RP 1 identification of either:

a. any mammal's head
b. head of a person (in some cases the response person was given where it was clear that the location of the percept was not the left corner - in such cases the response was scored (H) but was not considered to represent correct identification

RP 2

must have included the animals or animal (calf, cow, bull) and the person: sex of person need not be specified

examples: "puppies" and "possum" are not considered RP
"the face of a man in the center of the picture facing me" is not to be considered RP
"a moose's head" = RP 1
"a boy with a white shirt, you can see the back of his head" = RP 1
"a woman and a calf" = RP 2

Slide 6 Leaves and House

RP 1 identification of any of the following

a. leaves, autumn leaves, fall foliage (nothing more specific, i.e., no leaves and flowers or leaves and grapes)
b. barn, house shed
c. fence, corral

RP 2

response must make it clear that S perceived white areas as background rather than as figure

examples: "a farm scene with a barn" = RP 1
"fall leaves" = RP 1
"leaves with the white background as the sky" = RP 2
"the leaves of a tree at the side of a house" = RP 2

Slide 7 Silverware

RP 1 Recognition of any of the following:

a. fork(s)
b. knife (knives)
c. spoon(s)
d. kitchen utensils (nothing more specific, i.e. no spatula)
e. red carpet, carpet, red tablecloth, red cloth

RP 2

must have included the 3 types of silverware (or general term "silverware") on a red background

example: "silverware floating in a red solution" = RP 1
"forks, knives and spoons on a tufted rug" = RP 2

Slide 8 Bicycles

RP 1 recognition of any of the following:

a. bicycle(s)
b. a building in the background
c. shrubbery, trees

RP 2

bicycles in front of a building

examples: "a rack of bicycles in front of a picket fence" = RP 1
"bicycles with large columns in the background" = RP 2

Qualifications and Uncertainty Remarks

Space was provided on each data collection form for the purpose of indicating the presence of qualifying remarks or indications of uncertainty (Q) (U), this was of interest at each level of blurredness, regardless of whether or not RP 1 or 2 was attained

examples

(Q) "Looks like a seashell"
"seems to be a ------"
"might be a ---"

(U) "I can't be sure but it looks like a ---"
"it's probably not a house but it sure ll one."
"DK (don't know)"

For the purposes of the analysis the scores Q and U were combined.

Other Considerations

There were instances in which the subject attained RP 1 and then changed his response so that it became incorrect. When the correct response persisted for 2 trials, it was considered as the correct response (RP 1) even if it was later changed. Judges indicated the occurrence of this event on the summary sheet.

BIBLIOGRAPHY

Arenberg, D. Anticipation interval and age differences in verbal learning. J. abnorm. Psychol., 1965, 70, 419-425.

_____. Verbal learning and retention. The Gerontologist, 1967, 7, 10-13.

Basowitz, H. & Korchin, S. J. Age differences in the perception of closure. J. abnorm. soc. Psychol., 1957, 54, 93-97.

Bayley, N. & Oden, M. H. The maintenance of intellectual ability in gifted adults. J. Gerontol., 1955, 10, 91-107.

Birren, J. E. Age changes in the speed of simple responses and perception and their significance for complex behavior. In Old age in the modern world. London: Livingstone Ltd., 1955, pp. 235-247.

_____. The psychology of aging. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1964.

_____, Butler, R. N., Greenhouse, S. W., Sokoloff, L. & Yarrow, M. R. (Eds.), Human aging: a biological and behavioral study. U.S. Govt. Printing Office, 1963.

_____, Reigel, K. F. & Robbin, J. S. Age differences in continuous word associations measured by speech recordings. J. Gerontol., 1962, 17, 95-96.

Botwinick, J. Cognitive processes in maturity and old age. New York, N.Y.: Springer, 1967.

