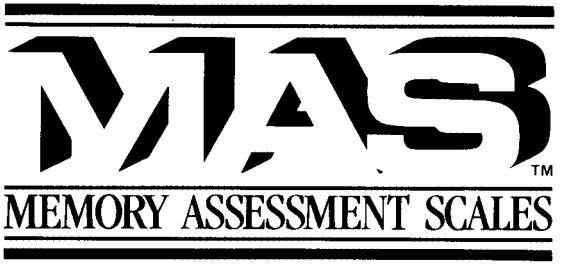

Professional Manual

by

J. Michael Williams, Ph.D.

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J. Michael Williams, Ph.D.
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1
Introduction

The Memory Assessment Scales (MAS) is an individually administered battery of tasks developed to assess memory functions in normal and clinical populations. The original design of the MAS emerged in 1981 from a review of the memory assessment literature in clinical psychology, cognitive psychology, and neuropsychology. Clinical and research articles from that time until the present have consistently noted the need for a comprehensive, well–designed, standardized memory assessment battery (e.g., Erikson & Scott, 1977; Loring & Papanicolaou, 1987; Mayes, 1986; Prigatano, 1977, 1978). Many professional reviews have criticized existing methods of assessing memory function, made numerous suggestions for improving existing methods, and specified methods and procedures which would constitute a well designed clinical memory battery. These frank suggestions and criticisms were a major influence in the development of the MAS.

The assessment of memory functions can be quite complex, and varying perspectives on the important parameters of concern continue to exist (e.g., Squire, 1987). While no clinical battery of memory tests could reasonably incorporate all of the tasks which have been shown to be sensitive to some aspect of memory function, there is fair consensus on the essential measures for clinical purposes (Erikson & Scott, 1977; Loring & Papanicolaou, 1987; Mayes, 1986; Russell, 1981). The major functions measured by the MAS include: verbal and nonverbal attention, concentration, and short–term memory; verbal and nonverbal learning and immediate memory; and memory for verbal and nonverbal material following delay. Measures of recognition, intrusions during verbal learning recall, and retrieval strategies are also provided.

A major consideration in the development of the MAS was that the design of the scales should recognize the common obstacles faced by psychologists in the delivery of clinical services. The MAS was designed with consideration for the varied clinical situations and restrictions that many professionals face in practice: the constraints of bedside administration, the need for materials that can be quickly displayed and easily transported, the need for scoring procedures that are straightforward and scores that are easily calculated. It is hoped that professionals using the MAS will find their endeavors easier, regardless of whether they are examining a neurosurgery patient at bedside, a patient in a private office, or a subject in a research laboratory.

Another consideration in the development of the MAS was more technical in nature. Professionals use memory scales to answer questions related to a variety of endeavors, including neuropsychological assessment, vocational assessment, and gerontologic evaluation. Different normative comparisons (e.g., comparison of the subject's performance with that of all adults, with adults of the same age, or with adults of the same age and education) are often required to answer these varied questions. For this reason, substantial effort has been expended to provide normative tables to facilitate the precision of professional opinions and decisions.

The chapters that follow provide information on the MAS subtests, MAS materials, administration and scoring procedures, normative tables, guidelines for interpretation, characteristics of the normative sample, reliability and validity studies, and procedures for generation of the normative tables.

Description of MAS Tasks, Subtests, & Scores

Overview

The MAS assesses three areas of cognitive function which are critical in the assessment of memory: (a) attention, concentration, and short–term memory; (b) learning and immediate memory; and (c) memory following a delay. For each of these areas, separate verbal and nonverbal tasks are used to measure material–specific (verbal versus visual–spatial) memory abilities. Both recall and recognition formats are used in assessing memory functioning. In addition, a task requiring the association of verbal and nonverbal material is included as one measure of memory skills used in everyday living.

In total, the MAS consists of 12 subtests, which are based on seven memory tasks. Five of the subtests involve the repeated assessment of retention of information learned in the initial administration of a memory task—these subtests provide measures of memory function following brief or extended periods of delay. The following is an overview of the MAS subtests, in the order of administration.

Subtests

List Learning. The first MAS subtest is an auditory verbal learning task which requires the subject to recall a list of 12 common words—3 of each from four semantic categories: countries, colors, birds, and cities. The list is presented for a maximum of six recall trials, or until the subject successfully recalls all 12 words on a single trial. Total number of words recalled constitutes the List Acquisition score. Additional scores, which provide measures of intrusions and the success of clustering strategies, can be calculated for analysis of the processes underlying the level of performance.

Prose Memory. The second MAS subtest is an auditory verbal prose recall task which requires the subject to recall a short story. Subjects are asked to recall the story from memory and are then asked nine questions about details of the story. Performance is measured by scoring responses to the questions. The number of correct responses constitutes the Immediate Prose Recall score. The Prose Memory subtest also serves as a verbal interference task for the next subtest (List Recall).

List Recall. This subtest requires the subject to recall the words presented in the List Learning subtest. The subject is then asked to recall the words within semantic categories, as prompted by the examiner. Finally, the subject is asked to select the words from a printed list of 24 words. The number of words successfully recalled is the List Recall score. Additional scores, which provide measures of intrusions, the success of clustering strategies, and list recognition, can be calculated for analysis of the processes underlying the level of performance.

Verbal Span. The Verbal Span subtest is a short–term auditory memory task which requires the subject to repeat increasingly longer series of numbers. The series range in length from two to nine single–digit numbers. Two trials are presented for each series, and the subtest is discontinued after failure on both trials for a series. This procedure is then repeated, with the requirement that the subject repeat the numbers in reverse order. Scores from both forms of administration combine to produce the Verbal Span score.

Visual Span. The Visual Span subtest is a nonverbal analogue of the Verbal Span subtest. An array of randomly distributed stars is placed before the subject. The examiner then points to a series of stars in a specified sequence. The subject must then point to the same stars in the same order. The number of stars in each sequence pair increases by one over pairs of

trials. The longest sequence successfully remembered is the Visual Span score.

Visual Recognition. The Visual Recognition subtest is a task which measures recognition memory for geometric (nonverbal) designs. The procedure involves a distractor task which is administered between design presentation and recognition. Five trials require a "same–different" recognition response and five trials require recognition of the design from an array of designs. Scores for all 10 trials are combined to provide the Immediate Visual Recognition Score.

Visual Reproduction. This subtest consists of two trials in which the subject is required to reproduce a geometric (nonverbal) design. A distractor task is administered between the design presentation and reproduction. Reproduction drawings are scored for the presence or absence of specific details. Scores for the two drawings are totaled to produce a Visual Reproduction score.

Names–Faces. The Names–Faces subtest is a measure of the ability to associate verbal (names) and nonverbal (faces) material. This task requires the subject to learn the names of individuals who are portrayed in photographs. Following learning trials, the subject is presented with photographs and is asked to recognize the correct name from a brief list of alternatives. Two trials are administered. Scores for the two trials are combined to produce the Immediate Names–Faces score.

Delayed List Recall. This subtest requires the subject to recall the words presented in the List Learning subtest. The subject is then asked to recall the words within semantic categories, as prompted by the examiner. The number of words correctly recalled constitutes the Delayed List Recall score. Additional scores, which provide measures of intrusions and the success of clustering strategies, can be calculated for analysis of the processes underlying the level of performance.

Delayed Prose Memory. In this subtest, memory for details of the prose story is tested. The subject is asked to recall the story from memory and is then asked nine questions concerning the details of the story. The number of correct responses to the nine questions constitutes the Delayed Prose Recall score.

Delayed Visual Recognition. In the Delayed Visual Recognition subtest, the subject is presented with 20 printed geometric designs, 10 of which were designs presented in the Visual Recognition subtest. The subject is asked to recognize the previously presented designs. The number of designs correctly identified constitutes the Delayed Visual Recognition score.

Delayed Names–Faces Recall. The Delayed Names–Faces subtest requires the subject to recognize the correct names of individuals portrayed in photographs, as presented in the Names–Faces subtest. The total number of correctly identified names is the Delayed Names–Faces score.

Scores

In addition to the 12 subtest scores, the MAS provides three Summary Scale scores and a Global Memory Scale score. The Short–term Memory Summary score, which provides a measure of general short–term memory, is based on scores for the Verbal Span and Visual Span subtests. The Verbal Memory Summary Scale score, which provides a measure of verbal memory ability, is based on the List Recall and Immediate Prose Recall subtest scores. The Visual Memory Summary Scale score, which provides a measure of nonverbal (i.e., visual–spatial and figural) memory abilities, is derived from the Visual Reproduction and Immediate Visual Recognition subtest scores. The Global Memory Scale score is a measure of general memory ability. It is derived from the Verbal and Visual Memory Summary Scale scores.

Verbal Process scores are ancillary scores which can be examined to generate hypotheses about strategies underlying performance on the list learning subtests. These scores are discussed in detail in Chapter 7.

Test Materials & Use

Test Materials

The MAS materials consist of the Professional Manual, the Stimulus Card Set, and the Record Form.

The Stimulus Card Set contains the following, in order of subtest administration:

- the Visual Span stimulus card
- the stimulus and distractor cards for the Visual Recognition task
- the stimulus and distractor cards for the Visual Reproduction task
- the five series of 10 stimulus cards each for the Names–Faces task

The 16–page Record Form provides space to record demographic information on the first page. The first page also contains the MAS Subtest Profile area and scoring areas for the Verbal Process scores, Summary Scale scores, and the Global Memory Scale score. The second page provides space to record referral information, background information, presenting complaints, behavioral observations, and observations about test–taking behaviors. Pages 3–11 contain abbreviated instructions for administration, in the order of subtest presentation, and spaces for recording and scoring responses to the MAS tasks. Stimuli for the List Learning, Prose Memory, and Verbal Span subtests, and sequences for the Visual Span subtest, are also provided within these pages. Page 12 provides space for notes pertaining to the qualitative aspects of test performance. Respondent Sheet 2 and Respondent Sheet 1 are located on pages 13–14 and 15–16 of the Record Form, respectively. These pages are perforated for easy removal.

Appropriate Populations

The MAS has been standardized and validated for use with adults 18 through 90 years of age. Reliable administration of the MAS to healthy individuals requires that test–takers have normal or corrected vision adequate for normal reading and have normal or corrected hearing adequate for normal conversation. These requirements may not pertain when administering the MAS to individuals with brain injury or disease (e.g., in cases with known visual field defects) and when the purpose of the evaluation is to document known or suspected neuropsychological deficits. The reliability and validity of administration in these cases will be a function of the professional training and expertise of the examiner.

Professional Requirements

The administration and scoring of the MAS can be performed by individuals who do not have formal training in neuropsychology, clinical psychology, or related fields. Although an experienced examiner is preferred, a trained person with a background in psychological testing may serve as an examiner. The administration and scoring procedures detailed in this manual should be carefully studied by the examiner. Training in the administration and scoring of the MAS should be provided by a qualified psychologist.

In keeping with the *Standards for Educational and Psychological Testing* (American Psychological Association, 1985), interpretation of MAS scores requires professional training in neuropsychology or clinical psychology. The utility of the MAS as a clinical measure is clearly related to the professional's background and knowledge. Test score interpretation should not be attempted without a firm understanding of psychological theories and principles of memory functioning.

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Administration

General Requirements

In addition to the MAS materials, the examiner will need a pencil for the respondent's use and a stopwatch or digital watch. Flat surfaces (e.g., desktops, bedside tables, clipboards) on which the examiner and respondent can write are also necessary.

Administration of the MAS tasks proceeds more smoothly when the two Respondent Sheets (pp. 13–14 and 15–16) are removed from the Record Form and are set aside in preparation for test administration. Examiners should take care that the respondent does not see Respondent Sheet 2 or Side A of Respondent Sheet 1 before subtests requiring these materials are administered.

As with the administration of any test, the testing environment should be comfortable, quiet, and free from distraction. The examiner should make every effort to ensure that there will be no interruptions during administration of the MAS.

While the MAS subtests are relatively easy to administer, even experienced examiners should complete at least two practice administrations to ensure that standardized procedures are followed without hesitation. Particular attention should be paid to administration of the Visual Span subtest. To assist in administration, synopsized directions for the administration of each subtest are provided in the Record Form. These directions are not a substitute for the directions provided in this manual but should serve as prompts which facilitate standardized administration.

Directions for the List Learning Subtest

Learning Trial 1. Turn to page 3 of the Record Form. Say to the respondent:

I'm going to read a list of 12 words to you. When I'm finished, I want you to tell me as many words as you can remember. It doesn't matter in what order you say them. We will practice the list six times or until you remember all 12 words. Do you understand? Listen carefully. Here are the words.

Be certain the respondent understands the task before proceeding. Read words from the Learning List at the rate of one per second. After reading the list, say: ***Now tell me as many of the words as you can remember.***

Record the responses in the column labeled Trial 1. Recording may be facilitated by entering just the first letter of the list words. Intrusions (i.e., words recalled that were not on the list) should be recorded verbatim. Repeated words may be recorded but are not formally scored. Plural forms of the list words are acceptable responses.

If the respondent asks about the order of recall or attempts to recall the words in the order of presentation, repeat that recall in any order is acceptable.

When the respondent cannot recall any more words, administer Learning Trial 2. If the subject successfully recalls the entire list, whether or not there are intrusions or repeated words, discontinue administration of the List Learning subtest and proceed to the next subtest (Prose Memory).

Learning Trial 2. Following the administration of Learning Trial 1, say:

I am now going to read the same list to you again. When I am finished, please tell me as many words as you can remember, including the words you said the first time. Do you understand?

Read the Learning List words, as in Learning Trial 1, and then say: ***Now, tell me all the words you***

can remember. Record the responses, as in Learning Trial 1, in the column labeled Trial 2 in the Record Form. If only the words that were missed on the previous trial are recalled instead of the whole list, remind the subject to repeat all of the words each time. As before, if the subject recalls the entire list, whether or not there are intrusions or perseverations, discontinue administering the List Learning subtest and proceed to Prose Memory.

Learning Trials 3 through 6. For each of these trials say:

> ***I'm going to say the words again. Tell me all the words you can remember, including the words you've said before.***

For each trial, present the Learning List and have the respondent recall as many words as he or she can remember. Record the responses in the Record Form, using the respective columns for each trial. Discontinue administration of the List Learning subtest after any trial in which the respondent recalls all 12 list words or after completion of Learning Trial 6.

Directions for the Prose Memory Subtest

Turn to page 4 of the Record Form. Say to the respondent:

> ***I am going to read a short story consisting of a few sentences. Listen carefully. When I am finished, I am going to ask you to tell me as much of it as you can remember. Do you understand? Here is the story.***

Reading from the Record Form, present the story to the respondent. After reading the story say: ***Now, tell me as much of the story as you remember.*** Record the respondent's production verbatim in the space labeled Immediate Free Recall on the Record Form.

Then say: ***Now I am going to ask you some questions about the story.*** Ask each of the nine questions listed on the Record Form. Record each response in the space provided to the right of each question. Ask all of the questions even if the answer was provided as part of the free recall.

Directions for the List Recall Subtest

Turn to page 5 of the Record Form. Say to the respondent:

> ***Remember that list of words that you learned a few minutes ago? Tell me as many of those words as you can remember. Begin.***

Record the responses in the column labeled Recall Trial in the same manner as during the List Learning subtest. Then say to the respondent: ***Now tell me the words in the list that were the names of Countries.***

Record the responses in the column labeled Cued Recall Trial. In a similar manner, ask the respondent to recall the list words that were the names of ***Colors, Birds,*** and ***Cities.*** Record all responses in the column labeled Cued Recall Trial. If the respondent does not recall all 12 words during the Cued Recall trial, proceed with the directions below; otherwise, proceed to the Verbal Span subtest.

If the client fails to recall all 12 words on cued recall, place Respondent Sheet 1 in front of the respondent with Side A facing up, along with a pencil. Say:

> ***Here are some pairs of words. One word in the pair was on the list that we have been practicing; the other word was not. Circle the word that was on the list.***

When the task is completed, set the Respondent Sheet and pencil aside before proceeding.

Directions for the Verbal Span Subtest

Numbers Forward. Turn to page 6 of the Record Form and say to the respondent:

> ***I am going to say a series of numbers for you to remember. When I am finished, I want you to say them in the exact order in which I said them.***

Read each series of numbers at a rate of one number per second. Record correct recall by circling the number to the right of the series. Record incorrect recall by marking a line through the number to the right of the series. Discontinue administration if the subject fails both trials of a series.

Numbers Backward. Say to the respondent:

> ***Again I am going to say a series of numbers. This time when I am finished, I want you to say them in the reverse order in which I said them.***

Use the same presentation rate and recording procedures as in Numbers Forward. If the respondent repeats the numbers in the same order as they were presented, remind the respondent to say them backwards. Readminister the same trial until the respondent understands that the numbers are to be repeated backwards. Mark the readministered trial as incorrect. Discontinue administration if the subject fails both trials of a series.

Directions for the Visual Span Subtest

Open the easel apparatus of the Stimulus Card Set so that it is stable. Place it on a flat surface with the front cover facing the respondent in such a way as to assure that the respondent cannot see the back portion of the easel. Turn to the Visual Span section to expose the Visual Span sequence key to the exam-

iner. Flip the cards from front to back until the sequence key faces the examiner.

Remove the Visual Span stimulus card from the pocket of the Stimulus Card Set. Place the stimulus card in front of the respondent in the same orientation as the sequence key when viewed by the examiner. The letter "E" on the stimulus card will be closest to the examiner while the letter "R" will be closest to the respondent when the card is properly oriented. Turn to page 7 of the Record Form. Say:

Here is a pattern of stars. I will touch a series of them with my pencil. Watch closely because when I am finished, I want you to touch the same stars in the same order that I did.

Using the numbered sequence key as a guide, touch the numbered stars at a rate of one per second in the order given in the Record Form. Use the eraser end of the pencil when touching the stimulus card to avoid marring the card.

Record correct recall by circling the number to the right of the series in the Record Form. Record incorrect recall by marking a line through the number to the right of the series. Discontinue administration if the subject fails both trials of a series. After administration is completed, return the Visual Span stimulus card to its pocket in the Stimulus Card Set.

Directions for the Visual Recognition Subtest

Sample Item. Place the Stimulus Card Set directly in front of the respondent. Turn to the section labeled Visual Recognition and say to the respondent: ***Now I am going to show you some designs that I want you to remember.*** Turn the first card over to reveal the Sample target design and say:

First, I will show you a design like this for a short time. Try to remember it and keep it in your mind. Look at it now.

Allow the respondent to view the design for 5 seconds. Then say: ***Now I would like you to work on this matching task.*** Turn over the next card to expose the visual distractor designs. Say:

I want you to count the number of designs below that match this top design (point to the design at the top of the card). ***See, here is one that matches right here*** (point to the first design that matches the top design). ***After a time I will say stop and ask how many matching designs you counted. Go ahead and count them now.***

Expose the distractor designs for 15 seconds and then say: ***Stop. How many matching designs did you count?*** After the respondent reports the number, say: ***Next I will show you a design like this.*** Turn over the next card to expose the test design. Say:

I want you to tell me if it is the same or different from the design that I showed you before I asked you to count. Is this the same or different from the one I showed you before?

Do not record the responses to the sample. The example task may be repeated until the examiner is certain that the respondent understands the nature of the task.

Items 1 through 5. Turn to the target figure of item 1 and say: ***Look at this design.*** Expose the design for 5 seconds. Turn to the distractor designs and say: ***Begin counting the matching designs.*** Expose the distractor designs for 15 seconds. Say to the respondent: ***Stop. How many did you count?*** Record this response in the space provided in the Record Form. Turn to the test design and say: ***Is this the same or different from the one I showed you before you started counting?*** Record the response in the space provided next to each item in the Record Form. Enter the letter "S" for "Same" and "D" for "Different."

Items 6 through 10. Present the target design and distractor designs in the same manner as items 1 through 5. However, when presenting the test designs, say: ***Now, which one of these five designs is the one I showed you before? Point to it.***

When the test designs for these items are exposed to the respondent, a location key for each response choice is also exposed to the examiner. Locations are labeled A through E and correspond to the locations of the designs as seen by the respondent. When the respondent points to a design, record the letter corresponding to the respondent's choice under the column in the Record Form labeled Figure Selected.

Directions for the Visual Reproduction Subtest

Return the pencil and Respondent Sheet 1 to the respondent with Side B facing up. Turn to the Visual Reproduction section of the Stimulus Card Set. Turn to page 8 of the Record Form. Say:

Now instead of asking you to recognize the designs, I want you to draw them for me. Draw the first one right here (point to the section of the Respondent Sheet labeled Drawing A) ***when I tell you to.***

Turn to the target design of the first item and say: ***Look at this design.*** Expose the design for 10 seconds. Turn to the distractor designs and say: ***Begin counting the matching designs.*** Present the distractor designs for 15 seconds. Turn over the next

card, which is blank, to cover the distractor designs, and say: ***Stop. How many did you count?*** Record this number in the space provided in the Record Form.

Then say: ***Now draw the design I showed you before you counted right here*** (point to the section of the Respondent Sheet labeled Drawing A).

Repeat this procedure for Drawing B, using the space labeled Drawing B on the Respondent Sheet. Retrieve the pencil and Respondent Sheet before continuing to the Names–Faces subtest.

Ideally, the respondent should spontaneously produce drawings which have some minimal likeness to the design. In the case when the respondent reports no memory of the design, the respondent should be strongly encouraged to draw anything about the design that can be remembered. If the respondent still reports being unable to remember anything about the figure, the trial should be repeated. When a trial is repeated, place an "X" in the space provided on the Record Form. If the subject is still unable to draw any part of the figure, present the trial without administering the distraction task. Make a note that the distractor task was omitted from the trial.

Directions for the Names–Faces Subtest

Turn to the Names–Faces Learning Series A section in the Stimulus Card Set. Say to the respondent:

I am going to show you 10 photographs of people. I'll tell you the name of each person as I show you the photograph. After I show you all 10, I will show you the photos again and ask you to tell me the name of the person.

Turn the first card over to expose the first photo in the series. When the photo is exposed to the respondent, the associated name is also exposed to the examiner. Read the name to the respondent and allow the respondent to view the photo for 5 seconds. Continue this procedure for all 10 photos. At the end of Learning Series A turn to the Names–Faces Test Series A and say:

Now I am going to show you each photo again and give you three names. You are to tell me which of the three names belongs with the photo.

Turn over the first card to expose the first photo in the series. When the photo is exposed to the respondent, the three name alternatives are also exposed to the examiner. Read the name alternatives to the respondent and ask: ***Which name belongs with the photo?*** Record the response in the space provided in the Record Form under Test Series A. At the end of Test Series A say to the respondent:

Again I am going to show you the 10 photographs and tell you the name of each person as I show you his or her photo. When I am finished, I will show you each photo and ask you to tell me which of the names belongs with the photo, just as before.

Administer Learning Series B and Test Series B using the same procedure as in Learning Series A and Test Series A, respectively. Record the responses to Test Series B in the corresponding space in the Record Form. Set the Stimulus Card Set to the side at the completion of this subtest.

Directions for the Delayed List Recall Subtest

Turn to page 9 of the Record Form. Say to the respondent:

Remember that list of words that we practiced at the beginning of the test? Tell me as many of those words as you can remember. Begin.

Record the responses, in the same manner as in the List Learning subtest, in the column labeled Recall Trial in the Record Form. Then say to the respondent:

Now tell me the words in the list that were the names of Countries.

Record the responses in the column labeled Cued Recall Trial. In a similar manner, ask the respondent to recall the list words that were the names of ***Colors, Birds,*** and ***Cities.*** Record all responses in the column labeled Cued Recall Trial.

Directions for the Delayed Prose Memory Subtest

Turn to page 10 of the Record Form. Say to the respondent:

Remember the short story that I read to you before? Tell me as much of the story as you can remember now.

If the respondent cannot remember any of the story, say:

It was a story about a bank robbery. Can you tell me anything else about it?

Record the respondent's production verbatim in the space labeled Delayed Free Recall on the Record Form. Then say: ***Now I am going to ask you some questions about the story.*** Ask each of the nine questions listed on the Record Form. Record each response in the space provided to the right of each question. Ask all the questions even if the answer was provided as part of the free recall.

Directions for the Delayed Visual Recognition Subtest

Place Respondent Sheet 2 in front of the

respondent with Side A facing up, along with a pencil. Turn to page 11 of the Record Form. Say:

Both sides of this form contain designs. Some of the designs you have seen before and others you have not. Draw an "X" through the designs that you have seen before. When you have completed this side, turn the sheet over and continue.

When the task is completed, retrieve the Respondent Sheet and pencil before proceeding.

Directions for the Delayed Names–Faces Recall Subtest

Place the Stimulus Card Set in front of the respondent and turn to Test Series C of the Names–Faces subtest. Say to the respondent:

Remember those names and faces we practiced? Just as before, I am going to show you each photo and give you three names. You are to tell me which one of the three names belongs with the photo.

Present the photos and name alternatives in Test Series C and record the responses in the spaces provided in the Record Form.

3

Scoring Procedures

Sample Record Form

For illustration, a completed Record Form is presented in Appendix A.

Scoring of the List Learning Subtest

List Acquisition Score. Turn to page 3 of the Record Form and locate the column labeled Trial 1. For this trial, add the number of words correctly recalled and enter this total in the space beneath the column labeled Correct. Do not include repeated words in this total (if they were recorded). Repeat this procedure for all trials that were administered. Because the respondent may have recalled all 12 words prior to the sixth learning trial, all six trials may not have been administered. For all Learning Trials that were not administered, enter the number 12 in the space labeled Correct at the bottom of each column. Add the Correct scores for all six trials and enter this sum in the space labeled List Acquisition.

Total Intrusions Score. Add the number of intrusions (i.e., words recalled that are not in the learning list) for Trial 1 and enter the total in the space beneath the column labeled Intrusions. Repeat this procedure for all trials that were administered. Add the Intrusions scores only for the trials administered and enter this total in the space labeled Total Intrusions.

Total Clusters Score. Within Trial 1 make an asterisk between words belonging to the same semantic category that were recalled consecutively. The maximum number of asterisks is eight. Count the number of asterisks and enter this total in the space beneath the column labeled Clusters. Repeat this procedure for all trials that were administered. Add the Clusters scores only for the trials administered and enter this total in the space labeled Total Clusters Score.

List Clustering: Acquisition Score. For the trials actually administered, add the Correct scores and enter this number in the space labeled Total Correct Words Recalled on Administered Trials. When all six trials are administered, the score for Total Correct Words Recalled on Administered Trials will equal the score for List Acquisition. Divide the Total Clusters score by the Total Correct Words Recalled on Administered Trials score and round to two decimal places. Enter this number in the space labeled List Clustering: Acquisition.

Scoring of the Prose Memory Subtest

Turn to page 4 of the Record Form. Although the subtest includes a free recall of the story, only responses to the nine cued recall questions are formally scored. Compare the response for question 1 to the scoring key provided in parentheses at the end of the question. If the response is correct, circle the "1" to the right of the response. If the response is incorrect, circle the "0." Repeat this procedure for questions 2 through 9.

In scoring responses, do not penalize the respondent for the use of synonyms or minor embellishments to the answer. For example, "two–thirty" is synonymous for "half past two" and should be scored as a correct response to question 3. Likewise, "put the large bills in the suitcases" would be a correct response to question 5 even though the story detail has been elaborated. Sum the circled numbers and enter this total in the space labeled Immediate Prose Recall.

Scoring of the List Recall Subtest

Turn to page 5 of the Record Form and locate the column labeled Recall Trial. Add the number of words correctly recalled and enter this total in the space beneath the column labeled Correct. Do not include repeated words in this total (if they were

recorded).

Within the column, make an asterisk between words belonging to the same semantic category that were recalled consecutively. The maximum number of asterisks is eight. Count the number of asterisks and enter this total in the space beneath the column labeled Clusters. Divide the Clusters score by the Correct score and round to two decimal places. Enter this number in the space labeled List Clustering: Recall.

Locate the column labeled Cued Recall Trial. Add the number of words correctly recalled and enter this total in the space beneath the column labeled Correct.

If the List Recognition task was administered, locate Side A of Respondent Sheet 1. Using the Learning List presented on the fifth page of the Record Form as a scoring key, count the number of correctly circled words. Enter this total in the space labeled List Recognition at the bottom of Side A of Respondent Sheet 1.

Scoring of the Verbal Span Subtest

Turn to the Numbers Forward section on page 6 of the Record Form. Locate the circled number corresponding to the longest successfully recalled number series. Enter this number in the space labeled Longest Forward. Note that the score is the length of the longest series recalled, not the number of series correctly recalled.

Move to the section labeled Numbers Backward. Locate the circled number corresponding to the longest successfully recalled number series and enter this number in the space labeled Longest Backward. Note that the score is the length of the longest series recalled, not the number of series correctly recalled.

Add Longest Forward and Longest Backward and enter this sum in the space labeled Verbal Span.

Scoring of the Visual Span Subtest

Turn to the Visual Span section on page 7 of the Record Form. Locate the circled number corresponding to the longest successfully recalled visual series. Note that the score is the length of the longest series recalled, not the number of series correctly recalled. Enter this number in the space labeled Visual Span.

Scoring of the Immediate Visual Recognition Subtest

Move to the section labeled Visual Recognition on page 7 of the Record Form. For Item 1, compare the recorded response to the answer given by the scoring key for the item. If the response matches the answer given in the scoring key, circle the "2" under the column labeled Score for this item. If the response does not match, circle the "0." Repeat this procedure for Items 2 through 5. Add the circled numbers under the Score column for Items 1 through 5 and enter this sum in the space labeled Total A.

For Item 6, compare the recorded response to the answers given by the scoring key for the item. If the response matches an answer given in the scoring key, circle the number to the right of the answer that it matches. If there is no match, leave the score blank. Repeat this procedure for Items 7 through 10. Add the circled numbers under the Score column for Items 6 through 10 and enter this total in the space labeled Total B. If no scores were circled (that is, all were blank), enter a "0" in this space. Add the scores for Total A and Total B and enter this sum in the space labeled Immediate Visual Recognition.

Scoring of the Visual Reproduction Subtest

Locate Side B of Respondent Sheet 1. Turn to page 8 of the Record Form and locate the section labeled Visual Reproduction. If an entry has been recorded under Trial Readministered for both Drawing A and Drawing B, a score for the Visual Reproduction subtest cannot be calculated. The drawings that were produced during these trials, however, may provide data for qualitative and process analysis. If an entry has been recorded under Trial Readministered for either Drawing A or Drawing B, a score for the Visual Reproduction subtest may be calculated by prorating. Directions for prorating scores are given below.

Scoring Drawing A. If an entry has been recorded in the Record Form under Drawing A Trial Readministered, do not score Drawing A. Instead, proceed to score Drawing B.

If there is no entry under Drawing A Trial Readministered, proceed as follows: examine the drawing made in the area labeled Drawing A on Respondent Sheet 1. Score the drawing according to the criteria listed below. When using the scoring criteria, the examiner should take into account the influence of poor drawing ability on the reproduction of the figures. Scoring criteria, as well as representative drawing examples, are given in Appendix B. After scoring the drawing, enter the score in the space labeled Score A on the Respondent Sheet.

Scoring criteria. Scores for Drawing A are assigned based on the following criteria:

Score = 0: Incorrect reproduction that does not qualify for a higher level of scoring (examples would be presence of only one circle or only one triangle),
or
miscellaneous shapes,
or
a drawing of the distractor design.

Score = 1: Presence of at least one triangle and one circle without a simple grid,
or
presence of a simple grid alone (the grid need not be accurately reproduced).

Score = 2: Presence of a simple grid and at least one triangle or one circle. The grid need not be accurately reproduced. The circle or triangle need not be properly placed or oriented.

Score = 3: Presence of a correct grid with three horizontal and two vertical lines (vertical lines stop at the intersection with the top and bottom horizontal lines) and at least two triangles and one circle (the circle and triangles need not be correctly located within the grid),
or
presence of a simple grid (need not be accurately produced) with three triangles and one circle (need not be correctly located in the grid).

Score = 4: Presence of a grid with three horizontal and two vertical lines (vertical lines extend beyond the top and bottom horizontal lines) and one circle and three triangles properly located and oriented within the grid,
or
presence of a grid with three horizontal lines and four vertical lines (vertical lines stop at top and bottom horizontal lines and the extra vertical lines are located on sides to form rectangle) and one circle and three triangles properly located and oriented within the grid.

Score = 5: Correct reproduction of the figure. Vertical lines of the grid terminate at the intersection of the top and bottom horizontal lines. Triangles and circle are properly located and oriented within the grid.

Scoring Drawing B. If an entry has been recorded in the Record Form under Drawing B Trial Readministered, do not score Drawing B. Instead, proceed to the directions for prorating Visual Reproduction scores.

If there is no entry under Drawing B Trial Readministered, proceed as follows: examine the drawing made in the area labeled Drawing B on Respondent Sheet 1. Score the drawing according to the criteria listed below. When using the scoring criteria, the examiner should take into account the influence of poor drawing ability on the reproduction of the figures. Scoring criteria, as well as representative drawing examples, are given in Appendix B. After scoring the drawing, enter the score in the space labeled Score B on the Respondent Sheet.

Scoring criteria. Scores for Drawing B are assigned based on the following criteria:

Score = 0: Incorrect reproduction that does not qualify for a higher level of scoring (examples would be a design other than a triangle with interior details),
or
a triangle with no interior design,
or
a circle without a straight vertical line beneath it,
or
reproduction of the distractor design.

Score = 1: a triangle with incorrect interior details,
or
a circle with a straight vertical line beneath it (which may or may not be attached to another shape).

Score = 2: Presence of two figures drawn separately and distinctly, one of which must satisfy the criteria for a score of 1. Neither figure is correctly reproduced.

Score = 3: Presence of at least one of the figures which is correctly reproduced. The second figure may be entirely incorrect.

