

MRCPPsych Old Age Module

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Cognition

Developing people

for health and

healthcare

OA Module: Cognitive Assessment

Aims and Objectives

- The aim is for the trainee to gain an overview of the main cognitive domains and their assessment.
- By the end of the session trainees should:
 - Understand the **brain regions** involved in the various **cognitive domains**.
 - Appreciate the concept and theory of a **bedside cognitive assessment**.
 - Have an awareness and understanding of the most common **cognitive syndromes**.
 - Be able to reflect on the **limitations of cognitive assessment and screening** tools.

OA Module: Cognitive Assessment

To achieve this

- Case Presentation
 - Journal Club
 - 555 Presentation
 - Expert-Led Session
 - MCQs
-
- Please sign the register and complete the feedback

OA Module: Cognitive Assessment

Expert Led Session

Cognitive Assessment

Dr Mark Worthington

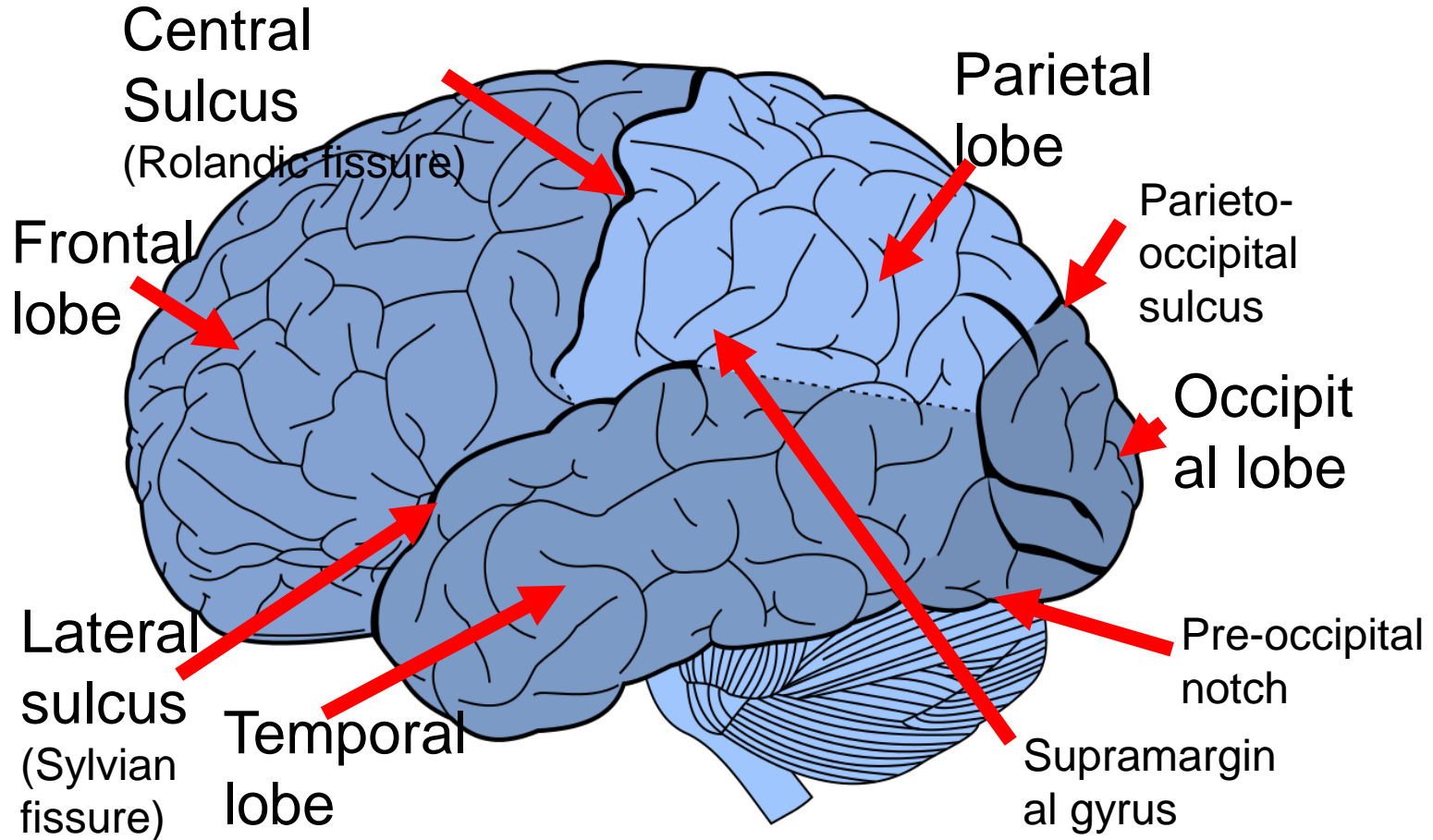
Consultant Old Age Psychiatrist

Lancashire Care NHS Foundation Trust

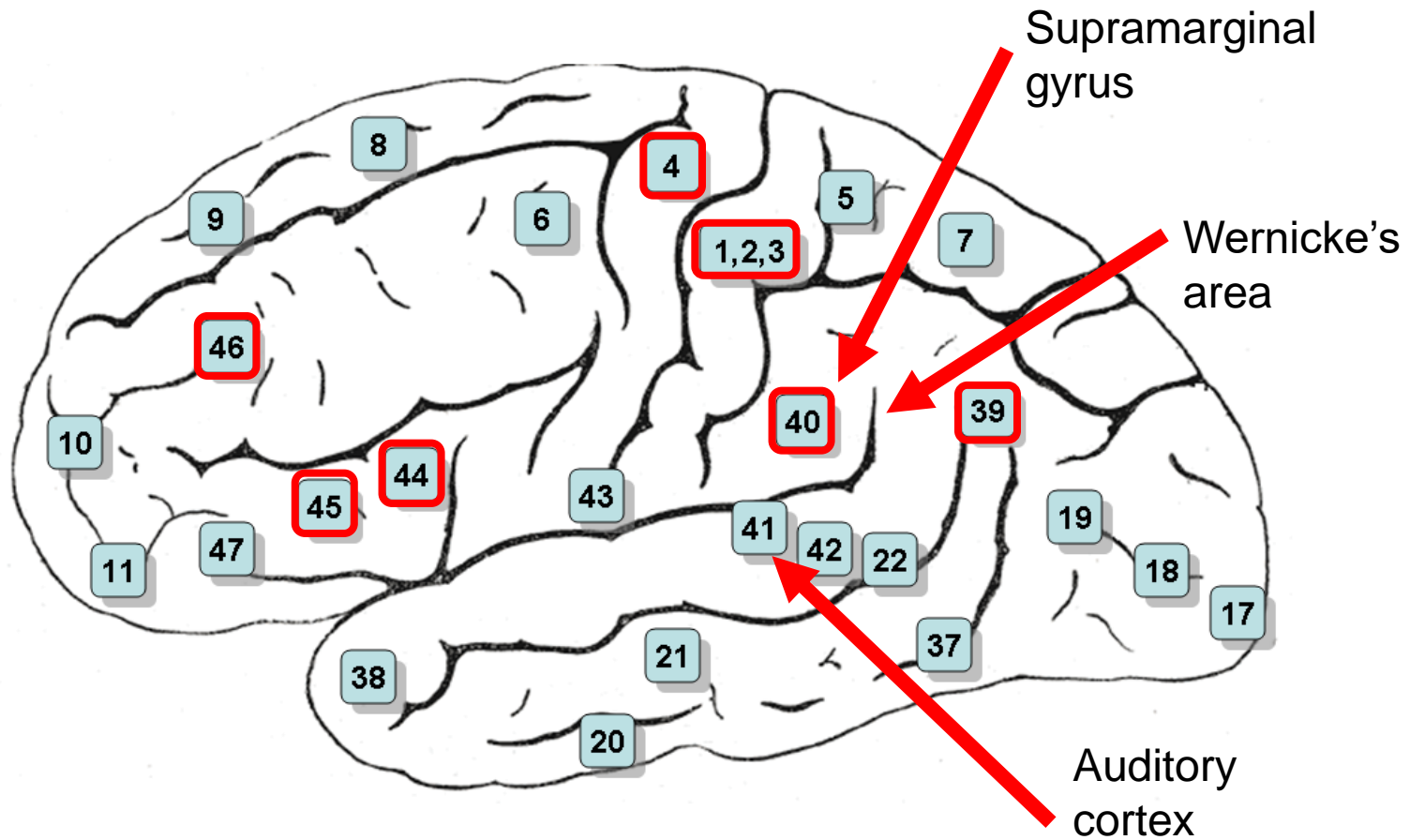
Outline

- Brain landmarks
- Cognitive domains
- Functional anatomy
- Cognitive assessment