_____, Robbin, J. S. & Brinley, J. J. Reorganization of perceptions with age. J. Gerontol., 1959, 14, 85-88.

_____ & Birren, J. E. Cognitive processes: mental abilities and psychomotor responses in healthy aged men. In J. E. Birren et al. (Eds.), Human aging: a biological and behavioral study. U.S. Government Printing Office, 1963, pp. 97-108.

Braun, H. Perceptual processes. In J. E. Birren (Ed.), Handbook of aging and the individual: psychological and biological aspects. Chicago: Univ. of Chicago Press, 1959, pp. 543-561.

Brinley, J. Cognitive sets, speed and accuracy of performance in the aged. In A. T. Welford and J. E. Birren (Eds.). Behavior, aging and the nervous system. Springfield, Ill.: Charles C. Thomas, 1965, pp. 114-149.

Bromely, D. Age and sex differences in the serial production of creative conceptual responses. J. Gerontol., 1967, 22, 32-42.

Bruner, J. S. & Potter, Molly C. Interference in visual recognition. Science, 1964, 144, 424-425.

Chown, Sheila M. Rigidity - a flexible concept. Psychol. Bull., 1959, 56, 195-223.

_____. Age and the rigidities. J. Gerontol., 1961, 16, 352-362.

Comalli, P. E., Wapner, S. & Werner, H. Perception of verticality in middle and old age. J. Psychol., 1959, 47, 259-266.

Edwards, A. Experimental design in psychological research. New York: Holt Rinehart and Winston, 1960.

Eisdorfer, C. Rorschach performance and intellectual functioning in the aged. J. Gerontol., 1963, 18, 358-363.

_____. Verbal learning response time in the aged. J. genet. Psychol., 1965, 107, 15-22.

_____. A tentative theory of the psycho-physiologic aspects of adult learning. Proc. National Conference on Manpower Training and the Older Worker. National Council on Aging, 1966.

_____. New dimensions and a tentative theory. Gerontologist, 1967, 7, 14-18.

_____, Axelrod, S. & Wilkie, F. L. Stimulus exposure time as a factor in serial learning in an aged sample. J. abnorm. soc. Psychol., 1963, 67, 594-600.

Frederiksen, J. R. The role of cognitive factors in the recognition of ambiguous visual stimuli. (Research Bulletin 65-23) Princeton, N.J.: Educational Testing Service, 1965.

_____. A study of perceptual recognition in two sense modalities. (Research Bulletin 66-32) Princeton, N.J.: Educational Testing Service, 1966.

Galloway, D. W. An experimental investigation of structural lag in perception. Amer. Psychologist, 1946, 1, 450 (Abstract).

Goldstein, K. The Organism. New York: American Book Co., 1939.

_____, & Sheerer, M. Abstract and concrete behavior: An experimental study with special tests. Psychol. monogr., 1941, 53, No. 2.

Griew, S. The learning of statistical structure: A preliminary study in relation to age. In C. Tibbitts and W. Donahue (Eds.), Social and psychological aspects of aging. New York: Columbia Univ. Press, 1962, pp. 765-769.

Heglin, H. J. Problem solving set in different age groups. J. Gerontol., 1956, 11, 310-317.

Inglis, J. Immediate memory, age and brain function. In A. T. Welford and J. E. Birren (Eds.), Behavior, aging and the nervous system. Springfield, Ill.: Charles C. Thomas, 1965, pp. 461-475.

Jones, H. E. Intelligence and problem solving. In J. E. Birren (Ed.). Handbook of aging and the individual: psychological and biological aspects. Chicago: Univ. of Chicago Press, 1959, pp. 700-738.

Korchin, S. J. & Basowitz, H. The judgement of ambiguous stimuli as an index of cognitive functioning in the aging. J. Pers., 1956, 25, 81-95.

_____ & Basowitz, H. Age differences in verbal learning. J. abnorm. soc. psychol., 1957, 54, 64-69.

Landahl, H. D. & Birren, J. E. Effects of age on the discrimination of lifted weights. J. Gerontol., 1959, 14, 48-55.

