

Understanding the Complexities of Cognition

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No Conflict of Interest

The **Cerebral Cortex**, which is the entire outer rind of the brain, includes multiple lobes and areas. It integrates information received from our senses, controls emotions, and holds memories and thoughts.

Parietal Lobe:
Reception and processing of sensory information

Hypothalamus:
Relay station between the cortex and our senses

Hippocampus:
Short-term memory

Temporal Lobe:
Memory, emotion, hearing and language

Frontal Lobe:
Decision making, problem solving and planning

Amygdala:
Emotions and social behavior

Cognitive processes make use of many parts of the brain. Nerve cells throughout the brain (neurons) communicate with each other, creating thoughts, feelings and memories.

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Objectives:

- 1. Define cognition & list the basic cognitive functions.**
- 2. Describe the components of a brief cognitive (mental status) assessment.**
- 3. Identify evidence based tools to use for assessing cognition.**


Definitions:


- **Literally “knowing”** (McLeod, 2015)
- **Refers to the mental process by which external or internal input is transformed, reduced, elaborated, stored, recovered & used** (Neisser, 1967)
- **Referring to the mental processes involved in gaining knowledge & comprehension** (Cherry, 2016)
- **The way the mind goes about perceiving, remembering & thinking** (Sieck, 2015)


- **The mental action or process of acquiring knowledge & understanding through thought, experience & the senses** (Oxford Dictionary)
- **Refers to the mental process or thinking skills that allow individuals to learn & function on a daily basis:**
 - **Activities of Daily Living (ADLs)**
 - **Instrumental Activities of Daily Living (IADLs)**
 - **At home, school, work, in the community**
 - **With others, creating relationships** (Fraser Health, n.d.)

Cognitive Development



- **Infants (0 – 18 months)**
 - Aware of surroundings 
 - Interest in exploration
 - Gather, sort & process information
- **Toddler (18 months – 3 years)**
 - Egocentric
 - Language use matures
 - Memory & imagination developed
 - Use instruments & tools 
 - Strive for independence

- **Pre/early school (3 – 6 years)**
 - Using imagery & memory skills
 - Self-centered world view
 - Social interactions skills
 - Learn negative concepts & actions
 - Test cognitive limits 
 - Increased attention span
 - Learning to read/write
 - Developing structured routines

- **Younger school age (6 – 12 years)**
 - Use logical & coherent actions in thinking & problem solving
 - Understand concepts of permanence & conservation
 - Build on past experiences
 - Increasing attention span
 - Age 6 = 15 minutes
 - Age 9 = 60 minutes 

- **Adolescent** (12 - 18 years)
 - Increased independence for thinking through problems & situations
 - Understand philosophy & higher math
 - Apply information to adapt
 - Transition to more advanced thinking that is more efficient & generally more complex
 - Think hypothetically
 - Improved abstract thinking
 - Metacognition (*thinking about thinking*)
 - Multidimensional
 - See things as relative rather than absolute



- **Adulthood** (*after age 18*)
 - Life experiences
 - Continuing education
 - Complete the process of maturation
 - Evolving sexuality
 - Move into adult roles & responsibilities
 - Secure autonomy
 - Complete values framework
 - Shift emphasis on self to others



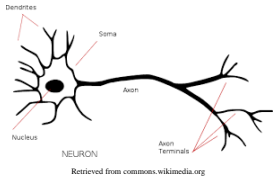
Cognition & Aging



- **Aging may affect cognition, memory, intelligence, personality & behavior**
- **Many changes in cognition & mental health are difficult to attribute to aging - they are often the result of disease**
- ***A rapid decrease in cognition is almost always due to disease***
- **Vocabulary can improve even in persons in their 80s**
- **Reduced memory performance can be improved using adaptive strategies**

- **With age, cognitive functions may remain stable or decline**
 - **Generally, stable functions include: attention span, everyday communication skills, many language skills (syntax), the ability to comprehend discourse & simple visual perception**
 - **Functions that may decline include: selective attention, naming of objects, verbal fluency, complex visuospatial skills & logical analysis**

- **Change in brain size**
 - **Neuron cell bodies/dendrites size & efficiency decreases leading to less effective communication between cells**
 - **Neuron axon (*white matter*) transmission slows**
- **Build up of plaques**
 - **Amyloid beta**
 - **Tau (*neuronal protein*)**
- **Vascular changes**