Key brain landmarks

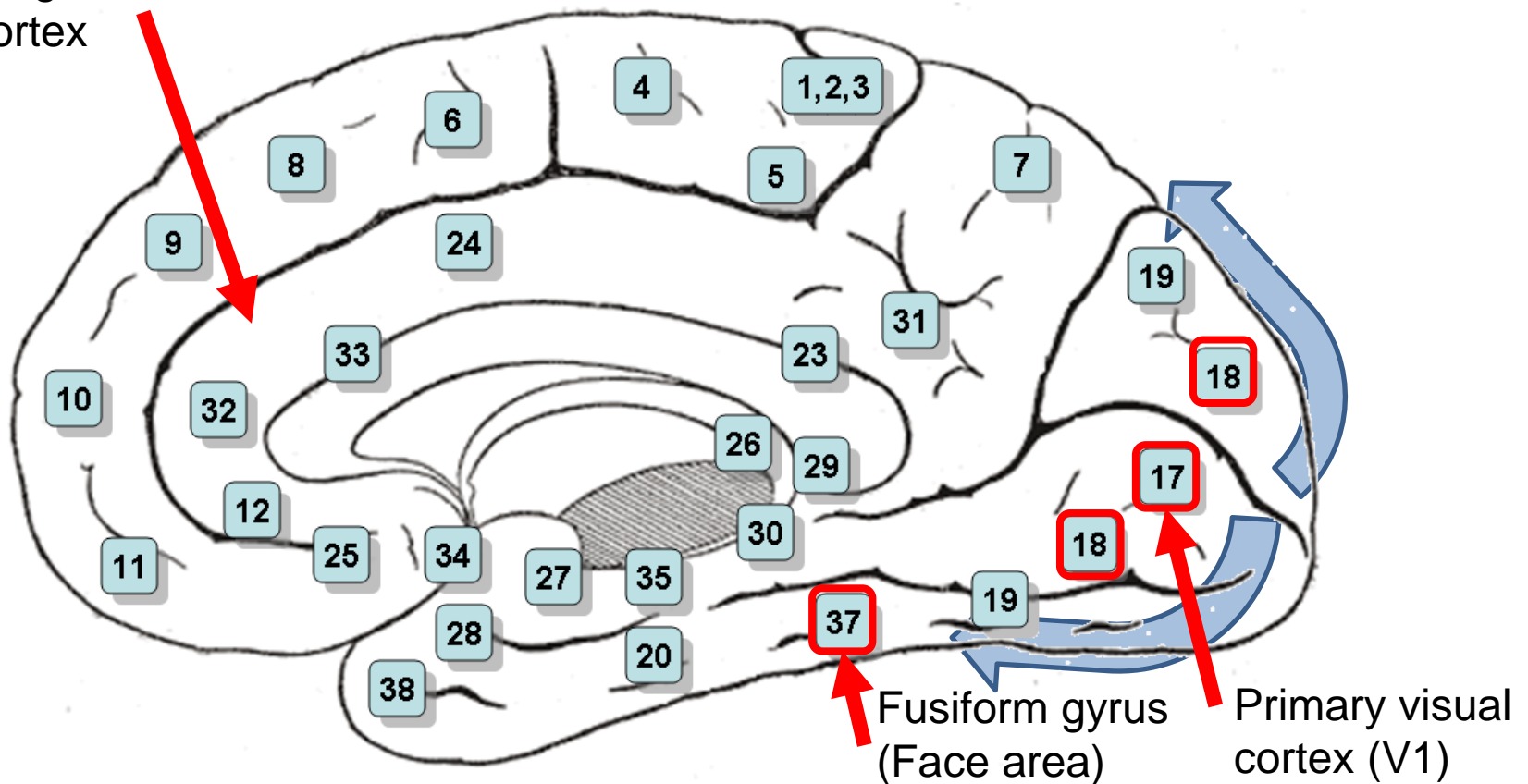


Brodmann areas



Brodmann areas

Cingulate cortex



Cognitive Domains

- Sensation
- Perception
- Motor and constructional
- Attention and concentration
- Memory
- Executive
- Processing
- Language

Cerebral dominance

Assessed by:

- Wada test (amobarbital)(Wada & Rasmussen 1960)
 - fMRI
 - Functional transcranial Doppler sonography (fTCD)
 - Dichotic listening – different auditory stimuli presented to each ear
-
- Right handed people:
 - 92% left hemisphere dominant
 - 6% right hemisphere; 2% bilateral

 - Left-handers:
 - 85% left hemisphere
 - 15% right or bilateral dominance (Rasmussen & Milner 1977)

Left-brain / right-brain

Left hemisphere:

- Role in language, arithmetic, verbal memory & visual recognition

Right hemisphere:

- Non-verbal perceptual tasks such as visuospatial recognition, emotional expression & elements of speech such as prosody

What is attention?

Ability to concentrate & focus on specific stimuli

Sustained attention (vigilance): concentration

Selective attention: selective focus / ignore irrelevant
e.g. conversation at party.

Divided attention: focus on >1 task simultaneously e.g.
preparing meal whilst on telephone

Alternating attention: cognitive flexibility, shifting
attention between tasks

Neurobiology of attention

Executive function - diffuse networks involving:

- **Top-down systems** (“orienting system”)
 - Prefrontal cortex
 - Frontal eye fields
 - Inter-parietal areas
 - Acetylcholine involved (basal forebrain)
- **Bottom-up systems** (“alerting system”)
 - Reticular activating system
 - Thalamus
 - Norepinephrine involved (locus coeruleus)

Attention – bedside assessment

- Digit span (6 ± 1)
- Serial 7s (elderly often struggle)
- Count backwards from 20→0
- Months of the year in reverse

Types of memory

Declarative
(Explicit)

Non-declarative
(implicit)

Long-term

Working
memory
(20-30 seconds)

