

CHAPTER 22

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Memory Rehabilitation

Difficulty with memory and learning is the most frequent complaint of individuals with neuropsychological disorders. Moreover, people typically find that memory impairment is particularly disabling in their everyday lives. For this reason, strategies that focus on the alleviation of real-world memory problems are likely to be of greatest benefit. The optimal strategies for any individual depend on both the nature and the level of memory impairment and the family- and self-reported difficulties in everyday life. This chapter provides an outline of some of the aspects of memory assessment that are especially important for rehabilitation planning and some practical methods for enhancing everyday memory functioning and solving some of the problems of daily living that people with memory disorders commonly experience. Before outlining important aspects of assessment and rehabilitation, we provide a brief review of relevant concepts.

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I. MEMORY PROCESSES AND CONCEPTS

Memory is often retrospective, a term that refers to retrieval of past experiences both recent and remote. Memory can also be prospective, or concerning the retrieval of future intentions, such as remembering to keep an appointment, remembering to take medication, or remembering to turn off the stove. Although the bulk of research on memory rehabilitation has focused on retrospective memory, remembering to perform an action in the future is often critical to everyday functioning.

The act of remembering depends on at least four basic processes and can fail as a result of a breakdown in any one of them. These processes include the following:

A. Attention

A multicomponent process that is critical for ensuring the entry of information into the system. Attentional processes are responsible for these behaviors:

- Selecting goal-relevant information from the range of stimuli in the environment
- Focusing on relevant information
- Inhibiting irrelevant information
- Sustaining focus until all relevant information has been selected and processed

B. Encoding

Initial processing of information that results in the formation of a memory trace. Semantic, or meaningful, analyses during encoding (i.e., deep processing) result in more durable memory traces.

C. Storage

The retention of information in the system through the process of consolidation.

D. Retrieval

The process of accessing the information in storage and bringing it to mind. The act of retrieval may be conscious, resulting in recollection of information from the past, in which case it is termed **explicit memory**. Information may come to mind or influence current behavior even when a person has no con-

scious recollection of its prior occurrence, in which case it is termed **implicit memory**.

II. MEMORY ASSESSMENT

To develop and initiate an effective memory rehabilitation program, determination of both the nature and the level of memory deficits through a thorough assessment is critical. The evaluation should focus on attention, retrospective verbal and visual memory, and prospective memory. In addition to differentiating between verbal and visual memory impairment, the results of the assessment can be used to identify specific encoding, storage, and retrieval deficits, as well as areas of strength that might later be exploited for rehabilitation purposes.

A. Attention

Individuals with attentional deficits may report difficulty recalling why they have entered a room or whether they have completed a task. Attentional capacity should be assessed independently of memory. Testing may reveal difficulty focusing or concentrating on relevant information and ignoring distractions, slowed information processing, and difficulty retaining material over even short intervals as well as staying on task for extended periods of time. Following are the attentional components and examples of appropriate measures that should be included in an assessment.

- **Selective attention:** digit span forward and recitation of automatic sequences (e.g., alphabet, months of the year)
- **Concentration:** digit span backward and mental arithmetic problems
- **Inhibition:** Stroop Color-Word Interference Task and Trail Making Test Part B
- **Sustained attention:** continuous-performance tests (e.g., Vigil Continuous Performance Test)

B. Verbal Retrospective Memory

Individuals with verbal memory deficits may report difficulty recalling conversations or verbal instructions. Following are the various aspects of verbal memory and examples of appropriate measures to include in any assessment.

- **List learning** may be assessed by the California Verbal Learning Test or the Hopkins Verbal Learning Test.

- **Narrative memory** is measured by the Logical Memory subtest of the Wechsler Memory Scale-III (WMS-III) and stories from the Rivermead Behavioral Memory Test.
- **Immediate memory**, which is recall of verbal information immediately following presentation, is assessed by most verbal memory tests. A selective deficit in immediate recall in the presence of good retention of material across a time delay may suggest a problem with encoding.
- **Delayed memory (recall and recognition)** is measured by recall of verbal information, typically after a 20- to 30-minute delay period. Poor retention of material is indicated by a substantially worse performance on delayed compared with immediate recall and may suggest a problem with storage. A selective deficit in recall as opposed to recognition may suggest a particular problem with retrieval of verbal material.

