

# Hearing with Our Brains

Karah Gottschalk, AuD, PhD



# Disclosures



Employed through Nova  
Southeastern University.



Otherwise, the author has no  
relevant financial or  
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# Outline



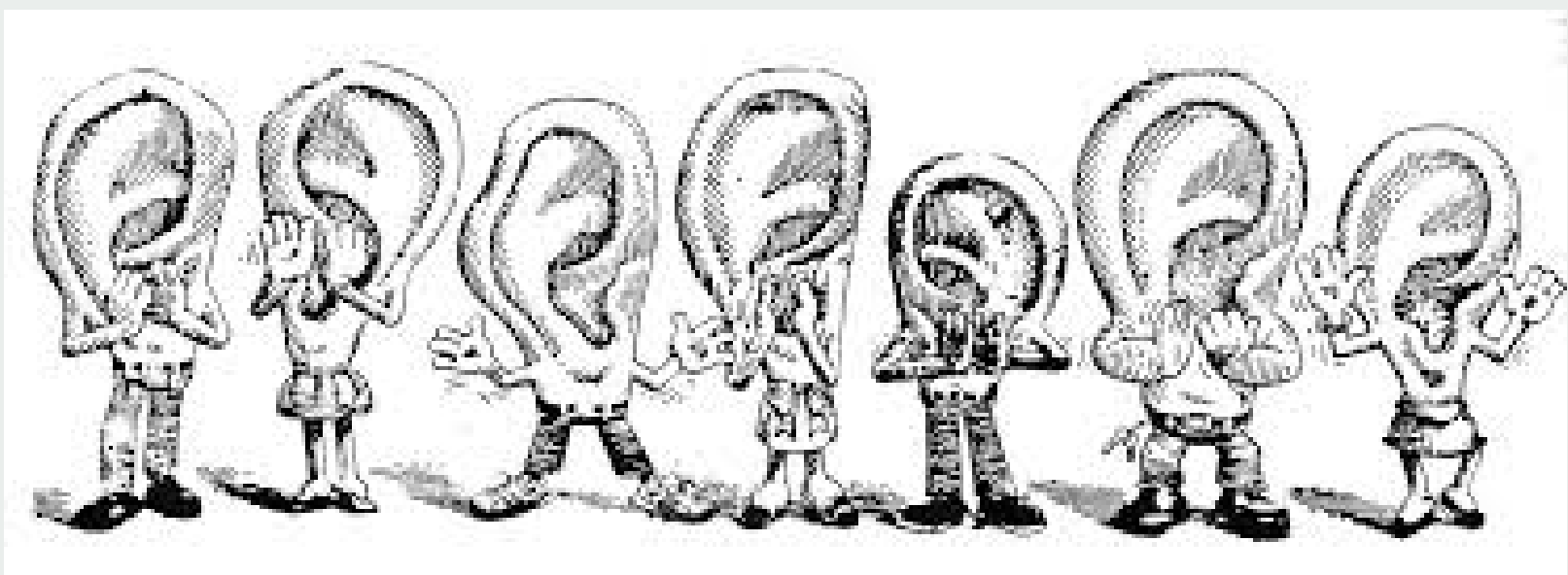
Importance of Cognition  
in Audiology

Explanation of  
Cognition

Brain and Cognitive  
Changes Throughout  
Life

Cognition and Hearing  
loss

Audiology and  
Cognitive Screeners





**But, what about  
the brain?**

# Number of Reasons Why We Should Discuss This With Our Patients


Hearing loss is one of the nine factors that can potentially contribute to the risk of dementia (Livingston, 2017)