Procedural

Conditioning

Priming

Episodic

Semantic

Verbal

Spatial

History

Anterograde memory loss can be elicited by asking about:

- Increasing use of lists
- Forgetting appointments / medication
- Repetition
- Losing items
- Difficulty keeping up with storylines / TV

Retrograde memory lost can be elicited by asking about:

- Past events & personal history (education; employment; major events)

Neurobiology of memory

Working memory – depends on frontal executive structures involved in attention and posterior areas related to the memory being rehearsed

LTM – dependent on limbic regions (Circuit of Papez)

- **Episodic:** limbic-diencephalic system & frontal connections
- **Semantic:** Anterior temporal lobe

Non-declarative (implicit) memory based in brain structures such as cerebellum (conditioning) & basal ganglia

Disorders affecting memory

Amnestic syndromes:

Memory loss markedly affected compared with other cognitive domains

Alzheimer's, vascular dementia, other dementias, hippocampal anoxia, herpes simplex encephalitis (hippocampal damage), Korsakoff's, bilateral thalamic infarction, drugs eg benzodiazepines

Transient global amnesia (TGA):

Marked anterograde amnesia > variable retrograde deficit

Seen in older adults with sudden onset profound but transient amnesia

General abilities & orientation to self maintained during episode

Transient epileptic amnesia (TEA):

Recurrent brief episodes

"Lacunae" of memory loss

Testing verbal memory

Remember 3 items

- *“I am going to say 3 words which I would like you to repeat after me. Try and remember them because I will ask you again later...”*

Ensure adequate registration

Poor registration may indicate deficits of attention or executive dysfunction

Can also assess memory for recent events (how they got to hospital / recent hospital admission)

Testing visual memory

Copy and recall shapes

“Hide and seek”

Semantic memory

Famous events, e.g.

- *“Please tell me the name of the current prime minister”*
- *“When was World War 2?”*

Autobiographical memory

- Need corroboration

Language

Not just speech:

- Comprehension
- Repetition
- Reading
- Writing
- Naming

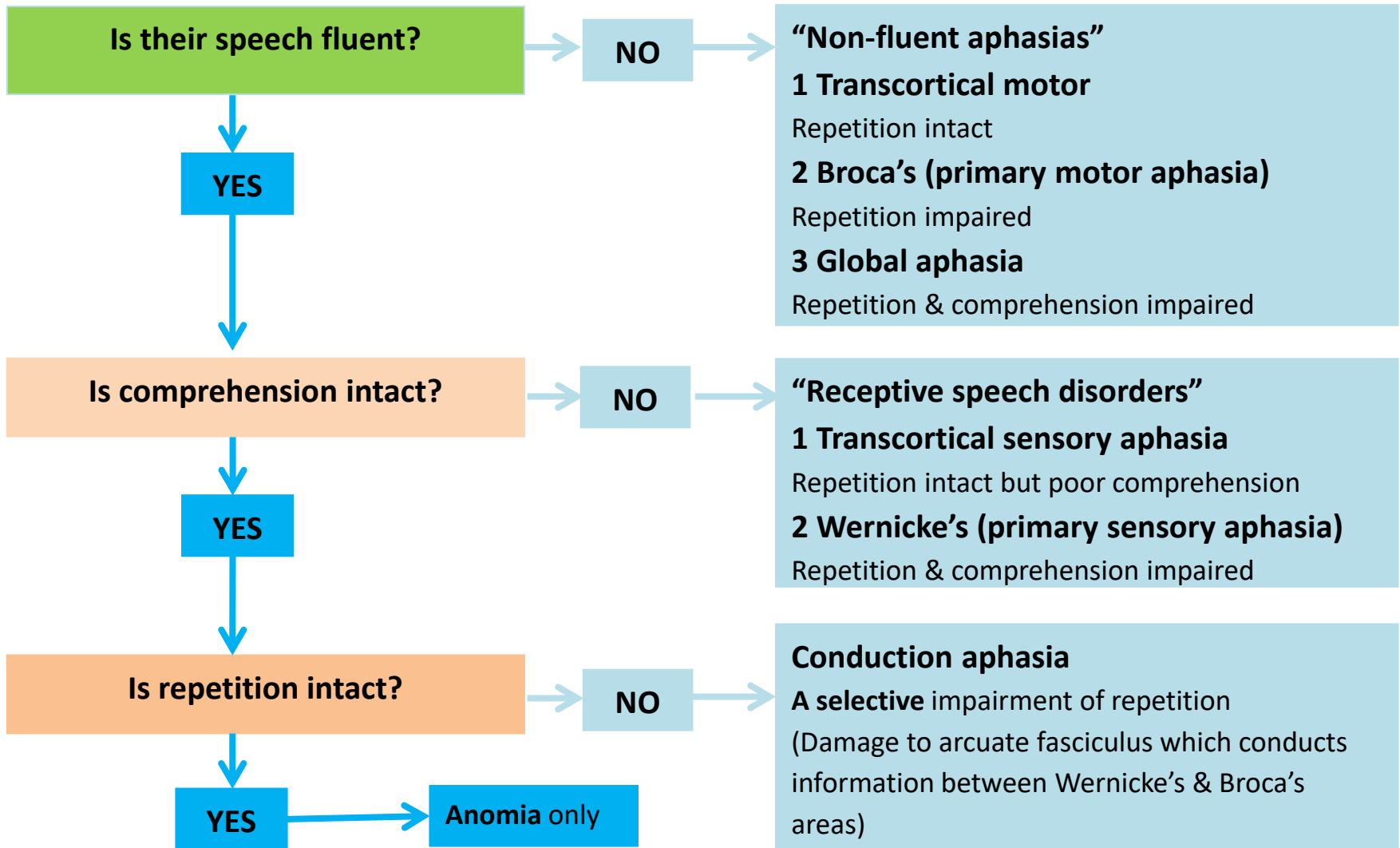
Speech disorders (Aphasias)