C. Visual Retrospective Memory

Visual memory deficits may be manifested in everyday life as difficulty recalling routes as well as objects or individuals in visual form. Types of visual memory important to assess and examples of appropriate measures follow:

- **Concrete visual memory** may be assessed by the Recognition Memory Test-Faces.
- **Abstract visual memory** is measured by the Visual Reproduction subtest of the WMS-III and the Rey-Osterreith Complex Figure.
- **Immediate memory**, which is recall of visual information immediately following presentation, is assessed by most visual memory tests.
- **Delayed memory (recall and recognition)** is measured by recall of visual information after a 20- to 30-minute delay period. The same patterns of performance and associated implications for the nature of memory impairment that are seen across various verbal memory tasks also apply to visual tasks.

D. Prospective Memory

Individuals with prospective memory deficits typically report difficulty remembering to do things in the future. For example, they frequently have trouble remembering to perform errands and to attend doctor appointments. The Prospective Memory

Screening Test (Sohlberg & Mateer, 1989a) is one of the few available validated instruments (also see Cockburn, 1996).

III. REHABILITATION

The following rehabilitation strategies are organized on the basis of the four processes critical for memory: attention, encoding, storage, and retrieval. Neuropsychologists can teach these strategies to their patients, choosing specific exercises on the basis of weaknesses identified during assessment. Many of the examples are worded as though addressing the patient for simplicity of presentation.

A. Improving Attention

As we mentioned earlier, attention is a requisite ability for successful remembering. If one does not devote attention to information at the time of presentation or encoding, it will likely not be accurately recalled later. There are a variety of methods to help patients increase their attention to information (see Higbee, 1993; Morse, 1994).

Verbal mediation: talking to oneself either aloud or silently when intending to perform or while performing a task

Purpose: To keep intentions (e.g., locking the front door) in mind until they are carried out or to help recall whether tasks have been accomplished.

Example: Saying "I am placing the keys on the table" to aid later recollection of the location of the keys.

Repetition: repeating back what has been said, paraphrasing the material

Purpose: To focus on conversations or verbal instructions.

Example: After being told the date, time, and location of an upcoming event, repeating back these details to the person who provided this information.

Controlling and reducing the rate at which information is presented: taking rest periods and small breaks within and between tasks

Purpose: To encode substantial amounts of information.

Example: Reading new information for 20-minute periods interspersed with short breaks, during which one engages in a different activity.

Reducing interference: eliminating distractions in the environment as much as possible

Purpose: To maintain focus when other external stimuli compete for attention.

Example: Turning off the television set when engaging in conversation.

Increasing the salience of the information: focusing on the consequences of not recalling the conversation at a later time

Purpose: To increase arousal and focus on conversations or verbal instructions.

Example: When informed about an upcoming event (such as a social gathering) focusing on the consequences of not recalling this information such as angering one's spouse.

B. Improving Encoding

1. GENERAL STRATEGIES

The following strategies can improve encoding in individuals with mild-to-moderate memory deficits. The choice of particular strategies and techniques should be guided by both the individual's reported failures in everyday memory and the assessment results. That is, techniques should take advantage of and build on an individual's cognitive strengths to compensate for weaknesses. For those with visual memory deficits, therefore, training should focus on verbal techniques, and for those with verbal memory impairment, visual techniques should be emphasized. Within each general encoding strategy (organization, association, visualization, and verbalization), a number of examples of specific techniques are described (see Higbee, 1993).

a. Organization

Individuals frequently have difficulty recalling information because it was not encoded in an organized manner. Recall can be enhanced by improving organization of the material as it is presented and encoded. Specific organizational techniques follow:

Categorization: Group items into categories that can later act as retrieval cues.

Purpose: To encode and recall lists of items that can be grouped by category.

Example: Group grocery store items by category (e.g., fruit, vegetables, meats, or canned goods) at the time the list is generated and encoded. Later, at the store, use the categories as cues to recall the items on the list.