Score = 4: Presence of both figures with one correctly reproduced. The other is correct except for improper reproduction of the interior details.

Score = 5: Correct reproduction of both figures.

Calculating the Visual Reproduction Score. Add Score A and Score B together and enter this total in the space labeled Visual Reproduction at the bottom of Respondent Sheet 1.

Prorating the Visual Reproduction score. If both Drawing A and Drawing B could not be scored because of readministration, a score for the Visual Reproduction subtest cannot be calculated. If either Drawing A or Drawing B could not be scored because of readministration, a score for the Visual Reproduction subtest may be calculated by prorating based upon the scorable drawing. Locate the score assigned to the scored drawing. Multiply this score by 2 and enter the result in the space labeled Visual Reproduction at the bottom of Respondent Sheet 1. Place

this score in parentheses to indicate that it was obtained by prorating.

Scoring of the Names–Faces Subtest

Move to the Names–Faces section on page 8 of the Record Form. Under Test Series A locate the response to Item 1. Compare the recorded response to the answer given in the Correct Response column for the item. If the response matches the answer given, circle the "1" under the column labeled Score for this item. If the response does not match, circle the "0." Repeat this procedure for Items 2 through 10. Add the circled numbers under the Score column for Items 1 through 10 and enter this sum in the space labeled Total A. Use the same procedure to score items for Test Series B and enter the sum of the scored responses in the space labeled Total B. Add the scores for Total A and Total B together and enter this sum in the space labeled Immediate Names–Faces.

Scoring of the Delayed List Recall Subtest

Turn to page 9 of the Record Form and locate the column labeled Recall Trial. Add the number of words correctly recalled and enter this total in the space beneath the column labeled Correct. Do not include repeated words in this total (if they were recorded). Within the column, make an asterisk between words belonging to the same semantic category that were recalled consecutively. The maximum number of asterisks is eight. Count the number of asterisks and enter this total in the space beneath the column labeled Clusters. Divide the Clusters score by the Correct score and round to two decimal places. Enter this number in the space labeled List Clustering: Delayed Recall.

Locate the column labeled Cued Recall Trial. Add the number of words correctly recalled and enter this total in the space beneath the column labeled Correct.

Scoring of the Delayed Prose Memory Subtest

Turn to page 10 of the Record Form. Although the subtest includes a free recall of the story, only responses to the nine delayed cued recall questions are formally scored. Locate the responses to the Delayed Cued Recall Trial. Compare the response given to question 1 to the scoring key provided in parentheses at the end of the question. If the response is correct, circle the "1" to the right of the response. If the response is incorrect, circle the "0." Repeat this procedure for questions 2 through 9. Do not penalize the respondent for the use of synonyms or minor embellishments to the answer. Sum the circled numbers and enter this total in the space labeled Delayed Prose Recall.

Scoring of the Delayed Visual Recognition Subtest

Locate Respondent Sheet 2 and turn to Side A. Turn to the Delayed Visual Recognition section on page 11 of the Record Form and locate the scoring key. Within the scoring key, locate the column for Figure 1. Circle the number in this column that corresponds to the response given to this figure on the Respondent Sheet. Repeat this procedure for Figures 2 through 10, using the respective columns in the scoring key. Turn to Side B of the Respondent Sheet and score the responses to Figures 11 through 20 in a similar fashion, using the respective columns of the scoring key. After scores for all figures have been recorded in the scoring key area, add the circled values across the row labeled Response: Marked on the scoring key. Enter this sum in the space provided under the column labeled Subtotal. Add the circled values across the row labeled Response: Not Marked and enter this sum in the space provided under the column labeled Subtotal. Add the two Subtotal scores together and enter this sum in the space labeled Delayed Visual Recognition.

Scoring of the Delayed Names–Faces Recall Subtest

Move to the Delayed Names–Faces Recall section on page 11 of the Record Form. Under Test Series C locate the response given to Item 1. Compare the recorded response to the answer given under the Correct Response column for the item. If the response matches the answer given, circle the "1" under the column labeled Score for this item. If the response does not match, circle the "0." Repeat this procedure for Items 2 through 10. Add the circled numbers under the Score column for Items 1 through 10 and enter this sum in the space labeled Delayed Names–Faces.

Completing the Scoring Areas

Once the raw scores have been calculated, they can be transcribed to the first page of the Record Form. Raw subtest scores have been tagged with circled uppercase letters to assist in transcribing them to their respective locations in the Subtest Profile.

Turn to page 3 of the Record Form and locate the raw List Acquisition score. Transcribe this raw score to the appropriate space in the Subtest Profile area. Similarly, transcribe the raw scores for Total Intrusions and List Clustering: Acquisition to their respective locations under the area labeled Verbal Process Scores. Locate the raw score for Immediate Prose Recall on page 4 and transcribe it to its location in the Subtest Profile area.

Turn to page 5 of the Record Form and locate the column labeled Recall Trial. At the bottom of the col-

umn, locate the raw score labeled Correct. Transcribe this score to the Subtest Profile area labeled List Recall. Transcribe the raw score labeled List Clustering: Recall to the respective location under Verbal Process Scores. Locate the column labeled Cued Recall Trial. Transcribe the Correct score under this column to the raw score area labeled Cued List Recall: Recall under Verbal Process Scores.

Turn to page 6 of the Record Form. Locate the raw score for Verbal Span and transcribe it to the respective location in the Subtest Profile area. Turn to page 7 and locate the raw scores for Visual Span and Immediate Visual Recognition. Transcribe these scores to their respective locations in the Subtest Profile area. Turn to page 8 of the Record Form and locate the raw score for Immediate Names–Faces. Transcribe this score to its location in the Subtest Profile area.

Turn to page 9 of the Record Form and locate the column labeled Recall Trial. At the bottom of the column, locate the raw score labeled Correct. Transcribe this score to the Subtest Profile area labeled Delayed List Recall. Transcribe the raw score labeled List Clustering: Delayed Recall to the respective location under Verbal Process Scores. Locate the column labeled Cued Recall Trial. Transcribe the Correct score under this column to the raw score area labeled Cued List Recall: Delayed Recall under Verbal Process Scores.

Locate the raw score for Delayed Prose Recall on page 10 of the Record Form and transcribe it to its location in the Subtest Profile area. Turn to page 11 of the form and locate the scores labeled Delayed Visual Recognition and Delayed Names–Faces. Transcribe these raw scores to their respective locations in the Subtest Profile area.

Locate Respondent Sheet 1 and turn to Side A. If the List Recognition task was administered, transcribe the raw List Recognition score to its respective location under Verbal Process Scores. If the task was not administered, place a dash in the location reserved for this raw score. Turn to Side B of Respondent Sheet 1 and locate the score labeled Visual Reproduction. Transcribe this score to its location in the Subtest Profile area. If no score could be derived for this subtest, place a dash in its raw score location in the Subtest Profile area.

Converting to Standardized Scores

Before converting the raw scores to standardized scores, the examiner must select which of the three MAS normative bases provides for the most meaningful comparisons. Normative data are provided in Appendixes C, D, and E. Descriptions of the normative bases and suggestions for selection are presented in Chapters 6 and 7, respectively.

Turn to the appropriate table in the selected Appendix. Record the number of the table or a brief description of the table title in the space labeled Normative Table on the first page of the Record Form. Locate the column labeled Verbal Span in the normative subtable labeled Subtests. Within the column, locate the raw score that corresponds to the raw Verbal Span score as entered in the profile. Move to the left or right of the table to locate the corresponding scale score. Transcribe the scale score to its respective location in the Subtest Profile area. Continue this procedure in an analogous manner for the remaining MAS subtests. If the raw score for Visual Reproduction was obtained by prorating, place the corresponding scale score in parentheses also.

Locate the subtable labeled Verbal Process Scores in the Appendix. Within the column labeled Total Intrusions, locate the range in which the raw Total Intrusions score falls. Move to the left or right to locate the percentile range and associated statistical interpretation. Place an "X" in the space under the corresponding statistical interpretation column on the first page of the Record Form. Repeat this process in an analogous manner for the remaining Verbal Process scores.

Calculating Summary Scale Scores

Locate the Summary Scales area on the first page of the Record Form. Transcribe the Verbal Span and Visual Span scale scores from the Subtest Profile area to their respective spaces in the Summary Scales area. Add the two scale scores together and enter this sum in the area labeled Total I + II. Similarly, transcribe the List Recall and Immediate Prose Recall scale scores to their respective spaces in the Summary Scales area. Add the two scale scores together and enter this sum in the area labeled Total III + IV. Use an analogous procedure to calculate the sum of the Visual Reproduction and Immediate Visual Recognition subtest scale scores. If a scale score for Visual Reproduction could not be derived, do not calculate this sum. In this case, place a dash in the space labeled Total V + VI. Sum the scale scores for List Recall, Immediate Prose Recall, Visual Reproduction, and Immediate Visual Recognition and enter this total in the space labeled Total III + IV + V + VI. If a scale score for Visual Reproduction could not be derived, do not calculate this score. Instead, place a dash in this space.

Locate the subtable in the selected Appendix labeled Summary Scales and find the column labeled Short–term Memory. Within this column, locate the raw score corresponding to Total I + II. Move to the right to locate the corresponding standard score and percentile. Enter the standard score in the space labeled Short–term Memory in the Summary Scales area on the first page of the Record Form. Use an analogous procedure to locate and record the standard scores for the remaining Summary Scales and the Global Memory Scale. If the scale score for Visual

Reproduction was based on prorating, place the Visual Memory score and Global Memory Scale score in parentheses.

When locating the standard scores of the Global Memory Scale, the examiner may have noted that the standard score of the Global Memory Scale may be more extreme than the standard scores associated with either the Verbal Memory Scale or the Visual Memory Scale, of which it is composed. This situation typically occurs with extremely high or low scores on both the Visual and Verbal Memory Scales. While the Global Memory Scale represents a composite of the Verbal Memory and Visual Memory Scales, extreme scores on both Verbal Memory and Visual Memory occur less frequently in the normal population than extreme scores on either scale alone. Thus, scores on the Global Memory Scale are not distributed as the average of Verbal Memory and Visual Memory Scale scores but, rather, have their own distribution.

Plotting the MAS Subtest Profile

To plot the respondent's performance on the MAS subtests, return to the Subtest Profile area. For each scale score listed at the top of the Profile, locate the line in the respective column that corresponds to the scale score and mark it with an "X." Scale scores are located at the extreme left and right of the Profile area. After all scores have been marked on the Profile, connect the "X"s with a line. Do not cross over any vertical lines when connecting the "X"s.

3

Normative Information

Normative Sample

Normative data for the MAS were collected from 843 adults. Normative subjects were recruited through newspaper advertisements and announcements to local community groups. Only subjects without a history of neurological disease or chronic substance abuse were accepted for participation. Examiners were graduate students or licensed psychologists trained in the administration of the MAS by the test author. Of the total sample, 361 subjects were men and 482 were women. Ages ranged from 18 to 90 years. This sample was used to derive three sets of normative tables. A subsample of 467 subjects was selected to provide norms based on U.S. population characteristics. The total sample was used to derive norms based on age decade and on age and education level.

A random, stratified sampling procedure was used to select the subsample of 467 subjects who would reflect the distribution of the U.S. population, classified by age and gender and by age and education characteristics. This sample was comprised of 221 men and 246 women. Census data for 1995 middle–series projections of the U.S. population were used in determining age and gender distributions (U.S. Department of Commerce, 1984). Middle–series projections for 1995 were thought to provide the best current and near–future representations of these population characteristics. Census data describing educational attainment in the U.S. population in 1987 were used to determine distributions by education (U.S. Department of Commerce, 1988). The 1987 data represent the most current descriptive information on educational attainment available at the present time. Table 1 presents the U.S. census and census–matched normative sample proportions. MAS raw score means and standard deviations for the U.S. census–matched sample are presented in Table 2.

Based on the results of regression analyses examining the influence of demographic characteristics on MAS scores (see Chapter 10) and on the desire to provide comparability with other tests of neuropsychological functioning, normative data were derived from the sample of 843 normal subjects classified according to age decade. Subjects were grouped into the following age categories: 18–29 years old, 30–39 years old, 40–49 years old, 50–59 years old, 60–69 years old, and 70 years of age and older. Table 3 presents descriptive statistics for the raw MAS scores based upon this classification.

The normal sample of 843 subjects was also divided into groups based on age and years of education. Regression analyses revealed these two demographic characteristics to have significant relationships to MAS scores (see Chapter 10). Results revealed no differences among the age groups of 18–29 years, 30–39 years, and 40–49 years. These groups were therefore combined. The four resultant age groups were each subdivided into three groups according to years of education: less than or equal to 11 years, 12 years (high school graduate), and equal to or greater than 13 years. Table 4 presents the descriptive statistics for this breakdown.

Normative Data

Separate normative data were derived for the U.S. census–matched sample and for the total normative sample classified by age decade and by age and education level. These data are presented in Appendixes C, D, and E, respectively. Chapter 10 presents a complete discussion of the procedures used to derive these normative data.

Standard Error of Measurement

The standard error of measurement (SE_M) was

Table 1

Percent of United States Census–matched MAS Normative Sample by Age and Gender and by Age and Education

Variable	Age group							
	18–49		50–59		60–69		70+	
	MAS sample	U.S. census	MAS sample	U.S. census	MAS sample	U.S. census	MAS sample	U.S. census
Gender								
Male	32.1	32.3	6.0	6.2	4.5	4.7	4.7	4.7
Female	32.5	32.1	6.7	6.7	5.6	5.5	7.8	7.8
Education								
Less than 12 years	10.8	10.7	3.2	3.5	3.7	3.7	6.0	6.1
12 years	26.5	26.4	5.4	5.3	3.9	3.8	3.9	3.9
Greater than 12 years	27.4	27.3	4.1	4.1	2.6	2.6	2.6	2.6

Note. $N = 467$. Proportions for age and gender were based on middle series projected data for 1995 as given in Table 6, U.S. Department of Commerce, Bureau of the Census, 1984, *Projections of the population of the United States, by age, sex, and race: 1983 to 2080* (Series P-25, No. 952), Washington, DC: U.S. Government Printing Office. Proportions for education were based on 1987 summary data given in Table 1, U.S. Department of Commerce, Bureau of the Census, 1988, *Educational attainment in the United States: March 1987 and 1986* (Series P-20, No. 428), Washington, DC: U.S. Government Printing Office.

calculated for the MAS subtests, Summary Scales, and Global Memory Scale. These calculations were performed for each normative base. Table 5 presents these data. Chapter 9 presents a detailed presentation of the methods used in calculating the SE_M.

Differences Between Global Memory Scale Scores and IQ Scores

The differences required for significance between the Global Memory Scale standard score and the Full Scale IQ score obtained on the Wechsler Adult Intelligence Scale—Revised (WAIS–R; Wechsler, 1981) were derived for each normative base. These values are the differences required between the two scores to achieve significance at the .05 level. Table 6 presents these values. Calculation of the difference scores is discussed in Chapter 9.

Base rates or frequency of occurrence for Summary Scale differences in the normative sample of 843 were also examined. In addition to the MAS, a subset of 471 subjects received the Satz–Mogel short–form administration (Satz & Mogel, 1962) of the WAIS–R, which was used to derive an estimate of Full Scale IQ score. Direction of the difference was ignored when computing the base rates. Base rates for Global Memory Scale less than Full Scale IQ, however, were also calculated because of the diagnostic interest in making this comparison. Table 7 presents these data.

Differences Among Summary Scale Scores

Minimum differences between pairs of Summary Scale scores required for significance also were calculated. These values are the differences required between two MAS Summary Scale scores to be significant at the .05 level. Summary Scale score differences are presented in Table 6. Chapter 9 contains a description of how these differences were derived.

Table 2

Means and Standard Deviations of MAS Scores for the U.S. Census–matched Normative Sample

MAS variable	*N*	Mean	Standard deviation
Verbal Span	466	11.53	2.24
Visual Span	421	5.26	1.14
List Acquisition	467	58.28	10.63
List Recall	467	10.10	2.10
Delayed List Recall	420	10.83	1.92
Immediate Prose Recall	467	5.80	1.83
Delayed Prose Recall	423	5.59	1.88
Immediate Names–Faces	426	16.47	3.37
Delayed Names–Faces	426	8.59	1.87
Visual Reproduction	467	5.94	2.45
Immediate Visual Recognition	467	16.54	3.07
Delayed Visual Recognition	423	17.65	1.90
Total Intrusions	467	2.96	4.73
List Clustering: Acquisition	466	0.26	0.15
List Clustering: Recall	466	0.32	0.20
List Clustering: Delayed Recall	388	0.42	0.22
Cued List Recall: Recall	465	10.15	2.48
Cued List Recall: Delayed Recall	416	11.09	1.64
List Recognition	248	11.83	0.97
Short–term Memory	421	19.23	5.07
Verbal Memory	467	18.87	5.05
Visual Memory	467	18.74	5.21
Global Memory Scale	467	37.62	9.00

Differences Among Subtest Scores

Significant differences between pairs of MAS subtest scale scores were also calculated. These values are the differences required between two MAS subtest scale scores to achieve significance at the .05 level. Pairwise scale score differences were calculated for each of the normative bases. Tables 8, 9, and 10 present these data for the U.S. census–matched, age decade, and age and education normative bases, respectively.

Verbal Process Scores

Normative data for the Verbal Process Scores were determined by calculating raw score ranges for two categories: scores equal to or less than the 16th percentile (1 *SD* from the mean) and scores greater than the 16th percentile. Normative data were derived separately for each of the three normative bases. These data are presented in Appendixes C, D, and E for the U.S. census–matched sample, age decade classification, and age and education classification, respectively. Complete discussion of how these data were derived is presented in Chapter 10.

Table 3

Means and Standard Deviations of MAS Scores for the Normative Sample by Age Decade

	Age decade					
MAS variable	18–29 *n* = 107	30–39 *n* = 71	40–49 *n* = 153	50–59 *n* = 166	60–69 *n* = 190	70 + *n* = 156
Verbal Span						
Mean	12.20	11.25	11.75	11.69	11.38	10.62
Standard deviation	2.46	2.28	2.04	2.21	1.86	2.15
Visual Span						
Mean	5.51	4.92	5.47	5.29	5.34	4.76
Standard deviation	1.12	0.79	1.21	1.17	1.11	1.15
List Acquisition						
Mean	59.37	57.62	60.88	60.88	58.66	50.55
Standard deviation	10.79	10.30	9.63	8.55	10.56	12.40
List Recall						
Mean	10.30	9.94	10.40	10.58	10.08	8.65
Standard deviation	1.82	2.10	1.98	1.67	2.17	2.78
Delayed List Recall						
Mean	10.91	10.92	11.29	11.26	11.15	9.75
Standard deviation	1.67	1.44	1.30	1.36	1.53	2.85
Immediate Prose Recall						
Mean	5.63	5.47	6.16	6.05	6.21	5.38
Standard deviation	1.77	1.98	1.74	1.72	1.74	1.86
Delayed Prose Recall						
Mean	5.23	4.85	6.11	6.11	6.24	5.27
Standard deviation	1.82	1.99	1.79	1.73	1.64	1.84
Immediate Names–Faces						
Mean	16.93	15.25	17.64	17.11	16.66	15.07
Standard deviation	2.93	4.17	2.37	2.81	3.22	3.41
Delayed Names–Faces						
Mean	8.75	8.20	9.15	8.88	8.70	7.91
Standard deviation	1.92	1.96	1.33	1.44	1.61	2.02
Visual Reproduction						
Mean	6.37	4.90	6.59	6.00	5.61	4.11
Standard deviation	2.44	2.47	2.17	2.38	2.36	2.09
Immediate Visual Recognition						
Mean	17.71	16.65	17.30	16.49	15.74	13.47
Standard deviation	2.41	2.86	2.64	2.94	3.00	3.41
Delayed Visual Recognition						
Mean	18.70	18.09	17.91	17.58	16.95	15.75
Standard deviation	1.39	1.82	1.49	1.63	1.68	2.21
Total Intrusions						
Mean	2.95	2.86	2.54	2.28	2.12	3.67
Standard deviation	4.62	4.14	4.42	3.49	4.06	4.74

Table 3 (Continued)

Means and Standard Deviations of MAS Scores for the Normative Sample by Age Decade

MAS variable	Age decade					
	18–29 $n = 107$	30–39 $n = 71$	40–49 $n = 153$	50–59 $n = 166$	60–69 $n = 190$	70+ $n = 156$
List Clustering: Acquisition						
Mean	0.23	0.26	0.27	0.28	0.26	0.26
Standard deviation	0.15	0.14	0.14	0.16	0.15	0.15
List Clustering: Recall						
Mean	0.30	0.31	0.35	0.37	0.32	0.29
Standard deviation	0.19	0.20	0.19	0.21	0.21	0.19
List Clustering: Delayed Recall						
Mean	0.38	0.38	0.47	0.50	0.44	0.39
Standard deviation	0.22	0.22	0.22	0.18	0.22	0.22
Cued List Recall: Recall						
Mean	9.85	9.45	10.45	10.10	10.51	9.57
Standard deviation	2.75	2.85	2.60	3.20	2.28	2.31
Cued List Recall: Delayed Recall						
Mean	11.02	10.90	11.49	11.48	11.34	10.08
Standard deviation	1.47	1.59	1.13	1.15	1.59	2.66
List Recognition						
Mean	12.00	12.00	11.91	11.42	11.64	11.39
Standard deviation	0.00	0.00	0.37	2.56	1.05	2.00
Short–term Memory						
Mean	19.33	16.32	18.91	19.48	19.85	18.60
Standard deviation	5.12	4.62	4.86	5.37	4.42	5.46
Verbal Memory						
Mean	19.12	17.10	18.88	19.16	19.73	18.42
Standard deviation	5.32	5.11	4.61	4.38	4.87	5.62
Visual Memory						
Mean	19.72	16.27	19.44	19.36	19.90	18.35
Standard deviation	5.14	5.38	4.74	4.96	5.26	5.93
Global Memory Scale						
Mean	38.84	33.37	38.32	38.55	39.63	36.77
Standard deviation	9.00	9.30	8.10	7.70	8.74	10.21

Note. Of the 843 subjects in the total sample, scores for all subtests were available for 677. The majority of missing scores occur on the List Recognition subtest, which is not administered when a subject obtains a score of 12 for Cued List Recall.

Table 4

Means and Standard Deviations of MAS Scores for the Normative Sample by Age and Education

MAS variable	Age group: 18–49, Education (Years) ≤11 $n=55$	12 $n=149$	≥13 $n=127$	50–59, Education (Years) ≤11 $n=28$	12 $n=55$	≥13 $n=83$	60–69, Education (Years) ≤11 $n=45$	12 $n=62$	≥13 $n=83$	70+, Education (Years) ≤11 $n=52$	12 $n=31$	≥13 $n=73$
Verbal Span												
Mean	10.71	11.75	12.30	10.75	11.39	12.22	10.84	11.42	11.63	9.81	10.68	11.18
Standard deviation	1.83	2.40	2.08	1.90	2.09	2.27	1.70	1.92	1.87	1.87	1.96	2.25
Visual Span												
Mean	4.88	5.37	5.60	5.10	5.51	5.20	5.09	5.23	5.54	4.35	4.83	5.09
Standard deviation	1.01	1.07	1.18	1.00	1.00	1.33	0.88	1.10	1.17	1.01	0.89	1.27
List Acquisition												
Mean	50.98	59.30	63.93	53.50	60.58	63.57	52.20	60.42	60.86	42.92	51.71	55.48
Standard deviation	11.86	9.63	7.24	11.48	6.94	6.80	13.47	9.19	8.17	11.91	10.59	10.80
List Recall												
Mean	9.22	10.27	10.72	9.26	10.69	10.93	8.69	10.40	10.60	7.15	9.23	9.48
Standard deviation	2.14	1.98	1.68	2.25	1.43	1.39	2.67	1.91	1.69	2.99	2.29	2.39
Delayed List Recall												
Mean	10.08	11.15	11.49	9.91	11.34	11.70	10.03	11.44	11.44	7.92	10.04	11.12
Standard deviation	2.22	1.18	1.05	2.36	0.88	0.68	2.58	0.90	0.97	3.48	2.35	1.29
Immediate Prose Recall												
Mean	4.73	5.92	6.22	5.57	6.02	6.24	5.53	6.13	6.64	4.58	5.55	5.88
Standard deviation	1.77	1.91	1.54	1.57	1.80	1.70	2.13	1.82	1.27	1.85	1.50	1.83
Delayed Prose Recall												
Mean	4.43	5.51	6.15	5.19	6.31	6.29	5.58	6.19	6.57	4.26	5.59	5.97
Standard deviation	1.80	1.96	1.64	1.57	1.73	1.70	1.71	1.94	1.24	1.88	1.45	1.61
Immediate Names–Faces												
Mean	14.71	16.65	18.29	15.13	16.24	18.31	14.60	16.90	17.47	13.00	15.19	16.54
Standard deviation	3.58	3.12	2.07	3.42	2.62	2.09	2.58	3.67	2.72	3.10	3.50	2.78
Delayed Names–Faces												
Mean	7.61	8.75	9.49	7.52	8.70	9.43	7.60	8.77	9.17	6.52	8.19	8.81
Standard deviation	2.00	1.81	0.97	1.73	1.36	1.02	1.30	1.96	1.17	2.05	1.68	1.55
Visual Reproduction												
Mean	4.36	6.01	7.10	4.50	6.07	6.46	4.13	5.73	6.33	3.30	4.03	4.73
Standard deviation	2.05	2.41	2.07	2.27	2.28	2.30	2.09	2.18	2.28	2.15	1.80	1.97
Immediate Visual Recognition												
Mean	16.13	17.20	17.91	15.36	16.55	16.83	14.20	15.95	16.42	11.92	13.23	14.69
Standard deviation	2.91	2.69	2.25	3.37	2.83	2.80	3.31	2.66	2.79	3.38	3.41	2.97
Delayed Visual Recognition												
Mean	17.90	18.19	18.41	17.43	17.34	17.80	16.33	17.19	17.06	15.02	15.55	16.43
Standard deviation	1.77	1.65	1.33	1.43	1.59	1.72	1.47	1.64	1.74	2.22	2.59	1.78
Total Intrusions												
Mean	4.93	2.26	2.36	4.04	2.27	1.69	4.36	1.94	1.05	5.65	2.97	2.55
Standard deviation	6.07	3.80	3.99	4.98	3.87	2.26	6.21	3.80	1.63	5.41	3.71	4.18
List Clustering: Acquisition												
Mean	0.21	0.24	0.29	0.19	0.27	0.32	0.23	0.27	0.27	0.21	0.27	0.29
Standard deviation	0.10	0.14	0.16	0.10	0.16	0.16	0.09	0.16	0.17	0.11	0.14	0.16
List Clustering: Recall												
Mean	0.32	0.30	0.36	0.26	0.37	0.41	0.29	0.33	0.33	0.23	0.27	0.34
Standard deviation	0.14	0.19	0.20	0.16	0.21	0.21	0.18	0.20	0.22	0.18	0.18	0.19
List Clustering: Delayed Recall												
Mean	0.33	0.41	0.48	0.36	0.49	0.60	0.39	0.46	0.46	0.31	0.38	0.45
Standard deviation	0.19	0.22	0.23	0.17	0.18	0.14	0.18	0.21	0.24	0.20	0.23	0.21
Cued List Recall: Recall												
Mean	9.27	10.25	10.13	9.14	9.96	10.53	9.42	10.83	10.88	8.23	9.94	10.37
Standard deviation	2.20	2.27	3.33	3.41	3.39	2.94	2.41	1.77	2.39	2.54	1.97	1.81
Cued List Recall: Delayed Recall												
Mean	10.04	11.31	11.65	10.38	11.61	11.82	10.28	11.76	11.52	8.43	10.52	11.28
Standard deviation	2.13	1.08	0.80	2.06	0.70	0.55	2.14	0.66	1.57	2.98	1.93	1.87

Table 4 (Continued)

Means and Standard Deviations of MAS scores for the Normative Sample by Age and Education

MAS variable	Age group											
	18–49			50–59			60–69			70+		
	Education (Years)			Education (Years)			Education (Years)			Education (Years)		
	≤11 $n=55$	12 $n=149$	≥13 $n=127$	≤11 $n=28$	12 $n=55$	≥13 $n=83$	≤11 $n=45$	12 $n=62$	≥13 $n=83$	≤11 $n=52$	12 $n=31$	≥13 $n=73$
List Recognition												
Mean	12.00	11.99	11.92	12.00	10.53	12.00	11.62	11.60	11.78	11.34	10.80	11.91
Standard deviation	0.00	0.10	0.36	0.00	3.97	0.00	1.16	0.97	0.67	1.90	3.26	0.30
Short–term Memory												
Mean	17.51	19.58	19.12	19.05	20.07	18.46	20.58	19.94	19.69	18.65	18.97	18.53
Standard deviation	4.98	5.45	4.40	5.61	5.30	5.61	3.91	4.52	4.61	4.67	4.73	5.72
Verbal Memory												
Mean	17.36	19.59	18.10	18.85	19.96	18.53	18.84	20.50	19.51	17.73	19.87	18.64
Standard deviation	4.60	5.19	5.23	5.07	4.60	4.83	6.42	4.93	3.92	5.42	4.70	5.45
Visual Memory												
Mean	17.71	19.09	19.09	18.46	19.80	18.39	18.62	20.48	19.49	19.10	18.19	18.37
Standard deviation	4.95	5.35	4.38	5.28	4.56	4.56	5.31	4.19	4.96	5.46	5.49	5.49
Global Memory Scale												
Mean	35.07	38.69	37.19	37.44	39.76	36.92	37.47	40.98	39.00	36.83	38.07	37.01
Standard deviation	8.37	9.11	8.01	9.51	6.87	7.59	10.67	7.28	7.26	10.14	8.68	9.06

Note. Of the 843 subjects in the total sample, scores for all subtests were available for 677. The majority of missing scores occur on the List Recognition subtest, which is not administered when a subject obtains a score of 12 for Cued List Recall.

Table 5

Standard Error of Measurement

MAS variable	Normative base		
	Census–matched	Age decade	Age and education
Subtest			
Verbal Span	1.37	1.41	1.37
Visual Span	1.53	1.53	1.47
List Acquisition	1.31	1.12	1.27
List Recall	1.53	1.64	1.34
Delayed List Recall	0.90	0.95	1.12
Immediate Prose Recall	0.73	0.67	0.73
Delayed Prose Recall	0.79	0.79	0.79
Immediate Names–Faces	0.85	0.79	0.90
Delayed Names–Faces	0.67	0.79	0.73
Visual Reproduction	0.90	0.95	1.12
Immediate Visual Recognition	1.62	1.50	1.62
Delayed Visual Recognition	0.85	0.95	0.95
Summary Scale			
Short–term Memory	5.20	4.97	4.97
Verbal Memory	4.24	4.24	4.24
Visual Memory	4.50	4.50	5.61
Global Memory Scale	3.35	3.35	3.67

Note. Standard deviation = 3, 15, and 15 for subtests, Summary Scales, and Global Memory Scale, respectively.

Table 6

Significant Differences Between MAS Global Memory Scale and IQ and Between MAS Summary Scales

	Normative base					
	Census–matched		Age decade		Age and education	
	Global Memory Scale		Global Memory Scale		Global Memory Scale	
WAIS-R FSIQ	8.23		8.23		8.74	
	Verbal Memory	Visual Memory	Verbal Memory	Visual Memory	Verbal Memory	Visual Memory
Short–term Memory	13.15	13.48	12.80	13.14	12.80	14.69
Verbal Memory	—	12.12	—	12.12	—	13.78

Note. WAIS-R FSIQ = Full Scale IQ score obtained on the Wechsler Adult Intelligence Scale—Revised (Wechsler, 1981).

Table 7

Base Rates of Differences Between MAS Summary Scales and Between MAS Global Memory Scale and IQ in the Normative Sample

	Standard score difference				
Proportion of Normative Sample	Short–term Memory ≠ Verbal Memory	Short–term Memory ≠ Visual Memory	Verbal Memory ≠ Visual Memory	Global Memory Scale ≠ Full Scale IQ	Global Memory Scale < Full Scale IQ
.50	12	11	11	11	3
.25	21	20	19	18	14
.10	30	29	26	25	23
.05	35	36	31	30	27

Note. $N = 843$. For base rates of differences involving Full Scale IQ, $N = 471$.

Table 8

Significant Differences Between MAS Subtests Based on U.S. Census-matched Normative Data

MAS variable	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition
Visual Span	4.03										
List Acquisition	3.72	3.95									
List Recall	4.03	4.24	3.95								
Delayed List Recall	3.21	3.48	3.12	3.48							
Immediate Prose Recall	3.04	3.32	2.94	3.32	2.27						
Delayed Prose Recall	3.10	3.37	3.00	3.37	2.35	2.11					
Immediate Names–Faces	3.16	3.43	3.06	3.43	2.43	2.20	2.27				
Delayed Names–Faces	2.99	3.27	2.88	3.27	2.20	1.94	2.03	2.12			
Visual Reproduction	3.21	3.48	3.12	3.48	2.49	2.27	2.35	2.43	2.20		
Immediate Visual Recognition	4.16	4.37	4.08	4.37	3.63	3.48	3.53	3.59	3.44	3.63	
Delayed Visual Recognition	3.16	3.43	3.06	3.43	2.43	2.20	2.27	2.36	2.12	2.43	3.59

Note. Significant difference = $1.96\sqrt{SE_{M_A}{}^2 + SE_{M_B}{}^2}$.