Improvement in patient care

Audiologists may be the gatekeepers to cognitive care

It is in our scope of practice





**BUT, There Are  
Some Barriers  
When  
Discussing  
This....**

# Let's Take a Peek at the Brain and Cognition

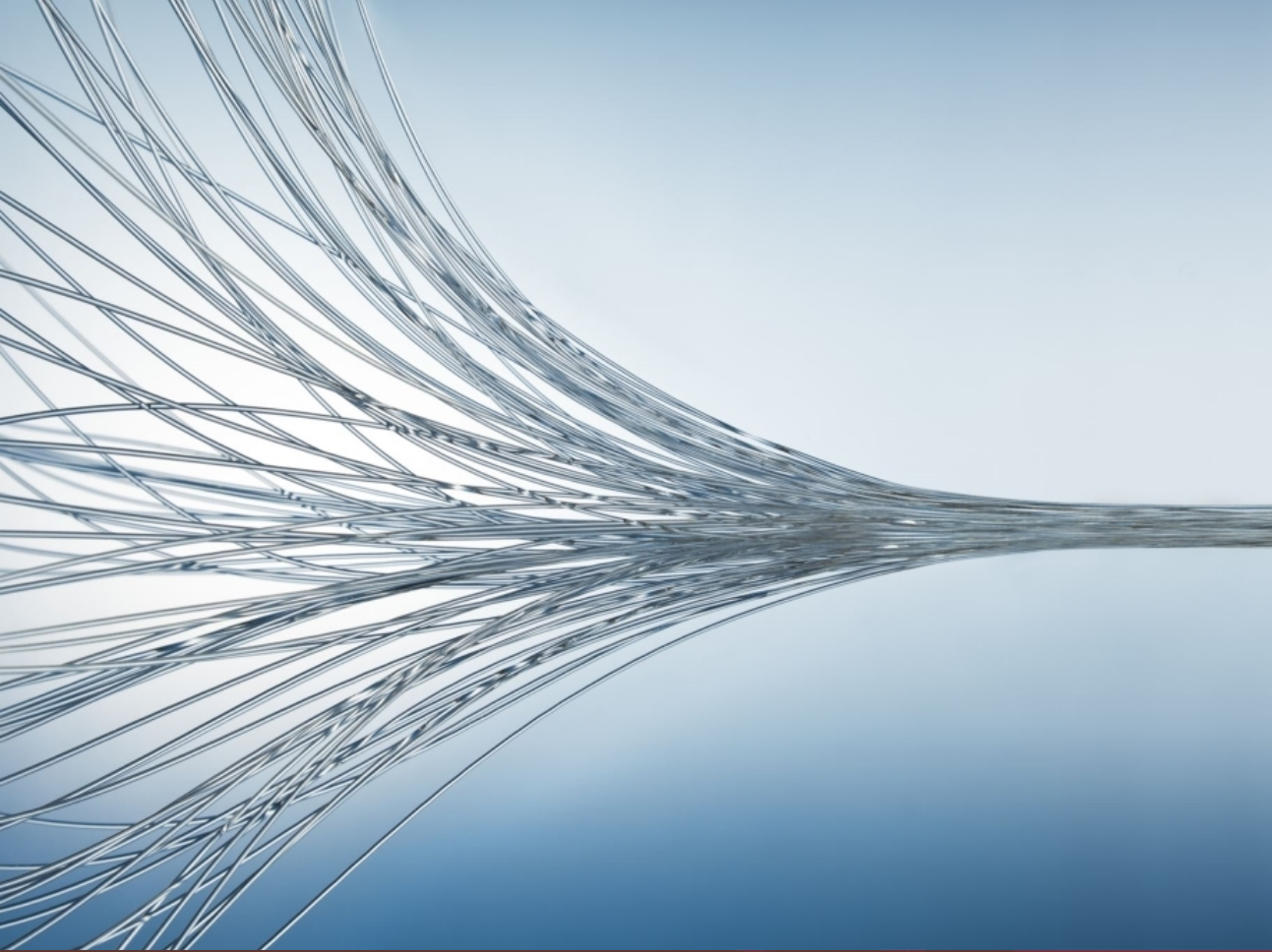






# Cognition

Early studies on cognition simply viewed it as intelligence ((Lezak et al., 2004).