Broca's area (frontal lobe; area 44):

- Non-fluent speech
- Effortful, halting, & telegraphic (“*cat sat mat*”)
- Paraphrasias (phonemic) can occur e.g. “*sitter*” (sister); “*hen*” (pen)
“*incollect*” (incorrect)
- Comprehension relatively preserved

Wernicke's area (dominant temporal; area 22)

- Fluent; lack of content; circumlocutions
- Phonemic & semantic (words close in meaning) (e.g. dad for husband)
paraphrasias; neologisms
- Poor comprehension



Reading

Alexia: acquired inability to comprehend written language caused by brain damage (Jacobson *et al*, 2007)

Dyslexia: Partial loss of reading abilities (also applies to development impairments)

Two forms of alexia:

- Alexia with agraphia (parieto-temporal)
- Alexia without agraphia (occipital)- “pure alexia” – *letter by letter reading*

Reading & Alexia

Peripheral dyslexia:

- The impairment is in visual perception – the language centres remain intact
- Can result from impaired acuity / visual neglect / eye movement abnormalities

Central dyslexia:

- Impairment of language centres

“Peripheral” dyslexia

Neglect dyslexia:

- Difficulty in reading initial part of word
 - Right hemisphere damage
- SISTER → SISTER
TRACTOR → TRACTOR
COMPUTER → COMPUTER

Alexia without agraphia (rare) (“pure word blindness”)

- Very specific form of visual agnosia
- Disconnection syndrome
- Can write words seen but not read words back
- Caused by lesions to occipital lobe / posterior fibres of corpus callosum (splenium)

“Central” dyslexia

Surface dyslexia (L inferior temporo-parietal)

- Difficulty with **irregular words** (e.g. pint / sew / thyme)
- Phonologically plausible errors
- Breakdown in links between word and meaning

Deep dyslexia (L hemisphere damage)

- Loss of sound-based reading (deficits in grapheme-phoneme conversion)
- Problems reading **non-words** (rint / glint / deak)
- Associated deficits in working memory
- Semantic errors (bird/pheasant for goose)

Writing & dysgraphia

Requires coordination of central (spelling) and peripheral (formation of letters) abilities. Affected more commonly than reading

Central dysgraphia – impairment of written **AND** oral spelling

Peripheral dysgraphia - Intact oral spelling with **impaired written spelling** suggests a writing dyspraxia (dyspraxic dysgraphia) or a neglect dysgraphia (a peripheral dysgraphia)

Neglect dysgraphia:

Initial parts of word misspelt

Seen with other non-dominant parietal lobe deficits

Classification – as per dyslexia

Surface dysgraphia (Left temporo-parietal)

- Difficulty spelling irregular words
- Phonologically plausible errors

Deep dysgraphia (Left hemisphere damage)

- Breakdown of sound-based route for spelling
- Unable to spell **non-words**
- Semantic errors

Language

Comprehension:

- Simple commands
- *“Please point to the ceiling”*
- *“Point to the pen.....”(etc)*
- More complex (3-stage) commands
- Graded sentences