Number of items: Count the number of items on the whole list or in each category at the time of encoding, and use this information at the time of retrieval.

Purpose: To encode and recall lists of information.

Example: If using a shopping list, count the number of items within each category (e.g., vegetables). Then, at the store, check to be sure that the correct number of items has been gathered. If the number is incorrect, scan the foods until the additional items are recognized.

Chunking: Group information into meaningful clusters.

Purpose: To recall number series (e.g., telephone numbers).

Example: Group the numbers in the series 6 7 3 4 5 6 into 677, 34, 56.

PQRST: Acronym for performing the steps Preview, Question, Read, State, and Test.

Purpose: To organize and recall prose or narrative information.

Example:

- Preview or skim the material prior to reading the text.
- Generate *questions* on the basis of the preview that can be answered by the material, including questions involving the five *wh's*: *who*, *what*, *where*, *when*, and *why*. For example: Who is the story about? What is the story about? Where did the events take place? When did the events take place? Why is this information useful to me?
- Read the text with the goal of answering the questions.
- State aloud or in written form the answers to the questions.

- Test memory by answering the questions without referring to the text.

b. Association

Another useful strategy to increase depth of encoding and thus facilitate recall is association. The concept involves connecting new information with previously stored material. Specific techniques to aid in forming associations follow:

Analogies: Find a similarity between new and old information.

Purpose: To encode and recall new information (e.g., concepts or relationships).

Example: If one is explaining how memory works, a useful analogy would be a large filing cabinet containing numerous bits of information to be filed, stored, and retrieved.

Compare and contrast: Compare and contrast the new information with related, stored information.

Purpose: To encode and recall new information.

Example: When meeting a new person by the name of Sally, compare and contrast her characteristics with those of other people named Sally.

c. Visual imagery

Use of imagery is a general strategy that involves forming a mental image of the information to be remembered. Imagery increases the depth of encoding and is particularly useful for individuals with verbal memory deficits. Imagery can be used to encode information that is typically processed visually (e.g., concrete objects, people's physical characteristics) as well as to encode verbal material that can be translated into visual images (e.g., verbal descriptions of actions). The more vivid and bizarre the image, the more likely it will be recalled at a later time. Visualizing objects or individuals moving or interacting makes the image more vivid, and exaggerating the size of objects makes them more bizarre. To remember to perform two errands, such as going to the bank and the dry cleaner, one might form a logical visual image such as money in a cash register at the dry cleaner. A more bizarre and thus more memorable image would be large dollar bills hanging from the dry cleaner's revolving rack in place of clothing. Other, more specific visual imagery techniques include the following:

Method of loci: Visualize to-be-remembered items placed along a familiar route, such as a walk through one's house. To recall items, take a walk through the house noting the new items that were visualized in each room.

Purpose: To encode and recall discrete items, especially in a specified order (e.g., lists of errands, topics in a speech).

Example: To remember a speech about general strategies for memory rehabilitation (e.g., organization, association) form a visual association between one's living room and the concept "organization" (e.g., decorative items in the living room rearranged by color or size); between one's dining room and the concept "association" (e.g., a friend or "associate" dancing on the dining room table); between one's kitchen and the concept "visualization" (e.g., eyeballs covering the kitchen counter), and so on. Later, imagine walking through the rooms of the house, noting the items that were "placed" there by visualization.

Pegword method: Using imagery, associate to-be-learned items with a pegword list that consists of previously learned nouns that rhyme with successive numbers. One standard pegword list is one-bun, two-shoe, three-tree, four-door, five-hive, six-sticks, seven-heaven, eight-gate, nine-wine, ten-hen.

Purpose: To encode and recall a list of items, especially in a specified order.

Example: To encode an errand list, associate bun with the first errand (e.g., going to the bank) by imagining a sandwich made out of a hamburger bun with a stack of bills instead of a

hamburger patty. Then imagine the second errand interacting with a shoe, and so on. To recall the items, proceed by recalling the overlearned Number 1, which acts as a cue for "bun." The hamburger is revisualized along with the stack of bills inside it.

