Cognitive Rehabilitation

Help for Attention, Memory, and Other Problems with Thinking
(Or: "Why can’t I remember to pick up bread on the way home?")

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Brain injury of any sort can cause a variety of cognitive impairments. For example, individuals often complain of difficulty with attention, short term memory, and multi-tasking even if they have no visible physical deficits. Neuropsychology is the discipline that is designed to assess and treat these cognitive problems. It's surprising how infrequently patients are referred for neuropsychological evaluation and treatment – it’s certainly something to request if you believe that you can benefit. Most major US insurance companies will cover the cost of an evaluation and of follow-up treatment.

The National Academy of Neuropsychology provides clear explanations of neuropsychological testing and the role of the neuropsychologist:

WHAT IS A NEUROPSYCHOLOGICAL EVALUATION?
A neuropsychological evaluation involves testing that is sensitive to problems in brain functioning. Unlike CT or MRI scans, which show what the structure of the brain looks like, neuropsychological testing examines how well the brain is working when it performs certain functions (for example, remembering). The types of tests that you will take depend upon the questions you and your doctor have. The tests may assess the following areas: attention and memory, reasoning and problem-solving, visual-spatial functions, language functions, sensory/perceptual functions, motor functions, academic skills, and emotional functioning. The tests are not invasive; that is, they do not involve attaching you to machines or using X-rays. Most of the tests will involve questions-and-answers, or working with materials on a table. Some tests may use a computer. The testing may be performed by the neuropsychologist or by a trained staff member. The neuropsychologist or a staff member will also spend some time talking with you about your medical, personal, and school history. The total time involved in your evaluation will depend upon the questions you and your doctor have.

WHAT IS A NEUROPSYCHOLOGIST?
A neuropsychologist is a licensed psychologist specializing in the area of brain-behavior relationships. Although a neuropsychologist has a doctoral degree in psychology, he or she does not just focus on emotional or psychological problems. The neuropsychologist has additional training in the specialty field of clinical neuropsychology. That means a neuropsychologist is educated in brain anatomy, brain function, and brain injury or disease. The neuropsychologist also has specialized training in administering and interpreting the specific kinds of tests included in your neuropsychological evaluation. As a part of the required education, a neuropsychologist also has years of practical experience working with people who have had problems involving the brain.

Cognitive Rehabilitation

Treatment for cognitive impairments is called “cognitive rehabilitation”. The neuropsychological test battery can feel very long, but it is important for the neuropsychologist to have as much information as possible about your functioning before she develops a cognitive rehabilitation plan. Like any rehabilitation therapy, cognitive therapy has two parts: 1) improving your ability to perform the impaired function through therapy techniques and at home practice and 2) developing strategies for compensating for any residual deficits. Also like other rehabilitation
therapies, neuropsychological assessment and cognitive rehabilitation break down functions into their individual components so that the broken links can be found and addressed. In physical therapy, walking is assessed by looking at a variety of factors including muscle strength, range of motion, and balance. It doesn't make sense to focus on strength when the real issue is balance. This is also true for cognitive rehabilitation.

Let’s take apart some of the common cognitive functions and see how neuropsychologists understand and address them.

Attention
What is attention? Do any of the following apply to you?

- “I try to watch TV but I just drift off. I can’t seem to stay focused on anything even when I’m relaxed and there are no distractions.”
- “I can’t cook while there is noisy construction work happening next door. I get too distracted.”
- “I can’t listen to the lecture and take notes at the same time. I can’t switch back and forth quickly enough.”
- “I can’t brush my daughter’s hair while I talk on the phone. I can’t do two things at once anymore.”

For the neuropsychologist, all of these are problems with attention, but the kind of attention required varies from task to task. As a result, the rehabilitation exercises vary depending on the problem.

Sustained attention
“I try to watch TV, but I just drift off. I can’t seem to stay focused on anything even when I’m relaxed and there are no distractions.”

Drifting off is a problem with focused or sustained attention. Although it can happen on occasion to anyone, this is most often a continuing problem for those with brain injury. Cognitive rehabilitation offers several types of exercises to address this issue. For the most basic exercises, you would listen to a tape and hear a series of numbers. You are asked to push a button every time you hear a specific number, for example “4”. You practice increasing the amount of time that you can continue the task without errors. The task can be made much more difficult by changing the rules for responding. For example, you could be asked to press the button every time you see a number that is 2 less than the number that came before it (* = push button): 10, 12, 8, 6*, 4*, 9, 7*. The task could use letters or words rather than numbers as well. In a second type of task, you are asked to count backwards from 100 by 3’s, 4’s etc. This also can be made more difficult by adding more rules. For example, counting backward by 3 then adding 1: 100, 97, 98, 95, 96….

Selective attention
“I can’t cook while there is noisy construction work happening next door. I get too distracted.”