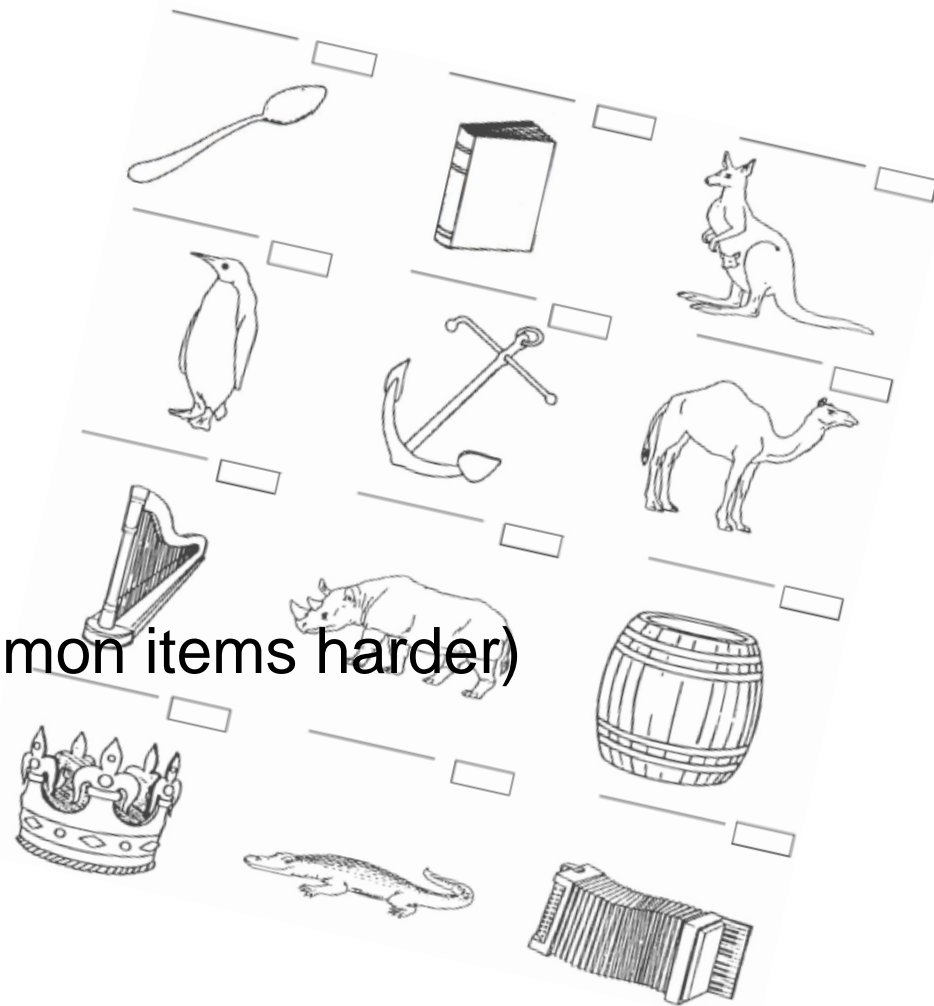
Repetition:

- Single words: e.g. *Hippopotamus, caterpillar, specificity*
- Phrases: e.g. *“A stitch in time saves nine”; “no ifs, ands, or buts”*.
- Listen carefully for errors in speech sounds (articulation) or phonemic paraphrasias

Language

Naming

- Anomia (word-finding)
- Naming errors
- Paraphrasias
- Frequency effect (less common items harder)
- May identify agnosia



Objects from Addenbrooke's Cognitive Examination (ACE-III)

Language

Reading

In simplest form:

- “Please follow this instruction”.....[CLOSE YOUR EYES]

and/or

- Ask to read aloud a paragraph from newspaper
- Can be tested (if necessary) using list of regular and irregular words

Language

Writing

- Write a sentence
- Write a dictated sentence
- What errors are there? (see earlier cognitive domain slides)
- Is oral spelling preserved? (suggests peripheral dysgraphia)

Apraxia

An inability to perform skilled previously learned actions despite intact understanding, sensory & motor systems

Apraxia

Requires both a conceptual knowledge **and** an ability to "produce" and control the necessary movements

- Ideational: loss of conceptual knowledge
- Ideomotor: impaired production of action

Some confusion around terms & inconsistent use
Best described by region (e.g. limb vs orobuccal)

Brain regions:

- Limited localising value – involvement of frontal & parietal lobes of dominant hemisphere

Apraxia – testing:

Imitation of gestures:

- Wave / salute / thumbs up / “ok”
- Meaningless gestures

Miming (use of objects)