Table 9

Significant Differences Between MAS Subtests Based on Age Decade Normative Data

MAS variable	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition
Visual Span	4.08										
List Acquisition	3.53	3.72									
List Recall	4.24	4.40	3.89								
Delayed List Recall	3.33	3.53	2.88	3.71							
Immediate Prose Recall	3.06	3.27	2.56	3.47	2.28						
Delayed Prose Recall	3.17	3.37	2.69	3.57	2.42	2.03					
Immediate Names–Faces	3.17	3.37	2.69	3.57	2.42	2.03	2.19				
Delayed Names–Faces	3.17	3.37	2.69	3.57	2.42	2.03	2.19	2.19			
Visual Reproduction	3.33	3.53	2.88	3.71	2.63	2.28	2.42	2.42	2.42		
Immediate Visual Recognition	4.03	4.20	3.67	4.36	3.48	3.22	3.32	3.32	3.32	3.48	
Delayed Visual Recognition	3.33	3.53	2.88	3.71	2.63	2.28	2.42	2.42	2.42	2.63	3.48

Note. Significant difference = $1.96\sqrt{SE_{M_A}{}^2 + SE_{M_B}{}^2}$.

Table 10

Significant Differences Between MAS Subtests Based on Age and Education Normative Data

MAS variable	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition
Visual Span	3.94										
List Acquisition	3.66	3.81									
List Recall	3.76	3.90	3.62								
Delayed List Recall	3.47	3.62	3.32	3.42							
Immediate Prose Recall	3.04	3.22	2.87	2.99	2.62						
Delayed Prose Recall	3.10	3.27	2.93	3.05	2.69	2.11					
Immediate Names–Faces	3.21	3.38	3.05	3.16	2.82	2.27	2.35				
Delayed Names–Faces	3.04	3.22	2.87	2.99	2.62	2.02	2.11	2.27			
Visual Reproduction	3.47	3.62	3.32	3.42	3.10	2.62	2.69	2.82	2.62		
Immediate Visual Recognition	4.16	4.29	4.03	4.12	3.86	3.48	3.53	3.63	3.48	3.86	
Delayed Visual Recognition	3.27	3.43	3.11	3.22	2.88	2.35	2.42	2.56	2.35	2.88	3.68

Note. Significant difference = $1.96\sqrt{SE_{M_A}{}^2 + SE_{M_B}{}^2}$.

7

Interpretation

Normative Comparisons

Clinical evaluations of memory function typically address one or both of two questions. The first question addresses the subject's functional level of cognitive ability. This question is often raised because of a need to determine whether the subject can meet the demands of life—returning to a particular type of employment, coping with a self–medication regime, or executing a will. The second question addresses the specifics of the diagnosis of memory disorder resulting from brain illness or injury. The MAS was designed to provide reliable information relevant to both questions. The MAS subtests allow the examiner to evaluate and contrast performance on tests of short–term, verbal, and nonverbal (figural, visual–spatial) memory abilities using a variety of recall and recognition formats. However, the use of appropriate normative data when making these comparisons is crucial.

Normalized scale and standard scores are used to interpret an individual's performance on the MAS. MAS subtest scale scores, which are normalized transformations of the raw subtest scores, have been constructed to have a mean of 10 and a standard deviation of 3. Scale scores provide information about the person's score relative to the scores of people in the normative sample. For example, a scale score of 12 would indicate that the person's score exceeds those of 75% of the subjects comprising the normative sample. Scale scores at or below 3 (i.e., equal to or less than the 1st percentile) are considered significant or in the impaired range of functioning. Scores in the range of 4 through 6 are suggestive of impairment and fall within the borderline range of performance. Scale scores of 7 or greater are considered to be within the normal range of performance.

The Global Memory Scale and Summary Scale scores, which also provide information about the respondent's performance relative to subjects in the normative sample, are normalized transformations of the subtest scale scores. Standard scores for these scales have a mean of 100 and a standard deviation of 15. Standard scores at or below 70 (i.e., equal to or less than the 2nd percentile) are considered significant, suggesting an impaired range of functioning. Standard scores in the range of 71 through 85 are suggestive of memory difficulties and fall within the borderline range of performance. Standard scores of 86 or greater are considered to be within the normal range of performance.

Selecting a Normative Table

The normative tables provided in Appendixes C, D, and E enable the MAS examiner to compare a respondent to others in the general population, in the same age group, and in the same age and education group. Choice of which normative table to use for comparison will typically be a function of the underlying reason for the evaluation.

Normative comparisons based on age and education (Appendix E) will probably serve best for most clinical evaluations and be especially valuable in evaluation of elderly individuals. These comparisons allow the examiner to assess memory performance with the normal effects of age and education removed. However, in a variety of evaluation situations, it is important to compare the subject to the general population or to an age–related cohort. For example, in situations where the evaluation focus is on vocational planning or on the individual's ability to return to the workplace, interpretation based on comparisons with general adult norms (Appendix C) may be most appropriate because of the diverse

background of others with whom the respondent will compete for jobs.

Of course, the test user can compute separate profiles based on all three normative tables and evaluate MAS performance based on each one. Because age and education have a different pattern of correlation with the MAS scores, a slightly different profile will emerge from each normative base. For example, scores on subtests measuring visual memory decline more rapidly with increasing age than scores on verbal memory subtests, while a different pattern holds for education.

The derivation of transformed subtest scale, Global Memory Scale, and Summary Scale scores is explained in Chapter 10.

Standard Error of Measurement

The SE_M is a measure of the reliability of a test that is particularly suited for the interpretation of individual scores. It provides an estimate of the standard deviation that would be obtained for a series of measurements for the same individual on a given test. In practical terms, the SE_M indicates that there is approximately a 68% chance that the individual's "true" score on a test will not deviate by more than plus or minus 1 SE_M from his or her obtained score (there is a 99% chance that the "true" score will lie within 2.58 SE_M of the obtained score). The standard errors of measurement for subtest, Global Memory Scale, and Summary Scale scores are provided in Table 5 for the general adult, age peer, and age–education peer groups. As a general rule of thumb, the SE_Ms for subtest, Global Memory Scale, and Summary Scale scores are 2, 4, and 5, respectively.

Global Memory Scale, Summary Scale, and IQ Score Comparisons

Frequently it is of interest to compare differences between overall memory ability and intellectual functioning and to compare differences among various memory abilities themselves. Such comparisons are often necessary to properly describe the nature of memory impairment. Normal intelligence in conjunction with impaired memory is characteristic of an organic amnesic disorder in which the temporal lobe structures have been selectively injured. Also, dementia–related illnesses, such as Alzheimer's disease, commonly show a pattern of memory skills below that of general intellectual skills in the early stages (Joynt & Shoulson, 1985).

Comparison of the Global Memory Scale score and Full Scale IQ score from the WAIS–R can be performed to assist in evaluating intellectual versus memory functioning. A difference of 9 points between the two scores is required to support the hypothesis that the individual's general memory abilities are different from intellectual abilities (see Table 6). Similarly, scores for the Short–term Memory, Verbal Memory, and Visual Memory Summary Scales can be compared using a difference of 14 points as the general guideline required for significance (see Table 6).

Such comparisons should also take into account the base rate of differences of differing magnitudes. Table 7 provides the frequency of occurrence of differences between WAIS–R Full Scale IQs and Global Memory Scale scores (WAIS–R Full Scale IQ minus Global Memory Scale score). Note that when the direction of the difference between the two scores is disregarded, a difference of 11 occurs in 50% of the cases and a difference of 18 occurs in 25% of the cases.

The base rates of differences among the Summary Scale scores are provided in Table 7. As a general guideline for all comparisons, a difference of 12 occurs in 50% of the cases and a difference of 20 occurs in 25% of the cases.

Verbal Process Scores

Verbal Process scores allow more detailed examination of the processes involved in verbal learning and recall.

Intrusions. A high number of intrusions suggests that the respondent is having problems in discriminating relevant from irrelevant responses. The content of the intrusive responses may provide clues as to the type of learning strategy being used by the respondent. Intrusions that are consistent with the semantic categories (e.g., the names of birds that are not on the word list) suggest that the respondent is using semantic clustering as a strategy. Irrelevant intrusions (e.g., the names of fruits or animals) are not uncommonly produced by individuals with memory impairment who are attempting to "satisfy" the examiner by producing responses. Irrelevant intrusions may also be seen in cases where the respondent is not motivated to perform or is attempting to exaggerate self–professed memory problems.

Clustering. List Clustering scores provide measures of the degree to which the respondent uses a learning strategy of organizing words on the List Learning subtest into semantic categories. Clustering can be an effective strategy for learning, since it facilitates encoding and retrieval. Since semantic clustering is a common strategy, low scores suggest that the respondent is using a different, and possibly less effective, learning strategy (such as serial clustering—clustering the list words by their serial position in the list).

Cued Recall. In cases in which performance on free recall subtests (List Recall, Delayed List Recall) is low, examination of Cued List Recall scores may provide hypotheses about the nature of the memory

problem. If the cued recall score is within expectation, problems in retrieval of stored information are suggested. If the cued recall score is low, then deficits in the ability to encode material are suggested.

List Recognition. The List Recognition score also provides information on relative deficits in encoding versus retrieval. When performance on free recall subtests (List Recall, Delayed List Recall) is low, a recognition score within the normal range suggests that the respondent has problems in the retrieval of stored information. If the recognition score is also low, then deficits in the ability to encode material are suggested.

MAS Subtest Profile Interpretation

Analysis of the MAS Subtest Profile can be helpful in describing the individual's pattern of strengths and weaknesses in memory abilities. Comparisons of subtest scores both within and across the major memory areas can help generate hypotheses to explicate results obtained on the Summary Scales. Chapter 6 presents tables showing the differences required for significance for each of the pairwise comparisons of subtest scores. As a general guideline, however, a difference of at least 3 points is required for significance.

Specific, neurologically based memory disorders are associated with characteristic patterns of performance on the MAS. These patterns are readily discernible through visual inspection of the MAS Subtest Profile. Several of these common patterns, along with a case example for each, are presented below. When interpreting MAS scores and profile patterns, the professional must remember that low scores may be a function of a number of "nuisance" variables known to affect performance. Individuals may do poorly on some or all subtests as a result of depression, anxiety, poor motivation, malingering, or other factors unrelated to neurological status.

General Memory Impairment. Poor scores on all MAS subtests suggest general memory impairment. This pattern frequently occurs in neurologically intact individuals who simply perform poorly on memory tests, as well as in individuals suffering from dementia–related illnesses. Demented individuals, however, generally produce lower scores than individuals who are poor test–takers. Scores on measures of short–term memory such as Verbal Span and Visual Span are often relatively better in the demented person, although performance may still not be in the normal range. As the dementia–related illness worsens, the individual may exhibit signs of extreme impairment in other cognitive skills. Qualitatively, for example, repeated words are very common on the List Learning subtest. Drawings from the Visual Reproduction subtest may also show perseverations. Deficits in language comprehension will often be obvious on the List Learning and Prose Memory subtests if the person is extremely impaired.

Case illustration 1. C.R. is an 83–year–old, right–handed female who completed seven years of formal education. She presented with a history of increasing everyday memory problems and judgment errors over the previous eight years. Family members reported that she committed memory errors in a variety of domains. She was unable to remember directions to new places, the names of new acquaintances, and the like. At the time of the evaluation, the family also noticed severe errors in judgment. She could not manage a bank account or checkbook and frequently withdrew cash from the bank which she would then sequester in hiding places about her home. She also hid valuable personal objects, such as her engagement ring, that could not later be found. C.R. became suspicious that other family members were taking these things from her and would not take any responsibility for having misplaced them. The family became increasingly concerned that C.R. would eventually misplace and lose all her money and valuables. Because of her unusual behavior, they brought her to a dementia assessment clinic for evaluation.

As part of the clinical evaluation, C.R. was administered the MAS. Although C.R. completed the battery, she was extremely resistant and needed many prompts and much encouragement to continue. She preferred telling stories about events in her past rather than working on the subtests. She also completed the WAIS–R and basic sensory and motor tests but refused further testing. In addition, C.R. was rated by her husband using the Cognitive Behavior Rating Scales (CBRS; Williams, 1987). These ratings documented the extreme errors in everyday memory, judgment, and planning that were reported informally. Figure 1 presents her MAS scores.

The pattern of test findings suggests extremely poor overall memory ability (Global Memory Scale = 74). Short–term, verbal, and visual memory abilities were all in the impaired or low borderline range (Short–term Memory = 53, Verbal Memory = 75, and Visual Memory = 77). As seen in her Subtest Profile, scores on all subtests were uniformly low. Qualitatively, her performance on the List Learning task revealed strong recency effects in the absence of primacy effects during recall. Although she spontaneously noticed that list items belonged to categories, she was unable to apply a clustering strategy to assist in recall (see scores for List Clustering under Verbal Process Scores in Figure 1).

Intact Short–term Memory with Poor Long–term Consolidation. An individual's ability to retain information over time and later recall and use that information is generally regarded as the hallmark of

Figure 1

General memory impairment

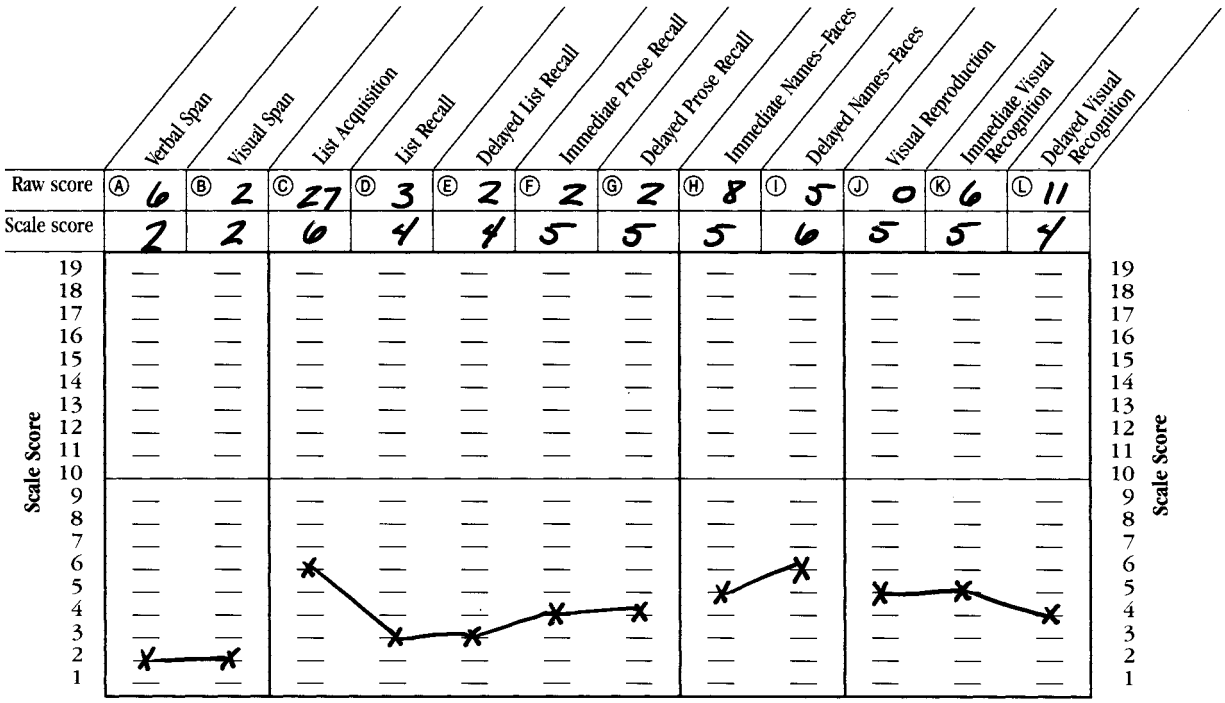
MAS Record Form

Name C.R. Test Date 3/9/90

Sex F Age 83 Education 7 Occupation Housewife

Handedness R Examiner

Subtest Profile



Normative Table AGE: 70+ / ED: ≤11 yrs.

Verbal Process Scores

	Raw score	Within expectations	Significant
Total Intrusions	8	X	— (High)
List Clustering			
Acquisition	.07	—	X (Low)
Recall	0	—	X (Low)
Delayed Recall	0	—	X (Low)
Cued List Recall			
Recall	4	—	X (Low)
Delayed Recall	4	—	X (Low)
List Recognition	10	—	X (Low)

Summary Scales

	Scale score		Standard score
I) Verbal Span	2		
II) Visual Span	2		
Total I + II	4	Short-term Memory	53
III) List Recall	4		
IV) Immediate Prose Recall	5		
Total III + IV	9	Verbal Memory	75
V) Visual Reproduction	5		
VI) Immediate Visual Recognition	5		
Total V + VI	10	Visual Memory	77
Total III + IV + V + VI	19	Global Memory Scale	74

Figure 2

Intact short-term memory with poor longer-term consolidation

MAS Record Form

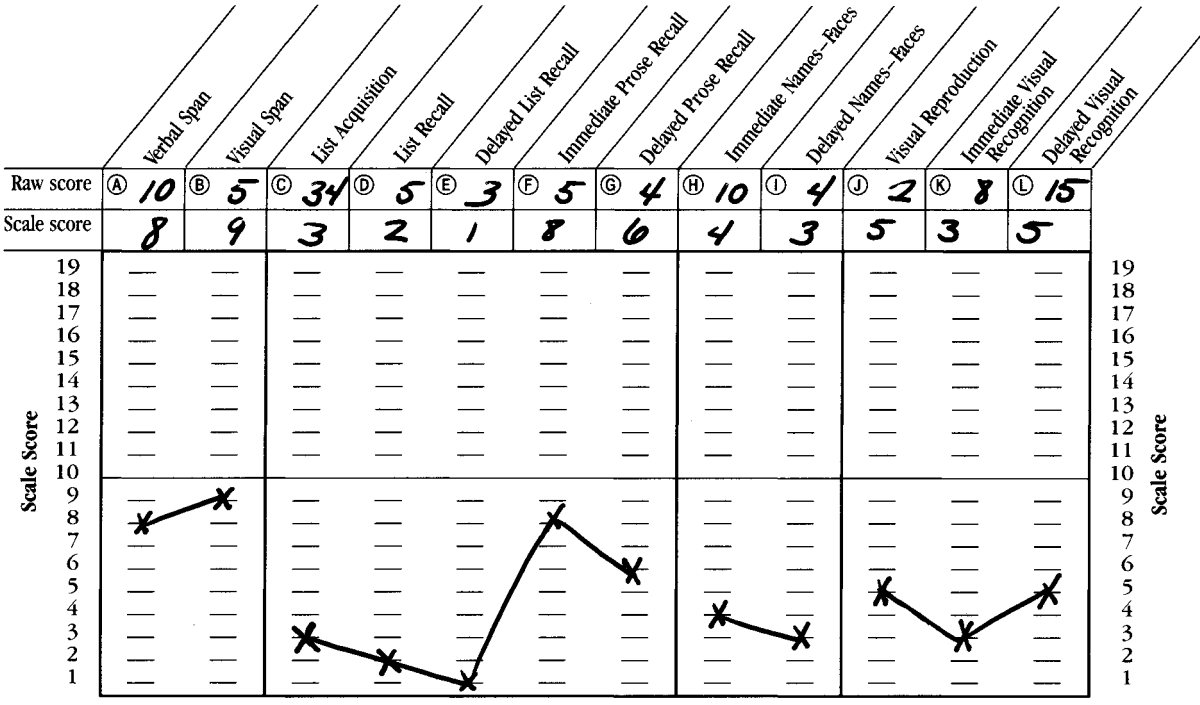
Name B.W. Test Date 2/13/89

Sex F Age 55 Education 12 Occupation HOUSEWIFE

Handedness R Examiner

Subtest Profile

	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition
Raw score	Ⓐ 10	Ⓑ 5	Ⓒ 34	Ⓓ 5	Ⓔ 3	Ⓕ 5	Ⓖ 4	Ⓗ 10	Ⓘ 4	Ⓙ 2	Ⓚ 8	Ⓛ 15
Scale score	8	9	3	2	1	8	6	4	3	5	3	5



Normative Table AGE 50-59 / EDUC.: 12 YRS.

Verbal Process Scores

	Raw score	Within expectations	Significant
Total Intrusions	4	—	X (High)
List Clustering			
Acquisition	18	X	— (Low)
Recall	0	—	X (Low)
Delayed Recall	0	—	X (Low)
Cued List Recall			
Recall	5	—	X (Low)
Delayed Recall	3	—	X (Low)
List Recognition	10	—	X (Low)

Summary Scales

	Scale score		Standard score
I) Verbal Span	8		
II) Visual Span	9		
Total I + II	17	Short-term Memory	93
III) List Recall	2		
IV) Immediate Prose Recall	8		
Total III + IV	10	Verbal Memory	74
V) Visual Reproduction	5		
VI) Immediate Visual Recognition	3		
Total V + VI	8	Visual Memory	67
Total III + IV + V + VI	18	Global Memory Scale	66

memory ability (Squire, 1986). However, some people with poor memory can adequately repeat new information immediately but cannot retain the information over intervals greater than a few seconds. This pattern is extremely common among low–ability, neurologically intact individuals and is a major diagnostic feature of organic amnesic disorder.

The amnesic syndrome is defined by a loss of memory for new information while other intellectual abilities, such as language and reasoning, remain intact. The syndrome is most often associated with lesions of the hippocampus and other medial temporal lobe structures. Patients with this syndrome usually have normal recall for remote, well–learned information and can learn motor skills and procedures. Short–term memory is also preserved. Because intellectual abilities are intact, many of these subjects will have IQ scores in the average range (Huppert & Piercy, 1976).

The MAS profile associated with organic amnesic disorder reflects Short–term Memory Scale scores that are within the normal range and Verbal and Visual Memory Scale scores that are below normal. There is often no significant difference between Verbal and Visual Memory Scale scores. Comparison of the Global Memory Scale score to Full Scale IQ frequently reveals significantly lower memory functioning.

Case illustration 2. B.W. is a 55–year–old, right–handed female with a high school education. She was referred for a neurological evaluation by her physician after she reported numerous everyday memory errors, difficulty in concentration, severe headaches, and irritability. A computer tomography brain scan revealed a mass near the third ventricle which extended bilaterally, although it was more pronounced on the right side than on the left. A biparietal craniotomy was performed and the right parietal lobe was retracted in order to allow access to the mass. The mass was discovered to be a dermoid cyst, which was removed without complications. Before the onset of memory disorder, B.W. had worked as a secretary but had spent most of her occupational life as a housewife.

B.W. was left with a severe anterograde amnesia. She was virtually unable to remember any new information. After many repetitions over the course of years, she was able to retain a very simple version of her illness and surgery. Coordination and strength on the left side were more impaired than on the right side. Spatial abilities were also impaired. These latter symptoms were probably the results of injury to the right hemisphere associated with surgical retraction and the general surgical approach. Other cognitive abilities, such as language and abstract reasoning, were essentially unimpaired as reflected by her WAIS–R Full Scale IQ score of 96. Although B.W. had visual–spatial and, to a lesser degree, motor impairment, her major deficit was memory disorder (Global Memory Scale = 66). Figure 2 presents her MAS scores.

B.W.'s performance on the MAS and WAIS–R was typical of individuals with pure organic amnesic disorder. She demonstrated normal general intellectual skills and intact short–term memory abilities (Short–term Memory = 93) in conjunction with impaired verbal and visual memory abilities (Verbal Memory = 74 and Visual Memory = 67). Examination of her MAS Subtest Profile reveals difficulty in verbal acquisition (List Acquisition = 3) and a general pattern of decreased memory performance with increased delay of recall. Similarly, she performed poorly on tasks of visual memory and appeared to have guessed on the Delayed Visual Recognition task. Further details regarding this patient are reported in Williams, Medwedeff, and Haban (1989).

Impaired Verbal Memory Performance. The MAS also allows for the examination of major content–specific memory difficulties, such as a relative deficit in memory for verbal information in comparison to visual–spatial information. Although a certain degree of differential performance is within the range of normal variation, more extreme differences occur among people with very impoverished verbal skills and among individuals with brain lesions lateralized to the hemisphere dominant for language. In the case of brain lesions, impaired performance on the verbal subtests of the MAS is primarily associated with disruption of the language function. These lesions are associated with an MAS profile pattern reflecting impaired verbal memory while visual memory abilities are in the normal range. Short–term memory abilities may also be impaired. Individuals with poor educational backgrounds and those who speak English as a second language will also perform poorly on the verbal sections of the MAS although scores may not be in the impaired range.

Case illustration 3. D.H. is a 69–year–old, right–handed male with eight years of formal education. He experienced a cerebral vascular accident (CVA) which resulted in damage to the posterior regions of the left hemisphere. He was admitted to the hospital with sensory and motor deficits involving the right side of the body. His language was garbled and confused, and he was disoriented to time and place. After one week of recovery in the hospital, he underwent a neuropsychological evaluation. Results of this evaluation revealed impaired language comprehension and semantic reasoning. He had great difficulty in reading, his auditory comprehension was poor, and he had frequent word–finding problems. Figure 3 presents his scores on the MAS.

Figure 3

Impaired verbal memory

MAS Record Form

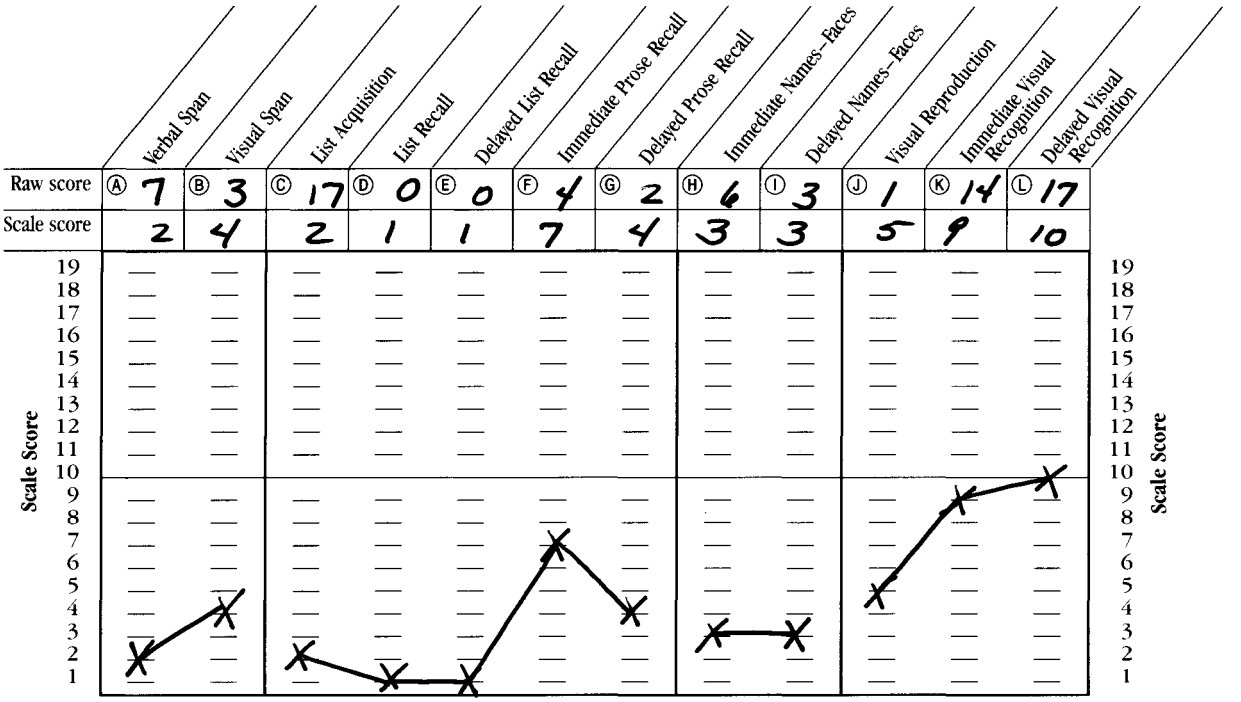
Name D.H. Test Date 1/12/90

Sex M Age 69 Education 8 Occupation Small Business Owner

Handedness R Examiner

Subtest Profile

	Ⓐ Verbal Span	Ⓑ Visual Span	Ⓒ List Acquisition	Ⓓ List Recall	Ⓔ Delayed List Recall	Ⓕ Immediate Prose Recall	Ⓖ Delayed Prose Recall	Ⓗ Immediate Names–Faces	Ⓘ Delayed Names–Faces	Ⓙ Visual Reproduction	Ⓚ Immediate Visual Recognition	Ⓛ Delayed Visual Recognition
Raw score	7	3	17	0	0	4	2	6	3	1	14	17
Scale score	2	4	2	1	1	7	4	3	3	5	9	10



Normative Table AGE: 60-69 / EDUC: ≤ 11 YRS.

Verbal Process Scores

	Raw score	Within expectations	Significant
Total Intrusions	3	X	— (High)
List Clustering			
Acquisition	12	—	X (Low)
Recall	0	—	X (Low)
Delayed Recall	0	—	X (Low)
Cued List Recall			
Recall	3	—	X (Low)
Delayed Recall	2	—	X (Low)
List Recognition	5	—	X (Low)

Summary Scales

	Scale score		Standard score
I) Verbal Span	2		
II) Visual Span	4		
Total I + II	6	Short–term Memory	58
III) List Recall	1		
IV) Immediate Prose Recall	7		
Total III + IV	8	Verbal Memory	71
V) Visual Reproduction	5		
VI) Immediate Visual Recognition	9		
Total V + VI	13	Visual Memory	84
Total III + IV + V + VI	21	Global Memory Scale	73

Typical of individuals with damage to the hemisphere dominant for language, D.H.'s verbal memory abilities were in the low borderline to impaired range of performance (Verbal Memory = 71). Visual memory abilities, however, were relatively preserved and may slightly underestimate his visual memory abilities because of the increased difficulty on the Visual Reproduction task associated with his mild right–sided hemiparesis (Visual Memory = 84, Visual Reproduction = 5, Immediate Visual Recognition = 9, and Delayed Visual Recognition = 10). His poor Short–term Memory score of 58 also reflected difficulty in attention and in processing verbal material.

Impaired Visual Memory Performance

Right hemisphere lesions, such as those caused by CVAs and brain tumors, are associated with impairment of visual–spatial abilities. Patients with these lesions tend to perform poorly on the visual memory tasks of the MAS because of disruption to the underlying neurological structures involved in visual–spatial perception. Impaired performance may also extend to Visual Span as well as to the longer–term consolidation measures of Visual Reproduction and Immediate and Delayed Visual Recognition. Because most people have equal experience in acquiring visual–spatial skills, there is less variability in visual memory performance among normal individuals. In the absence of a positive history of brain illness or head injury, poor performance on the visual memory tasks in the context of normal verbal memory usually suggests that some extraneous influence, such as poor visual acuity or low motivation, has been influential.

Case illustration 4. S.E. is a 46–year–old, right–handed female with 15 years of formal education. She was taken to the hospital by family members who became concerned over what they described as unusual behavior. This behavior consisted of incorrect dressing, such as wearing a blouse inside out or buttoned awry, and arriving at social functions without certain minor articles of clothing, such as a stocking or belt. They also reported unusual behaviors during her weekly round of golf. She would hit the ball down the fairway but then had no memory of where the ball was located. She also would drive the golf cart in seemingly random directions across the golf course.

A computer tomography brain scan revealed a large infiltrating tumor which had its greatest mass over the right frontal lobe. It was layered over the right hemisphere and extended to the parietal and temporal lobes. Since the tumor was so large, no surgery was attempted. A neuropsychological examination revealed moderate left–sided visual neglect, left–sided motor weakness, and numerous visual–spatial processing deficits. On the WAIS–R, S.E. obtained a Verbal IQ of 108 and a Performance IQ of 73. Figure 4 presents her MAS scores.

S.E.'s performance on the MAS clearly demonstrates her visual memory impairment. Her Verbal Memory score was in the normal range of performance while her Visual Memory score was found to be in the impaired range (Verbal Memory = 98 and Visual Memory = 66). Inspection of her MAS Subtest Profile reveals normal to borderline performance on all of the verbal memory subtests. Verbal Process scores were also within expectation for her age and education. However, her scores on the Visual Reproduction and Delayed Visual Recognition subtests were in the impaired range. Her adequate performance on Immediate Visual Recognition, in contrast to that of Delayed Visual Recognition, was consistent with the behavioral descriptions of visual memory difficulties associated with increased periods of delayed recall.

Impaired Memory with Variable Performance

As previously mentioned, many factors influence performance on neuropsychological tests. These include psychological factors such as depression and anxiety, poor motivation, and malingering. For example, individuals suffering from depression may experience psychomotor retardation or cognitive ruminations which can affect their test performance. Although there is no clear method to differentiate neurological from nonneurological factors in poor memory performance, there are two guidelines which may be helpful. The first is that most nonneurological factors do not lower performance into the impaired range on memory tests (Williams, Little, Scates, & Blockman, 1987). The second is that the influence of nonneurological factors tends to produce an inconsistent profile of performance (Lezak, 1983). Factors such as low motivation or anxiety wax and wane over the course of testing. Scores on some subtests may be completely within the normal or superior range while others are in the impaired range. This evidence is more compelling if more difficult items within a test are passed while easier items are failed. Such inconsistencies are a strong indication that nonneurological factors are influencing performance.

Case illustration 5. T.L. is a 65–year–old, right–handed male with 12 years of formal education. He was referred for an evaluation by his psychiatrist to help rule out the possibility of a dementing disorder. T.L.'s family members reported that he had had numerous problems over the past nine months with attention and memory. Both T.L.'s family and his psychiatrist also described a long history of depression. T.L. had been treated with a variety of psychotropic medications and had most recently been receiving imipramine for his depression.