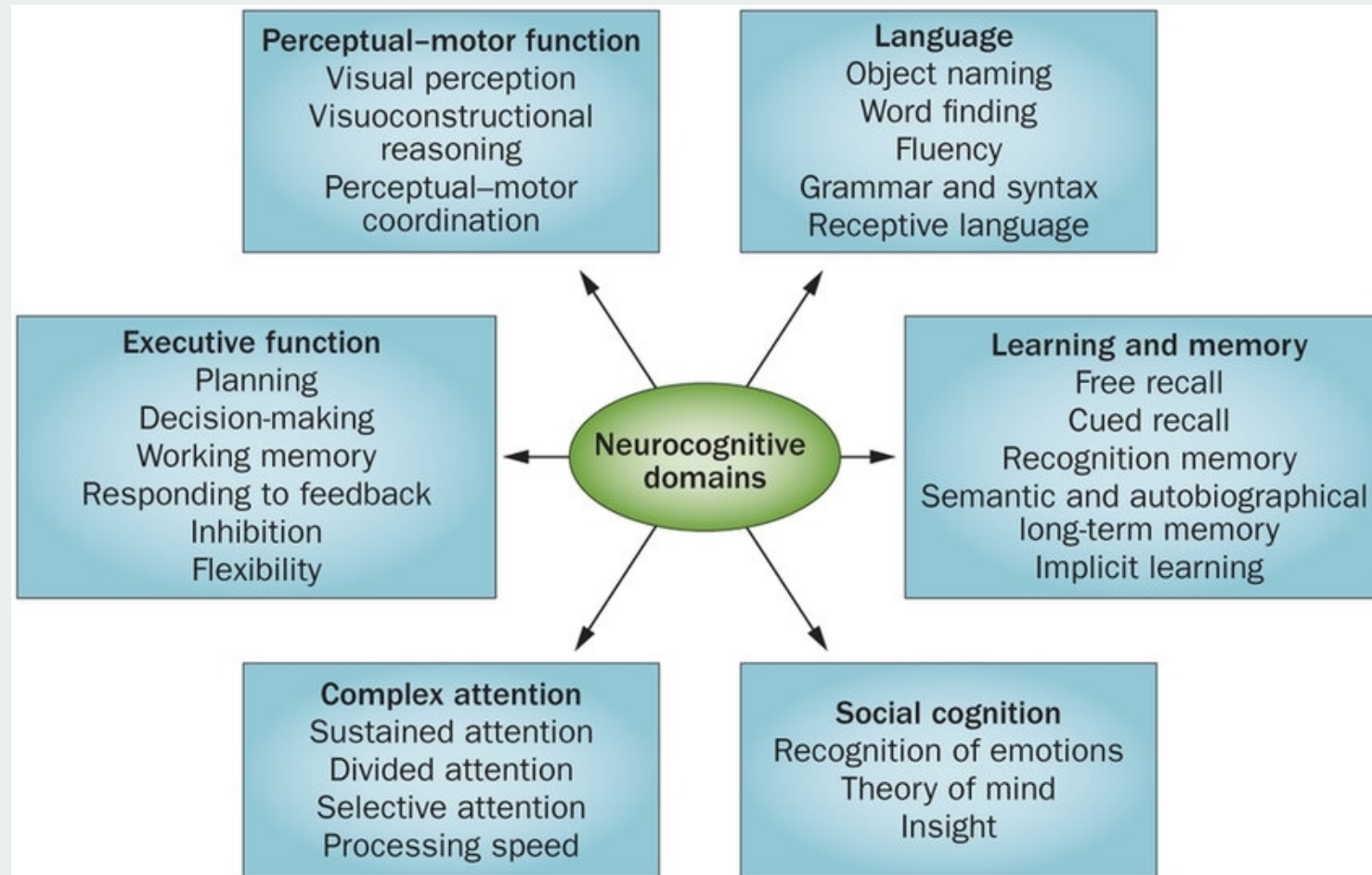
- Cognition now represents a web of complex processes.
- The term ‘cognition’ refers to the many different processes by which humans and animals understand and make sense of the world (Frith, 2008).

# Cognition



# Cognitive Domains

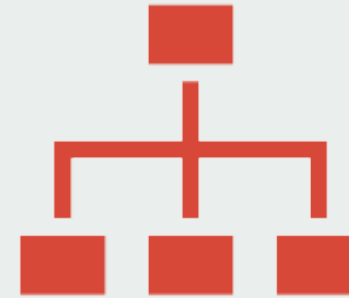
- The Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-V) states cognitive functions can be separated into six key domains.



# Executive Functioning



Allows a person to engage in appropriate, independent, purposive, and self-serving behavior.



Executive functioning includes the ability to self-monitor, organize, plan, reason, and problem-solve



# Attention

- Attention is a broad term that applies to the cognitive process that allows one to selectively concentrate on certain parts of available information
- Can be categorized into four different types: sustained, selective, divided, and processing speed (Anderson, 2004; Lezak et al., 2012) .