- Pretend to comb hair / brush teeth
- Shouldn't use body part as object

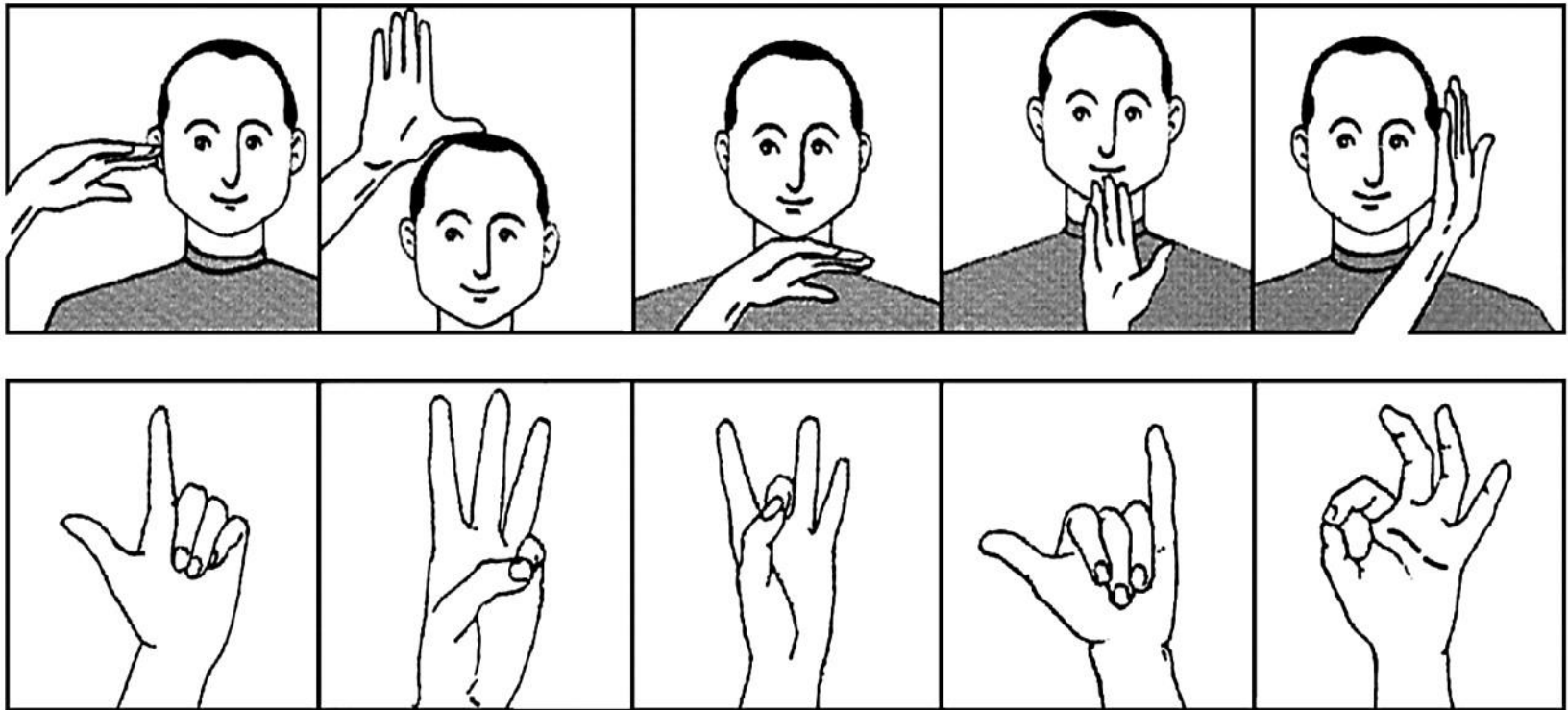
Orobuccal movements: (Insular/L inferior frontal lesions)

- Ask to blow out imaginary match
- Cough
- Lick lips

Motor sequencing

- e.g. Luria (also forms part of frontal / executive assessment)

Hand movements in apraxia



Kipps C M , and Hodges J R J *Neurol Neurosurg Psychiatry* 2005;76:i22-i30

Visuospatial

Deficits

Visual agnosia - failure of object recognition

Visual neglect

Visual inattention / sensory extinction

Dressing & constructional dyspraxia – technically not dyspraxia but visuospatial impairment

Topographical disorientation (novel environments)

Vision

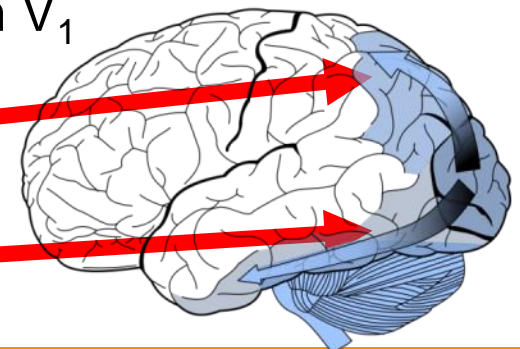
Signals pass from the retina to the lateral geniculate nucleus and then to primary visual cortex (V_1)(striate cortex) – specific parts of cortex map to specific parts of visual field (“retinotopic”)

Extra-striate areas are organised by function – e.g. detection of motion or colour

Visual information passes in 2 “streams” – a dorsal (occipitoparietal) stream and a ventral (occipitotemporal) stream from V_1 to the visual association areas

Dorsal stream: spatial processing

Ventral stream: object recognition



Visual object agnosia

(associative or semantic visual agnosia)

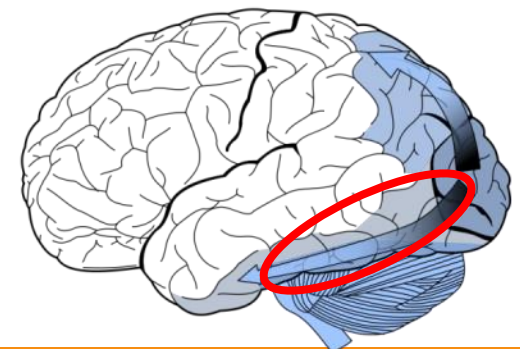
Most commonly encountered form of agnosia

Perception intact: images of objects can be copied & drawn

Due to impairment of semantic knowledge – can affect any modality – visual agnosia refers to inability to access by vision. (NB - Associative agnosia usually refers to more generalised semantic loss).