Getting distracted by background noise is an issue of selective attention. Selective attention is the ability to focus on the important or relevant stimuli in the presence of distracting stimuli. To treat selective attention, you would perform exercises like those above, but add background noise, often on tape. Ideally, the background noise should be the same type as that which is a problem for you in your real life. Many individuals are distracted by internal stimuli such as thoughts or worries. For this, neuropsychologists may encourage writing down thoughts and worries before beginning the task. Being distracted by internal stimuli also can be a sign of
depression or an anxiety disorder. Therapy or medication to treat these underlying causes may be in order.

**Alternating attention**
“I can’t listen to the lecture and take notes at the same time. I can’t switch back and forth quickly enough.”

Not being able to switch back and forth is a problem of *alternating attention*. Alternating attention is required for any two tasks that require thought and that are performed at the same time.

Several types of exercises can begin to treat this. In one, you are presented with a list of numbers. You would cross out odd numbers until the therapist says “change”. You would then begin to cross out even numbers. The task becomes more difficult as the length of time between changes shortens. Alternately, you could be presented with pairs of numbers and be asked to change back and forth between adding and subtracting when cued. Finally, you may look at words that are printed differently from the meaning of the word: BIG little LITTLE big little LITTLE big little LITTLE. You would be asked first to read the words and then to say the size of each words. In this example, the response should be “big little big little big little little” and then the size of each word “big little big big little little big.” There are many other exercises that work along this same principle. These types of exercises are very difficult even for most people without any type of brain injury.

**Divided attention**
“I can’t brush my daughter’s hair while I talk on the phone. I can’t do two things at once anymore.”

Not being able to do two things at once is a problem with *divided attention*. In divided attention, an individual is being asked to perform two tasks at once, but one task should be something that a person can do without thinking or with very little thought. In the example of brushing a child’s hair while talking on the phone, brushing hair should be an automatic task performed with some attention but little thought. To address this issue, you may be asked to perform the task of pushing a buzzer in response to a specific number as in the sustained attention example above.

The difference here is that you will both hear numbers through a headset and see number flashed individually on a screen. They will not be the same numbers. You must push the buzzer if either tape or screen has the specific number. Alternately, you may be asked to perform sorting exercises. For example, you may be presented with a deck of cards and asked to sort the cards by suit. During the sorting, you also are supposed to turn over any card that contains a specific letter, such as the letter “n” (one, seven, nine, ten, Queen, King). Again, this is quite a challenge, even for those without a brain injury.

**Processing Speed**
Reduced processing speed, how long it takes to move through a task, is often a problem for those with brain injuries. All of the exercises above are designed to address this issue as well. Individuals can try to increase their speed at performing each task with practice.

**Memory**
Memory is a multi-step process and a problem can occur at any step along the way. It is helpful for a neuropsychologist to explore where in the process your memory is being affected, particularly since what seem like memory issues may instead be problems with attention or with
visual or auditory processing. For problems that are caused directly by memory deficits, the most common and most effective way to manage the situation is to develop “compensatory techniques”, things outside of you that can help you stay organized and remember. Let’s look at the stages of memory.

**Attention**
This is the first stage. You can’t process something and store it if you haven’t paid attention to it in the first place. All of the exercises above are intended to address this part of the memory process.

**Encoding**
In encoding, a person links information to something that is already known. In other words, a piece of information is categorized. How well you are able to do this plays a large role in whether you are able to store information. For example, suppose you are just learning what a pot is. It is much more effective to categorize it as cookware than as something that rhymes with “spot”. Problems in encoding can arise in several ways. It may not be a categorization problem, but could be the result of a problem with the language center of the brain or with visual or auditory processing areas. In this case, addressing those other issues may help with encoding. Damage to the frontal lobes or in the dorsomedial thalamus can result directly in problems with categorization and organization. We’ll talk about some ideas for treating these and other memory stage issues below.

**Storage**
Individuals, particularly those with hippocampal damage and associated mesial temporal lobe damage can be left with a limited ability to store new information. Encoded information does make it to long term memory, but the memory deteriorates quickly and the information can’t be retrieved. You may have categorized a pot correctly as cookware and have stored this information, but your brain just isn’t able to keep the information for long. The next time you see a pot, you won’t remember what it is.

**Consolidation**
Consolidation happens when you integrate your new knowledge – a pot is cookware – with more detailed information that you already know. For example, when you have consolidated, you have figured out how it fits into the class of cookware: that a pot is different from a pan, that you can use it to boil water, etc.

**Retrieval**
Retrieval is the ability to get information out of memory without cues. Retrieval problems can be the result of damage to a language area (aphasia), or can occur directly with damage to many different areas of the brain. A person with a retrieval problem often has the tip of the tongue phenomena: “Dorothy came from….oh, the name of the town is on the tip of my tongue. Just name a few towns in Kansas. I’ll recognize it when I hear it.” If the memory problem happens before the retrieval stage, a person will not be able to recognize the right name from a list.