# Language

- Language is a system that consists of the development, acquisition, maintenance and use of complex systems of communication.

(Atkinson & Shiffrin, 1968; Fuster, 1995; Lezak et al., 2012)



# Perceptual Motor Function

Combination of sensory and motor skills which allows an individual to synchronize body movements (Lezak et al., 2012).





# Social Cognition

Social cognition refers to the brain's processing of social information.

- Ability to determine others' emotions.
- How to respond to those emotions appropriately.



(Frith, 2008; Harvey & Penn, 2010; Henry et al., 2015)

# Now That We Have Cognition Background...



# The Aging Brain



Just like many bodily functions and structures, there are changes that occur to the aging brain.

Aging results in the brain experiencing changes in size, vasculature, and cognition.

Loss of gray and white matter

Decrease in cortical density and neurotransmitter systems

# General Changes to the Aging Brain

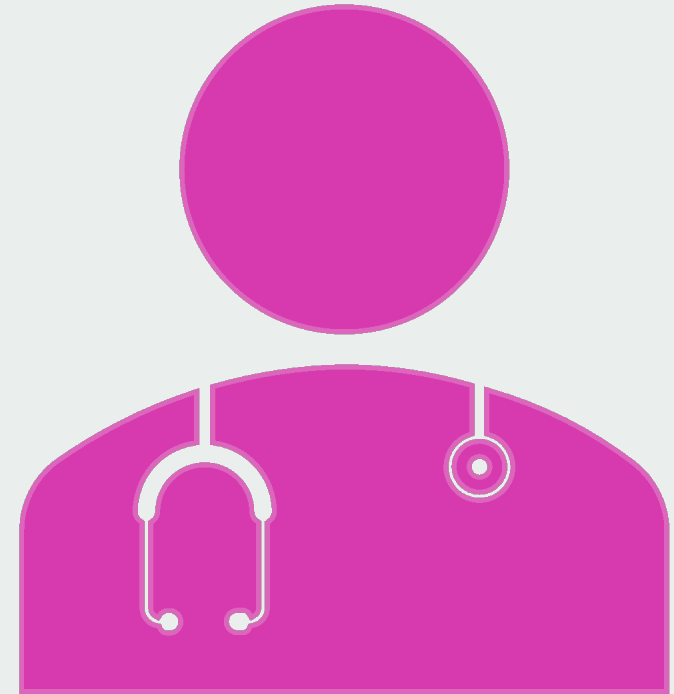
Brain changes do not occur similarly across all brain regions.




As the age of the person increased, the MRIs revealed a decrease in the volumes of the frontal lobes (0.55% per year) and the temporal lobes (0.28% per year) (Coffey et al., 1992).



**Now, What May We  
See in Our Patients?**



# Normative Cognitive Changes



As we age, there are subtle cognitive changes that occur.

These small changes can have impacts on a person's quality of life and everyday function.

# Normative Cognitive Changes



## Executive Functioning

- Most aspects of EF will decline with age

## Attention

- All subthemes notice a decline throughout the lifespan

## Memory

- Memory is the most common cognitive complaint
- Decline noted but may remain stable until later stages of life

## Language

- Abilities remain relatively intact throughout the lifespan.
- Vocabulary may improve or remain stable