Cognitive Functions & Domains



- **Attention**

- Mechanisms by which we prepare to process stimuli, focus on what to process & determine how far it will be processed & whether it should call us to action

- Types:



- *Sustained*: ability to focus over time

- *Selective*: ability to distinguish relevant from irrelevant information

- *Divided*: ability to perform 2 or > tasks at the same time

- **Learning**

- Acquiring knowledge through experience, study or being taught; acquisition of information, skills & knowledge measured by an improvement in some overt response

- **Memory**

- Involves mental processes of retaining & retrieving information for later use

- Types:

- *Recall*: retrieving information

- *Recognition*: matching information



- **Executive Function**
 - Ability to achieve insight & self awareness
 - Reflect on, initiate, evaluate & regulate thinking & behavior
 - Incorporate feedback
 - Generate strategies or sequence complex actions
 - Flexible coordination
 - Control
 - Goal orientation

} ♥ of the domain



- **Organization:**
 - Attention
 - Planning & prioritizing
 - Sequencing
 - Problem solving
 - Working memory
 - Cognitive flexibility
 - Abstract thinking
 - Rule acquisition
 - Selecting relevant sensory information



- **Regulation:**
 - Initiation of action
 - Self/impulse control
 - Emotional regulation
 - Monitoring internal & external stimuli
 - Initiating & inhibiting context specific behavior
 - Self-monitoring
 - Moral reasoning
 - Decision making



- **Abstract Thinking**
 - Ability to use generalized information & apply it to specific, new situations
- **Language**
 - Ability to verbally comprehend, repeat, express & write
 - *Phonologic knowledge*: use of sounds
 - *Lexical knowledge*: the name of an item & the meaning of a word
 - *Syntactic knowledge*: ability to combine words correctly

- **Sensory-Perceptual/Motor Function**
(sensorimotor)
 - Ability to:
 - Detect normal visual, auditory & tactile sensations
 - Perform gross & fine motor tasks
 - Coordinate small &/or large muscle groups to accomplish tasks
 - Integrate  &/or  coordination

- **Visual Spatial Perception** *(construction)*
 - Ability to recognize, perceive & construct; ability to understand & interpret relationships
- | | |
|----------|---------|
| EEEE | AAAAAAA |
| EE EE | AAAAAAA |
| EE EE | AA |
| EEEEEEEE | AAAAAAA |
| EEEEEEEE | AAAAAAA |
| EE EE | AA |
| EE EE | AAAAAAA |
| EE EE | AAAAAAA |
- Possin, 2010

- **Emotional Control/Regulation**

- Involves the initiation of new, or the alteration of ongoing, emotional response through the action of regulatory processes

(Ochsner & Gross, 2005)

- Ability to function in many life situations depends on mood, temperament & personality traits

- Neural interconnections within the brain between the prefrontal cortex & the limbic system

(Hoffman, 2011)

- **Conceptualization - mental flexibility & the capacity for abstraction decline with age however, the greatest age differences appear among those who are 70 or older**



- **Reaction Time – interval time between the presentation of a stimulus & the initiation of the muscular response to that stimulus**

- Simple reaction time = 1 possible response

- Choice reaction time = several possible responses; takes longer to determine

Components of a Cognitive Assessment

- **Orientation**
 - Time: day, date, month, season, year; time of day
 - Place: name of the building
 - Person: name, age, date of birth
- **Attention**
 - Serial 7's
 - Spelling “world” backwards
 - Recitation of the months of the year in reverse order
 - Digital span



- **Language**
 - Engage in conversation & assess fluency, articulation, phonemic & semantic errors
 - Naming ability
 - Reading
 - Write a simple command: “Close your eyes”; ask to read newspaper aloud
 - Writing
 - Have the individual write a sentence
 - Comprehension
 - Note primary language spoken/read

- **Comprehension**
 - Single word comprehension (coin, key, pen)
 - Sentence comprehension
 - “Touch the pen and then the watch”
 - “Touch the watch, after touching the keys and the pen”
 - “If the lion ate the tiger, who remained?”