Figure 4

Impaired visual memory

MAS Record Form

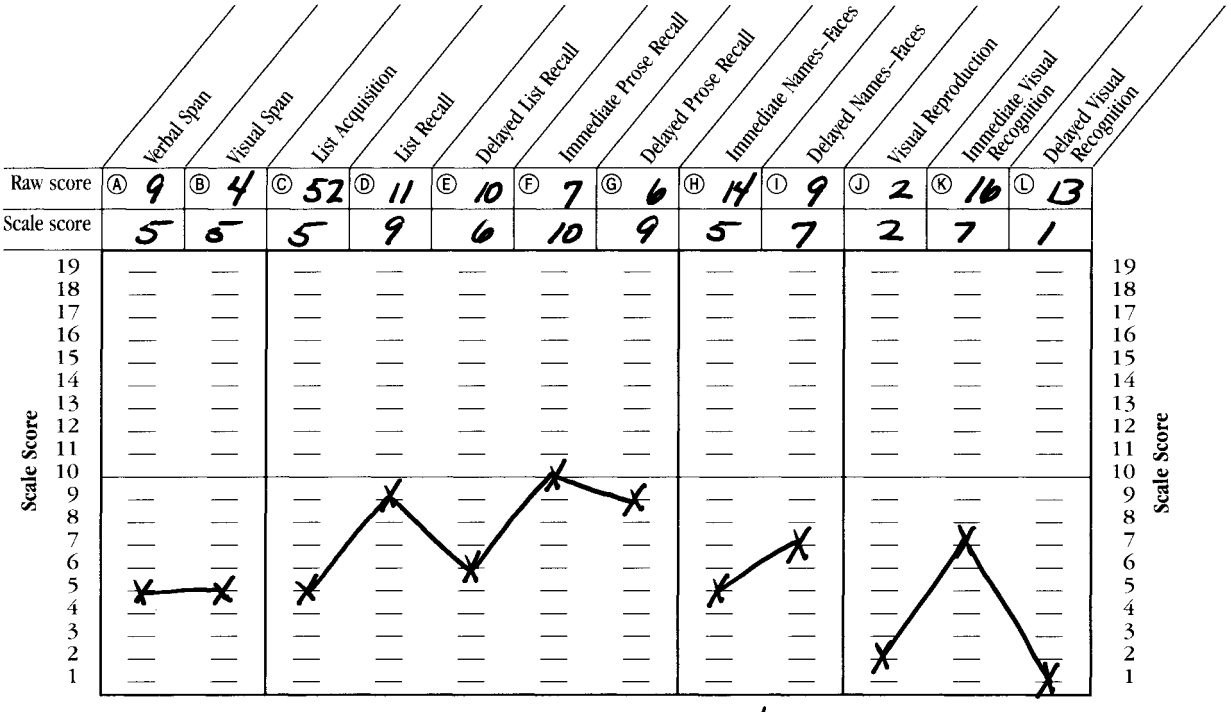
Name S.E. Test Date 11 / 1 / 89

Sex F Age 46 Education 15 Occupation Teacher

Handedness R Examiner

Subtest Profile

	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition
Raw score	Ⓐ 9	Ⓑ 4	Ⓒ 52	Ⓓ 11	Ⓔ 10	Ⓕ 7	Ⓖ 6	Ⓗ 14	Ⓘ 9	Ⓙ 2	Ⓚ 16	Ⓛ 13
Scale score	5	5	5	9	6	10	9	5	7	2	7	1



Normative Table AGE: 18-49 / EDUC: ≥13 yrs.

Verbal Process Scores

	Raw score	Within expectations	Significant
Total Intrusions	0	X	— (High)
List Clustering			
Acquisition	.42	X	— (Low)
Recall	.48	X	— (Low)
Delayed Recall	.50	X	— (Low)
Cued List Recall			
Recall	12	X	— (Low)
Delayed Recall	12	X	— (Low)
List Recognition	12	X	— (Low)

Summary Scales

	Scale score		Standard score
I) Verbal Span	5		
II) Visual Span	5		
Total I + II	10	Short–term Memory	72
III) List Recall	9		
IV) Immediate Prose Recall	10		
Total III + IV	19	Verbal Memory	98
V) Visual Reproduction	2		
VI) Immediate Visual Recognition	7		
Total V + VI	9	Visual Memory	66
Total III + IV + V + VI	28	Global Memory Scale	80

Figure 5

Impaired memory with variable performance

MAS Record Form

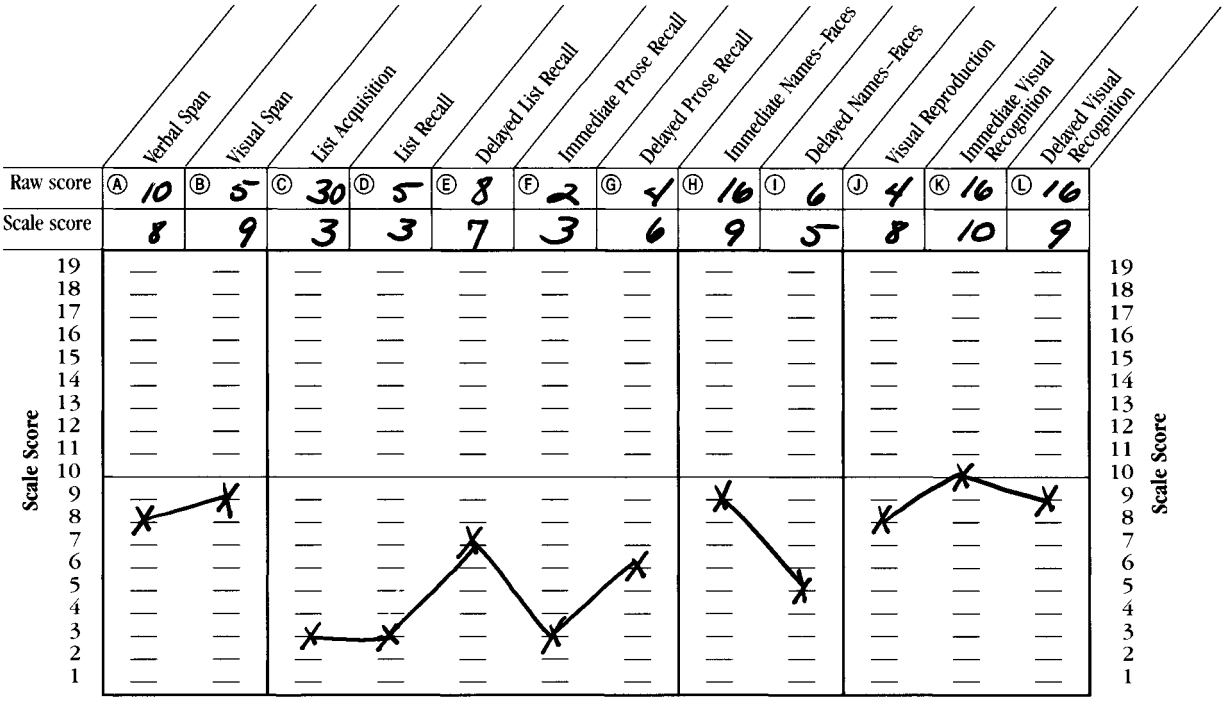
Name T.L. Test Date 6/8/90

Sex M Age 65 Education 12 Occupation Retired

Handedness R Examiner

Subtest Profile

	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition
Raw score	Ⓐ 10	Ⓑ 5	Ⓒ 30	Ⓓ 5	Ⓔ 8	Ⓕ 2	Ⓖ 4	Ⓗ 16	Ⓘ 6	Ⓙ 4	Ⓚ 16	Ⓛ 16
Scale score	8	9	3	3	7	3	6	9	5	8	10	9



Normative Table AGE 60-69/EDUC: 12 YRS.

Verbal Process Scores

	Raw score	Within expectations	Significant
Total Intrusions	0	X	— (High)
List Clustering			
Acquisition	12	X	— (Low)
Recall	0	—	X (Low)
Delayed Recall	2	X	— (Low)
Cued List Recall			
Recall	4	—	X (Low)
Delayed Recall	5	—	X (Low)
List Recognition	12	X	— (Low)

Summary Scales

	Scale score		Standard score
I) Verbal Span	8		
II) Visual Span	9		
Total I + II	17	Short-term Memory	93
III) List Recall	3		
IV) Immediate Prose Recall	3		
Total III + IV	6	Verbal Memory	65
V) Visual Reproduction	8		
VI) Immediate Visual Recognition	10		
Total V + VI	18	Visual Memory	97
Total III + IV + V + VI	24	Global Memory Scale	76

Throughout the assessment, T.L. appeared distracted and disinterested in the evaluation. Although he was reasonably cooperative, he persistently asked when the assessment was to end. He rushed through many parts of the evaluation once he determined that the task was tedious. On many task items, he responded quickly with "I don't know" rather than persisting to arrive at a correct response or even guessing at an answer. Figure 5 presents his scores on the MAS.

Overall, T.L.'s memory abilities were in the borderline range of performance (Global Memory Scale = 76). Both Short–term Memory and Visual Memory scores were in the normal range (Short–term Memory = 93, Visual Memory = 97). However, his obtained score of 65 on Verbal Memory places him in the impaired range of functioning for verbal memory abilities. Examination of the Subtest Profile reveals inconsistencies in his verbal memory performance that suggest a nonneurological basis for his poor verbal memory performance. During the List Learning task, his acquisition pattern was extremely variable. On some trials he recalled many words, while on other trials he appeared disinterested and reported that he did not recall any more words than the few he had just given. Similar to his variable performance on the List Learning task, his score on Delayed Prose Recall is significantly better than his score on Immediate Prose Recall, a pattern of findings inconsistent with neurologically based memory impairment. T.L.'s pattern of scores on the MAS is more typical of the inconsistencies and performance levels associated with nonneurological memory impairment.

3

Development of the MAS

Overview

A major influence on the design of the MAS was the body of studies of amnesic disorder which were published following the historic papers by Milner and her colleagues (Milner, 1965, 1968; Milner, Corkin, & Teuber, 1968). Prominent among these investigations of organic memory disorder were those of Butters (Butters & Cermak, 1980; Butters & Miliotis, 1985), Squire (1986), Baddeley and Warrington (1970), and Schacter (Schacter & Crovitz, 1977; Schacter & Tulving, 1982). These investigations, along with many others, examined and described the phenomena associated with impairment of memory. Contained within these studies is a diverse array of memory assessment procedures, as well as a general theoretical foundation for conceptualizing salient memory constructs. Although most methods were not designed as general clinical procedures, many were amenable to modification for inclusion in a comprehensive memory assessment battery.

These experimental investigations also provided considerable theoretical understanding for interpreting the test findings in individual cases. The current theoretical models of memory function which each test user applies to the assessment of a subject are to some extent a product of these experimental investigations. These theoretical models were incorporated into the procedures of the MAS and represent the melding of theoretical models with the constraints and demands of usual clinical practice.

Other sources of assessment methodology that were influential in the design of the MAS came from studies of memory by cognitive psychologists. Memory is the most studied of all cognitive abilities, and many experimental psychologists with a general interest in memory have made contributions to the understanding of the clinical neuropsychology of memory. As cognitive neuropsychology has emerged in recent years, this overlap of interest between cognitive psychologists and clinical neuropsychologists is commonplace (Cermak, 1982; Williams & Long, 1988).

After the literature was reviewed for methods and prescriptions for improving assessment, the factors discussed below were identified as being critical in the design of the MAS.

Verbal and Visual–Spatial Content

The assessment of both verbal and visual–spatial (sometimes called nonverbal or figural) memory content is widely supported in the literature in neuropsychology and experimental psychology (Milner, 1968, 1971). The distinction between verbal and visual–spatial memory is so well accepted that it is often not explicitly stated in studies of brain illness and memory disorder. In the realm of clinical assessment, and especially in neuropsychology, this distinction is reinforced by commonly accepted models of lateralized memory function and hemispheric specificity for verbal and visual–spatial content (Russell, 1986). It is uncertain whether the hemispheres are strictly lateralized in terms of consolidation for verbal information in the dominant hemisphere and visual–spatial in the nondominant hemisphere (Squire, 1986). However, the division of content is supported by numerous studies which demonstrated that lesions in each hemisphere produce lower memory scores corresponding to the verbal or visual–spatial content which was used to examine consolidation (Butters & Miliotis, 1985; Lezak, 1983).

The separation of verbal and visual–spatial memory content is firmly represented in the tasks and scoring of the MAS. The MAS uses two general methods for assessing verbal consolidation: (a) a list

learning task, in which a subject is required to consolidate a 12–item list clusterable according to categories, and (b) a prose passage recall task. Visual consolidation is assessed by the use of a distraction procedure in which (a) a figure is presented, (b) the subject engages in a visual distraction task, and (c) consolidation is tested by recognition and recall formats. This distraction procedure is a version of the Brown–Peterson distraction method (Brown, 1958; Peterson & Peterson, 1959).

Immediate and Delayed Recall

Numerous studies of organic amnesic disorder and cognitive studies of memory strongly support the general distinction of immediate and delayed recall. Immediate recall consists of retention of information for its immediate use. Delayed recall or consolidation refers to the retention and maintenance of information over an extended period. Neuropsychological studies of memory disorder strongly suggest that these processes are dissociable (Butters & Miliotis, 1985; Hirst, 1982; Squire, 1986). Amnesic subjects are usually able to repeat information immediately but have a selective deficit in consolidation which prevents accurate recall after a delay period. The duration of successful recall from short–term memory ranges from 10 to 30 seconds. Retention after 30 seconds is usually considered a property of consolidation (Baddeley & Warrington, 1970). An important aspect of this consolidation deficit is that information is rapidly forgotten over a brief delay interval (Butters, Salmon, Heindel, & Granholm, 1988). In regard to clinical assessment methods, a delay period of 30 seconds is sufficient to measure this phenomenon. Losses after 30 seconds may represent forgetting from long–term storage and retrieval deficits as well as failure to consolidate.

The MAS incorporates a variety of immediate and delayed recall methods. For example, the designs for the visual recognition task are recalled immediately (Immediate Visual Recognition subtest) and after a delay period (Delayed Visual Recognition subtest). The word list for the List Acquisition subtest is recalled after two delay periods (List Recall subtest, Delayed List Recall subtest).

Interference During the Recall Interval

The sensitivity of the memory consolidation system to interference during the recall interval is crucial in diagnosing memory disorder. Butters and Cermak (1980), among others, have systematically examined this sensitivity among a variety of patients with discrete memory disorder. Studies of interference effects also have a long history of study in cognitive psychology (see Cermak, 1982). Numerous formal and informal clinical memory assessment procedures rely on the concept of delay with interference (Albert & Moss, 1984).

The concept of controlled interference during the recall interval is a prominent feature of the MAS verbal and visual consolidation tasks. The MAS contains no empty recall intervals in which the examiner must invent a task to fill the recall interval. All recall intervals are controlled to the extent that there are well–defined tasks to administer to subjects as part of a distraction procedure.

Recall and Recognition Formats

One of the few noncontroversial findings in the study of memory is that recognition memory is superior to recall (Huppert & Piercy, 1976). This finding has important consequences for the design of clinical memory tests. Individuals who are very impaired are often unable to make a response on a subtest which uses only a recall format. Yet the individual may have consolidated some information which can be measured by a recognition format. In a similar way, the memory ability of any individual may be underestimated when only recall formats are included.

Tasks comprising the MAS make extensive use of both recall and recognition formats. The verbal memory procedures use distraction and cued recognition formats in addition to free recall of the verbal material. The visual subtests include recall assessed by the drawing of figures as well as the identification of figures within a recognition format.

Practical Considerations in the Design of the MAS

A major task in designing a memory battery is to balance the number of tasks against the realistic time constraints of the usual clinical setting. Simply stated, a clinical memory battery will not be successful if it takes more than one hour to administer or if it has cumbersome or inefficient elements. A streamlined and efficient format is required—one that includes the most important procedures in the shortest administration time.

One result of this selection process is that many valued assessment procedures are excluded from the MAS. One way to resolve this dilemma is to use other tests to supplement the MAS. Supplementary procedures should be chosen according to the subject's condition and referral question, and they should be consistent with theoretical models of memory function. For example, if there is a concern about modality–specific memory disorders, the MAS may be supplemented with tests of memory for tactile, olfactory, and other specific sensory information (e.g., Butters, Lewis, Cermak, & Goodglass, 1973; Milner, 1971; Milner & Taylor, 1972). Likewise, clinicians may find great utility in the self–report of

everyday memory problems (Kopelman, Wilson, & Baddeley, 1989). Such tests can easily supplement the MAS in most assessment settings.

Construction of MAS Tasks

List Learning Task. The clusterable list was derived from a study of memory disorder by Rubin and Butters (1981). They discovered that amnesic subjects had great difficulty ordering the list by categories and using clustering strategies to aid consolidation. Structured list–learning tasks have a long history in cognitive psychology (Puff, 1982) and have recently been developed as clinical instruments (Delis, Kramer, Kaplan, & Ober, 1987). The MAS list originally consisted of 15 items from five semantic categories. Words were selected that ranged in value from easy to moderate in association value as listed by Thorndike and Lorge (1944). Names of colors and birds comprised the easy words while names of cities and countries comprised the moderate words. Words were also selected to have unique first letters to allow for easy recording. In initial trials, however, the 15–item list proved too difficult for demented subjects. The list was shortened to the 12 items that comprise the final version.

The 12–item list was then examined for the number of administration trials necessary for learning. During initial investigations, the list was administered until the subject was able to report all 12 items. Many demented subjects, however, failed to completely acquire the list even after 20 trials. Based on these results, the learning trials were limited to 6, which was within the range required for most normal subjects to acquire the list.

The free recall, cued recall, clustering, and recognition procedures were all derived from the copious literature on list–learning methodology (Puff, 1982). These procedures represent the major sources used to quantify performance on list–learning tasks.

Prose Memory. The short story and cued recall questions of the MAS were taken directly from a study by Rawling and Lyle (1978). They presented prose stories with accompanying recall questions to chronic alcoholic and Korsakoff patients and described the memory abilities characteristic of each group. They also presented an enhanced, efficient methodology for presentation and testing of prose memory. Similar methods are also found in the cognitive psychology literature. The methodology used by these investigators was appealing because it had been used to assess brain–injured patients. With the permission of Rawling and Lyle, their prose story and questions, written for use in Australia, were modified slightly to make them consistent with American phrasing. The modified story and questions were used as the prose memory task in the MAS.

Verbal Span. Forward and backward number span methodology also has a long history in cognitive psychology and clinical assessment of intelligence (Wechsler, 1939, 1945). Digit series for this task were constructed by randomly choosing numbers between the values of 1 and 9. The longest sequence of digits that the subject can recall forward and backward after immediate presentation was conceptualized as the verbal span. Two attempts at each series length were allowed for stability of measurement.

Visual Span. The Visual Span task is a variation of the block–tapping test designed by Corsi (described in Milner, 1971). In order to make it clinically efficient, stimuli were printed on a page rather than using blocks. The longest sequence that the subject can reproduce is the visual memory span. Again, two attempts at each sequence length were allowed for stability of measurement.

Visual Recognition. The basic presentation format for the visual memory tasks is an application of the Brown–Peterson distraction technique (Brown, 1958; Peterson & Peterson, 1959). In this technique, a stimulus is presented, a distraction task is administered, and recall is then tested using free recall or recognition procedures.

The geometric forms used as stimuli were designed to be simple figures that could easily be visualized and examined during the relatively brief exposure intervals. The distraction task was composed of similar geometric figures that would interfere with the visual consolidation of the target figure.

A multiple choice format was employed for half the designs because it increased the variability of scores among normal subjects. Full credit is awarded for matching the figure absolutely and partial credit is awarded for matching to the figure deemed most similar to the target. The figure most similar to the target was determined by presenting the figures to a sample of 10 subjects and asking them to sort the figures by degree of similarity to the original figure. In all cases, the subjects sorted the figures according to the designation of most similar used in the present scoring system.

The delayed recognition memory trial consists of 10 of the original Visual Recognition designs plus an equal number of distractors. Distractors were constructed by drawing the original figure and then varying that drawing by one or two details. Such drawings were then distinctly different but still maintained many details which were the same as the original figure.

Visual Reproduction. Stimuli for the Visual Reproduction task were constructed in a manner similar to that used in constructing the figures of the Visual Recognition task. Scoring descriptions used for the drawing trials were developed after examining 100 drawings made by normal and brain–injured subjects and blindly sorting them into five categories of performance level. The descriptions which characterized each level were then constructed by examining the sorted drawings and describing the details and drawing features characteristic of the groups.

Names–Faces. Stimuli for the Names–Faces task were selected from photographs contained within the yearbook of a local high school. Photographs were selected that contained images of people in everyday environments and clothing in order to provide cues available in the "real" world. Posed pictures were avoided. Photographs of six women and four men were chosen.

Names associated with the pictures in the Learning Series and names used as foils in the Test Series were chosen from the local phone book according to the author's sense of what are generally familiar names. Gender–appropriate names were randomly assigned to the pictures of men and women. Position in the presentation sequence of the Test Series was also randomly assigned.

Reliability & Validity

Generalizability Coefficients

Generalizability theory (Cronbach, Gleser, Nanda, & Rajaratnam, 1972) was used to design a study to estimate the subjects' true–score variance on MAS scores. Because of the free recall format and serial administration of the List Learning task, traditional internal consistency statistics are not appropriate measures of reliability. Generalizability theory explicitly recognizes multiple sources of test score variance simultaneously through the use of analysis of variance (ANOVA) methodology. For each factor in the ANOVA generalizability study, a variance component can be estimated and used in a decision study to calculate generalizability coefficients. Generalizability coefficients can be viewed as analogues to traditional reliability coefficients. Brennan (1983), Cronbach et al. (1972), and Shavelson, Webb, and Rowley (1989) present more complete discussions and development of generalizability theory and procedures.

A subset of 30 subjects from the standardization sample were administered the MAS on two occasions. The sample consisted of 18 men and 12 women who ranged in age from 20 to 89 years ($M = 42.37$, $SD = 19.69$). The average interval between test administrations was approximately 6 months ($M = 191.70$ days, $SD = 70.19$). A repeated–measures ANOVA design was used, with time of MAS administration comprising the within–subjects factor and subjects comprising the blocking factor. Scale and standard scores based on the census–matched, age decade, and age and education normative data were each calculated for this sample and analyzed separately. Generalizability coefficients were calculated for all scores with the exception of Verbal Process scores because of their dichotomous scoring. Tables 11, 12, and 13 present the results of these generalizability studies.

Generalizability coefficients for the MAS subtests ranged from .70 to .95 across all three normative bases and averaged .85 to .86. For the Summary Scales, coefficients ranged from .86 to .92 and averaged .89 to .91. Coefficients for the Global Memory Scale ranged from .94 to .95 with an average of .95. These coefficients indicate that the subtests, Summary Scales, and Global Memory Scale of the MAS possess excellent reliability for all three normative bases.

Interexaminer reliability of scoring for the drawings of the Visual Reproduction task was also investigated through generalizability analysis. Reliability for both experienced and naive MAS examiners was studied separately. A group of 12 people, composed of clinical psychology faculty members and graduate students who had no formal training in administration of the MAS, comprised the naive sample. Most of the students had had training only in general intellectual assessment. A set of drawings that covered the range of possible scores was then selected from 10 subjects in the normative sample. Raters were given a sheet listing the scoring criteria and asked to score the drawings independent of other participants in the study. As seen in Table 14, generalizability coefficients were .953 for Drawing A and .968 for Drawing B.

Similar to the above study, a group of 10 examiners experienced in the administration and scoring of the MAS was asked to participate. These examiners had attended training sessions to learn the administration of the MAS, and all had tested at least five normative subjects. A separate set of drawings from five subjects in the normative sample was then selected. Raters were told to score the drawings according to the scoring criteria and asked to score the drawings independent of other participants in the study. Generalizability coefficients were found to

Table 11

Generalizability Analyses for Scoring Based on U.S. Census–matched Norms

MAS scale	Source of variation	ANOVA mean square	Estimated variance component	Decision variance component[a]	Generalizability coefficient[b]
Verbal Span					
	Subject (S)	16.87	6.68	6.68	
	Time (T)	0.07	0.00	0.00	
	Residual (E)	3.51	3.51	1.76	.79
Visual Span					
	Subject (S)	10.43	3.88	3.88	
	Time (T)	0.82	0.00	0.00	
	Residual (E)	2.68	2.68	1.34	.74
List Acquisition					
	Subject (S)	17.48	7.11	7.11	
	Time (T)	91.27	2.93	1.47	
	Residual (E)	3.27	3.27	1.64	.81
List Recall					
	Subject (S)	15.03	5.54	5.54	
	Time (T)	41.67	1.26	0.63	
	Residual (E)	3.94	3.94	1.97	.74
Delayed List Recall					
	Subject (S)	12.53	5.68	5.68	
	Time (T)	8.07	0.23	0.12	
	Residual (E)	1.17	1.17	0.59	.91
Immediate Prose Recall					
	Subject (S)	21.17	9.98	9.98	
	Time (T)	45.07	1.46	0.73	
	Residual (E)	1.20	1.20	0.60	.94
Delayed Prose Recall					
	Subject (S)	19.58	9.09	9.09	
	Time (T)	18.15	0.56	0.28	
	Residual (E)	1.39	1.39	0.70	.93
Immediate Names–Faces					
	Subject (S)	17.36	7.98	7.98	
	Time (T)	8.82	0.25	0.13	
	Residual (E)	1.40	1.40	0.70	.92
Delayed Names–Faces					
	Subject (S)	13.94	6.63	6.63	
	Time (T)	4.82	0.14	0.07	
	Residual (E)	0.68	0.68	0.34	.95
Visual Reproduction					
	Subject (S)	13.64	6.20	6.20	
	Time (T)	0.15	0.00	0.00	
	Residual (E)	1.25	1.25	0.63	.91
Immediate Visual Recognition					
	Subject (S)	12.91	4.59	4.59	
	Time (T)	10.42	0.22	0.11	
	Residual (E)	3.73	3.73	1.87	.71
Delayed Visual Recognition					
	Subject (S)	14.91	6.88	6.88	
	Time (T)	21.60	0.68	0.34	
	Residual (E)	1.15	1.15	0.58	.92
Short-term Memory					
	Subject (S)	371.83	164.51	164.51	
	Time (T)	1.67	0.00	0.00	
	Residual (E)	42.80	42.80	21.40	.88

Table 11 (Continued)

Generalizability Analyses for Scoring Based on U.S. Census–matched Norms

MAS scale	Source of variation	ANOVA mean square	Estimated variance component	Decision variance component[a]	Generalizability coefficient[b]
Verbal Memory					
	Subject (S)	566.88	260.16	260.16	
	Time (T)	1601.67	51.84	25.92	
	Residual (E)	46.56	46.56	23.28	.92
Visual Memory					
	Subject (S)	374.21	169.89	169.89	
	Time (T)	88.82	1.81	0.91	
	Residual (E)	34.44	34.44	17.22	.91
Global Memory Scale					
	Subject (S)	497.12	237.23	237.23	
	Time (T)	792.07	25.65	12.83	
	Residual (E)	22.65	22.65	11.33	.95

Note. $N = 30$. Subject $df = 29$, time $df = 1$, and residual $df = 29$.

[a]Decision variance component = estimated variance component / frequency of sampling in the study. Frequency of sampling = 1 for subject, 2 for time, and 2 for residual. [b]Generalizability coefficient = $\hat{\sigma}^2(S) / \hat{\sigma}^2(S) + \hat{\sigma}^2(E)$, as estimated by the decision variance components.

Table 12

Generalizability Analyses for Scoring Based on Age Decade Norms

MAS scale	Source of variation	ANOVA mean square	Estimated variance component	Decision variance component[a]	Generalizability coefficient[b]
Verbal Span					
	Subject (S)	17.09	6.63	6.63	
	Time (T)	0.82	0.00	0.00	
	Residual (E)	3.82	3.82	1.91	.78
Visual Span					
	Subject (S)	9.54	3.53	3.53	
	Time (T)	1.07	0.00	0.00	
	Residual (E)	2.48	2.48	1.24	.74
List Acquisition					
	Subject (S)	13.41	5.74	5.74	
	Time (T)	74.82	2.43	1.22	
	Residual (E)	1.92	1.92	0.96	.86
List Recall					
	Subject (S)	12.62	4.42	4.42	
	Time (T)	30.82	0.90	0.45	
	Residual (E)	3.78	3.78	1.89	.70
Delayed List Recall					
	Subject (S)	16.69	7.54	7.54	
	Time (T)	11.27	0.32	0.16	
	Residual (E)	1.61	1.61	0.81	.90
Immediate Prose Recall					
	Subject (S)	22.54	10.67	10.67	
	Time (T)	52.27	1.70	0.85	
	Residual (E)	1.20	1.20	0.60	.95
Delayed Prose Recall					
	Subject (S)	20.35	9.43	9.43	
	Time (T)	18.15	0.56	0.28	
	Residual (E)	1.49	1.49	0.75	.93
Immediate Names–Faces					
	Subject (S)	20.44	9.52	9.52	
	Time (T)	11.27	0.33	0.17	
	Residual (E)	1.40	1.40	0.70	.93
Delayed Names–Faces					
	Subject (S)	15.51	7.20	7.20	
	Time (T)	6.67	0.19	0.10	
	Residual (E)	1.11	1.11	0.56	.93

Table 12 (Continued)

Generalizability Analyses for Scoring Based on Age Decade Norms

MAS scale	Source of variation	ANOVA mean square	Estimated variance component	Decision variance component[a]	Generalizability coefficient[b]
Visual Reproduction					
	Subject (S)	14.47	6.49	6.49	
	Time (T)	0.00	0.00	0.00	
	Residual (E)	1.48	1.48	0.74	.90
Immediate Visual Recognition					
	Subject (S)	11.55	4.33	4.33	
	Time (T)	15.00	0.40	0.20	
	Residual (E)	2.90	2.90	1.45	.75
Delayed Visual Recognition					
	Subject (S)	16.81	7.58	7.58	
	Time (T)	32.27	1.02	0.51	
	Residual (E)	1.65	1.65	0.83	.90
Short–term Memory					
	Subject (S)	405.94	180.87	180.87	
	Time (T)	0.27	0.00	0.00	
	Residual (E)	44.20	44.20	22.10	.89
Verbal Memory					
	Subject (S)	592.03	271.94	271.94	
	Time (T)	1685.40	54.57	27.29	
	Residual (E)	48.16	48.16	24.08	.92
Visual Memory					
	Subject (S)	386.94	175.91	175.91	
	Time (T)	123.27	2.94	1.47	
	Residual (E)	35.13	35.13	17.57	.91
Global Memory Scale					
	Subject (S)	507.68	240.63	240.63	
	Time (T)	912.60	29.54	14.77	
	Residual (E)	26.43	26.43	13.22	.95

Note. $N = 30$. Subject $df = 29$, time $df = 1$, and residual $df = 29$.

[a]Decision variance component = estimated variance component / frequency of sampling in the study. Frequency of sampling = 1 for subject, 2 for time, and 2 for residual. [b]Generalizability coefficient = $\hat{\sigma}^2(S) / \hat{\sigma}^2(S) + \hat{\sigma}^2(E)$, as estimated by the decision variance components.

Table 13

Generalizability Analyses for Scoring Based on Age and Education Norms

MAS scale	Source of variation	ANOVA mean square	Estimated variance component	Decision variance component[a]	Generalizability coefficient[b]
Verbal Span					
	Subject (S)	20.26	8.05	8.05	
	Time (T)	0.82	0.00	0.00	
	Residual (E)	4.16	4.16	2.08	.79
Visual Span					
	Subject (S)	11.79	4.48	4.48	
	Time (T)	1.67	0.00	0.00	
	Residual (E)	2.84	2.84	1.42	.76
List Acquisition					
	Subject (S)	14.00	5.71	5.71	
	Time (T)	93.75	3.04	1.52	
	Residual (E)	2.58	2.58	1.29	.82
List Recall					
	Subject (S)	19.51	7.84	7.84	
	Time (T)	33.75	1.00	0.50	
	Residual (E)	3.82	3.82	1.91	.80

Table 13 (Continued)

Generalizability Analyses for Scoring Based on Age and Education Norms

MAS scale	Source of variation	ANOVA mean square	Estimated variance component	Decision variance component[a]	Generalizability coefficient[b]
Delayed List Recall					
	Subject (S)	19.80	8.57	8.57	
	Time (T)	9.60	0.23	0.12	
	Residual (E)	2.67	2.67	1.34	.86
Immediate Prose Recall					
	Subject (S)	20.78	9.82	9.82	
	Time (T)	48.60	1.58	0.79	
	Residual (E)	1.15	1.15	0.58	.94
Delayed Prose Recall					
	Subject (S)	23.15	10.76	10.76	
	Time (T)	20.42	0.63	0.32	
	Residual (E)	1.62	1.62	0.81	.93
Immediate Names–Faces					
	Subject (S)	21.29	9.72	9.72	
	Time (T)	11.27	0.31	0.16	
	Residual (E)	1.85	1.85	0.93	.91
Delayed Names–Faces					
	Subject (S)	19.46	9.15	9.15	
	Time (T)	8.07	0.23	0.12	
	Residual (E)	1.17	1.17	0.59	.94
Visual Reproduction					
	Subject (S)	11.51	4.93	4.93	
	Time (T)	0.07	0.00	0.00	
	Residual (E)	1.65	1.65	0.83	.86
Immediate Visual Recognition					
	Subject (S)	10.12	3.59	3.59	
	Time (T)	16.02	0.44	0.22	
	Residual (E)	2.95	2.95	1.48	.71
Delayed Visual Recognition					
	Subject (S)	15.76	7.06	7.06	
	Time (T)	30.82	0.97	0.49	
	Residual (E)	1.64	1.64	0.82	.90
Short-term Memory					
	Subject (S)	452.90	202.01	202.01	
	Time (T)	0.82	0.00	0.00	
	Residual (E)	48.89	48.89	24.45	.89
Verbal Memory					
	Subject (S)	668.64	308.95	308.95	
	Time (T)	1826.02	59.18	29.59	
	Residual (E)	50.74	50.74	25.37	.92
Visual Memory					
	Subject (S)	332.84	143.38	143.38	
	Time (T)	138.02	3.06	1.53	
	Residual (E)	46.09	46.09	23.05	.86
Global Memory Scale					
	Subject (S)	518.44	242.68	242.68	
	Time (T)	920.42	29.58	14.79	
	Residual (E)	33.07	33.07	16.54	.94

Note. $N = 30$. Subject $df = 29$, time $df = 1$, and residual $df = 29$.