Link method: Form a visual association or link between items that follow one another in a series.

Purpose: To encode and recall lists of concrete objects.

Example: To encode a list of items that includes *dog*, *hat*, *flower*, and *table*, first form a visual association between *dog* and *flower* by imagining a dog wearing a straw hat, then form an association between *hat* and *flower* by imagining a hat with a large purple flower on it, and last, link the flower and the table by imagining a card table imprinted with purple flowers. When it is time to recall the list, only *dog* must be recalled independently; once *dog* is recalled, it acts as a cue for the hat, which cues the flower, and so on down the list.

Face-name association: Relate a person's name to a prominent physical feature through imagery.

Purpose: To learn and remember people's names.

Example: If *Butters* is the name to be recalled, transform it into a concrete image (e.g., butter), identify a prominent physical feature of the person (e.g., light, wavy hair), and then form a visual image associating the feature with the name (e.g., butter dripping from the hair). Later, to recall the name when confronted with the person, recognize the prominent physical feature (the person's hair), use this feature as a retrieval cue to recall the image-name association (butter dripping), and transform the image into the name *Butters*.

d. Verbalization

There are a variety of verbal techniques that increase depth of encoding and that are particularly useful for individuals who have weak visual abilities along with relatively strong verbal skills.

Rhyming: Rhyme new information with previously stored material.

Purpose: To learn and recall simple verbal information.

Example: If a car is parked on the fourth floor of a garage, a rhyme could be four-door.

Keyword method: Transform a to-be-learned term into words already in one's lexicon, and relate them to one another in a meaningful way.

Purpose: To acquire new vocabulary words and associated meanings.

Example: To learn the word *Zolofit* (trade name of a commonly prescribed antidepressant drug), transform the word into

Zoe and *loft*, and associate the two words with each other: "My friend Zoe is happy living in a loft."

Acronyms: Create a word using the first letter of each item or step in a to-be-remembered list or task.

Purpose: To encode and recall a list of items or steps in a task.

Example: To remember a shopping list of bread, eggs, apples, and milk, use the first letter of each item to generate the word *beam*. Later, recall the word *beam*, and use each letter in the word as a cue to recall each item in the list.

Acrostics: Use the first letter of each item to generate a word, then form a sentence using the created words.

Purpose: To encode and recall a list of items or steps in a task.

Example: A sentence using the previously mentioned list (bread, eggs, apples, and milk) could be "better [bread] eat [eggs] all [apples] of the meal [milk]," and the first letter of each word in the sentence is a cue to recall each item in the list.

Story method: Create a story out of the list of items.

Purpose: To encode and recall a list of items or steps in a task.

Example: To remember the list *dog*, *hat*, *flower*, *table*, make up a story such as the following: My *dog* put on my big straw *hat*, picked a pretty purple *flower*, and sat on the *table* to eat it.

2. TRAINING DOMAIN-SPECIFIC TASKS

The techniques described in this section largely rely on implicit rather than explicit memory systems. Individuals with severe explicit memory deficits frequently have normal implicit memory ability. Therefore, memory that relies on implicit processes can be useful for individuals with moderate-to-severe memory impairment in whom improvement of general memory functioning is unlikely to occur. These techniques can be used to train performance in a broad range of specific tasks, from making a sandwich to using a computer.

Spaced retrieval: To strengthen encoding, practice retrieving items at gradually increasing intervals (see Schacter, Rich, & Stamp, 1985).

Purpose: To learn specific information or tasks.

Example: To learn a grooming skill, an individual might perform the task once, then again after 1 minute, then after 5 minutes, 10 minutes, and so on, with progressively longer intervals between repetitions.

Errorless learning: To speed and strengthen encoding, prevent the occurrence of errors during learning (see Baddeley, 1992).

Purpose: To learn the steps to perform a new task.

Example: To learn how to use a computer, the individual performs the task with close guidance, one step at a time, repeatedly, with as much information as necessary to complete each step without error. Each step must be completed without error several times before proceeding to the next step.

Vanishing cues: Gradually withdraw cue information across learning trials (see Glisky, Schacter, & Butters, 1994).