• **Memory**

- *Anterograde*: recall of a name & address after 5 minutes
- *Retrograde*: ask about recent sporting or personal events
- Names of 3 items



• **Repetition**

- Use of a series of words of increasing complexity
 - Hippopotamus, aubergine, emerald
- Sentence
 - “No ifs, ands or buts”
 - “The orchestra played and the audience applauded”



• **Executive function**

- Letter (F)
- Category fluency (animals)
- **Praxis** (Kipps & Hodges, 2005)
 - Meaningful & meaningless gestures
 - Luria 3 step test (fist-edge-palm)

• **Visuospatial**

- Clock drawing
- Overlapping pentagons



• **Appearance & Behavior**

- **Chronologic vs. apparent age**
- **Basic grooming & hygiene**
- **Dress** (*age appropriate; accessories; weather conditions*)
- **Assistive devices**
- **Gait & motor coordination**
- **Slowness of thought**
- **Inappropriateness**
- **Work speed**



• **Emotional Stability**

- **Affect** (*outward expression of feelings & emotion; any facial expression or body movement that indicates emotion*)
- **Emotions** (*chemical release in response to the interpretation of a specific trigger*)
- **Feelings** (*something we sense; integration of emotion from the chemical release; last longer than emotions*)
- **Mood** (*a generalized emotional state; a collection of input; heavily influenced by environment*)

• **Body Language** (*nonverbal communication*)

- **Facial expression**
- **Eye contact** (*culturally appropriate*)
- **Posture** (*slouched, erect, leaning*)
- **Alertness** (*sleepy, easily distractible, conversation wanders, awake*)
- **Coherence** (*responses easy to understand, concrete, appropriate detail, overly detailed, difficult to follow*)
- **Thought Processes** (*confabulations, flight of ideas, grandiosity, magical thinking, obsessions, delusions, depersonalization*)

• Manner & Approach

– Speech

- Easily understood
- Complete sentences
- Rate/volume WNL
- Pressured, slow
- Accent
- Tone (soft spoken, loud)



– Noteworthy mannerisms or gestures

Evidence-Based



Tools

**VAMC
SLUMS Examination**
Questions about this examination visit www.va.gov/va16

Name: _____ Age: _____ Level of education: _____

In parentheses? _____

1. What day of the week is it? _____
2. What is the year? _____
3. What state are we in? _____
4. Please remember these five objects. I will ask you what they are later.
Apple Pear Tin House Car
5. You have \$100 and you go to the store and buy a dozen apples for \$3 and a bicycle for \$20.
How much did you spend?
How much do you have left?
 - Ⓐ \$14 amount
 - Ⓑ \$10 amount
 - Ⓒ \$12 amount
 - Ⓓ \$10 amount
6. Please name as many animals as you can in one minute.
 - Ⓐ 10 animals
 - Ⓑ 20 animals
 - Ⓒ 15 animals
 - Ⓓ 10 animals
7. What were the five objects I asked you to remember? I point for each one correct.
8. I am going to give you a series of numbers and I would like you to give them to me backwards.
For example, if I say 42, you would say 24.
 - Ⓐ 27
 - Ⓑ 62
 - Ⓒ 33
9. This is a clock face. Please put in the hour markers and the time at ten minutes to eleven o'clock.
 - Ⓐ Hour markers okay
 - Ⓑ Time correct
10. Please place an X in the triangle.
 - Ⓐ Which of the above figures is largest?
11. I am going to tell you a story. Please listen carefully because afterwards, I'm going to ask you some questions about it.

Jill was a very successful stockbroker. She made a lot of money on the stock market. She then met Jack, a first-rate right handman, who she married and had three children. They lived in Chicago. She then stopped work and stayed at home to bring up her children. When they were teenagers, she went back to work. She and Jack lived happily ever after.

 - Ⓐ What was the female's name?
 - Ⓑ What work did she do?
 - Ⓒ What was the male's name?
 - Ⓓ What state did she live in?

TOTAL SCORE

Score	Department of Veterans Affairs	SAINT LOUIS UNIVERSITY	Less than High School, Basic level
27-36			20-30
21-26		MENCIP*	20-24
1-20		Demerita	1-19

* Add Non-cognitive Disorder

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VISUOSPATIAL / EXECUTIVE Copy cube. Draw CLOCK. (Then paint clock.)

NAMING Lion, Rhino, Camel. Color, Numbers, Hands.

MEMORY FACE, VELVET, CHURCH, DAILY, RED.

ATTENTION Need list of digits 1-9. Subject has to repeat them in the forward order. Subject has to repeat them in the backward order.

LANGUAGE Repeat 1-9. Only have that lists to the one to help recall.

ABSTRACTION Identify between a female - orange - blue.