## Perceptual Motor

- Declines will be seen across all subthemes

## Social Cognition

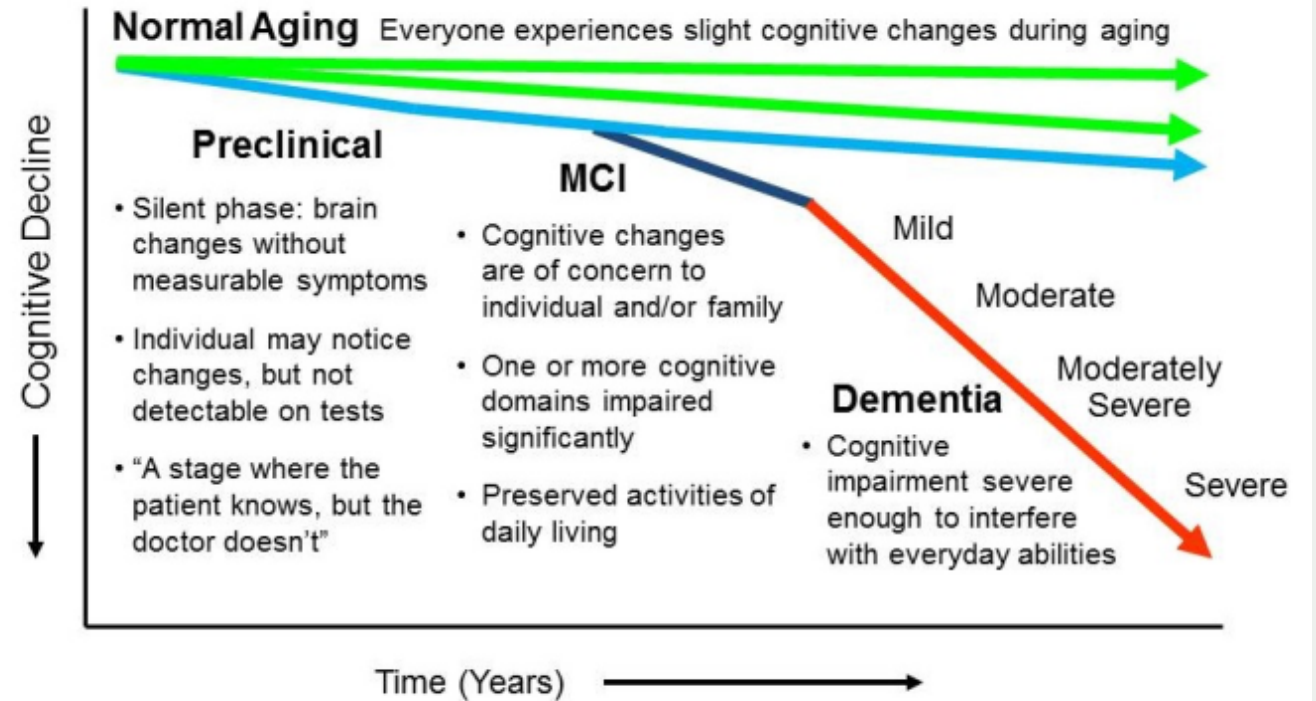
- Respond less accurately to false belief stories and were unable to determine intentions

**Sadly, We Will Also  
See Non-Normative  
Changes**





# Non-Normative Changes



# Hearing Loss and Cognition


Most research agrees that hearing loss has an impact on cognition.

# Normative Cognitive Changes

Cognitive abilities, including memory and executive functions, decline with aging and are strongly involved in the speech communication process.

For many older listeners, cognitive decline and hearing loss is a critical factor in causing difficulty understanding speech, particularly in challenging environments (Salthouse, 1991; Frisina, 2009, Verhaeghen, 2011; Besser et al., 2013; Ronnberg et al., 2013).

# Research Findings Have Suggested That Hearing Loss In Older Adults Is Associated With



Lower  
cognitive  
functions  
(Lin, 2011)



Higher rate  
of cognitive  
decline



All-cause  
dementia



Higher risk  
of  
developing  
cognitive  
impairment  
compared  
to those  
without  
hearing  
loss.



# Hearing Loss Had Significant Associations With Cognitive Decline

## Executive Functioning

- Overall EF declined
- Working memory declined

## Attention

- Overall attention declined
- Processing speed declined

## Memory

- Semantic memory declined
- Immediate recall declined
- Episodic memory

## Language

- Fluency was not impacted

## Perceptual Motor

- Visuospatial ability declined

## Social Cognition

- Differences in social cognitive tasks.




# But...CORRELATION DOES NOT MEAN CAUSATION

Recent survey shows  
that 100% of people  
who drink water,  
die.



That's a fact.