[a]Decision variance component = estimated variance component / frequency of sampling in the study. Frequency of sampling = 1 for subject, 2 for time, and 2 for residual. [b]Generalizability coefficient = $\hat{\sigma}^2(S) / \hat{\sigma}^2(S) + \hat{\sigma}^2(E)$, as estimated by the decision variance components.

Table 14

Generalizability Analyses for Visual Reproduction Scoring

Sample	Stimulus	Source of variation	*df*	ANOVA mean square	Estimated variance component	Decision variance component[a]	Generalizability coefficient[b]
Naive examiners							
	Drawing A						
		Subject (S)	9	7.019	0.562	0.562	
		Rater (R)	11	0.827	0.055	0.005	
		Residual (E)	99	0.276	0.276	0.023	.953
	Drawing B						
		Subject (S)	9	10.219	0.826	0.826	
		Rater (R)	11	0.515	0.021	0.002	
		Residual (E)	99	0.301	0.301	0.025	.968
Experienced examiners							
	Drawing A						
		Subject (S)	4	5.620	0.551	0.551	
		Rater (R)	9	0.109	0.000	0.000	
		Residual (E)	36	0.109	0.109	0.011	.981
	Drawing B						
		Subject (S)	4	23.050	2.301	2.301	
		Rater (R)	9	0.044	0.001	0.000	
		Residual (E)	36	0.039	0.039	0.004	.998

[a]Decision variance component = estimated variance component / frequency of sampling in the study. For naive examiners, frequency of sampling = 1 for subject, 12 for rater, and 12 for residual. For experienced examiners, frequency of sampling = 1 for subject, 10 for rater, and 10 for residual.
[b]Generalizability coefficient = $\hat{\sigma}^2(S) / \hat{\sigma}^2(S) + \hat{\sigma}^2(R) + \hat{\sigma}^2(E)$, as estimated by the decision variance components.

be .981 for Drawing A and .998 for Drawing B. Table 14 also presents the generalizability results of this study.

Standard Error of Measurement

The SE_M was calculated for the MAS subtests, Summary Scales, and Global Memory Scale. Generalizability coefficients were used as the estimates of reliability. These calculations were performed for each of the three normative bases. For the MAS subtests, SE_Ms were found to range from .67 to 1.64 across all three normative bases and averaged 1.09 to 1.12. For the Summary Scales, SE_Ms ranged from 4.24 to 5.61 and averaged 4.57 to 4.94 across the normative bases. Global Memory Scale SE_Ms ranged from 3.35 to 3.67 with a mean of 3.46. Table 5 presents the SE_M data (see Chapter 6).

Differences Between Global Memory Scale and IQ and Differences Among Summary Scales

The difference required for significance between the Global Memory Scale score and the Full Scale IQ score obtained on the WAIS–R was derived according to the following formula: significant difference = $1.96\sqrt{SE_{M_A}{}^2 + SE_{M_B}{}^2}$. The SE_M of the WAIS–R Full Scale IQ score as given in the test manual was used for these calculations. These standard score differences were calculated for each of the normative bases. Table 6 presents the minimum difference necessary for significance at the .05 level (see Chapter 6). Differences between pairs of Summary Scale scores were also calculated in a similar manner. Table 6 also presents these data.

Base rates or the frequencies of occurrence of these differences were also examined in the normative sample. Summary Scale score differences were calculated by taking the absolute value of the difference; that is, the direction of the difference between pairs of scores was ignored when computing the base rates. A subset of 471 subjects in the normative sample received the Satz–Mogel short-form administration (Satz & Mogel, 1962) of the WAIS–R, which was used to derive an estimate of Full Scale IQ score. These data were used to examine base rates for differences between Global Memory Scale and Full Scale IQ scores. Base rates for the occurrence of Global Memory Scale less than Full Scale IQ were also calculated. Table 7 presents these data (see Chapter 6).

Differences Among Subtest Scale Scores

Differences between pairs of subtest scale scores were also calculated. The difference derived is the minimum difference required between the two MAS subtest scale scores to be significant at the .05 level. Pairwise scale score differences were calculated for each of the normative bases using the formula pre-

sented above. Tables 8, 9, and 10 present these data for the U.S. census–matched, age decade, and age and education normative bases, respectively (see Chapter 6).

Validity Studies

Convergent and Discriminant Validity. The convergent and discriminant validity of the MAS was examined by correlating MAS scores from 677 normative subjects. Only subjects who had been administered every subtest (e.g., List Recognition) were included in this analysis. The effects of age and education were partialled from these correlations. It was expected that subtests of short–term memory and attention would correlate more highly with each other and only moderately with other subtests. Likewise, subtests of verbal memory were expected to correlate more highly with one another, regardless of whether recall was immediate or delayed, than with subtests of visual memory. The opposite prediction was made for the visual subtests. Scores from the Names–Faces subtest were expected to be moderately correlated with both verbal and visual memory subtests. The pattern of correlation results generally supported these predictions. Table 15 presents the matrix of intercorrelations.

Factorial Validity. A series of marker variable factor analyses were performed on MAS subtest scores from 471 normals and 52 neurologically impaired subjects. Normal and clinical subjects were analyzed separately. The marker variables used in the analyses were the three WAIS–R factors of Verbal Comprehension, Perceptual Organization, and Attention/Concentration (Kaufman, 1990). Marker variables were included in all analyses and were computed according to the following formulas:

> Verbal Comprehension = Sum of scale scores on Information, Vocabulary, Comprehension, and Similarities.
>
> Perceptual Organization = Sum of scale scores on Block Design, Object Assembly, and Picture Completion.
>
> Attention/Concentration = Sum of scores on Digit Span and Arithmetic.

These variables were derived from the Satz–Mogel short–form administration of the WAIS–R (Satz & Mogel, 1962) in the normal sample or from the complete WAIS–R administration in the case of the neurologically impaired sample. Because the MAS tasks are divided to measure verbal and nonverbal memory content as well as immediate recall and attention, these markers were deemed important in establishing the construct integrity of the MAS. MAS subtests were expected to load on the same factor as the marker variable that measures similar constructs.

Separate analyses were conducted for the immediate and delayed MAS scores. Research has shown that specific method factors emerge when immediate and delayed components from a single test are included in one analysis (Larrabee, Kane, Schuck, & Francis, 1985; Russell, 1982). All scores were adjusted for the effects of age and education and analyzed through principal components factor analysis with varimax rotation. Factors with eigenvalues greater than 1.0 were retained for rotation. A variable was classified as loading on a factor if the factor loading was equal to or greater than .40.

Normal sample. The analysis of MAS immediate scores from the normal subjects yielded a two–factor solution (eigenvalues = 3.68 and 1.39, respectively). Factor 1 contained prominent loadings from all of the MAS consolidation measures and the WAIS–R marker variables of Verbal Comprehension and Perceptual Organization. This factor was inferred to be a general memory and intelligence factor and accounted for 27.9% of the variance. Factor 2 contained prominent loadings from Verbal Span, Visual Span, and the WAIS–R Attention/Concentration Factor. This factor was labeled an attention/concentration factor and accounted for 22.8% of the variance. Table 16 presents these factor loadings.

When delayed scores from the MAS subtests were subjected to a similar analysis, virtually the same factor results emerged. A two–factor solution was found to best describe the data (eigenvalues = 3.38 and 1.37, respectively). Factor 1, which accounted for 26.6% of the variance, contained loadings from the MAS delayed consolidation measures and the marker variables of Verbal Comprehension and Perceptual Organization. Verbal Span, Visual Span, and the Attention/Concentration marker variable loaded highly on Factor 2. Factor 2 accounted for 26.2% of the variance. Table 17 presents the results of this analysis.

Neurologically impaired sample. Results from the neurologically impaired sample yielded distinctly different and theoretically compelling results. Analysis of immediate consolidation measures resulted in a three–factor solution (eigenvalues = 3.74, 1.63, and 1.28, respectively). Factor 1, which accounted for 23.9% of the variance, was defined by loadings from Perceptual Organization, Visual Span, Visual Reproduction, and Immediate Visual Recognition. Immediate Names–Faces loaded on both Factor 1 and Factor 3. Factor 2 had loadings from all the marker variables, Verbal Span, and Visual Span and accounted for 23.8% of the variance. Factor 3 contained high loadings from List Recall, Immediate Prose Recall, and the secondary loading of Immediate Names–Faces. Factor 3 accounted for 18.8% of the variance. Based on the pattern of factor loadings, Factor 1 was thought to reflect nonverbal memory

Table 15

MAS Subtest and Summary Scale Intercorrelations Adjusted for Age and Education Effects

MAS variable	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Short–term Memory	Verbal Memory	Visual Memory
Visual Span	.337														
List Acquisition	.241	.219													
List Recall	.180	.154	.669												
Delayed List Recall	.192	.131	.636	.730											
Immediate Prose Recall	.229	.143	.473	.427	.361										
Delayed Prose Recall	.246	.139	.486	.437	.377	.916									
Immediate Names–Faces	.189	.176	.437	.378	.376	.385	.375								
Delayed Names–Faces	.185	.148	.423	.397	.416	.322	.326	.703							
Visual Reproduction	.211	.228	.415	.356	.316	.350	.373	.394	.393						
Immediate Visual Recognition	.215	.133	.356	.311	.337	.230	.250	.297	.297	.373					
Delayed Visual Recognition	.172	.090	.353	.313	.317	.210	.216	.270	.298	.323	.400				
Short–term Memory	.815	.780	.263	.187	.176	.215	.220	.191	.169	.249	.200	.160			
Verbal Memory	.240	.165	.605	.793	.550	.817	.767	.404	.380	.375	.283	.274	.268		
Visual Memory	.250	.188	.394	.344	.323	.309	.327	.365	.358	.789	.778	.404	.295	.412	
Global Memory Scale	.292	.210	.595	.678	.520	.671	.652	.458	.440	.692	.630	.403	.335	.841	.839

Note. $N = 677$.

Table 16

Varimax Factor Loadings of Immediate Memory MAS Subtests and Marker Variables for the Normal Sample

Variable	Factor 1	Factor 2
Verbal Comprehension	.572	.487
Perceptual Organization	.463	.440
Attention/Concentration	.303	.802
Verbal Span	.092	.851
Visual Span	−.017	.643
List Recall	.653	.032
Immediate Prose Recall	.661	.082
Immediate Names–Faces	.729	.077
Visual Reproduction	.651	.168
Immediate Visual Recognition	.575	.150

Note. $N = 471$. Scores were residualized for the effects of age and education.

Table 17

Varimax Factor Loadings of Delayed Memory MAS Subtests and Marker Variables for the Normal Sample

Variable	Factor 1	Factor 2
Verbal Comprehension	.496	.550
Perceptual Organization	.400	.491
Attention/Concentration	.298	.800
Verbal Span	.094	.828
Visual Span	−.087	.651
Delayed List Recall	.719	.059
Delayed Prose Recall	.653	.206
Delayed Names–Faces	.753	.045
Delayed Visual Recognition	.614	.108

Note. $N = 471$. Scores were residualized for the effects of age and education.

Table 18

Varimax Factor Loadings of Immediate Memory MAS Subtests and Marker Variables for the Neurologically Impaired Sample

Variable	Factor 1	Factor 2	Factor 3
Verbal Comprehension	−.043	.713	.360
Perceptual Organization	.685	.406	−.163
Attention/Concentration	.121	.845	.072
Verbal Span	.279	.776	−.010
Visual Span	.439	.531	−.058
List Recall	.238	−.057	.838
Immediate Prose Recall	.007	.206	.810
Immediate Names–Faces	.624	.184	.504
Visual Reproduction	.793	.171	.111
Immediate Visual Recognition	.751	−.025	.293

Note. $N = 52$. Scores were residualized for the effects of age and education.

Table 19

Varimax Factor Loadings of Delayed Memory MAS Subtests and Marker Variables for the Neurologically Impaired Sample

Variable	Factor 1	Factor 2	Factor 3
Verbal Comprehension	.619	.282	−.072
Perceptual Organization	.574	−.072	.609
Attention/Concentration	.799	.090	.169
Verbal Span	.836	.110	−.093
Visual Span	.654	.192	.116
Delayed List Recall	.002	.897	.073
Delayed Prose Recall	.245	.776	−.200
Delayed Names–Faces	.293	.780	.150
Delayed Visual Recognition	−.053	.055	.922

Note. $N = 52$. Scores were residualized for the effects of age and education.

and reasoning. Factor 2 was thought to be a short–term memory and concentration factor, and Factor 3 was most likely a verbal memory factor. Table 18 presents these factor analytic results.

The analysis of delayed memory measures from the neurologically impaired sample revealed a pattern of findings similar to those obtained in the analysis of the immediate memory measures. Again, a three–factor solution was found to provide an adequate fit for the data (eigenvalues = 3.32, 1.63, and 1.18, respectively) and accounted for 29.2%, 24.0%, and 14.9% of the variance, respectively. All three marker variables loaded on the first factor, with Attention/Concentration having the largest loading, along with loadings from Verbal Span and Visual Span. Factor 2 comprised loadings from Delayed List Recall, Delayed Prose Recall, and Delayed Names–Faces. Factor 3 was comprised of loadings from Perceptual Organization and Delayed Visual Recognition. These factors were thought to reflect short–term memory and concentration, verbal memory, and nonverbal memory and reasoning, respectively. Table 19 presents these factor–analytic results.

These factor–analytic studies support the division of the Summary Scale scores and the use of a global measure of memory in the MAS. The finding of a general memory factor for both immediate and delayed recall measures in the normal sample is clearly consistent with the use of a general memory score. This finding also suggests that verbal and visual memory processes are correlated among the normal subjects and do not form separate factors. In contrast, the factor analyses of neurologically impaired subjects clearly suggests a verbal, visual, and attention/concentration structure in the constructs embodied in the MAS. An examination of the manner in which WAIS–R marker variables were correlated with the factors suggests that the WAIS–R Verbal Comprehension, Perceptual Organization,

Table 20

Means and Standard Deviations of MAS Scores for Clinical Groups Based on Norms for Age and Education

MAS variable	Clinical group: Dementia $n = 34$	Closed-head trauma $n = 37$	Left hemisphere lesion $n = 16$	Right hemisphere lesion $n = 23$
Verbal Span				
Mean	7.03	7.76	6.50	7.35
Standard deviation	2.88	2.10	3.86	2.41
Visual Span				
Mean	5.77	6.22	6.00	5.35
Standard deviation	3.83	3.48	3.31	2.99
List Acquisition				
Mean	4.62	5.41	3.44	6.70
Standard deviation	1.79	2.68	1.71	2.72
List Recall				
Mean	3.32	4.62	2.44	6.57
Standard deviation	2.16	3.65	1.83	3.68
Delayed List Recall				
Mean	3.15	4.68	3.13	6.30
Standard deviation	1.89	3.58	2.16	2.93
Immediate Prose Recall				
Mean	5.44	7.30	6.50	8.57
Standard deviation	2.38	2.69	2.19	2.39
Delayed Prose Recall				
Mean	3.82	7.05	4.56	7.30
Standard deviation	2.96	3.21	2.25	3.52
Immediate Names–Faces				
Mean	3.65	5.00	4.75	6.04
Standard deviation	2.68	3.67	2.60	3.76
Delayed Names–Faces				
Mean	3.68	4.89	5.19	6.44
Standard deviation	2.42	3.43	3.02	3.26
Visual Reproduction				
Mean	5.62	6.41	7.19	5.52
Standard deviation	2.45	3.18	3.19	1.90
Immediate Visual Recognition				
Mean	6.53	6.70	8.50	6.70
Standard deviation	2.59	3.49	3.52	2.75
Delayed Visual Recognition				
Mean	8.50	7.46	8.75	7.48
Standard deviation	4.75	3.99	3.99	4.37
Total Intrusions				
Mean	5.68	6.32	8.69	3.96
Standard deviation	4.92	6.66	7.64	4.77
List Clustering: Acquisition				
Mean	0.15	0.18	0.11	0.19
Standard deviation	0.10	0.10	0.08	0.13
List Clustering: Recall				
Mean	0.19	0.23	0.12	0.29
Standard deviation	0.19	0.17	0.16	0.24
List Clustering: Delayed Recall				
Mean	0.25	0.30	0.19	0.21
Standard deviation	0.24	0.15	0.18	0.19
Cued List Recall: Recall				
Mean	4.88	7.84	4.19	8.78
Standard deviation	2.92	2.51	2.59	2.49
Cued List Recall: Delayed Recall				
Mean	4.09	7.95	4.50	8.09
Standard deviation	3.15	2.51	2.92	4.17

Table 20 (Continued)

Means and Standard Deviations of MAS Scores for Clinical Groups Based on Norms for Age and Education

MAS variable	Clinical group: Dementia $n=34$	Closed-head trauma $n=37$	Left hemisphere lesion $n=16$	Right hemisphere lesion $n=23$
List Recognition				
Mean	10.77	10.84	10.69	10.52
Standard deviation	1.96	2.93	2.12	3.52
Short-term Memory				
Mean	80.56	85.38	80.75	80.65
Standard deviation	17.13	14.38	20.41	12.80
Verbal Memory				
Mean	73.15	80.95	73.69	88.70
Standard deviation	8.79	13.43	8.90	14.32
Visual Memory				
Mean	80.82	82.11	90.25	79.91
Standard deviation	12.74	18.98	17.89	13.50
Global Memory Scale				
Mean	73.71	78.62	78.25	82.04
Standard deviation	10.20	16.35	14.05	13.65

and Attention/Concentration Factors are reflected in the Verbal, Visual, and Short-term Memory Summary Scale scores of the MAS, respectively. The factor analyses essentially separated the loading pattern of the general memory factor found among the normative subjects into separate verbal and visual memory factors. Apparently, the separate correlation patterns could emerge because neurologically impaired subjects, especially those with lesions lateralized to one hemisphere, have differential patterns of performance on verbal and visual-spatial tests. Normative subjects do not have these patterns of differential performance.

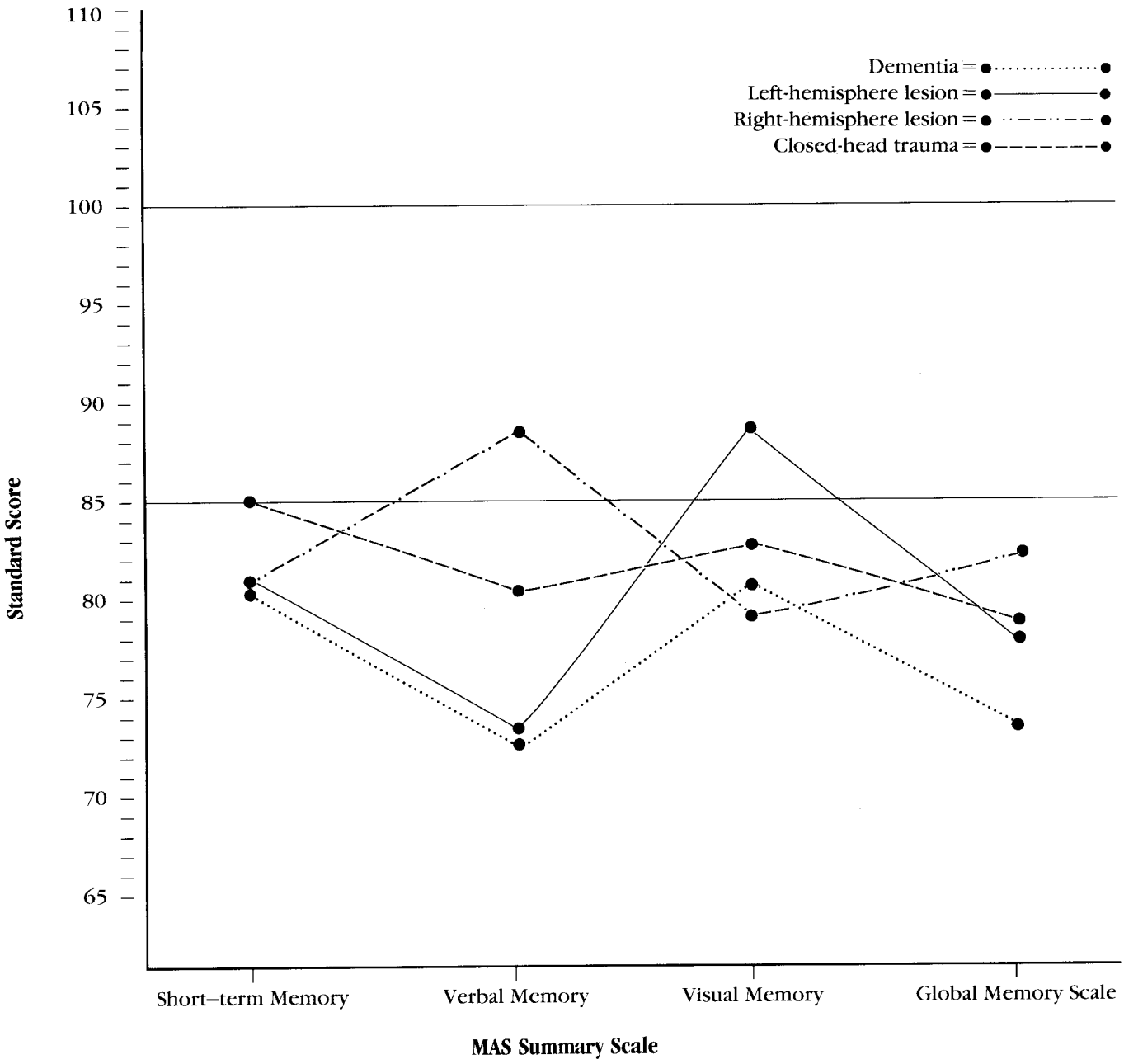
Group Differentiation. Validity of the MAS was also examined by comparing MAS scores from the 843 subjects in the normative sample to scores from 110 subjects with known neurological impairment. Comparisons were made using scale and standard scores derived from the age and education normative tables. Subjects comprising the neurologically impaired sample were patients from five different medical settings located across the United States. Patients comprising the lateralized lesions groups (i.e., left and right CVA) had all sustained CVAs which resulted in prominent neurological impairment involving one cerebral hemisphere. Patients in the closed-head trauma group had all sustained a coma of at least one hour's duration. Patients with dementia-related illness had received medical evaluations which assigned them the presumptive diagnosis of Alzheimer's disease or multi-infarct dementia. All subjects in the neurologically impaired sample received medical examinations that included brain imaging techniques such as computed tomography, magnetic resonance, or radiation scans. Findings from the medical examinations were consistent with the diagnostic categories in which they were classified.

Comparisons of mean subtest and Summary Scale scores were performed by a one-way ANOVA with group membership comprising the classification factor. Results showed that all neurologically impaired groups had significantly lower scores on all MAS subtests and Summary Scales ($p<.05$ in all cases). Table 20 presents means and standard deviations of all MAS scores for the clinical groups. More important was the finding that scores within the impaired groups corresponded to predicted patterns. Patients with left hemisphere lesions performed worse than patients with right hemisphere lesions on verbal memory subtests while patients with right hemisphere lesions performed worse on the visual memory tasks. The differential performance of these two clinical groups presumably occurred because the component verbal and visual-spatial skills which underlie these MAS subtests were differentially affected in these patients.

Although the results strongly reflect lateralized patterns, statistically significant differences emerged only on the MAS Summary Scales and Global Memory Scale. Individual subtests reflecting verbal and visual differences always demonstrated differential

Figure 6

Mean MAS Summary Scale scores and Global Memory Scale scores by diagnostic group



performance in the predicted directions but most did not reach statistical significance. However, the MAS Summary Scale score comparisons all showed the expected mean differences and all, with the exception of Visual Memory, were statistically significant ($p<.05$). Figure 6 presents a plot of the Summary Scale score means.

As seen in Figure 6, patients with dementia–related illness had lower scores on virtually every MAS Summary Scale than any of the other groups. Left and right hemisphere lesion groups performed similarly, with respective differences on Verbal and Visual Memory, and somewhat better overall than the demented group. Patients with closed–head trauma performed the best of all clinical groups, but performance was still below the normal range. These findings are consistent with numerous studies of these disorders.

6 Derivation of Normative Data

Normative data for the MAS were collected from 843 adults. These subjects ranged in age from 18 to 90 years. Of the sample, approximately 43% were men and 57% were women. Data from these subjects were used to derive norms based on: (a) a U.S. census–matched subsample, (b) age decade, and (c) age and education level. Chapter 6 presents a full description of the normative sample and selection and classification procedures.

Influence of Demographic Variables

Analyses were conducted to examine the potential effects of age, gender, and education on MAS scores obtained from the normative sample of 843 subjects. Hierarchical polynomial regression analysis was used to investigate the relationship among these variables. Age and its various powers, education and its various powers, gender, and the various interactions were entered as predictors in that relative order. Results showed a significant linear and quadratic effect for age and a significant linear effect for education on MAS scores ($p<.05$ in all cases). The proportion of variance in MAS scores accounted for by these relationships ranged from approximately 6% to 27%. Gender was found to have a significant relationship with only seven of the MAS scores and accounted for less than 4% of the variance at a maximum. Because of the weak relationship of gender to MAS scores, gender was not included as a basis for deriving normative data.

Calculation of Norms

Normalized scale and standard scores for the U.S. census–matched sample were calculated directly from the sample percentile distributions. Means and standard deviations of the subtest scale scores were derived to equal 10 and 3, respectively, while standard scores for the MAS Summary Scales and the Global Memory Scale were derived to have a mean of 100 and a standard deviation of 15. These data are presented in Appendix C. Calculation of normative data for the Verbal Process scores is presented later in this chapter.

The method of continuous norming was used to derive separate normative data for the age decade and age and education classifications of the normative sample. Continuous norming has been recommended in the case where continuous variables have been found to have a relationship with the scores of interest, in order to correct for irregularities in: (a) the distributions of scores within groups and (b) trends in the means and standard deviations across groups when group sample sizes are 200 or smaller (Angoff & Robertson, 1987). Calculation of normative scores by the method of continuous norming involves the following sequence of steps:

1. Determining the lines or curves of best fit for the progression of means and standard deviations across age groups, using polynomial regression
2. Estimating the mean, standard deviation, skewness, and kurtosis of the distribution of scores for each age group
3. Calculating percentile and standard scores based on the estimates obtained from the above two steps
4. Evaluating the accuracy of the computed norms

This series of steps is implemented for each test score that requires normative transformation. Angoff and Robertson (1987), Gorsuch (1983), Roid (1983), and Zachary and Gorsuch (1985) present detailed discussions of the method of continuous norming.

Table 21

Fitted Means and Standard Deviations of MAS Scores for the Normative Sample by Age Decade

MAS variable	Age decade					
	18–29	30–39	40–49	50–59	60–69	70+
Verbal Span						
Mean	11.97	11.93	11.79	11.56	11.25	10.75
Standard deviation	2.43	2.27	2.15	2.07	2.02	2.02
Visual Span						
Mean	5.42	5.41	5.37	5.27	5.14	4.93
Standard deviation	1.00	1.05	1.09	1.11	1.12	1.11
List Acquisition						
Mean	58.66	61.05	61.58	60.33	57.38	51.65
Standard deviation	9.97	9.19	8.96	9.25	10.03	11.62
List Recall						
Mean	10.12	10.56	10.65	10.41	9.87	8.82
Standard deviation	1.87	1.76	1.76	1.88	2.10	2.50
Delayed List Recall						
Mean	10.78	11.31	11.50	11.35	10.88	9.90
Standard deviation	1.61	1.21	1.09	1.22	1.59	2.36
Immediate Prose Recall						
Mean	5.54	5.93	6.12	6.13	5.98	5.57
Standard deviation	1.78	1.76	1.74	1.75	1.77	1.81
Delayed Prose Recall						
Mean	5.09	5.72	6.07	6.16	6.00	5.47
Standard deviation	1.90	1.85	1.81	1.77	1.74	1.72
Immediate Names–Faces						
Mean	16.42	17.09	17.31	17.11	16.49	15.22
Standard deviation	3.11	2.98	2.93	2.93	3.00	3.17
Delayed Names–Faces						
Mean	8.59	8.91	9.01	8.91	8.61	7.99
Standard deviation	1.87	1.62	1.50	1.48	1.57	1.82
Visual Reproduction						
Mean	6.13	6.29	6.21	5.90	5.37	4.44
Standard deviation	2.29	2.35	2.35	2.31	2.23	2.08
Immediate Visual Recognition						
Mean	17.48	17.54	17.23	16.51	15.45	13.70
Standard deviation	2.49	2.58	2.69	2.84	3.00	3.24
Delayed Visual Recognition						
Mean	18.62	18.39	18.02	17.49	16.83	15.87
Standard deviation	1.30	1.41	1.53	1.65	1.77	1.93
Short–term Memory						
Mean	18.60	18.87	19.05	19.13	19.13	19.02
Standard deviation	4.74	4.81	4.87	4.93	4.99	5.05
Verbal Memory						
Mean	18.55	18.97	19.18	19.21	19.05	18.63
Standard deviation	5.11	4.72	4.55	4.57	4.80	5.32
Visual Memory						
Mean	18.86	19.21	19.37	19.34	19.12	18.62
Standard deviation	5.02	4.88	4.86	4.95	5.15	5.52
Global Memory Scale						
Mean	37.40	38.19	38.57	38.56	38.19	37.25
Standard deviation	8.76	8.20	7.99	8.09	8.51	9.41

Age Decade Classification. To estimate the shape of the distributions, the total sample was divided into 22 subgroups. These age groups were: 18–21, 22–25, 26–29, 30–34, 35–39, 40–41, 42–43, 44–46, 47–49, 50–51, 52–54, 55–56, 57–59, 60–61, 62–63, 64–65, 66–67, 68–69, 70–72, 73–75, 76–79, and 80 years of age and older. Subgroups averaged approximately 38 subjects each with a range of 31 to 49 subjects.

Scores on all the subtests, Summary Scales, and Global Memory Scale of the MAS were selected for continuous norming. Distributions of scores on the Verbal Process scores were too highly skewed to warrant treatment with this procedure. Means and

Table 22

Fitted Means and Standard Deviations of MAS Scores for the Normative Sample by Age and Education

MAS variable	Age group: 18–49, Education (Years) ≤11	18–49, 12	18–49, ≥13	50–59, ≤11	50–59, 12	50–59, ≥13	60–69, ≤11	60–69, 12	60–69, ≥13	70+, ≤11	70+, 12	70+, ≥13
Verbal Span												
Mean	11.22	11.67	12.31	10.86	11.40	12.04	10.57	11.12	11.75	9.89	10.66	11.31
Standard deviation	2.09	2.15	2.20	1.83	1.93	2.05	1.82	1.93	2.05	1.90	2.00	2.12
Visual Span												
Mean	5.14	5.32	5.59	5.03	5.24	5.49	4.89	5.11	5.35	4.56	4.88	5.13
Standard deviation	.98	1.05	1.15	1.03	1.10	1.19	1.02	1.10	1.19	.98	1.08	1.17
List Acquisition												
Mean	55.41	59.03	64.65	55.26	59.21	63.91	52.56	56.57	61.08	45.09	51.27	56.01
Standard deviation	10.38	9.16	7.25	10.15	8.87	7.32	10.96	9.64	8.15	13.32	11.30	9.74
List Recall												
Mean	9.62	10.22	11.14	9.53	10.19	10.97	9.06	9.73	10.48	7.80	8.83	9.62
Standard deviation	2.06	1.83	1.47	2.10	1.85	1.55	2.32	2.07	1.79	2.92	2.50	2.20
Delayed List Recall												
Mean	10.39	11.01	11.97	10.34	11.03	11.85	9.98	10.68	11.48	8.96	9.98	10.81
Standard deviation	1.86	1.35	.56	1.97	1.38	.68	2.24	1.65	.96	3.02	2.17	1.46
Immediate Prose Recall												
Mean	5.32	5.72	6.38	5.62	6.02	6.52	5.47	5.89	6.37	4.87	5.49	5.99
Standard deviation	1.86	1.77	1.63	1.78	1.70	1.59	1.80	1.70	1.59	1.88	1.75	1.64
Delayed Prose Recall												
Mean	4.97	5.45	6.25	5.54	5.99	6.55	5.40	5.88	6.43	4.75	5.45	6.02
Standard deviation	1.89	1.82	1.69	1.73	1.67	1.59	1.70	1.63	1.55	1.70	1.61	1.53
Immediate Names–Faces												
Mean	15.43	16.55	18.25	15.22	16.48	18.02	14.73	16.03	17.55	13.38	15.18	16.72
Standard deviation	3.00	2.75	2.38	3.13	2.83	2.47	3.23	2.92	2.57	3.48	3.07	2.71
Delayed Names–Faces												
Mean	8.00	8.62	9.55	7.85	8.55	9.41	7.61	8.34	9.20	6.98	8.00	8.83
Standard deviation	1.80	1.56	1.18	1.63	1.39	1.10	1.73	1.48	1.20	2.09	1.72	1.43
Visual Reproduction												
Mean	5.23	5.91	6.93	4.88	5.67	6.60	4.36	5.15	6.05	3.03	4.22	5.16
Standard deviation	2.17	2.17	2.18	2.26	2.24	2.21	2.20	2.18	2.14	2.03	2.04	2.01
Immediate Visual Recognition												
Mean	16.52	17.19	18.12	15.35	16.22	17.20	14.40	15.24	16.15	12.30	13.67	14.66
Standard deviation	2.83	2.61	2.34	3.30	3.00	2.63	3.42	3.11	2.75	3.58	3.19	2.83
Delayed Visual Recognition												
Mean	17.98	18.21	18.48	17.01	17.38	17.77	16.43	16.77	17.12	15.29	15.89	16.28
Standard deviation	1.54	1.48	1.42	1.71	1.63	1.55	1.84	1.77	1.71	2.14	2.00	1.92
Short-term Memory												
Mean	18.88	18.95	19.07	19.09	19.13	19.18	19.08	19.13	19.18	18.97	19.05	19.10
Standard deviation	4.93	4.95	4.97	4.95	4.96	4.98	4.97	4.98	5.00	4.99	5.00	5.02
Verbal Memory												
Mean	18.44	18.60	18.91	19.00	19.09	19.23	18.98	19.10	19.22	18.71	18.90	19.04
Standard deviation	5.19	5.03	4.75	4.99	4.84	4.66	5.09	4.94	4.77	5.46	5.21	5.03
Visual Memory												
Mean	18.52	18.68	18.91	18.58	18.75	18.95	18.61	18.79	19.00	18.64	18.84	19.05
Standard deviation	4.90	4.69	4.38	5.09	4.84	4.55	5.30	5.06	4.78	5.82	5.43	5.14
Global Memory Scale												
Mean	36.98	37.28	37.82	37.61	37.86	38.19	37.62	37.90	38.23	37.36	37.75	38.08
Standard deviation	8.77	8.22	7.37	8.77	8.17	7.46	9.12	8.51	7.81	10.10	9.19	8.47

standard deviations of the selected scales for the 22 subgroups were analyzed separately by polynomial regression. Mean subgroup age and its various powers were used as predictors. Results from these analyses found the linear and quadratic components to yield the best fitting curves for the means. Similar results were found to best describe the progression of standard deviations across age subgroups. Means and standard deviations were fitted for the six original age groups using the respective quadratic regression equations. These data are presented in Table 21.