RELATED RECALL FACE, VELVET, CHURCH, DAILY, RED.

Optional Write NO. DATE.

ORIENTATION Date, Month, Year, Day, Place, City.

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Mini-Cog™ Instructions for Administration & Scoring

Step 1: Three Word Registration

Look directly at person and say: "Please listen carefully. I am going to say three words that I want you to repeat back to me one and by the remember. The words are listed at a list of words from the appendix below. Please say them for me now." If the person is unable to repeat the words after three attempts, move on to Step 2 (Clock Drawing).

The following and other word lists have been used to cover or meet clinical purposes. For repeated administrations, use of an alternative word list is recommended.

Version 1 Stomach	Version 2 Locket	Version 3 Whisper	Version 4 Whisker	Version 5 Caption	Version 6 Daughter
Chair	Table	Baby	Finger	Picture	Mountain

Step 2: Clock Drawing

Say: "Now, I want you to draw a clock for me. First, put in all of the numbers where they go." When that is completed, say: "Now, use the hands to 10 past 6."

Use preprinted circle (see next page) for this exercise. Repeat instructions as needed as this is not a memory test. Move to Step 3 if the clock is not complete within three minutes.

Step 3: Three Word Recall

Ask the person to recall all three words you listed in Step 1. Say: "What were the three words I asked you to remember?" Record the word list version number and the person's answers below.

Word List Version: _____ Person's Answers: _____

Scoring

Word Recall: 0-3 points. 1 point for each word spontaneously recalled without cueing.

Clock Draw: 0-2 points. Repeat clock = 2 points. A normal clock has all numbers placed in the correct position and approximately correct position (e.g., 10, 5, 6) and it was drawn and drawn with any missing or duplicate numbers. Hands are pointing to the 10 past 6 or refused to draw a clock (refusal) = 0 points.

Total Score: 0-5 points. Total score = Word Recall score + Clock Draw score.

A total score of 3 on the Mini-Cog™ has been established for dementia screening, but many individuals with clinically meaningful cognitive impairment will score higher. Manual and online for further explanation of program goals.

Clock Drawing ID: _____ Date: _____

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Patient name: _____ Date: _____

GPCOG Screening Test

Step 1. Patient Examination

Unless specified, each question should only be asked once

Name and Address for subsequent recall test

1. *I am going to give you a name and address. After I have said it, I want you to repeat it. Remember this name and address because I am going to ask you to tell it to me again in a few minutes. John Brown, 42 West Street, Kensington. (Allow a maximum of 4 attempts)*

Time Orientation

2. *What is the date?* (exact only) Correct Incorrect

Clock Drawing - Use Ink on single page

3. *Please mark on all the numbers to indicate the hours of a clock (5 correct spacing required)*

4. *Please mark in pencil to show 10 minutes past eleven o'clock (11:10)*

Information

5. *Can you tell me something that happened in the news recently?* (Recently = in the last week. If a general answer is given, eg "war", "lot of rain", ask for details. Only specific answer scores)

Recall

6. *What was the name and address I asked you to remember*

John

Brown

42

West St

Kensington

Total correct (score out of 9)

Instructions:

- If patient scores 8, no significant cognitive impairment and further testing not necessary.
- If patient scores 5-8, more information required. Proceed with Step 2, informant section.
- If patient scores 0-4, cognitive impairment is indicated. Conduct standard investigations.

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Informant Interview

Date: _____

Informant's name: _____

Informant's relationship to patient, i.e. informant is the patient's: _____

These six questions ask how the patient is compared to when s/he was well, say 5 - 10 years ago.

Compared to a few years ago:

	Yes	No	Don't Know	N/A
• Does the patient have more trouble remembering things that have happened recently than s/he used to?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Does he or she have more trouble recalling conversations a few days later?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• When speaking, does the patient have more difficulty in finding the right word or tend to use the wrong words more often?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Is the patient less able to manage money and financial affairs (e.g. paying bills, budgeting)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Is the patient less able to manage his or her medication independently?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Does the patient need more assistance with transport (either private or public)? (If the patient has difficulties due only to physical problems, e.g. bad leg, tick 'no')	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Total score (out of 6)

Instructions:

- If patient scores 0-3, cognitive impairment is indicated. Conduct standard investigations.

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There can be no knowledge without emotion. We may be aware of a truth, yet until we have felt its force, it is not ours. To the cognition of the brain must be added the experience of the soul.

Arnold Bennett

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