Purpose: To acquire domain-specific knowledge, including steps to perform a new task.

Example: To learn a new task, break it down into steps and teach each step separately. Present as many cues as necessary for correct responding. Gradually withdraw the cues across trials until the individual completes the task successfully without aid.

C. Improving Storage and Retention

Once information has been encoded, employing the following techniques may help to maintain the information until it is retrieved and thereby increase the probability of recall (see Higbee, 1993). These techniques are most useful for individuals with mild-to-moderate memory impairment. They can also be helpful for those with moderate-to-severe deficits if material has been successfully encoded.

Distributed practice: To increase the strength of the memory trace, distribute practicing of a new task or material across time. That is, practice the material for shorter, more frequent periods, rather than for longer, less frequent sessions.

Purpose: To learn specific information or new tasks.

Example: To learn to play a specific piece for the piano, practice it daily for a half hour rather than for three and a half hours once a week.

Review: Review information periodically.

Purpose: To maintain new information in storage.

Example: Carry index cards containing new information and read them periodically throughout the day.

Overlearning: Continue to practice newly learned tasks or information well beyond the first correct performance or recitation.

Purpose: To increase the strength of a memory trace and maintain it in storage.

Example: When studying for an examination, continue to quiz oneself on the new information well after the first time it is correctly recited.

D. Improving Retrieval

1. GENERAL STRATEGIES

Memory impairment is often at least partially attributable to retrieval failure. The following strategies are useful for most individuals who have difficulty retrieving well-known information such as familiar names or aspects of their daily routine (see Higbee, 1993).

Relaxation: Use relaxation techniques such as deep breathing at the time of retrieval. Relaxation techniques are particularly useful for individuals who are able to recall information in certain situations but not in others.

Purpose: To reduce retrieval difficulties caused by anxiety.

Example: Use deep breathing to reduce anxiety and maximize retrieval performance during an examination or a presentation.

Structuring the environment and routine: Keep items in the same place all the time, and perform routine actions and tasks in a consistent manner.

Purpose: To recall the location of objects and to remember to perform specific tasks.

Example: Keep eyeglasses or wallet in one designated location. Pair a new task (e.g., taking new medication) with another, overlearned task in the daily routine (e.g., brushing one's teeth) by keeping the medication with the toothpaste so that the latter task will act as a visual cue to perform the former task.

2. SEARCH TECHNIQUES

Search techniques are self-initiated ways for systematically generating cues that trigger retrieval of stored information (see Higbee, 1993).

Mental retracing: Reconstruct the events leading up to and occurring after an item was misplaced.

Purpose: To find missing items.

Example: To find lost keys, mentally reenact the events of the day.

Alphabetic searching: Systematically go through the alphabet, generating words beginning with each letter until the correct word is retrieved.

Purpose: To retrieve specific verbal information.

Example: To retrieve a forgotten name, start with the letter *a* and generate names beginning with that letter, continuing through the alphabet until the correct name is recalled.

Recreating context: Recreate the environmental and contextual factors that were present at the time of encoding.

Purpose: To retrieve all kinds of information.

Example: To recall a conversation held with another individual during a meal at a restaurant, recreate the environment and context either mentally, through imagery, or physically, by returning to the restaurant.

3. CUEING TECHNIQUES

Cueing can be used by the caregiver of a memory-impaired individual to trigger retrieval of stored information. These techniques can be useful for memory-impaired individuals who are not able to generate cues independently but who are able to benefit from cues provided by others (see Van der Linden & Vander Kaa, 1989). Although retrieval through cueing does not necessarily increase one's level of functioning or independence, it can help a memory-impaired individual experience some success in coping with the environment.

First-letter cueing: Provide the first letter of the object or name.

Purpose: To recall specific information.

Example: During a visit to the doctor's office, the caregiver provides the memory-impaired individual with a first letter as a cue, to create an opportunity to recall a new symptom or problem.

Category cueing: Provide the category of the information.

Purpose: To recall specific information, especially information that has been categorically organized at the time of encoding.