# Three Main Possibilities to Explain the Relationship



Perhaps, there is a casual impact of hearing on cognition fx

OR, cognition does indeed impact hearing

OR, the two things are not directly related, but they share a common third factor

**How to incorporate  
this into your own  
practice?**



# Cognitive Screeners



Montreal Cognitive  
Assessment (MoCA)

Mini-Mental State  
Exam (MMSE)

Mini-Cog

General Practitioner  
Assessment of  
Cognition (GPCOG)

St. Louis University  
Mental Status Exam  
(SLUMS)

Short Informant  
Questionnaire on  
Cognitive Decline in  
the Elderly (Short  
IQCODE)

# MoCA

VISUOSPATIAL / EXECUTIVE							POINTS			
						Copy cube <input type="checkbox"/>	Draw CLOCK. (Ten past eleven) (3 points) <input type="checkbox"/>	___/5		
Contour <input type="checkbox"/> Numbers <input type="checkbox"/> Hands <input type="checkbox"/>										
NAMING										
							___/3			
MEMORY										
Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.				FACE	VELVET	CHURCH	DAISY	RED	No points	
				1st trial						
				2nd trial						
ATTENTION										
Read list of digits (1 digit/ sec.). Subject has to repeat them in the forward order Subject has to repeat them in the backward order				<input type="checkbox"/> 2 1 8 5 4 <input type="checkbox"/> 7 4 2			___/2			
Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors. <input type="checkbox"/> F B A C M N A A J K L B A F A K D E A A A J A M O F A A B							___/1			
Serial 7 subtraction starting at 100 <input type="checkbox"/> 93 <input type="checkbox"/> 86 <input type="checkbox"/> 79 <input type="checkbox"/> 72 <input type="checkbox"/> 65 4 or 5 correct subtractions: 3 pts, 2 or 3 correct: 2 pts, 1 correct: 1 pt, 0 correct: 0 pt							___/3			
LANGUAGE										
Repeat: I only know that John is the one to help today. <input type="checkbox"/> The cat always hid under the couch when dogs were in the room. <input type="checkbox"/>							___/2			
Fluency / Name maximum number of words in one minute that begin with the letter F <input type="checkbox"/> ____ (N ≥ 11 words)							___/1			
ABSTRACTION										
Similarity between e.g. banana - orange = fruit <input type="checkbox"/> train - bicycle <input type="checkbox"/> watch - ruler							___/2			
DELAYED RECALL										
Has to recall words WITH NO CUE				FACE	VELVET	CHURCH	DAISY	RED	Points for UNCUED recall only	
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Optional										
Orientation <input type="checkbox"/> Date <input type="checkbox"/> Month <input type="checkbox"/> Year <input type="checkbox"/> Day <input type="checkbox"/> Place <input type="checkbox"/> City							___/6			
© Z.Nasreddine MD www.mocatest.org Normal ≥ 26 / 30 TOTAL							___/30			



Maximum      Score

5      ( )

5      ( )

**Orientation**

What is the (year) (season) (date) (day) (month)?

Where are we (state) (country) (town) (hospital) (floor)?

**Registration**

3      ( )

Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer. Then repeat them until he/she learns all 3. Count trials and record.  
Trials \_\_\_\_\_

**Attention and Calculation**

5      ( )

Serial 7's. 1 point for each correct answer. Stop after 5 answers.  
Alternatively spell "world" backward.

**Recall**

3      ( )

Ask for the 3 objects repeated above. Give 1 point for each correct answer.

**Language**

2      ( )

Name a pencil and watch.

1      ( )

Repeat the following "No ifs, ands, or buts"

3      ( )

Follow a 3-stage command:

"Take a paper in your hand, fold it in half, and put it on the floor."

1      ( )

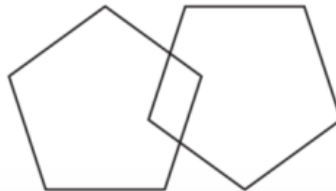
Read and obey the following: CLOSE YOUR EYES

1      ( )

Write a sentence.

1      ( )

Copy the design shown.



\_\_\_\_\_

Total Score

# MMSE

# How Else to Help Your Patients



Compile a list of local health care providers who specialize in cognitive and memory disorders.

Based on screening results, discuss the need for a referral

# In Summary



While cognitive screening tests are clinical tools that have been used for years, they are receiving increased recognition from audiologists.

The demographic change is bringing in more older clients who are likely to have impaired hearing as well as cognition, audiologists should know more about abnormal cognitive changes with aging, their impact on communication, and the use of cognitive screening tests.

The background of the slide features a dense field of 3D dollar signs (\$). Most are dark grey or black, but one dollar sign in the center-right is a vibrant orange. A semi-transparent purple rectangular overlay covers the left half of the image. Within this overlay, there are faint, concentric circular patterns and a dotted line forming a larger circle.

Questions?

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