Lindquist, E. F. Design and analysis of experiments in psychology and education. Boston: Houghton Mifflin, 1953.

Luria, A. R. Human brain and psychological processes. New York: Harper and Row, 1966.

Neisser, U. Cognitive psychology. New York: Appleton Century Crofts, 1967.

Owens, W. A., Jr. Age and mental ability. Gen. psychol. Monogr., 1953, 48, 3-54.

Potter, Molly C. Identification of out-of-focus pictures: resistance to conceptual and perceptual reorganization. Paper read at International Congress of Psychology, Moscow, U.S.S.R., August, 1966.

_____. On perceptual recognition. In Studies in Cognitive Growth. J. S. Bruner et. al. (Eds.), New York: John Wiley and Sons Inc., 1966, pp. 103-134.

Prados, M. & Fried, E. G. Personality structure of the older age groups. J. clin. Psychol., 1947, 2, 113-120.

Rabbitt, P. M. Set and age in a choice-response task. J. Gerontol., 1964, 19, 301-306.

_____. Age and discrimination between complex stimuli. In A. T. Welford and J. E. Birren (Eds.), Behavior, aging and the nervous system. Springfield, Ill.: Charles C. Thomas, 1965, pp. 35-53.

_____. Age and transmitted information. In G. A. Talland (Ed.). Human Aging and Behavior. New York: Academic Press, 1968, pp. 75-92.

_____ & Birren, J. E. Age and responses to sequences of repetitive and interruptive signals. J. Gerontol., 1967, 2, 143-149.

Riegel, K. F. Personality theory and aging. In J. E. Birren (Ed.). Hanbook of aging and the individual: psychological and biological aspects. Chicago: Univ. of Chicago Press, 1959, pp. 797-851.

Ruch, F. L. The differentiative effect of age upon learning. J. gen. Psychol., 1934, 11, 261-286.

Schaie, K. W. Rigidity-flexibility and intelligence: a cross-sectional study of the adult life span from 20-70 years. Psychol. Monogr., 1958, 72, 1-25.

Selfridge, O. G. & Neisser, U. Pattern recognition by machine. Sci. Amer., 1960, 203, 60-68.

Singer, Margaret T. Personality measurements in the aged. In Human Aging: a Biological and Behavioral Study. J. E. Birren, et. al (Eds.) U.S. Government Printing Office, 1963, pp. 217-249.

Stone, J. L. & Norris, A. H. Activities and attitudes of participants in the Baltimore Longitudinal Study. J. Gerontol., 21, 1966, 575-580.

Talland, G. A. The effect of set on accuracy of auditory perception. Brit. J. Psychol., 1958, 49, 117-130.

_____. Age and the effect of anticipatory set on accuracy of perception. J. Gerontol., 1959, 14, 202-207.

Thaler, Margaret. Relationship among Wechsler, Weigl, Rorschach, EEG Findings and abstract-concrete behavior in a group of normal aged subjects. J. Gerontol. 1956, 11, 404-408.

Verville, E. and Cameron, N. Age and sex differences in the perception of incomplete pictures by adults. J. genet. Psychol., 1946, 68, 149-157.

Wallace, J. G. Some studies of perception in relation to age. Brit. J. Psychol., 1956, 47, 283-297.

Wallace, M. & Kogan, N. Aspects of judgements and decision making: Interrelationships and changes with age. Behav. Sci., 1961, 6, 23-35.

Wapner, S., Werner, H. & Comalli, P. E. Perception of part-whole relationships in middle and old age. J. Gerontol., 1960, 15, 412-416.

Welford, A. T. Aging and human skill. London: Oxford University Press, 1958.

Wetherick, N. E. Changing an established concept: A comparison of the ability of young, middle aged and old subjects. Gerontologia, 1965, 11, 82-95.

Wyatt, D. F. & Campbell, D. T. On the liability of stereotype or hypothesis. J. abnorm. soc. psychol., 1951, 46, 496-500.