The procedure of continuous norming assumes that the best estimate of distribution shape is derived from the composite aggregated across age levels (Angoff & Robertson, 1987). Composite estimates of skewness and kurtosis were calculated from the weighted averages of these respective values in the 22 subgroups, using size of the sample as weights. Percentile and normalized standard scores corresponding to raw scores were derived according to the Johnson–curve method (Hill, Hill, & Holder, 1976) through the use of a computer program written specifically for this purpose (Roid, 1989). This method estimates the cumulative probabilities of a distribution with a given mean and standard deviation based on probability values of the normal curve adjusted for the skewness and kurtosis of the distribution. Scale scores for the MAS subtests were derived to have a mean of 10 and a standard deviation of 3, while standard scores for the MAS Summary Scales were derived to have a mean of 100 and a standard deviation of 15. These percentile and normalized standard scores are presented in Appendix D for each of the original six age groups.

Accuracy of the calculated percentile and standard score norms was evaluated by comparing the computer–derived percentile values with those derived from the raw frequency distribution of scores for each age group Except for the expected trend from the fitting of means and minor fluctuations of skew, the distributions matched closely at each age group.

Age and Education Classification. The procedure of continuous norming was repeated using the normative sample classified by age and education. To estimate the shape of the distributions, the total sample was divided into 18 subgroups based on age and education level. Subgroups averaged approximately 38 subjects each with a range of 28 to 73 subjects.

Again, only scores on the subtests, Summary Scales, and Global Memory Scale of the MAS were selected for continuous norming. Means and standard deviations of the selected scales for the 18 subgroups were analyzed separately by polynomial regression. Mean subgroup age and education and their various powers were used as predictors. Results from these analyses found the linear and quadratic components of age and the linear component of education to yield the best fitting curves for the means. Similar results were found to best describe the progression of standard deviations across the subgroups. Means and standard deviations were then fitted for the 12 original age and education groups using the respective regression equations. These data are presented in Table 22.

Composite estimates of skewness and kurtosis were again calculated from the weighted averages of these respective values in the 18 subgroups, using size of the sample as weights. Percentile and normalized standard scores corresponding to raw scores were derived according to the same method used in deriving scores for the age decade classification. Scale scores for the MAS subtests were derived to have a mean of 10 and a standard deviation of 3, while standard scores for the MAS Summary Scales were derived to have a mean of 100 and a standard deviation of 15. These percentile and normalized standard scores are presented in Appendix E for each of the original 12 age and education groups.

Accuracy of the calculated percentile and standard score norms was again evaluated by comparing the computer–derived percentile values with those derived from the raw frequency distribution of scores for each age group. As before, the distributions matched closely for each group except for the expected trend from the fitting of means and minor fluctuations of skew.

Verbal Process Scores. Normative data for the Verbal Process scores were determined by calculating raw score ranges for two categories: scores equal to or less than the 16th percentile (1 *SD* from the mean) and scores greater than the 16th percentile. Total Intrusions scores were ranked in descending order prior to calculating percentile scores. It was decided that normative data presented in a categorical manner would more accurately reflect the skewed nature of the distributions of these scales. Normative data were derived separately for each of the three normative bases. These data are presented in Appendixes C, D, and E for the U.S. census–matched sample, age decade classification, and age and education classification, respectively.

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APPENDIX A

MAS Record Form

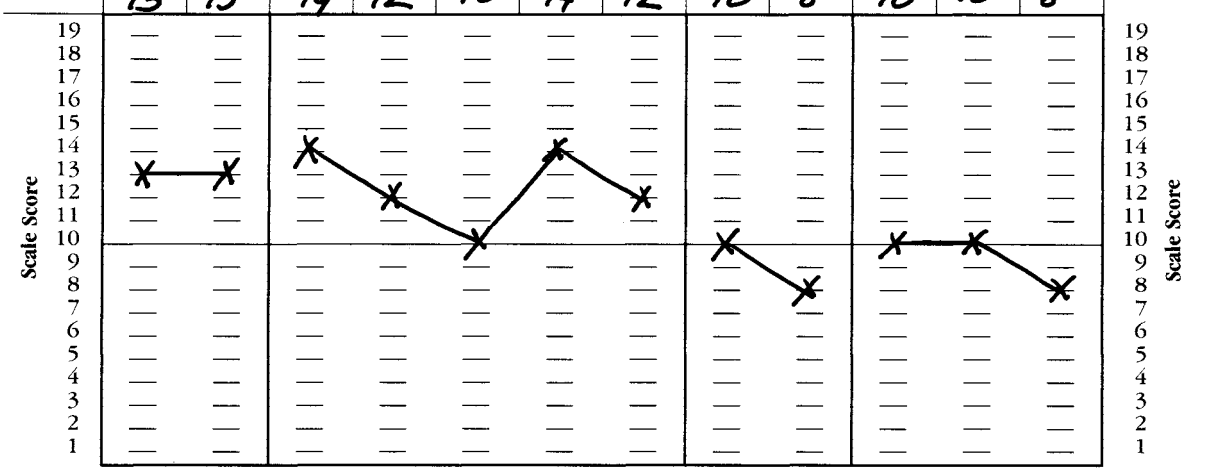
Name D. Smith Test Date 6/24/90

Sex M Age 69 Education 8 yrs. Occupation Retired

Handedness R Examiner J.T. Jones, Ph.D.

Subtest Profile

	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition
Raw score	Ⓐ 13	Ⓑ 6	Ⓒ 65	Ⓓ 11	Ⓔ 11	Ⓕ 8	Ⓖ 7	Ⓗ 16	Ⓘ 7	Ⓙ 5	Ⓚ 15	Ⓛ 16
Scale score	13	13	14	12	10	14	12	10	8	10	10	8



Normative Table Ages: 60-69 / Educ: ≤ 11 yrs.

Verbal Process Scores

	Raw score	Within expectations	Significant
Total Intrusions	1	✓	___ (High)
List Clustering			
Acquisition	.20	✓	___ (Low)
Recall	.45	✓	___ (Low)
Delayed Recall	.45	✓	___ (Low)
Cued List Recall			
Recall	12	✓	___ (Low)
Delayed Recall	10	✓	___ (Low)
List Recognition	12	✓	___ (Low)

Summary Scales

	Scale score		Standard score
I) Verbal Span	13		
II) Visual Span	13		
Total I + II	26	Short-term Memory	120
III) List Recall	12		
IV) Immediate Prose Recall	14		
Total III + IV	26	Verbal Memory	123
V) Visual Reproduction	10		
VI) Immediate Visual Recognition	10		
Total V + VI	20	Visual Memory	103
Total III + IV + V + VI	46	Global Memory Scale	114

Referral Information

Referral Question Client referred by his physician for concerns over reported memory problems.

Background Information/Presenting Complaints Family is concerned over client's recent complaints about remembering names of new acquaintances and locations of articles placed around the house. Client states his memory "just isn't what it used to be."

Behavioral Observations

Client appeared concerned re memory. Attitude was cooperative and friendly. No apparent deficits in language, speech or motor functions. Physical appearance was unremarkable.

Testing Situation

Rapport
- ✓ Excellent
- ___ Good
- ___ Fair
- ___ Poor

Cooperation
- ✓ Excellent
- ___ Adequate
- ___ Variable
- ___ Resistant
- ___ Noncompliant

Effort on Tests
- ✓ Excellent
- ___ Adequate
- ___ Fair
- ___ Variable
- ___ Poor

List Learning

Instructions: ***I'm going to read a list of 12 words. When I'm finished, I want you to tell me as many words as you can remember. It doesn't matter in what order you say them. We will practice the list six times or until you remember all 12 words. Do you understand? Listen carefully. Here are the words.*** Discontinue administration after all 12 words are correctly recalled during a trial.

Learning Trials

Learning List	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6
Blue	B	S	B	C *		
England	E	I *	E *	R		
Sparrow	P	E	I	E		
Yellow	I	B	P *	B *		
Italy	Greece	R	D	O		
Paris	S	O	R	S		
Crow	O	P *	O	I		
Orange	C *	D	S	P *		
Denver	R	C	Y	D		
Japan	I	Y	C	A		
Athens		A		Y		
Robin				J		

Correct	8	11	10	12	12	12
Intrusions	1	0	0	0		
Clusters	1	2	2	3		

List Acquisition (Total Correct) 65 ©

Total Clusters 8

Total Intrusions 1

Total Correct Words Recalled on Administered Trials 41

List Clustering: Acquisition .20

Prose Memory

Instructions: ***I am going to read a short story consisting of a few sentences. Listen carefully. When I am finished, I am going to ask you to tell me as much of it as you can remember. Do you understand? Here is the story.***

Prose Story: The Bank Robbery

Three armed men burst through the doors of the bank at Hillstone on Tuesday afternoon, just after half past two. They ordered a frightened 19-year-old teller to fill the six large, red suitcases they carried with money. When the bags were filled, the three men ran to a green, late-model station wagon and drove off along Mark Street.

Immediate Free Recall Trial: ***Now, tell me as much of the story as you remember.*** Record the respondent's production verbatim in the area below.

Immediate Free Recall:

3 masked men with guns ran into a bank and had a cashier stuff money in the suitcases they brought. After the hold-up, they ran to a station wagon and got away.

Immediate Cued Recall Trial: ***Now I am going to ask you some questions about the story.***

1. How many men burst into the bank? (3)	3	0 (1)
2. Where was the bank? (at Hillstone)	Hill something	(0) 1
3. At what time did the robbery occur? (2:30)	2:30	0 (1)
4. How old was the teller? (19)	19	0 (1)
5. What did the men order the teller to do? (fill the suitcases)	fill the suitcases	0 (1)
6. What color were the suitcases? (red)	red	0 (1)
7. When the cases were filled, what did the men do? (ran to [or got into] the car)	ran to the car	0 (1)
8. What kind of car did the men drive away in? (a station wagon)	station wagon	0 (1)
9. What street did they drive away on? (Mark Street)	Mark St.	0 (1)

Immediate Prose Recall 8

List Recall

Instructions:

Recall Trial: Do not read the Learning List. ***Remember that list of words that you learned a few minutes ago? Tell me as many of those words as you can remember. Begin.***

Cued Recall Trial: ***Now tell me the words in the list that were the names of Countries (Colors, Birds, Cities).***

Learning List	Recall Trial	Cued Recall Trial
Blue	E	I
England	B *	E
Sparrow	Y *	J
Yellow	O	B
Italy	S *	Y
Paris	C *	O
Crow	R	S
Orange	I	C
Denver	D *	R
Japan	A	D
Athens	J	A
Robin		P

Correct 11 ⓓ

Correct 12

Clusters 5

List Clustering: Recall .45

List Recognition

Instructions: Place Respondent Sheet 1 in front of the respondent with Side A facing up, along with a pencil. ***Here are some pairs of words. One word in the pair was on the list that we have been practicing; the other word was not. Circle the word that was on the list.*** After the respondent has completed the task, retrieve the materials before proceeding.

Verbal Span

Numbers Forward

Instructions: ***I am going to say a series of numbers for you to remember. When I am finished, I want you to say them in the exact order in which I said them.*** Discontinue if the respondent fails both trials of a series.

Series		Series	
1–2	2	5–8–3–9–7–1	6
3–6	2	2–7–4–1–6–9	6
7–9–1	3	3–5–1–9–7–4–6	7
4–6–9	3	5–7–9–3–1–8–6	7
5–8–2–6	4	2–4–9–3–5–8–6–1	8
6–3–7–9	4	4–9–6–3–1–7–5–8	8
1–4–2–6–8	5	5–8–6–4–1–3–9–2–7	9
7–5–8–2–4	5	7–9–5–3–1–6–2–4–8	9

Longest Forward 7

Numbers Backward

Instructions: Say to the respondent: ***Again I am going to say a series of numbers. This time when I am finished, I want you to say them in the reverse order in which I said them.*** Discontinue if the respondent fails both trials of a series.

Series		Series	
3–9	2	5–1–4–9–7–3	6
7–1	2	9–5–7–3–6–8	6
5–1–8	3	8–3–1–5–9–2–4	7
2–6–7	3	9–3–7–5–8–6–4	7
8–5–2–4	4	8–6–3–9–4–5–1–7	8
9–7–1–2	4	3–8–4–9–7–5–2–6	8
6–3–5–7–2	5	2–4–7–9–6–8–5–3–1	9
1–7–5–3–6	5	7–4–6–1–9–3–6–2–5	9

Longest Backward 6

Verbal Span (Longest Forward + Longest Backward) 13 Ⓐ

Visual Span

Instructions: Properly orient the stimulus card in front of the respondent. Say: ***Here is a pattern of stars. I will touch a series of them with my pencil. Watch closely because when I am finished, I want you to touch the same stars in the same order that I did.*** Discontinue if the respondent fails both trials of a series.

Series		Series	
1–2	2	5–8–3–9–7–1	6
3–6	2	2–7–4–1–6–9	6
7–9–1	3	3–5–1–9–7–4–6	7
4–6–9	3	5–7–9–3–1–8–6	7
5–8–2–6	4	2–4–9–3–5–8–6–1	8
6–3–7–9	4	4–9–6–3–1–7–5–8	8
1–4–2–6–8	5	5–8–6–4–1–3–9–2–7	9
7–5–8–2–4	5	7–9–5–3–1–6–2–4–8	9

Visual Span 6 Ⓑ

Visual Recognition

Instructions:

Example: Place the Stimulus Card Set in front of the respondent. ***Now I am going to show you some designs that I want you to remember.*** Present the sample target design and say: ***First, I will show you a design like this for a short time. Try to remember it and keep it in your mind. Look at it now.*** Expose the figure for 5 seconds. ***Now I would like you to work on this matching task.*** Turn over the next card to expose the visual distractor designs. ***I want you to count the number of designs below that match this top design*** (point to the design at the top of the card). ***See, here is one that matches right here*** (point to the first design that matches the top design). ***After a time I will say stop and ask how many matching designs you counted. Go ahead and count them now.*** Expose the distractor designs for 15 seconds. ***Stop. How many matching designs did you count? Next I will show you a design like this*** (turn over the next card to expose the test design). ***I want you to tell me if it is the same or different from the design I showed you before I asked you to count. Is this the same or different from the one I showed you before?*** Do not record the responses to the sample.

Items 1 through 5: When presenting the test figure, ask the respondent: ***Is this the same or different from the one I showed you before you started counting?***

Items 6 through 10: When presenting the test figure, ask the respondent: ***Now, which one of these five designs is the one I showed you before? Point to it.***

Item	Number Counted	Response	Scoring Key	Score
1	6	S	S	0 (2)
2	9	S	S	0 (2)
3	4	D	D	0 (2)
4	4	D	S	(0) 2
5	6	D	D	0 (2)
			Total A	8

Item	Number Counted	Figure Selected	Scoring Key	Score
6	10	A	A C	(2) 1
7	4	A	D B	2 1
8	7	C	A C	2 (1)
9	3	C	C B	(2) 1
10	8	C	C B	(2) 1
			Total B	7

Immediate Visual Recognition (Total A + Total B) 15 Ⓚ

Visual Reproduction

Instructions: Return the pencil and Respondent Sheet 1 with Side B facing up to the respondent. ***Now instead of asking you to recognize the designs, I want you to draw them for me. Draw the first one right here*** (point to the section of the Respondent Sheet labeled Drawing A) ***when I tell you to. Look at this design.*** Expose the design for 10 seconds. Turn to the distractor designs and say: ***Begin counting the matching designs.*** Present the distractor designs for 15 seconds. ***Stop. How many did you count? Now draw the design I showed you before you counted right here*** (point to the section of the Respondent Sheet labeled Drawing A). Repeat the procedure for Drawing B using the space labeled Drawing B on the Respondent Sheet. Retrieve the Respondent Sheet before continuing to Names–Faces.

	Drawing A	Drawing B
Number Counted	5	6
Trial Readministered		

Names–Faces

Instructions: ***I am going to show you 10 photographs of people. I'll tell you the name of each person as I show you the photograph. After I show you all 10, I will show you the photos again and ask you to tell me the name of the person.*** Present each photo for 5 seconds. At the end of the learning series turn to the Names–Faces Test Series A, in the Stimulus Card Set. ***Now I am going to show you each photo again and give you three names. You are to tell me which of the three names belongs with the photo.*** At the end of Test Series A, say to the respondent: ***Again I am going to show you the 10 photographs and tell you the name of each person as I show you his or her photo. When I am finished, I will show you each photo and ask you to tell me which of the names belongs with the photo, just as before.*** Repeat this procedure with Names–Faces Learning Series B and Test Series B.

Test Series A				Test Series B			
Item Number	Response	Correct Response	Score	Item Number	Response	Correct Response	Score
1	Emerson	David Emerson	0 (1)	1	Ford	Edward Ford	0 (1)
2	Davis	Edward Ford	(0) 1	2	Kellerman	Barbara Kellerman	0 (1)
3	Olson	Walter Davis	(0) 1	3	Carter	Donna Carter	0 (1)
4	Weiss	Sally Weiss	0 (1)	4	Weiss	Sally Weiss	0 (1)
5	Bannister	Ann Bannister	0 (1)	5	Wilson	Jane Wilson	0 (1)
6	Neal	Donna Carter	(0) 1	6	Moore	Susan Moore	0 (1)
7	Wilson	Jane Wilson	0 (1)	7	Emerson	David Emerson	0 (1)
8	Moore	Susan Moore	0 (1)	8	Bannister	Ann Bannister	0 (1)
9	Abbott	Robert Abbott	0 (1)	9	Ford	Robert Abbott	(0) 1
10	Kellerman	Barbara Kellerman	0 (1)	10	Davis	Walter Davis	0 (1)
		Total A 7				Total B 9	

Immediate Names–Faces (Total A + Total B) 16 Ⓗ

Delayed List Recall

Instructions:

Delayed Recall Trial: Do not read the Learning List. ***Remember that list of words that we practiced at the beginning of the test? Tell me as many of those words as you can remember. Begin.***

Delayed Cued Recall Trial: ***Now tell me the words in the list that were the names of Countries (Colors, Birds, Cities).***

Learning List	Recall Trial	Cued Recall Trial
Blue	E	E
England	B	I
Sparrow	R*	
Yellow	C *	B
Italy	S	O
Paris	Y *	Y
Crow	D	S
Orange	P *	C
Denver	D *	R
Japan	A	D
Athens	J	P
Robin	E	

Correct 11 Ⓔ

Correct 10

Clusters 5

List Clustering: Delayed Recall .45

Delayed Prose Memory

Instructions:

Delayed Free Recall Trial: ***Remember the short story that I read to you before? Tell me as much of the story as you can remember now.*** If the respondent cannot remember any of the story, say: ***It was a story about a bank robbery. Can you tell me anything else about it?***

Delayed Free Recall:

There were some men who robbed a bank of lots of money. A teller stuffed the money in some suitcases the robbers brought. A station wagon picked them up as they left the bank.

Delayed Cued Recall Trial: ***Now I am going to ask you some questions about the story.***

1. How many men burst into the bank? (3)	3	0 (1)
2. Where was the bank? (at Hillstone)	Don't know	(0) 1
3. At what time did the robbery occur? (2:30)	2:30	0 (1)
4. How old was the teller? (19)	19	0 (1)
5. What did the men order the teller to do? (fill the suitcases)	fill up the suitcases	0 (1)
6. What color were the suitcases? (red)	red	0 (1)
7. When the cases were filled, what did the men do? (ran to [or got into] the car)	went to a car	0 (1)
8. What kind of car did the men drive away in? (a station wagon)	station wagon	0 (1)
9. What street did they drive away on? (Mark Street)	Don't know	(0) 1

Delayed Prose Recall 7 ©

Delayed Visual Recognition

Instructions: Place Respondent Sheet 2 in front of the respondent, along with a pencil. Be sure that Side A with figures 1 through 10 is facing up. ***Both sides of this form contain designs. Some of the designs you have seen before and others you have not. Draw an "X" through the designs that you have seen before. When you have completed this side, turn the sheet over and continue.*** Retrieve the Respondent Sheet and pencil before proceeding.

Scoring Key

Figure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Subtotal
Response: Marked	(1)	(0)	(1)	0	(1)	0	(1)	0	1	(1)	(0)	(1)	0	0	(1)	1	(1)	0	(1)	0	8
Response: Not Marked	0	1	0	(1)	0	(1)	0	(1)	(0)	0	1	1	(1)	(1)	0	(0)	0	(1)	0	(1)	8

Delayed Visual Recognition [16] (L)

Delayed Names–Faces Recall

Instructions: Turn to the Names–Faces Test Series C in the Stimulus Card Set. ***Remember those names and faces we practiced? Just as before, I am going to show you each photo and give you three names. You are to tell me which one of the three names belongs with the photo.*** Present the photos and name alternatives in Test Series C.

Test Series C			
Item Number	Response	Correct Response	Score
1	Moore	Susan Moore	0 (1)
2	Emerson	David Emerson	0 (1)
3	Davis	Walter Davis	0 (1)
4	Wilson	Jane Wilson	0 (1)
5	Neal	Donna Carter	(0) 1
6	Ford	Robert Abbott	(0) 1
7	Kellerman	Barbara Kellerman	0 (1)
8	Weiss	Sally Weiss	0 (1)
9	Bannister	Ann Bannister	0 (1)
10	Davis	Edward Ford	(0) 1

Delayed Names–Faces [7] (I)

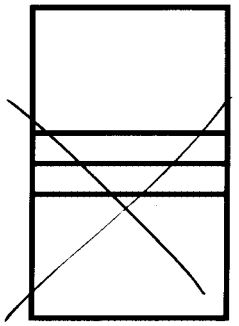
Notes:

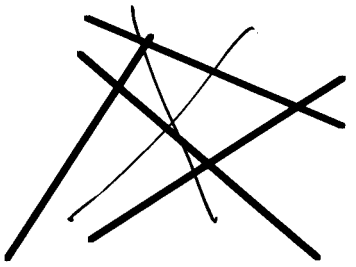
List Learning: Asked if it was okay to repeat words.
List Recall: Spontaneously mentioned color and bird categories.

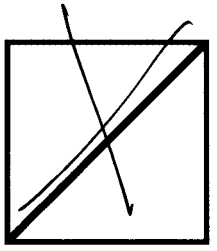
Respondent Sheet 2

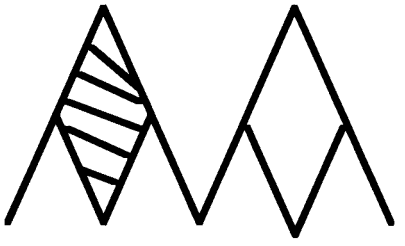
Side A

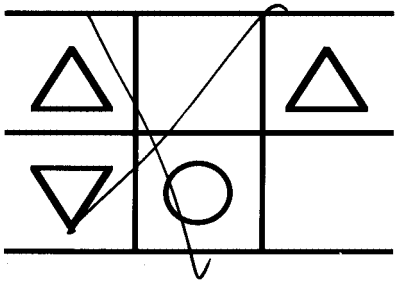
Name D. Smith Sex M Age 69 Date 6 / 24 / 90

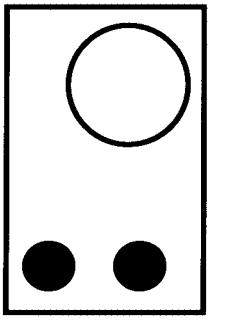
1. 

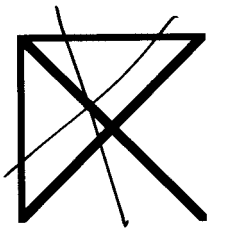
2. 

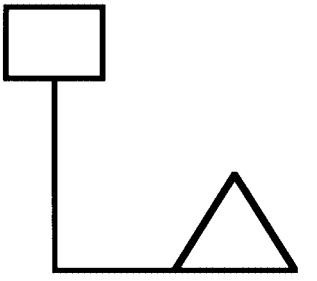
3. 

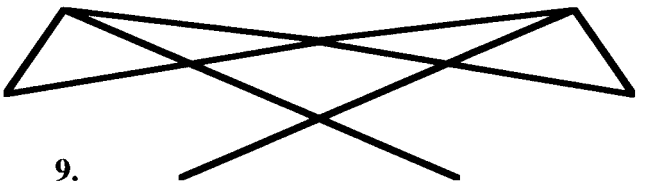
4. 

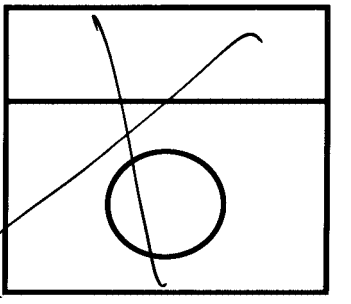
5. 

6. 

7. 

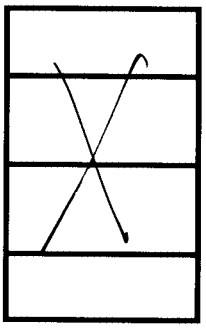
8. 

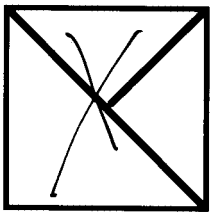
9. 

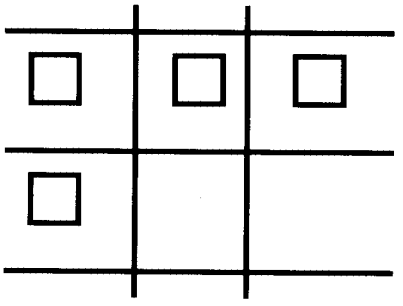
10. 

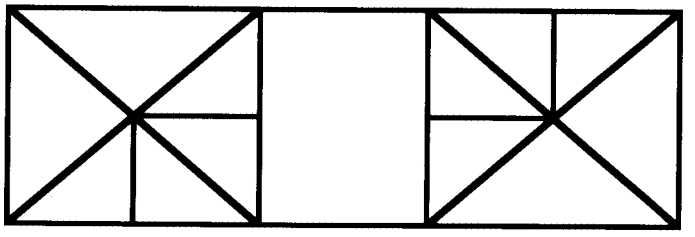
Respondent Sheet 2

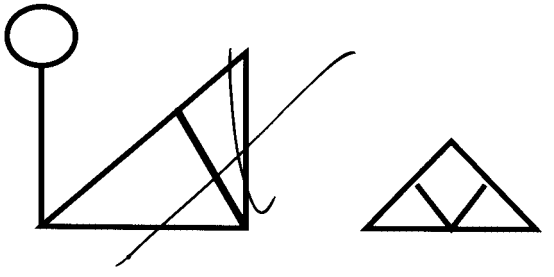
Side B

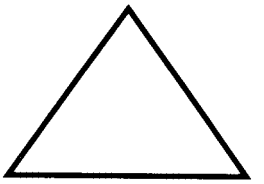
11. 

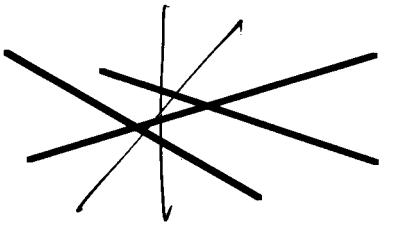
12. 

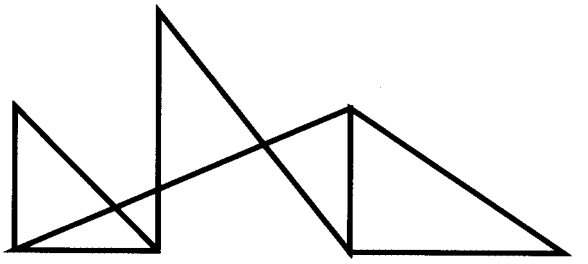
13. 

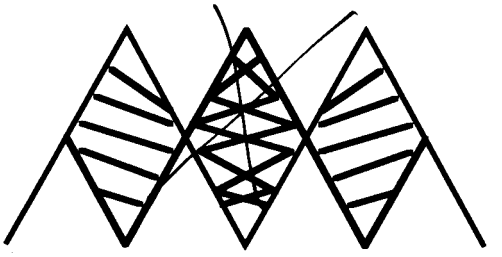
14. 

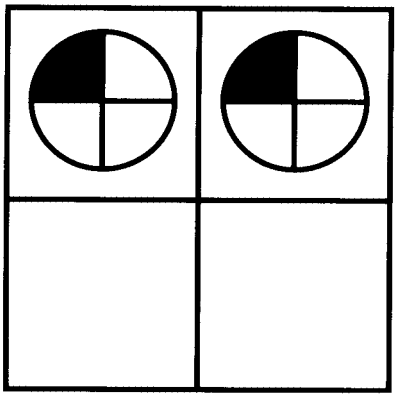
15. 

16. 

17. 

18. 

19. 

20. 

Respondent Sheet 1

Side A

Name D. Smith Sex M Age 69 Date 6/24/90

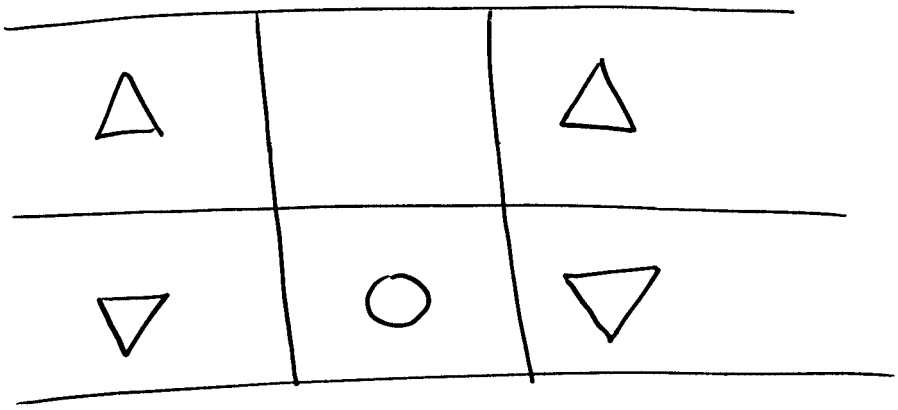
Red	Rome	Gray	Orange
Blue	Athens	Yellow	White
Robin	Magpie	Denver	Dublin
Starling	Sparrow	Seattle	Paris
England	Japan	Egypt	Woodpecker
India	Mongolia	Italy	Crow

List Recognition 12

Respondent Sheet 1

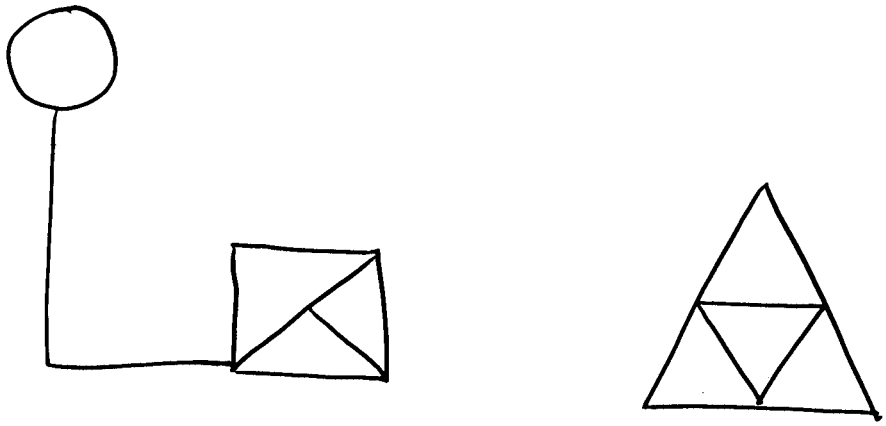
Side B

Drawing A



Score A 3

Drawing B



Score B 2

Visual Reproduction (Score A + Score B) 5 Ⓙ

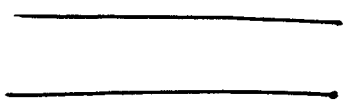
APPENDIX B
Visual Reproduction Scoring Criteria and Examples

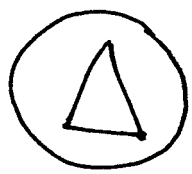
Score the Visual Reproduction drawings according to the criteria listed below. When using the scoring criteria, the examiner should take into account the influence of poor drawing ability on the reproduction of the figures.