Example: While shopping, the caregiver provides the memory-impaired individual with category cues such as "clothing" or "hardware" to aid recall of specific items to purchase.

4. EXTERNAL AIDS

External aids are physical instruments used to enhance everyday functioning by circumventing memory. They are especially useful for performing tasks that rely on prospective memory, or memory for future intentions (see Harris, 1992; Higbee, 1993).

Written reminders (e.g., instructions, memos, checklists): Write information down and place it in a prominent location.

Purpose: To provide cues to perform a future act or to serve as a reminder of a past act.

Example: To remember to pass along a phone message, write a note and place it on the refrigerator.

Timers (e.g., watch alarms, alarm clocks, cooking timers): Set timer to go off when a task needs to be performed.

Purpose: To provide an auditory cue or reminder to perform a future act.

Example: Set a cooking timer to go off when the washing machine cycle is completed as a cue to take the laundry out of the washer and place it in the dryer.

Computerized paging system: Program a paging system (e.g., Neupage; Hersh & Treadgold, 1994) so that the pager vibrates or produces a tone that acts as a cue to look at the display. The display contains a message about an event or action to be performed.

Purpose: To provide cues to perform a future act.

Example: Program into the system various medication names and times the drugs should be taken so that the pager reminds one to take specific medications when the appropriate times arrive.

Appointment books, diaries, and calendars: Record actions to be performed in the future and review past actions.

Purpose: To remember to perform future actions and to recall past actions.

Example: To retrieve information regarding a previous meeting, refer to one's appointment book.

Electronic organizers: Enter personal information as well as actions to be performed into organizer and set electronic timer.

Purpose: To remember to perform future actions as well as to retrieve personal information.

Example: Personal information such as insurance policy numbers or driver's license number can be stored for simple access when away from home.

Memory notebook: A comprehensive notebook system has been developed by Sohlberg and Mateer (1989b). The notebook is carried throughout the day and is used to record information about past and future actions, as well as personal information and other useful material. It is individualized and contains separate sections relevant to one's life. Sections can be referred to and information can be recorded as frequently as hourly or only when new information (such as appointments or phone numbers) is presented.

Purpose: To retrieve information, provide cues to perform future acts, and provide structure and organization to an individual's daily routine.

Example: The notebook may include sections such as these:

- (1) Orientation: Record personal information (e.g., owner's address, phone number, medications, names of physicians, name of pharmacy).
- (2) Memory log: Record the events of the day (e.g., phone conversations, tasks completed).
- (3) Calendar: Keep track of holidays and schedule appointments and other personal events.
- (4) Things to do: Record tasks to be completed, and cross them off as they are performed.
- (5) Transportation information: Include relevant material for public transportation (e.g., bus schedules, phone numbers for taxi services).
- (6) Feelings log: Record feelings about the changes experienced since the injury.
- (7) Relevant people: Record names and addresses as well as identifying information about people with whom one has regular contact (e.g., physical descriptions, photographs, or personal interests).
- (8) Work-related information: Include names of coworkers, instructions on how to complete work-related tasks, and locations.

IV. CONCLUSION

Losing the ability to recall information can be devastating and often affects nearly all aspects of life. Clearly, all the techniques described in this chapter are not appropriate for everyone. Some techniques are too complex to be acquired or too cumbersome to be applied by many patients. Nevertheless, learning and using just one or two methods can greatly improve independence or quality of life. For example, if an individual with a focal, severe memory impairment is unable to remember to perform many activities of daily living, a computerized paging system that provides cues to perform tasks could substantially increase his or her independence. An individual with a relatively mild memory deficit who remains employed but has a problem making required presentations because of difficulty remembering the content and consequent anxiety may learn to use the method of loci along with deep breathing; these techniques may greatly improve his or her performance and ultimately help maintain employment.

Individuals with more severe cognitive deficits in addition to memory impairment pose the greatest challenge. It is usually impossible to improve their memory functioning substantially. However, applying a few simple methods (e.g., caregiver cuing,

labeling drawers) in a few situations (remembering complaints during a doctor visit, finding clothes to dress oneself) that are particularly distressing for the individual can improve coping and thus quality of life.

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