**Treatment for memory problems**
There are many ideas about the most effective methods for improving memory after brain injury. Below, I’ve listed a couple of methods by McKay Moore Sohlberg and Catherine Mateer. A common complaint among folks with memory problems is difficulty remembering to do things they were supposed to do. In one exercise, you are given a task to perform, but are asked to wait a specific period of time before doing it. During the wait time, the exercise can be set up so that you either just sit or you perform an alternate activity (a “distracter” task). You do have
access to a clock. The exercise becomes more difficult by increasing the amount of time between being assigned the task and having to perform it.

Another way in which memory problems are treated is through the development of a memory notebook system with very detailed instruction and a great deal of practice in using it. A memory notebook is a binder or planner filled with forms and divided by categories. It is much like a Daytimer® but with sections tailored to address the individual's memory deficit. Possible sections could include:

Orientation: A script that you can use to give people pertinent information about yourself, your medical history and any other relevant information.

Memory log: Forms for charting information about what you have done. You are asked to make a note every time you change your activity during the day. On average, you will be making a note hourly. As time consuming as this may seem, the memory log is usually part of everyone’s memory notebook. Keeping the log helps memory by forcing you to think about what you have done for that period of time. Writing it down further increases the likelihood that you will remember what you have done later. And, if your memory does fail, you have a reference to look at.

Calendar: The calendar should have dates and times that you can use for scheduling appointments and other activities.

Things to do: This section has forms for listing errands and other future tasks. It would also contain a space for the due date and completion date.

Transportation: If you have trouble remembering how to get places, this may contain maps and/or bus information to get you to the places you most commonly go.

Feelings log: This section has forms to record your feelings about events, etc.

Names: Contains forms to record names and identifying information of new people.

Today at work: These are forms that are adapted for your specific job that allow you to record all the necessary information you need to perform your work.

As you are using the memory notebook in real life, you will find that some things that occur will fall into multiple sections. For example, if you are invited to a potluck on Sunday night and asked to bring an entrée, you will need to put a note on both the calendar and in the Things to Do section (make an entrée). You may also need to note receiving the invitation in your Memory log, put directions in the Transportation section, or put the host’s information in the Names section. Although this can be somewhat complicated, with practice it will become second nature. The memory notebook itself is a way of developing better categorization and organization skills that will lead to better encoding even without the notebook.

Executive Functions
Executive functions are those things we do that require a variety of processes, e.g. planning or time management. Often, these activities become difficult for individuals who have had a brain injury. Below, we’ll look at a few of these and talk about ways in which they may be addressed in cognitive rehabilitation.
Planning
We all carry out activities every day that require planning, even if we are not aware of it. Grocery shopping, paying bills, planting a garden, getting ready for work all include an element of planning. Some individuals have difficulty developing, organizing, and executing plans after a brain injury.

The planning process can be broken down into six steps that can be addressed by cognitive rehabilitation.

1. **Knowing the steps needed to complete a plan.** To address this, a therapist would give you a task that requires planning skills such as applying for a credit card, preparing a meal, or finding a job and ask you to list all of the steps involved in the process in any order. You would be graded on how complete your list is.

2. **Putting the steps in order (sequencing).** You would be asked to take the list you developed above, and put the items in sequential order.

3. **Initiate the plan.** Taking the first step can be difficult for individuals with some types of brain injury. To improve this, a person must first become aware of the problem and then practice initiating in many different settings. For example, you could be asked to initiate a conversation, sit down with the checkbook, or write a paragraph on a topic you know well.

4. **Carrying out the plan.** Carrying out a plan often requires performing many steps and some may have multiple components. It may require higher level organizational skills to keep the plan moving along and it can be easy to become overwhelmed. To practice, a therapist could develop a list of errands to run and ask you to do them. The errands would be arranged from least to most complex. Happily, you’d be able to use your memory notebook if you have one, and there should be someone to come along with you.

5. **Repair.** Many times plans need to be changed because an obstacle develops that makes the original plan impossible to complete. A therapist can develop hypothetical situations that require you to think about how you would change a plan. For example, what if you needed Shiitake mushrooms to complete a meal you were preparing for a special dinner party, but the grocery store was out of them? Alternately, what if you needed to get to an appointment, but you walked out of your house and saw that you had a flat tire? Working out hypothetical situations can make coping with obstacles in real life easier.

6. **Speed of Response.** This means that you accomplish your goal in a reasonable amount of time. Practicing planning and carrying out plans should improve your efficiency over time.

Time Management
Brain injuries can result in difficulties with time management. It may become harder to judge time and to estimate how long it will take to perform a task. Good time management involves several steps.