Drawing A

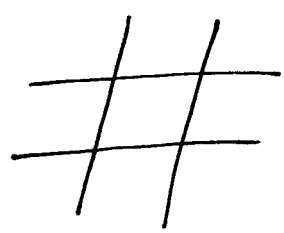
Scoring Criteria. Scores for Drawing A are assigned based on the following criteria:

Score = 0: Incorrect reproduction that does not qualify for a higher level of scoring (examples would be presence of only one circle or only one triangle),
or
miscellaneous shapes,
or
a drawing of the distractor design.

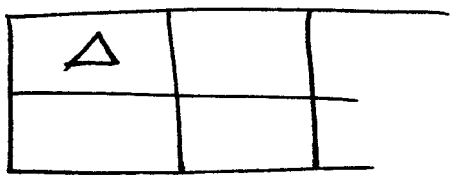


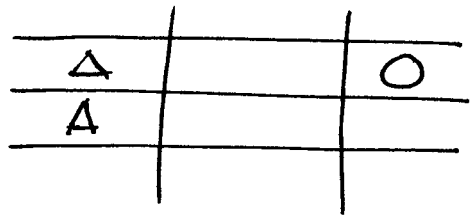


Score = 1: Presence of at least one triangle and one circle without a simple grid,
or
presence of a simple grid alone (the grid need not be accurately reproduced).

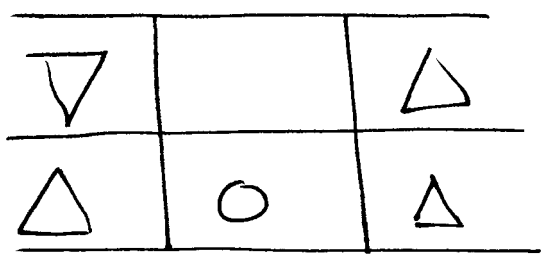


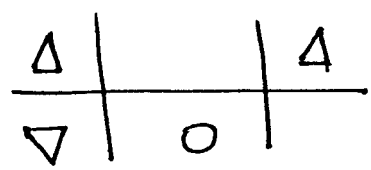
Score = 2: Presence of a simple grid and at least one triangle or one circle. The grid need not be accurately reproduced. The circle or triangle need not be properly placed or oriented.



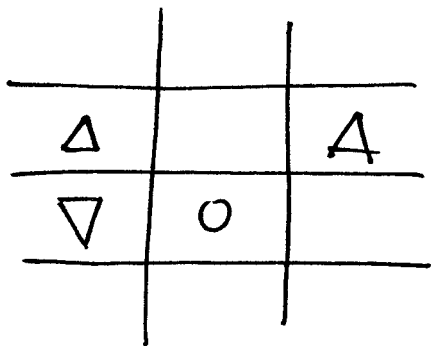


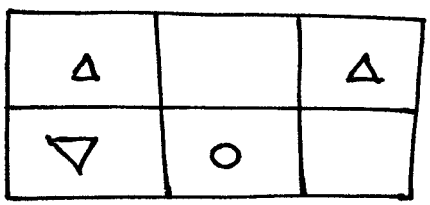
Score = 3: Presence of a correct grid with three horizontal and two vertical lines (vertical lines stop at the intersection with the top and bottom horizontal lines) and at least two triangles and one circle (the circle and triangles need not be correctly located within the grid),
or
presence of a simple grid (need not be accurately produced) with three triangles and one circle (need not be correctly located in the grid).



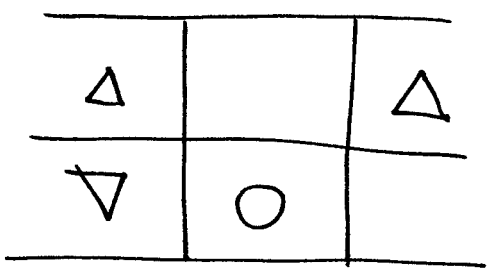


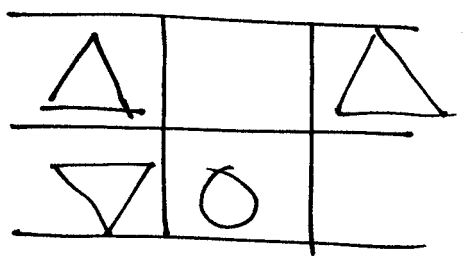
Score = 4: Presence of a grid with three horizontal and two vertical lines (vertical lines extend beyond the top and bottom horizontal lines) and one circle and three triangles properly located and oriented within the grid,
or
presence of a grid with three horizontal lines and four vertical lines (vertical lines stop at top and bottom horizontal lines and the extra vertical lines are located on sides to form rectangle) and one circle and three triangles properly located and oriented within the grid.





Score = 5: Correct reproduction of the figure. Vertical lines of the grid terminate at the intersection of the top and bottom horizontal lines. Triangles and circle are properly located and oriented within the grid.





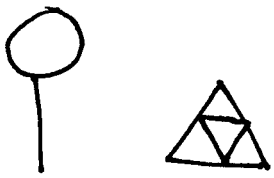
Drawing B

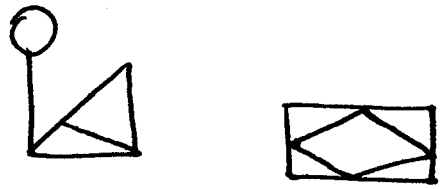
Scoring Criteria. Scores for Drawing B are assigned based on the following criteria:

Score = 0: Incorrect reproduction that does not qualify for a higher level of scoring (examples would be a design other than a triangle with interior details),
or
a triangle with no interior design,
or
a circle without a straight vertical line beneath it,
or
reproduction of the distractor design.

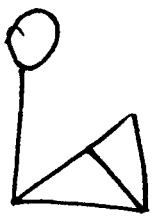
Score = 1: a triangle with incorrect interior details,
or
a circle with a straight vertical line beneath it (which may or may not be attached to another shape).

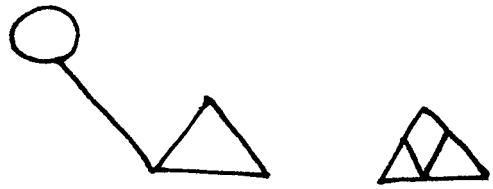
Score = 2: Presence of two figures drawn separately and distinctly, one of which must satisfy the criteria for a score of 1. Neither figure is correctly reproduced.



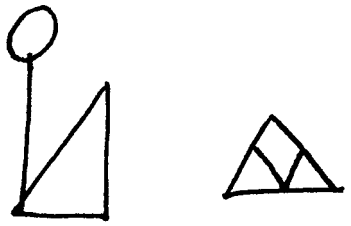


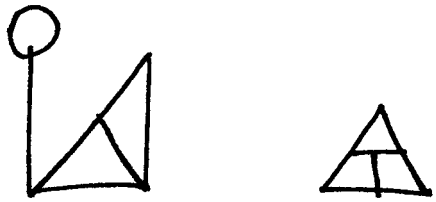
Score = 3: Presence of at least one of the figures which is correctly reproduced. The second figure may be entirely incorrect.



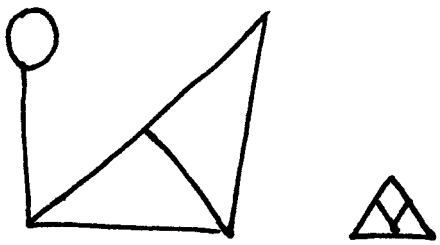


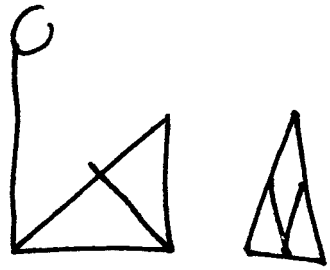
Score = 4: Presence of both figures with one correctly reproduced. The other is correct except for improper reproduction of the interior details.





Score = 5: Correct reproduction of both figures.





APPENDIX C

Normative Data for U.S. Census–matched Sample

Table C1

Normative Data for U.S. Census–matched Sample

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19			72										19	>99
>99	18													18	>99
99	17	18	9											17	99
98	16	17	8	71			9							16	98
95	15	16						9			10			15	95
91	14	15	7	70								20	20	14	91
84	13	14		69	12		8	8	20		9			13	84
75	12	13	6	67–68				7	19	10	8	19		12	75
63	11			65–66		12	7						19	11	63
50	10	12		62–64	11		6	6	18		7	18		10	50
37	9	11	5	58–61				5	17	9	6	17	18	9	37
25	8	10		53–57	10	11	5		15–16	8	5	15–16	17	8	25
16	7			48–52	9	10	4	4	14	7	4	14	16	7	16
9	6	9	4	42–47	8	9		3	12–13	6	3	12–13	15	6	9
5	5			37–41	6–7	7–8	3		10–11	5	2	11	14	5	5
2	4	8		31–36	5	5–6	2	2	8–9	4		9–10	13	4	2
1	3		3	27–30	3–4	3–4			6–7	3	1	8	12	3	1
<1	2			24–26	2		1	1	4–5	2		7	11	2	<1
<1	1	0–7	0–2	0–23	0–1	0–2	0	0	0–3	0–1	0	0–6	0–10	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<6	>.12	>.10	>.17	>8	>10	12	>16	Within expectations
Significant	≤16	≥6	≤.12	≤.10	≤.17	≤8	≤10	≤11	≤16	Significant

Table C1 (Continued)

Summary Scales

Short–term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile	Short–term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum						Scale score sum					
33–34				146	>99		19			99	47
32				143	>99	19			37	98	45
				141	>99			18		97	42
				139	>99	18	18		36	96	40
31				138	>99			17	35	95	37
			58	137	99		17			94	35
				136	99	17			34	93	32
				135	99			16	33	92	30
30			57	134	99		16			91	28
	29			133	99	16			32	90	25
			56	132	98			15		89	23
		29		131	98		15		31	88	21
29			55	130	98	15		14	30	87	19
	28			129	97		14			86	18
			54	128	97				29	85	16
		28		127	97	14		13	28	84	14
28			53	126	96		13			83	13
	27			125	95				27	82	12
			52	124	95	13		12	26	81	10
27		27		123	94		12			80	9
			51	122	93	12			25	79	8
	26			121	92			11		78	7
26		26	50	120	91		11		24	77	6
			49	119	90	11			23	76	6
	25			118	89			10		75	5
		25	48	117	87		10		22	74	4
25				116	86	10			21	73	4
			47	115	84					72	3
	24	24		114	83		9	9	20	71	3
24			46	113	81	9			19	70	2
				112	79					69	2
	23	23	45	111	77		8		18	68	2
23			44	110	75	8		8	17	67	1
				109	73					66	1
	22	22	43	108	70		7		16	65	1
22				107	68	7				64	1
			42	106	66			7	15	63	1
	21	21	41	105	63					62	1
21				104	61	6	6		14	61	<1
		20	40	103	58				13	60	<1
	20			102	55			6	12	58	<1
20			39	101	53	5	5		11	56	<1
		19	38	100	50	2–4	2–4	2–5	4–10	53	<1

APPENDIX D

Normative Data by Age Decade

Table D1

Age: 18 Through 29 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19													19	>99
>99	18		9											18	>99
99	17						9							17	99
98	16	18	8											16	98
95	15	17						9						15	95
91	14	16	7	72			8		20		10			14	91
84	13	15		71	12			8			9	20	20	13	84
75	12	14		69–70		12	7		19		8			12	75
63	11	13	6	67–68				7		10	7	19		11	63
50	10	12		64–66	11		6	6	18			18	19	10	50
37	9	11		61–63		11			16–17	9	6	17		9	37
25	8		5	57–60	10		5	5	15		5		18	8	25
16	7	10		53–56	9	10	4	4	14	8	4	15–16		7	16
9	6	9		49–52	8	9			12–13	7		14	17	6	9
5	5		4	44–48	7	8	3	3	11	6	3	13		5	5
2	4	8		40–43	6	6–7	2	2	9–10		2	12	16	4	2
1	3			35–39	5	5		1	8	5		11		3	1
<1	2		3	31–34	4	4	1		7	4		10	15	2	<1
<1	1	0–7	0–2	0–30	0–3	0–3	0	0	0–6	0–3	0–1	0–9	0–14	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	Cued List Recall: List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<7	>.08	>.10	>.10	>8	>10	12	>16	Within expectations
Significant	≤16	≥7	≤.08	≤.10	≤.10	≤8	≤10	≤11	≤16	Significant

Table D1 (Continued)

Summary Scales

Short–term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
33–34				146	>99
32				143	>99
	30			141	>99
				139	>99
31			57	138	>99
				137	99
30	29		56	136	99
				135	99
			55	134	99
				133	99
29	28			132	98
			54	131	98
				130	98
28			53	129	97
				128	97
	27		52	127	97
27				126	96
			51	125	95
		27		124	95
26	26			123	94
			50	122	93
		26		121	92
			49	120	91
25	25			119	90
		25	48	118	89
				117	87
24	24		47	116	86
		24		115	84
			46	114	83
23				113	81
	23	23	45	112	79
				111	77
22			44	110	75
	22	22		109	73
			43	108	70
21			42	107	68
	21			106	66
		21	41	105	63
20				104	61
	20		40	103	58
		20		102	55
19			39	101	53
	19		38	100	50
		19		99	47
18			37	98	45
	18			97	42
		18	36	96	40
17				95	37
	17	17	35	94	35
			34	93	32
				92	30
16	16	16	33	91	28
			32	90	25
	15			89	23
15		15	31	88	21
			30	87	19
	14			86	18
14		14	29	85	16
				84	14
	13		28	83	13
13		13	27	82	12
	12		26	81	10
				80	9
12		12	25	79	8
	11		24	78	7
		11		77	6
	10		23	76	6
11			22	75	5
	9	10		74	4
			21	73	4
10			20	72	3
	8	9		71	3
			19	70	2
	7		18	69	2
9		8	17	68	2
				67	1
	6	7	16	66	1
8			15	65	1
				64	1
	5	6	14	63	1
			13	62	1
7	4		12	61	<1
		5		60	<1
	3		10–11	58	<1
6	2	4	9	56	<1
2–5		2–3	4–8	53	<1

Table D2

Age: 30 Through 39 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19													19	>99
>99	18													18	>99
99	17	18	9											17	99
98	16	17	8				9							16	98
95	15	16						9						15	95
91	14		7	72							10			14	91
84	13	15		71			8	8			9	20	20	13	84
75	12	14		69–70	12	12			20					12	75
63	11	13	6	67–68			7	7	19	10	8	19		11	63
50	10	12		64–66				6	18		7	18	19	10	50
37	9			61–63	11		6		17	9	6	17		9	37
25	8	11	5	57–60	10	11	5	5	16		5		18	8	25
16	7	10		53–56	9			4	15	8	4	15–16	17	7	16
9	6			49–52	8	10	4		13–14	7		14		6	9
5	5	9	4	44–48	7	9	3	3	12	6	3	13	16	5	5
2	4	8		40–43	6	8		2	10–11		2	12		4	2
1	3		3	35–39	5	7	2	1	9	5		11	15	3	1
<1	2			31–34	4	5–6	1		8	4		10	14	2	<1
<1	1	0–7	0–2	0–30	0–3	0–4	0	0	0–7	0–3	0–1	0–9	0–13	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<8	>.15	>.11	>.09	>8	>9	12	>16	Within expectations
Significant	≤16	≥8	≤.15	≤.11	≤.09	≤8	≤9	≤11	≤16	Significant

Table D2 (Continued)

Summary Scales

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
34				146	>99
33				143	>99
32				141	>99
				139	>99
				138	>99
31				137	99
				136	99
				135	99
30			55	134	99
	28			133	99
			54	132	98
29				131	98
			53	130	98
				129	97
28	27			128	97
			52	127	97
				126	96
27			51	125	95
	26	27		124	95
				123	94
			50	122	93
26		26		121	92
	25		49	120	91
				119	90
25			48	118	89
		25		117	87
	24		47	116	86
24				115	84
		24	46	114	83
				113	81
23	23		45	112	79
		23		111	77
			44	110	75
22				109	73
	22	22	43	108	70
				107	68
21			42	106	66
	21			105	63
		21	41	104	61
20				103	58
	20		40	102	55
		20		101	53
19			39	100	50

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
				99	47
	19	19	38	98	45
18				97	42
			37	96	40
	18	18	36	95	37
17				94	35
			35	93	32
	17	17		92	30
16			34	91	28
	16			90	25
		16	33	89	23
15			32	88	21
	15			87	19
		15	31	86	18
				85	16
14	14	14	30	84	14
			29	83	13
				82	12
13	13	13	28	81	10
			27	80	9
	12			79	8
12		12	26	78	7
			25	77	6
	11			76	6
11		11	24	75	5
				74	4
	10		23	73	4
		10	22	72	3
10				71	3
	9		21	70	2
		9	20	69	2
9	8			68	2
		8	19	67	1
			18	66	1
	7		17	65	1
8				64	1
	6	7	16	63	1
			15	62	1
		6		61	<1
7	5		14	60	<1
		5	13	58	<1
6	4		12	56	<1
2–5	2–3	2–4	4–11	53	<1

Table D3

Age: 40 Through 49 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19													19	>99
>99	18													18	>99
99	17	18	9											17	99
98	16	17	8											16	98
95	15	16					9	9						15	95
91	14	15	7	72							10		20	14	91
84	13			71			8	8			9	20		13	84
75	12	14		69–70	12				20		8			12	75
63	11	13	6	67–68		12	7	7	19	10		19	19	11	63
50	10	12		64–66					18		7	18		10	50
37	9	11		61–63	11		6	6	17	9	6	17	18	9	37
25	8		5	57–60	10	11	5	5	16		5	16		8	25
16	7	10		53–56	9				15	8	4	15	17	7	16
9	6			49–52	8	10	4	4	13–14	7		14	16	6	9
5	5	9	4	44–48	7	9	3	3	12	6	3	13		5	5
2	4	8		40–43	6	8			11		2	11–12	15	4	2
1	3		3	35–39	5	7	2	2	9–10	5		10	14	3	1
<1	2			31–34	4	5–6		1	8	4		9		2	<1
<1	1	0–7	0–2	0–30	0–3	0–4	0–1	0	0–7	0–3	0–1	0–8	0–13	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	Cued List Recall: List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<5	>.14	>.13	>.17	>9	>11	12	>16	Within expectations
Significant	≤16	≥5	≤.14	≤.13	≤.17	≤9	≤11	≤11	≤16	Significant

Table D3 (Continued)

Summary Scales

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
34				146	>99
33				143	>99
				141	>99
32				139	>99
				138	>99
				137	99
31				136	99
				135	99
				134	99
30				133	99
			54	132	98
				131	98
29			53	130	98
	27			129	97
				128	97
28			52	127	97
				126	96
			51	125	95
27	26	27		124	95
				123	94
			50	122	93
26		26		121	92
	25		49	120	91
				119	90
25			48	118	89
		25		117	87
			47	116	86
24	24			115	84
		24		114	83
			46	113	81
	23			112	79
23		23	45	111	77
				110	75
			44	109	73
22	22	22		108	70
			43	107	68
				106	66
21			42	105	63
	21	21		104	61
			41	103	58
20				102	55
	20	20	40	101	53
				100	50

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
19			39	99	47
	19	19		98	45
			38	97	42
18			37	96	40
	18	18		95	37
			36	94	35
17				93	32
	17	17	35	92	30
				91	28
16			34	90	25
	16	16	33	89	23
				88	21
15			32	87	19
	15	15		86	18
			31	85	16
14		14		84	14
	14		30	83	13
			29	82	12
13		13		81	10
	13		28	80	9
			27	79	8
12		12		78	7
	12		26	77	6
				76	6
11		11	25	75	5
	11		24	74	4
				73	4
	10	10	23	72	3
10			22	71	3
				70	2
	9	9	21	69	2
9			20	68	2
				67	1
	8	8	19	66	1
			18	65	1
8				64	1
	7	7	17	63	1
			16	62	1
				61	<1
7	6	6	15	60	<1
			14	58	<1
6	5	5	13	56	<1
2–5	2–4	2–4	4–12	53	<1

Table D4

Age: 50 Through 59 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19													19	>99
>99	18	18												18	>99
99	17	17	9											17	99
98	16		8											16	98
95	15	16		72			9	9			10		20	15	95
91	14	15	7	71								20		14	91
84	13	14		70			8	8	20		9			13	84
75	12	13	6	68–69	12						8	19	19	12	75
63	11			66–67		12	7	7	19	10	7	18		11	63
50	10	12		63–65	11				18		6	17	18	10	50
37	9	11	5	60–62			6	6	17	9	5	16		9	37
25	8			56–59	10	11	5		16			15	17	8	25
16	7	10		52–55	9			5	15	8	4	14	16	7	16
9	6	9	4	47–51	8	10	4	4	13–14	7	3	13		6	9
5	5			42–46	7	9	3		12	6		12	15	5	5
2	4	8		38–41	6	8		3	10–11	5	2	10–11	14	4	2
1	3		3	33–37	5	7	2	2	9			9	13	3	1
<1	2			29–32	4	5–6		1	8	4		8		2	<1
<1	1	0–7	0–2	0–28	0–3	0–4	0–1	0	0–7	0–3	0–1	0–7	0–12	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<4	>.12	>.13	>.30	>9	>11	12	>16	Within expectations
Significant	≤16	≥4	≤.12	≤.13	≤.30	≤9	≤11	≤11	≤16	Significant

Table D4 (Continued)

Summary Scales

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
34–35				146	>99
				143	>99
33				141	>99
				139	>99
32				138	>99
			56	137	99
31				136	99
				135	99
			55	134	99
				133	99
30			54	132	98
				131	98
		29		130	98
29	27		53	129	97
				128	97
		28	52	127	97
28				126	96
				125	95
	26	27	51	124	95
27				123	94
			50	122	93
		26		121	92
26	25		49	120	91
				119	90
			48	118	89
25		25		117	87
				116	86
	24		47	115	84
24		24		114	83
			46	113	81
	23			112	79
23		23	45	111	77
				110	75
			44	109	73
22	22	22		108	70
			43	107	68
				106	66
21			42	105	63
	21	21		104	61
			41	103	58
20				102	55
	20	20	40	101	53
				100	50

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
19			39	99	47
	19	19		98	45
			38	97	42
18			37	96	40
	18	18		95	37
			36	94	35
17				93	32
	17	17	35	92	30
				91	28
16			34	90	25
	16	16	33	89	23
				88	21
15			32	87	19
	15	15		86	18
			31	85	16
14			30	84	14
	14	14		83	13
			29	82	12
13		13		81	10
	13		28	80	9
			27	79	8
12		12		78	7
	12		26	77	6
			25	76	6
11		11		75	5
	11		24	74	4
			23	73	4
	10	10		72	3
10			22	71	3
			21	70	2
	9	9		69	2
9			20	68	2
		8	19	67	1
	8			66	1
			18	65	1
8		7		64	1
	7		17	63	1
			16	62	1
7	6	6	15	61	<1
			14	60	<1
		5		58	<1
6	5		12–13	56	<1
2–5	2–4	2–4	4–11	53	<1

Table D5

Age: 60 Through 69 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19	18												19	>99
>99	18		9											18	>99
99	17	17		72									20	17	99
98	16	16	8	71							10	20		16	98
95	15	15		70			9	9						15	95
91	14		7	69					20		9			14	91
84	13	14		67–68	12		8	8			8	19	19	13	84
75	12	13	6	65–66		12			19	10	7	18		12	75
63	11	12		63–64	11		7	7				17	18	11	63
50	10			60–62					18		6	16		10	50
37	9	11	5	56–59	10		6	6	16–17	9	5	15	17	9	37
25	8	10		52–55	9	11	5	5	15	8	4	14	16	8	25
16	7			48–51	8	10			14		3	13		7	16
9	6	9	4	43–47	7	9	4	4	12–13	7		12	15	6	9
5	5			38–42	6	8	3	3	11	6	2	10–11	14	5	5
2	4	8	3	33–37	5	7			10	5		9	13	4	2
1	3			28–32	4	5–6	2	2	8–9	4	1	7–8	12	3	1
<1	2	7	2	23–27	2–3	3–4	1	1	7	3		6		2	<1
<1	1	0–6	0–1	0–22	0–1	0–2	0	0	0–6	0–2	0	0–5	0–11	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<4	>.10	>.09	>.16	>9	>11	12	>16	Within expectations
Significant	≤16	≥4	≤.10	≤.09	≤.16	≤9	≤11	≤11	≤16	Significant

Summary Scales

Short–term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile	Short–term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum						Scale score sum					
35–37			60	146	>99	19		19		99	47
34			59	143	>99		19		38	98	45
33		32	58	141	>99					97	42
				139	>99	18		18	37	96	40
32			57	138	>99		18		36	95	37
				137	99					94	35
		31	56	136	99	17		17	35	93	32
31				135	99		17			92	30
				134	99				34	91	28
		30	55	133	99	16		16	33	90	25
30	28			132	98		16			89	23
			54	131	98				32	88	21
		29		130	98	15	15	15	31	87	19
29				129	97					86	18
			53	128	97			14	30	85	16
	27			127	97	14	14			84	14
28		28	52	126	96				29	83	13
				125	95			13	28	82	12
			51	124	95	13	13			81	10
27	26	27		123	94				27	80	9
			50	122	93		12	12	26	79	8
				121	92	12				78	7
26		26		120	91				25	77	6
	25		49	119	90		11	11	24	76	6
				118	89	11				75	5
25		25	48	117	87			10	23	74	4
				116	86		10		22	73	4
	24		47	115	84	10			21	72	3
24		24		114	83		9	9		71	3
			46	113	81				20	70	2
				112	79					69	2
23	23		45	111	77	9	8	8	19	68	2
		23		110	75				18	67	1
			44	109	73			7	17	66	1
22	22			108	70	8	7			65	1
		22	43	107	68				16	64	1
				106	66		6	6	15	63	1
21			42	105	63					62	1
	21	21	41	104	61	7			14	61	<1
				103	58		5	5	13	60	<1
20		20	40	102	55				12	58	<1
	20			101	53	6	4	4	11	56	<1
			39	100	50	2–5	2–3	2–3	4–10	53	<1

Table D6

Age: 70+

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19	18		71–72							10	20	20	19	>99
>99	18	17	9	70										18	>99
99	17	16	8	69					20		9	19		17	99
98	16			68			9	9					19	16	98
95	15	15	7	67	12						8			15	95
91	14	14		65–66		12	8	8	19	10		18		14	91
84	13	13	6	63–64							7	17	18	13	84
75	12			61–62	11		7	7	18		6			12	75
63	11	12		58–60					17	9		16	17	11	63
50	10	11	5	55–57	10	11	6	6	16		5	15		10	50
37	9	10		51–54	9			5	15	8	4	14	16	9	37
25	8			46–50	8	10	5		14		3	12–13	15	8	25
16	7	9	4	41–45	7	8–9	4	4	12–13	7		11	14	7	16
9	6			35–40	6	7			11	6	2	10		6	9
5	5	8		29–34	4–5	5–6	3	3	9–10	5		8–9	13	5	5
2	4		3	23–28	3	3–4	2	2	8	4	1	7	12	4	2
1	3	7		17–22	1–2	2			7	3		5–6	11	3	1
<1	2		2	12–16	0	1	1	1	6	2		4	10	2	<1
<1	1	0–6	0–1	0–11		0	0	0	0–5	0–1	0	0–3	0–9	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<7	>.11	>.08	>.13	>7	>8	12	>16	Within expectations
Significant	≤16	≥7	≤.11	≤.08	≤.13	≤7	≤8	≤11	≤16	Significant

Table D3 (Continued)

Summary Scales

Short–term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
35–37		34–38	61–69	146	>99
34	31	33	60	143	>99
33			59	141	>99
				139	>99
32	30	32	58	138	>99
				137	99
		31	57	136	99
31				135	99
	29			134	99
			56	133	99
30		30		132	98
			55	131	98
	28			130	98
29		29	54	129	97
				128	97
			53	127	97
28		28		126	96
	27		52	125	95
				124	95
27		27	51	123	94
	26			122	93
			50	121	92
26		26		120	91
			49	119	90
	25			118	89
25		25	48	117	87
				116	86
	24		47	115	84
24		24		114	83
			46	113	81
				112	79
23	23	23	45	111	77
			44	110	75
				109	73
22	22	22	43	108	70
				107	68
			42	106	66
21	21	21	41	105	63
				104	61
		20	40	103	58
20	20			102	55
			39	101	53
19		19	38	100	50
	19			99	47
			37	98	45
18	18	18	36	97	42
				96	40
		17	35	95	37
17	17			94	35
			34	93	32
		16	33	92	30
16	16			91	28
			32	90	25
	15	15	31	89	23
15			30	88	21
		14		87	19
	14		29	86	18
14			28	85	16
	13	13		84	14
			27	83	13
13		12	26	82	12
	12			81	10
			25	80	9
12	11	11	24	79	8
			23	78	7
	10	10		77	6
			22	76	6
11			21	75	5
	9	9	20	74	4
				73	4
10	8	8	19	72	3
			18	71	3
	7		17	70	2
9		7		69	2
			16	68	2
	6	6	15	67	1
8			14	66	1
	5		13	65	1
		5		64	1
	4		12	63	1
7		4	11	62	1
			10	61	<1
	3		9	60	<1
6		3	8	58	<1
		2	7	56	<1
2–5			5–6	53	<1

APPENDIX E

Normative Data by Age and Education

Table E1

Age: 18 Through 49 Years
Education: Less Than or Equal To 11 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19	18												19	>99
>99	18		9											18	>99
99	17	17	8	72			9	9						17	99
98	16	16		71					20		10			16	98
95	15	15	7	69–70				8			9			15	95
91	14			68		12	8		19	10		20	20	14	91
84	13	14		66–67	12			7			8			13	84
75	12	13	6	63–65	11		7		18		7	19		12	75
63	11	12		61–62				6	17	9	6	18	19	11	63
50	10			58–60	10		6		16			17		10	50
37	9	11	5	54–57		11	5	5	15	8	5	16	18	9	37
25	8	10		51–53	9	10		4	14		4	15		8	25
16	7			46–50	8	9	4		13	7	3	14	17	7	16
9	6	9	4	42–45		8	3	3	12	6		13	16	6	9
5	5	8		36–41	7	7	2	2	10–11	5	2	12		5	5
2	4			30–35	6	5–6		1	9	4		10–11	15	4	2
1	3		3	23–29	5	4	1		7–8	2–3	1	9	14	3	1
<1	2	7		16–22	3–4	3		0	6	1		7–8	13	2	<1
<1	1	0–6	0–2	0–15	0–2	0–2	0		0–5	0	0	0–6	0–12	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<11	>.10	>.14	>.10	>7	>8	12	>16	Within expectations
Significant	≤16	≥11	≤.10	≤.14	≤.10	≤7	≤8	≤11	≤16	Significant

Table E1 (Continued)

Summary Scales

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
33–37	30			146	>99
32				143	>99
	29		60	141	>99
31			59	139	>99
			58	138	>99
				137	99
30		30	57	136	99
	28			135	99
			56	134	99
29				133	99
		29	55	132	98
			54	131	98
28				130	98
	27	28	53	129	97
				128	97
27			52	127	97
		27		126	96
			51	125	95
26	26			124	95
		26	50	123	94
				122	93
25			49	121	92
	25			120	91
		25	48	119	90
24				118	89
			47	117	87
	24	24		116	86
23			46	115	84
				114	83
		23	45	113	81
22	23		44	112	79
				111	77
		22	43	110	75
21	22			109	73
			42	108	70
		21		107	68
20			41	106	66
	21			105	63
		20	40	104	61
19				103	58
	20		39	102	55
		19	38	101	53
18				100	50

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
	19		37	99	47
		18		98	45
17	18		36	97	42
				96	40
		17	35	95	37
16	17		34	94	35
				93	32
		16	33	92	30
15	16			91	28
			32	90	25
	15	15	31	89	23
14				88	21
			30	87	19
	14	14		86	18
13			29	85	16
	13		28	84	14
		13		83	13
12	12		27	82	12
			26	81	10
		12		80	9
11	11		25	79	8
			24	78	7
	10	11		77	6
			23	76	6
10	9		22	75	5
		10		74	4
	8		21	73	4
9			20	72	3
		9	19	71	3
	7			70	2
8			18	69	2
	6	8	17	68	2
			16	67	1
7	5			66	1
		7	15	65	1
			14	64	1
6	4		13	63	1
			12	62	1
	3	6		61	<1
			11	60	<1
5	2	5	9–10	58	<1
			8	56	<1
2–4		2–4	4–7	53	<1

Table E2

Age: 18 Through 49 Years
Education: 12 Years (High School Graduate)

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19													19	>99
>99	18	18	9											18	>99
99	17	17												17	99
98	16		8				9	9						16	98
95	15	16		71–72							10			15	95
91	14	15	7	70				8	20		9			14	91
84	13	14		68–69	12		8					20	20	13	84
75	12		6	66–67		12		7	19	10	8			12	75
63	11	13		64–65	11		7		18		7	19	19	11	63
50	10	12		61–63			6	6		9	6	18		10	50
37	9	11	5	58–60	10			5	17			17	18	9	37
25	8			55–57		11	5		16	8	5	16		8	25
16	7	10		51–54	9	10	4	4	14–15		4	15	17	7	16
9	6	9		47–50		9		3	13	7	3	14		6	9
5	5		4	42–46	8	8	3		12	6		13	16	5	5
2	4	8		37–41	7		2	2	10–11	5	2	12	15	4	2
1	3		3	31–36	6	7		1	9	4		10–11		3	1
<1	2			24–30	5	6	1		8	2–3	1	9	14	2	<1
<1	1	0–7	0–2	0–23	0–4	0–5	0	0	0–7	0–1	0	0–8	0–13	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<5	>.11	>.10	>.11	>9	>10	12	>16	Within expectations
Significant	≤16	≥5	≤.11	≤.10	≤.11	≤9	≤10	≤11	≤16	Significant

Table E2 (Continued)