1. **Time estimation.** Individuals with frontal lobe injuries may have difficulty judging how much time has passed. You may start an activity and look up to discover that an hour has passed
without your noticing. To improve this, a therapist may ask you to tell her when a certain amount of time has passed, e.g. 1 minute, 5 minutes, or 15 minutes. Sometimes you may just sit and wait for the time to pass or you may have a distracting activity in the interim. The task gets harder as the length of time increases.

2. Creating a time schedule. It’s important to be able to estimate how long it is going to take to complete tasks. You may practice creating realistic time schedules with a therapist for activities like getting ready in the morning (shower, dressing, breakfast, etc), cleaning the house, running errands, or performing work-related tasks. This requires both time management and planning skills.

3. Carrying out activities in the amount of time scheduled. Next, you may be asked to carry out the activities on your time schedule to see if your estimates were reasonable for you. To do this, you need to keep track of how long it actually took to complete the items on your schedule and compare this to your estimates. You may also need to look at whether you got stuck in an activity and kept at it too long without thinking about when your next task was supposed to start. For example, perhaps you needed to assemble a bike in the morning and then get to a doctor’s appointment in the early afternoon. If the bike assembly doesn’t go well, you’ll need to track the time and recognize that it may need to be left incomplete in order to make it to the appointment on time.

4. Repairing the schedule. Finally, it is important to be able to revise a schedule if it’s not working. This can be done in the middle of a schedule by revising the time estimates for all of the subsequent activities. Or, it can be done once the entire schedule is completed.

**Self-Regulation**

Self-awareness is the ability to use internal and external feedback to control and change your behavior. Often with frontal lobe damage, this ability may be compromised.

Becoming self-aware requires three primary skills:

1. **Awareness.** This means that you are able to make statements about your own behavior that indicates you understand what you are doing and the impact it has on others.

2. **Ability to respond to this feedback.** This means being able to change your behavior, if needed, in response to your awareness.

3. **Impulse control.** Self-regulation also requires impulse control. This means that you are able to think before acting. Having good impulse control helps in controlling inappropriate behavior. The key to addressing these issues is improving awareness. A therapist may design an exercise in which you are asked to put a hash mark on a piece of paper every time you do a behavior, such as interrupting another person while they are talking. The therapist will give you a specific period of time during which you observe yourself, and the therapist will track the behavior as well. At the end of the time, you and the therapist will compare notes. The behavior doesn’t have to be something you need to change – the point of the exercise is simply to become aware of what you do. Increasing awareness is often the best way to change a behavior over time, and can go a long way toward improving self-control.

**Treatment using Compensation**

Some people continue to have executive function impairments even after a great deal of cognitive rehabilitation. For these individuals, developing a very set schedule and routine may
help in compensating for the deficit. The individual may need to change professions to a job with more structure, less responsibility, and reduced social interaction in order to function more successfully.

**Other Areas Addressed by Cognitive Rehabilitation**

Cognitive rehabilitation can be used to address other types of cognitive impairment as well. For example, a therapist may be able to help with visual processing. The work would focus on how you understand what you see and how you respond to what you see. This is different from a vision therapist or ophthalmologist who would concentrate on the actual muscles and nerves of your eye.

A therapist may address the use of language. Unlike speech therapy, the focus of cognitive rehabilitation is to learn how to use the right language at the right time. For example, after a brain injury, a person may experience increased difficulty initiating a conversation and knowing how to make small talk. Or, a person may not think about asking for help when needed. Cognitive rehabilitation therapists work on the practical use of everyday speech. A therapist may address directly issues of problem solving. Some problem solving is involved in planning, time management, and self-regulation training, but it can become the focus of the treatment if needed.

Finally, a cognitive rehabilitation therapist may address abstract reasoning. Some types of reasoning include creative reasoning, logical reasoning, and social reasoning. A typical example of logical thinking is the Dinner Party exercise in which you are asked to design a seating chart for a dinner party but have many identified guests who have special seating needs, i.e. Jane won’t sit next to Sandy, Sandy must sit to the right of Ben, etc. The challenge is to figure out how to arrange the seats so that everyone is happy. An example of creative reasoning is brainstorming – generating as many ideas on a topic as you can. For example, you could be asked to come up with as many ways of using a piece of paper as possible (write on it, use it as a fan, make a paper airplane, start a fire, line your birdcage, etc). Finally, social reasoning involves understanding why some behaviors are or are not appropriate. For example, what are two good reasons why most people call ahead before visiting an out-of-town friend? Or, when would it be a good idea to send flowers to someone? When would it be a bad idea?

Cognitive rehabilitation can be enormously helpful in regaining some of the mental abilities you had before your brain injury. The easiest way to find a neuropsychologist in your area is to ask your neurologist. If this doesn’t work, call a local rehabilitation hospital with a stroke and brain injury unit or your state’s psychological association for a referral.

**References**


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