Summary Scales

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
35–36				146	>99
34	29			143	>99
33				141	>99
32				139	>99
			57	138	>99
				137	99
31	28		56	136	99
				135	99
			55	134	99
30				133	99
			54	132	98
				131	98
29	27	28	53	130	98
				129	97
			52	128	97
28				127	97
		27	51	126	96
	26			125	95
27			50	124	95
		26		123	94
			49	122	93
26				121	92
	25	25	48	120	91
				119	90
25			47	118	89
				117	87
	24	24	46	116	86
24				115	84
			45	114	83
		23		113	81
23	23		44	112	79
				111	77
		22	43	110	75
22	22			109	73
			42	108	70
		21		107	68
21			41	106	66
	21			105	63
		20	40	104	61
20				103	58
	20		39	102	55
				101	53
19		19	38	100	50

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
	19			99	47
			37	98	45
18		18		97	42
	18		36	96	40
			35	95	37
17		17		94	35
	17		34	93	32
				92	30
16	16	16	33	91	28
				90	25
			32	89	23
15	15	15		88	21
			31	87	19
	14		30	86	18
14		14		85	16
			29	84	14
	13			83	13
			28	82	12
13	12	13	27	81	10
				80	9
			26	79	8
12	11	12	25	78	7
				77	6
	10		24	76	6
11		11	23	75	5
	9			74	4
			22	73	4
10	8	10	21	72	3
				71	3
			20	70	2
9	7	9	19	69	2
				68	2
	6		18	67	1
8		8	17	66	1
	5		16	65	1
				64	1
		7	15	63	1
7	4		14	62	1
				61	<1
	3		13	60	<1
6		6	11–12	58	<1
	2		10	56	<1
2–5		2–5	4–9	53	<1

Table E3

Age: 18 Through 49 Years
Education: Equal To or Greater Than 13 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19													19	>99
>99	18													18	>99
99	17	18	9											17	99
98	16													16	98
95	15	17	8				9	9						15	95
91	14	16									10			14	91
84	13	15	7	72				8					20	13	84
75	12	14		70–71	12		8				9	20		12	75
63	11	13	6	68–69				7	20		8			11	63
50	10			66–67		12	7		19	10	7	19	19	10	50
37	9	12		64–65	11		6	6	18			18		9	37
25	8	11	5	61–63					17		6	17	18	8	25
16	7			58–60	10	11	5	5	16	9	5	16		7	16
9	6	10		55–57		10		4	15	8	4	15	17	6	9
5	5	9	4	51–54	9	9	4		14			14	16	5	5
2	4			47–50			3	3	13	7	3	13		4	2
1	3		3	42–46	8	8			12	6		12	15	3	1
<1	2	8		37–41	7	7	2	2	11	4–5	2	11	14	2	<1
<1	1	0–7	0–2	0–36	0–6	0–6	0–1	0–1	0–10	0–3	0–1	0–10	0–13	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<5	>.13	>.11	>.17	>9	12	12	>16	Within expectations
Significant	≤16	≥5	≤.13	≤.11	≤.17	≤9	≤11	≤11	≤16	Significant

Table E3 (Continued)

Summary Scales

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
				146	>99
34				143	>99
33				141	>99
				139	>99
32				138	>99
				137	99
31				136	99
				135	99
				134	99
				133	99
30			53	132	98
	27			131	98
			52	130	98
29				129	97
			51	128	97
				127	97
28			50	126	96
	26			125	95
		26		124	95
27			49	123	94
				122	93
			48	121	92
26	25	25		120	91
			47	119	90
				118	89
25		24	46	117	87
	24			116	86
				115	84
24			45	114	83
		23		113	81
	23		44	112	79
23				111	77
		22	43	110	75
				109	73
22	22		42	108	70
				107	68
		21	41	106	66
21	21			105	63
				104	61
		20	40	103	58
20				102	55
	20		39	101	53
		19		100	50

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
19			38	99	47
	19			98	45
			37	97	42
18		18		96	40
	18		36	95	37
				94	35
17		17	35	93	32
	17			92	30
			34	91	28
16		16		90	25
	16		33	89	23
				88	21
15	15		32	87	19
		15		86	18
			31	85	16
14	14			84	14
		14	30	83	13
	13			82	12
13			29	81	10
			28	80	9
	12	13		79	8
12			27	78	7
	11			77	6
		12	26	76	6
11			25	75	5
	10			74	4
		11	24	73	4
10	9		23	72	3
				71	3
			22	70	2
9	8	10		69	2
			21	68	2
	7		20	67	1
		9		66	1
8			19	65	1
	6			64	1
		8	18	63	1
7	5		17	62	1
				61	<1
	4		16	60	<1
6		7	15	58	<1
	3		13–14	56	<1
2–5	2	2–6	4–12	53	<1

Table E4

Age: 50 Through 59 Years
Education: Less Than or Equal To 11 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19	17–18												19	>99
>99	18		9											18	>99
99	17	16	8	72										17	99
98	16	15		70–71			9	9	20	10	10		20	16	98
95	15		7	69		12					9			15	95
91	14	14		67–68			8	8	19		8	20		14	91
84	13	13	6	65–66	12							19	19	13	84
75	12			63–64	11		7	7	18		7	18		12	75
63	11	12		60–62					17	9	6	17	18	11	63
50	10	11		58–59	10		6	6	16		5	16		10	50
37	9		5	54–57	9	11			15	8		15	17	9	37
25	8	10		51–53		10	5	5	14		4	14	16	8	25
16	7	9		46–50	8	9	4	4	13	7	3	13		7	16
9	6		4	42–45	7	8			11–12	6	2	11–12	15	6	9
5	5			36–41		6–7	3	3	10	5		10	14	5	5
2	4	8	3	30–35	6	5	2	2	8–9	4	1	8–9		4	2
1	3			24–29	4–5	4			6–7	3		6–7	13	3	1
<1	2		2	16–23	3	3	1	1	5	2	0	5	12	2	<1
<1	1	0–7	0–1	0–15	0–2	0–2	0	0	0–4	0–1		0–4	0–11	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<9	>.09	>.11	>.17	>6	>8	12	>16	Within expectations
Significant	≤16	≥9	≤.09	≤.11	≤.17	≤6	≤8	≤11	≤16	Significant

Table E4 (Continued)

Summary Scales

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile	Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum						Scale score sum					
35–37				146	>99	19			38	99	47
34				143	>99		19	18	37	98	45
33				141	>99					97	42
	29			139	>99	18			36	96	40
32			59	138	>99		18	17		95	37
				137	99				35	94	35
31			58	136	99	17				93	32
			57	135	99		17	16	34	92	30
	28	30		134	99				33	91	28
			56	133	99	16	16			90	25
30				132	98			15	32	89	23
		29	55	131	98				31	88	21
				130	98	15	15			87	19
29			54	129	97			14	30	86	18
	27	28		128	97		14			85	16
			53	127	97	14			29	84	14
28			52	126	96			13	28	83	13
		27		125	95		13			82	12
			51	124	95	13			27	81	10
27	26			123	94		12	12	26	80	9
			50	122	93					79	8
		26		121	92	12			25	78	7
26			49	120	91		11	11	24	77	6
	25			119	90					76	6
		25	48	118	89	11	10		23	75	5
25				117	87			10	22	74	4
			47	116	86		9		21	73	4
	24	24		115	84	10		9		72	3
24			46	114	83				20	71	3
				113	81		8		19	70	2
		23	45	112	79			8		69	2
23	23			111	77	9	7		18	68	2
			44	110	75				17	67	1
		22	43	109	73		6	7	16	66	1
22				108	70	8			15	65	1
	22		42	107	68					64	1
		21		106	66		5	6	14	63	1
21			41	105	63	7			13	62	1
	21			104	61		4		12	61	<1
		20	40	103	58			5	11	60	<1
20				102	55	6	3		10	58	<1
	20	19	39	101	53		2	4	8–9	56	<1
				100	50	2–5		3	5–7	53	<1

Table E5

Age: 50 Through 59 Years
Education: 12 Years (High School Graduate)

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19	18												19	>99
>99	18	17												18	>99
99	17		9											17	99
98	16	16	8											16	98
95	15	15		71–72			9	9			10		20	15	95
91	14		7	70					20		9	20		14	91
84	13	14		68–69	12		8	8		10			19	13	84
75	12	13	6	66–67		12			19		8	19		12	75
63	11	12		64–65	11		7	7	18		7	18		11	63
50	10			61–63					17	9	6	17	18	10	50
37	9	11	5	58–60	10		6	6	16		5	16		9	37
25	8	10		55–57		11	5	5	15	8		15	17	8	25
16	7			52–54	9	10			14		4	14	16	7	16
9	6	9	4	47–51	8	9	4	4	13	7	3	12–13		6	9
5	5			43–46		8	3		11–12	6	2	11	15	5	5
2	4			38–42	7	7		3	10	5		10	14	4	2
1	3	8	3	32–37	6		2	2	9	4	1	8–9	13	3	1
<1	2		2	25–31	5	6			7–8	2–3		7		2	<1
<1	1	0–7	0–1	0–24	0–4	0–5	0–1	0–1	0–6	0–1	0	0–6	0–12	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<4	>.10	>.11	>.30	>9	12	12	>16	Within expectations
Significant	≤16	≥4	≤.10	≤.11	≤.30	≤9	≤11	≤11	≤16	Significant

Table E5 (Continued)

Summary Scales

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
35–36				146	>99
34				143	>99
33				141	>99
				139	>99
32				138	>99
			57	137	99
				136	99
31			56	135	99
	28			134	99
			55	133	99
30		29		132	98
			54	131	98
				130	98
29	27	28	53	129	97
				128	97
			52	127	97
28				126	96
		27	51	125	95
	26			124	95
27			50	123	94
		26		122	93
			49	121	92
26				120	91
	25	25	48	119	90
				118	89
25			47	117	87
		24		116	86
	24		46	115	84
24				114	83
		23	45	113	81
				112	79
23	23		44	111	77
				110	75
		22	43	109	73
22				108	70
	22		42	107	68
		21		106	66
21			41	105	63
	21			104	61
		20	40	103	58
20				102	55
	20		39	101	53
		19		100	50

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
19			38	99	47
	19			98	45
		18	37	97	42
18				96	40
	18		36	95	37
		17		94	35
17			35	93	32
	17		34	92	30
		16		91	28
16			33	90	25
	16			89	23
		15	32	88	21
15				87	19
	15		31	86	18
		14	30	85	16
14	14			84	14
			29	83	13
		13		82	12
13	13		28	81	10
			27	80	9
	12	12		79	8
12			26	78	7
			25	77	6
	11	11		76	6
11			24	75	5
	10		23	74	4
		10		73	4
10	9		22	72	3
			21	71	3
		9		70	2
	8		20	69	2
9			19	68	2
	7	8		67	1
			18	66	1
8	6		17	65	1
				64	1
		7	16	63	1
7	5		15	62	1
			14	61	<1
	4	6	13	60	<1
6			12	58	<1
	3	5	11	56	<1
2–5	2	2–4	4–10	53	<1

Table E6

Age: 50 Through 59 Years
Education: Equal To or Greater Than 13 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19													19	>99
>99	18	18												18	>99
99	17		9											17	99
98	16	17												16	98
95	15	16	8				9						20	15	95
91	14	15	7					9			10			14	91
84	13			71–72							9	20		13	84
75	12	14		70	12		8	8	20				19	12	75
63	11	13	6	68–69						10	8	19		11	63
50	10	12		66–67	11	12	7	7	19		7	18	18	10	50
37	9			63–65					18		6	17		9	37
25	8	11	5	61–62			6	6	17	9		16	17	8	25
16	7	10		58–60	10	11	5	5	16		5	15		7	16
9	6			54–57		10			15	8	4	14	16	6	9
5	5	9	4	50–53	9	9	4	4	14		3	13	15	5	5
2	4			46–49	8	8			12–13	7		11–12		4	2
1	3		3	41–45	7	7	3	3	11	6	2	10	14	3	1
<1	2	8	2	36–40	6	6		2	10	4–5		9	13	2	<1
<1	1	0–7	0–1	0–35	0–5	0–5	0–2	0–1	0–9	0–3	0–1	0–8	0–12	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<3	>.15	>.17	>.42	>9	12	12	>16	Within expectations
Significant	≤16	≥3	≤.15	≤.17	≤.42	≤9	≤11	≤11	≤16	Significant

Table E6 (Continued)

Summary Scales

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile	Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum						Scale score sum					
35				146	>99	19		19		99	47
34				143	>99				38	98	45
33				141	>99		19			97	42
				139	>99	18		18	37	96	40
32				138	>99					95	37
				137	99		18		36	94	35
				136	99	17		17		93	32
31				135	99				35	92	30
				134	99		17			91	28
			54	133	99	16		16	34	90	25
30				132	98					89	23
			53	131	98		16		33	88	21
	27			130	98	15				87	19
29			52	129	97		15	15	32	86	18
				128	97				31	85	16
			51	127	97	14				84	14
28		27		126	96		14	14	30	83	13
			50	125	95					82	12
	26			124	95	13			29	81	10
27		26		123	94		13	13		80	9
			49	122	93				28	79	8
				121	92	12	12			78	7
26			48	120	91			12	27	77	6
	25	25		119	90				26	76	6
			47	118	89	11	11			75	5
25				117	87			11	25	74	4
		24	46	116	86		10		24	73	4
	24			115	84	10				72	3
24				114	83				23	71	3
		23	45	113	81		9	10		70	2
				112	79				22	69	2
23	23		44	111	77	9	8		21	68	2
				110	75			9		67	1
		22	43	109	73				20	66	1
22				108	70	8	7		19	65	1
	22		42	107	68					64	1
		21		106	66		6	8	18	63	1
21			41	105	63	7			17	62	1
	21			104	61					61	<1
		20	40	103	58		5	7	16	60	<1
20				102	55	6	4		15	58	<1
				101	53			6	13–14	56	<1
	20		39	100	50	2–5	2–3	2–5	4–12	53	<1

Table E7

Age: 60 Through 69 Years
Education: Less Than or Equal To 11 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19	17–18												19	>99
>99	18	16	9	72										18	>99
99	17		8	70–71					20	10	10		20	17	99
98	16	15		69		12	9	9			9	20		16	98
95	15	14	7	67–68										15	95
91	14			65–66	12		8	8	19		8	19	19	14	91
84	13	13	6	63–64					18		7	18		13	84
75	12	12		61–62	11		7	7		9	6	17	18	12	75
63	11			58–60	10				17			16		11	63
50	10	11	5	55–57		11	6	6	16		5	15	17	10	50
37	9	10		51–54	9		5	5	15	8	4	14		9	37
25	8			47–50	8	10			13–14	7	3	13	16	8	25
16	7	9	4	43–46		9	4	4	12			12	15	7	16
9	6			38–42	7	7–8	3		11	6	2	10–11	14	6	9
5	5	8		32–37	6	5–6		3	9–10	5	1	8–9	13	5	5
2	4		3	26–31	5	4	2	2	7–8	4		7		4	2
1	3			19–25	3–4	3	1		6	2–3	0	5–6	12	3	1
<1	2	7	2	11–18	2	2		1	4–5	1		3–4	11	2	<1
<1	1	0–6	0–1	0–10	0–1	0–1	0	0	0–3	0		0–2	0–10	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<6	>.13	>.10	>.20	>7	>9	12	>16	Within expectations
Significant	≤16	≥6	≤.13	≤.10	≤.20	≤7	≤9	≤11	≤16	Significant

Summary Scales

Short–term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
35–37	30			146	>99
34			62–63	143	>99
33		33	61	141	>99
				139	>99
32	29	32	60	138	>99
			59	137	99
31		31		136	99
			58	135	99
				134	99
			57	133	99
30	28	30	56	132	98
				131	98
			55	130	98
29		29		129	97
			54	128	97
	27			127	97
28		28	53	126	96
				125	95
			52	124	95
27	26	27	51	123	94
				122	93
			50	121	92
26		26		120	91
			49	119	90
	25	25		118	89
25			48	117	87
				116	86
		24	47	115	84
24	24		46	114	83
				113	81
		23	45	112	79
23	23			111	77
			44	110	75
		22		109	73
22			43	108	70
	22			107	68
		21	42	106	66
21			41	105	63
	21			104	61
		20	40	103	58
20				102	55
	20		39	101	53
		19		100	50

Short–term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
19			38	99	47
	19	18	37	98	45
				97	42
18			36	96	40
	18	17		95	37
			35	94	35
17			34	93	32
	17	16		92	30
			33	91	28
16	16		32	90	25
		15		89	23
			31	88	21
15	15			87	19
		14	30	86	18
	14		29	85	16
14		13		84	14
			28	83	13
	13		27	82	12
13		12		81	10
	12		26	80	9
			25	79	8
12	11	11	24	78	7
				77	6
			23	76	6
11	10	10	22	75	5
				74	4
	9	9	21	73	4
10			20	72	3
	8		19	71	3
		8	18	70	2
9	7			69	2
			17	68	2
		7	16	67	1
	6		15	66	1
8			14	65	1
	5	6		64	1
			13	63	1
7	4		12	62	1
		5	11	61	<1
	3		10	60	<1
6	2	4	9	58	<1
			7–8	56	<1
2–5			6	53	<1

Table E8

Age: 60 Through 69 Years
Education: 12 Years (High School Graduate)

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19	18												19	>99
>99	18	17	9										20	18	>99
99	17	16		72										17	99
98	16		8	71			9	9			10			16	98
95	15	15	7	70					20		9	20	19	15	95
91	14	14		68–69						10		19		14	91
84	13			66–67	12	12	8	8	19		8		18	13	84
75	12	13	6	64–65	11						7	18		12	75
63	11	12		62–63			7	7	18		6	17	17	11	63
50	10	11		59–61	10			6	17	9		16		10	50
37	9		5	56–58		11	6		16		5	15	16	9	37
25	8	10		52–55	9		5	5	15	8	4	14	15	8	25
16	7			48–51	8	10			14		3	13	14	7	16
9	6	9	4	44–47		9	4	4	12–13	7		11–12		6	9
5	5			39–43	7	7–8	3		11	6	2	10	13	5	5
2	4	8	3	33–38	6	6		3	9–10	5	1	8–9	12	4	2
1	3			27–32	5	5	2	2	8	4		7	11	3	1
<1	2		2	20–26	3–4				6–7	2–3	0	5–6	10	2	<1
<1	1	0–7	0–1	0–19	0–2	0–4	0–1	0–1	0–5	0–1		0–4	0–9	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<3	>.09	>.09	>.17	>10	12	12	>16	Within expectations
Significant	≤16	≥3	≤.09	≤.09	≤.17	≤10	≤11	≤11	≤16	Significant

Table E8 (Continued)

Summary Scales

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile	Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum						Scale score sum					
35–37				146	>99	19			38	99	47
34				143	>99		19			98	45
33			60	141	>99			18	37	97	42
	29		59	139	>99	18				96	40
32				138	>99		18		36	95	37
			58	137	99			17	35	94	35
		31	57	136	99	17				93	32
31				135	99		17		34	92	30
				134	99			16		91	28
	28	30	56	133	99	16			33	90	25
30			55	132	98		16			89	23
		29		131	98			15	32	88	21
			54	130	98	15	15		31	87	19
29				129	97					86	18
	27		53	128	97			14	30	85	16
		28		127	97	14	14			84	14
28			52	126	96				29	83	13
				125	95		13	13	28	82	12
		27	51	124	95	13				81	10
27	26			123	94				27	80	9
			50	122	93		12	12	26	79	8
		26		121	92	12				78	7
26			49	120	91		11	11	25	77	6
				119	90				24	76	6
	25	25	48	118	89	11	10			75	5
25				117	87			10	23	74	4
			47	116	86				22	73	4
		24		115	84	10	9		21	72	3
24	24		46	114	83			9		71	3
				113	81		8		20	70	2
		23	45	112	79	9			19	69	2
23	23			111	77			8		68	2
			44	110	75		7		18	67	1
		22		109	73				17	66	1
22			43	108	70	8	6	7	16	65	1
	22			107	68					64	1
		21	42	106	66		5		15	63	1
21				105	63	7		6	14	62	1
	21		41	104	61				13	61	<1
		20	40	103	58		4		12	60	<1
20				102	55	6	3	5	11	58	<1
	20		39	101	53				9–10	56	<1
		19		100	50	2–5	2	3–4	5–8	53	<1

Table E9

Age: 60 Through 69 Years
Education: Equal To or Greater Than 13 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19													19	>99
>99	18	18												18	>99
99	17	17	9											17	99
98	16		8										20	16	98
95	15	16		72			9	9			10			15	95
91	14	15	7	71								20		14	91
84	13	14		69–70				8			9	19	19	13	84
75	12			67–68	12	12	8		20		8			12	75
63	11	13	6	65–66	11				19	10	7	18	18	11	63
50	10	12		63–64			7	7	18			17		10	50
37	9	11	5	60–62			6	6			6	16	17	9	37
25	8			57–59	10	11			17	9	5	15		8	25
16	7	10		54–56	9		5	5	16		4	14	16	7	16
9	6		4	50–53		10			14–15	8		13	15	6	9
5	5	9		46–49	8	9	4	4	13	7	3	11–12	14	5	5
2	4		3	41–45	7	7–8	3		12		2	10		4	2
1	3	8		36–40	6	6		3	10–11	6		9	13	3	1
<1	2	7	2	30–35	5	5	2	2	9	4–5	1	7–8	12	2	<1
<1	1	0–6	0–1	0–29	0–4	0–4	0–1	0–1	0–8	0–3	0	0–6	0–11	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<2	>.09	>.09	>.11	>10	12	12	>16	Within expectations
Significant	≤16	≥2	≤.09	≤.09	≤.11	≤10	≤11	≤11	≤16	Significant

Table E9 (Continued)

Summary Scales

Short–term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
35				146	>99
34				143	>99
33				141	>99
				139	>99
32				138	>99
				137	99
			56	136	99
31				135	99
			55	134	99
				133	99
30			54	132	98
		29		131	98
			53	130	98
29	27			129	97
		28	52	128	97
				127	97
28				126	96
		27	51	125	95
				124	95
27	26		50	123	94
		26		122	93
			49	121	92
26				120	91
	25		48	119	90
		25		118	89
25			47	117	87
				116	86
	24	24	46	115	84
24				114	83
			45	113	81
		23		112	79
23	23		44	111	77
				110	75
		22		109	73
22			43	108	70
	22			107	68
		21	42	106	66
21				105	63
	21		41	104	61
				103	58
20		20	40	102	55
				101	53
	20		39	100	50

Short–term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
19		19		99	47
			38	98	45
	19			97	42
18		18	37	96	40
				95	37
	18		36	94	35
17		17		93	32
			35	92	30
	17		34	91	28
16		16		90	25
	16		33	89	23
				88	21
15		15	32	87	19
	15			86	18
			31	85	16
14		14		84	14
	14		30	83	13
			29	82	12
13	13	13		81	10
			28	80	9
				79	8
12	12	12	27	78	7
			26	77	6
	11			76	6
11		11	25	75	5
				74	4
	10		24	73	4
10		10	23	72	3
	9			71	3
			22	70	2
	8		21	69	2
9		9		68	2
			20	67	1
	7		19	66	1
8		8	18	65	1
				64	1
	6		17	63	1
7		7	16	62	1
	5			61	<1
			15	60	<1
6	4	6	14	58	<1
	3		12–13	56	<1
2–5	2	2–5	4–11	53	<1

Table E10

Age: 70 +
Education: Less Than or Equal To 11 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19	16–18	9	70–72					20		9–10	20	20	19	>99
>99	18		8	68–69			9	9		10				18	>99
99	17	15		67		12			19		8	19		17	99
98	16	14	7	65–66				8				18	19	16	98
95	15			63–64			8		18		7			15	95
91	14	13	6	61–62	12			7			6	17	18	14	91
84	13	12		58–60	11		7		17	9		16		13	84
75	12			55–57	10			6	16		5	15	17	12	75
63	11	11	5	52–54	9	11	6				4	14		11	63
50	10	10		48–51	8			5	14–15	8		13	16	10	50
37	9			44–47		10	5		13	7	3	12	15	9	37
25	8	9	4	39–43	7	8–9	4	4	12		2	11		8	25
16	7	8		33–38	6	7	3		10–11	6	1	9–10	14	7	16
9	6			27–32	5	5–6		3	9	5		8	13	6	9
5	5	7	3	20–26	4	3–4	2	2	7–8	3–4	0	6–7	12	5	5
2	4			12–19	2–3	1–2	1		5–6	2		4–5	11	4	2
1	3			4–11	1	0		1	4	0–1		3	10	3	1
<1	2	6	2	0–3	0		0	0	2–3			1–2	9	2	<1
<1	1	0–5	0–1						0–1			0	0–8	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<9	>.09	>.00	>.11	>5	>4	12	>16	Within expectations
Significant	≤16	≥9	≤.09	≤.00	≤.11	≤5	≤4	≤11	≤16	Significant

Table E10 (Continued)

Summary Scales

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
35–38	31–32	36–38	67–70	146	>99
34	30	35	65–66	143	>99
33		34	64	141	>99
			63	139	>99
32			62	138	>99
		33	61	137	99
31	29		60	136	99
				135	99
		32	59	134	99
				133	99
30		31	58	132	98
	28		57	131	98
				130	98
29		30	56	129	97
				128	97
			55	127	97
28	27	29	54	126	96
				125	95
		28	53	124	95
27				123	94
	26		52	122	93
		27	51	121	92
26				120	91
			50	119	90
	25	26		118	89
25			49	117	87
		25	48	116	86
				115	84
24	24		47	114	83
		24		113	81
			46	112	79
23	23	23	45	111	77
				110	75
22			44	109	73
		22	43	108	70
	22			107	68
21			42	106	66
		21		105	63
	21		41	104	61
20		20	40	103	58
				102	55
	20		39	101	53
19		19	38	100	50
	19			99	47
		18	37	98	45
18			36	97	42
	18			96	40
		17	35	95	37
17			34	94	35
	17	16		93	32
			33	92	30
16	16		32	91	28
		15		90	25
	15		31	89	23
15		14	30	88	21
			29	87	19
	14			86	18
14		13	28	85	16
	13		27	84	14
		12		83	13
13	12		26	82	12
			25	81	10
	11	11	24	80	9
12			23	79	8
				78	7
	10	10	22	77	6
			21	76	6
11	9	9	20	75	5
			19	74	4
	8			73	4
10		8	18	72	3
	7		17	71	3
		7	16	70	2
9	6		15	69	2
			14	68	2
	5	6	13	67	1
8				66	1
	4		12	65	1
			11	64	1
7			10	63	1
				62	1
				61	<1
				60	<1
6				58	<1
5				56	<1
2–4				53	<1

Table E11

Age: 70+
Education: 12 Years (High School Graduate)

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19	17–18		72							10			19	>99
>99	18		9	71								20	20	18	>99
99	17	16	8	70			9	9			9			17	99
98	16	15		68–69					20			19		16	98
95	15		7	66–67						10	8		19	15	95
91	14	14		64–65	12	12	8	8	19			18		14	91
84	13	13	6	62–63	11						7	17	18	13	84
75	12			60–61			7	7	18		6	16		12	75
63	11	12		57–59	10				17	9	5		17	11	63
50	10	11	5	54–56	9	11	6	6	16			15		10	50
37	9	10		50–53			5	5	15	8	4	14	16	9	37
25	8			46–49	8	10			14		3	12–13	15	8	25
16	7	9	4	41–45	7	9	4	4	13	7		11	14	7	16
9	6			36–40	6	7–8			11–12	6	2	10		6	9
5	5	8		30–35	5	6	3	3	10	5	1	8–9	13	5	5
2	4		3	24–29	4	4–5	2		8–9	4		7	12	4	2
1	3	7		16–23	3	3		2	7	3	0	5–6	11	3	1
<1	2		2	8–15	1–2	2	1	1	5–6	1–2		3–4	10	2	<1
<1	1	0–6	0–1	0–7	0	0–1	0	0	0–4	0		0–2	0–9	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	Cued List Recall: List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<6	>.12	>.09	>.10	>8	>9	12	>16	Within expectations
Significant	≤16	≥6	≤.12	≤.09	≤.10	≤8	≤9	≤11	≤16	Significant

Table E11 (Continued)

Summary Scales

Short–term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
35–37	31	35–37	65–68	146	>99
34	30	34	63–64	143	>99
33			62	141	>99
		33	61	139	>99
32	29		60	138	>99
				137	99
		32	59	136	99
31			58	135	99
		31		134	99
			57	133	99
30	28			132	98
		30	56	131	98
				130	98
29			55	129	97
		29	54	128	97
	27			127	97
28			53	126	96
		28		125	95
			52	124	95
27				123	94
	26	27	51	122	93
				121	92
26			50	120	91
		26	49	119	90
	25			118	89
25			48	117	87
		25		116	86
			47	115	84
24	24	24		114	83
			46	113	81
				112	79
23	23	23	45	111	77
			44	110	75
				109	73
22		22	43	108	70
	22			107	68
			42	106	66
21		21		105	63
	21		41	104	61
			40	103	58
20		20		102	55
	20		39	101	53
		19		100	50

Short–term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
19			38	99	47
	19			98	45
		18	37	97	42
18			36	96	40
	18			95	37
		17	35	94	35
17	17		34	93	32
		16		92	30
			33	91	28
16	16			90	25
		15	32	89	23
			31	88	21
15	15			87	19
		14	30	86	18
	14		29	85	16
14				84	14
	13	13	28	83	13
			27	82	12
13	12	12		81	10
			26	80	9
			25	79	8
12	11	11	24	78	7
				77	6
	10		23	76	6
11		10	22	75	5
	9			74	4
		9	21	73	4
10	8		20	72	3
			19	71	3
		8	18	70	2
9	7			69	2
			17	68	2
	6	7	16	67	1
8			15	66	1
	5		14	65	1
		6		64	1
7	4		13	63	1
			12	62	1
		5	11	61	<1
	3		10	60	<1
6	2	4	9	58	<1
			7–8	56	<1
2–5			6	53	<1

Table E12

Age: 70 +
Education: Equal To or Greater Than 13 Years

Subtests

%ile	Scale score	Verbal Span	Visual Span	List Acquisition	List Recall	Delayed List Recall	Immediate Prose Recall	Delayed Prose Recall	Immediate Names–Faces	Delayed Names–Faces	Visual Reproduction	Immediate Visual Recognition	Delayed Visual Recognition	Scale score	%ile
		Raw scores													
>99	19	18												19	>99
>99	18													18	>99
99	17	17	9	72							10	20	20	17	99
98	16	16	8	71			9	9						16	98
95	15			69–70							9	19		15	95
91	14	15	7	67–68					20		8		19	14	91
84	13	14		66	12	12	8	8				18		13	84
75	12	13	6	63–65	11				19	10	7	17	18	12	75
63	11	12		61–62			7	7			6	16		11	63
50	10			58–60	10				18				17	10	50
37	9	11	5	55–57		11	6	6	17	9	5	15	16	9	37
25	8	10		52–54	9		5		16		4	14		8	25
16	7			48–51	8	10		5	15	8		12–13	15	7	16
9	6	9	4	43–47	7	9	4	4	13–14	7	3	11	14	6	9
5	5			38–42		7–8			12	6	2	10	13	5	5
2	4	8	3	32–37	6	6	3	3	11			8–9	12	4	2
1	3			26–31	4–5	4–5	2		9–10	5	1	7	11	3	1
<1	2	7	2	19–25	3	3		2	8	3–4		6	10	2	<1
<1	1	0–6	0–1	0–18	0–2	0–2	0–1	0–1	0–7	0–2	0	0–5	0–9	1	<1

Verbal Process Scores

Statistical interpretation	%ile	Total Intrusions	List Clustering: Acquisition	List Clustering: Recall	List Clustering: Delayed Recall	Cued List Recall: Recall	Cued List Recall: Delayed Recall	List Recognition	%ile	Statistical interpretation
		Raw scores								
Within expectations	>16	<6	>.13	>.11	>.22	>9	12	12	>16	Within expectations
Significant	≤16	≥6	≤.13	≤.11	≤.22	≤9	≤11	≤11	≤16	Significant

Table E12 (Continued)

Summary Scales*

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
35–36			63	146	>99
34		34	61–62	143	>99
33		33	60	141	>99
	29		59	139	>99
32		32		138	>99
			58	137	99
				136	99
31		31	57	135	99
				134	99
	28		56	133	99
30		30	55	132	98
				131	98
			54	130	98
29		29		129	97
			53	128	97
	27			127	97
28		28	52	126	96
				125	95
			51	124	95
27	26	27		123	94
			50	122	93
				121	92
26		26	49	120	91
				119	90
	25		48	118	89
25		25		117	87
			47	116	86
				115	84
24	24	24	46	114	83
				113	81
			45	112	79
23	23	23		111	77
			44	110	75
				109	73
22		22	43	108	70
	22			107	68
			42	106	66
21		21		105	63
	21		41	104	61
				103	58
20		20	40	102	55
	20			101	53
			39	100	50

Short-term Memory	Verbal Memory	Visual Memory	Global Memory Scale	Standard score	%ile
Scale score sum					
19		19	38	99	47
	19			98	45
			37	97	42
18		18		96	40
	18		36	95	37
				94	35
17		17	35	93	32
	17			92	30
		16	34	91	28
16	16		33	90	25
				89	23
		15	32	88	21
15	15			87	19
			31	86	18
	14	14	30	85	16
14				84	14
			29	83	13
	13	13	28	82	12
13				81	10
	12		27	80	9
		12		79	8
12			26	78	7
	11		25	77	6
		11		76	6
11	10		24	75	5
			23	74	4
	9	10	22	73	4
10				72	3
			21	71	3
	8	9	20	70	2
9				69	2
	7		19	68	2
		8	18	67	1
8	6		17	66	1
		7		65	1
			16	64	1
7	5		15	63	1
		6	14	62	1
	4			61	<1
			13	60	<1
6	3	5	11–12	58	<1
	2		10	56	<1
2–5		2–4	4–9	53	<1