Lesions of anterior left temporal lobe

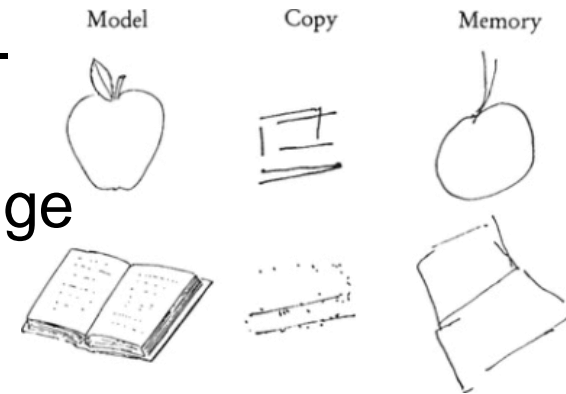
Tests: Pyramid & Palms Test



Apperceptive visual agnosia

Objects not seen as whole or meaningful - **impairment of perception**

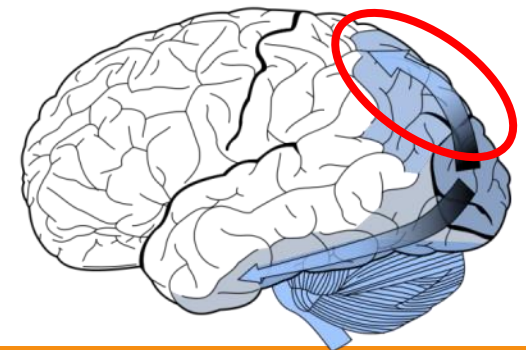
(can name objects by description; knowledge retained)



Difficulty copying images but do better when draw pictures from memory

Struggle on tests of object matching

Tests: incomplete letters, VOSP

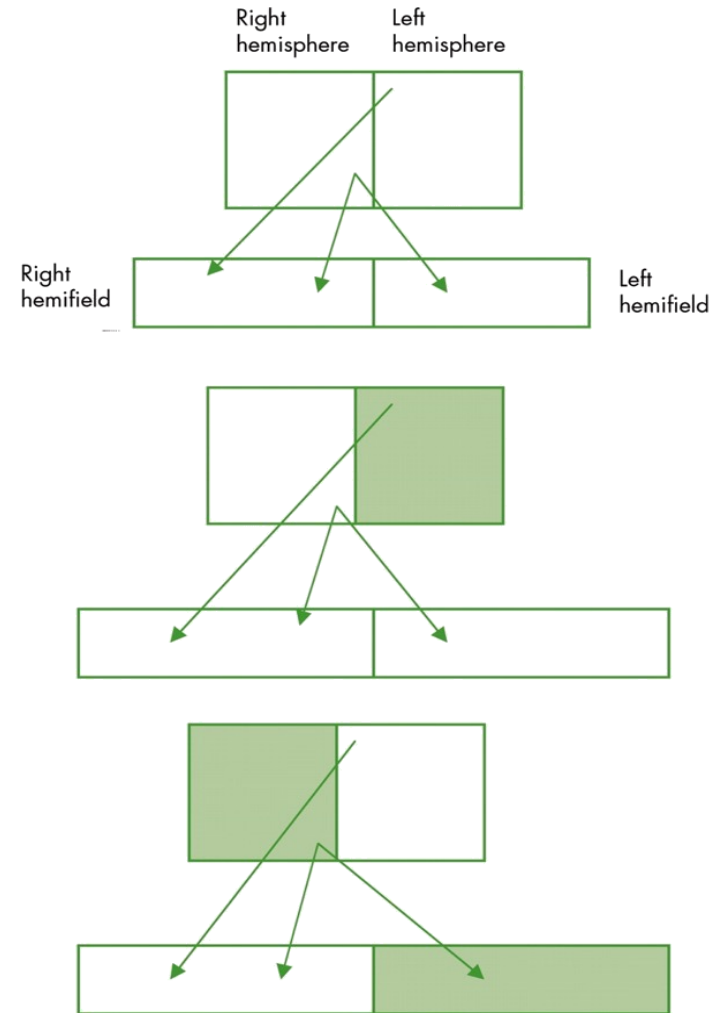


Visual neglect

Deficit of visual attention to external space/body

Usually left-sided (lack of bilateral representation)

Left hemisphere damage results in no visual field deficit, while right hemisphere damage results in neglect to the left





Schematic representation of how a visual scene might appear to people with left homonymous hemianopia (middle panel) and left neglect (bottom panel).

Hemianopia obeys the midline and affects only the contralesional visual field.

Neglect affects parts of the ipsilesional field in addition to the contralesional field – so there is a lateralised bias of attention towards the side of the lesion.

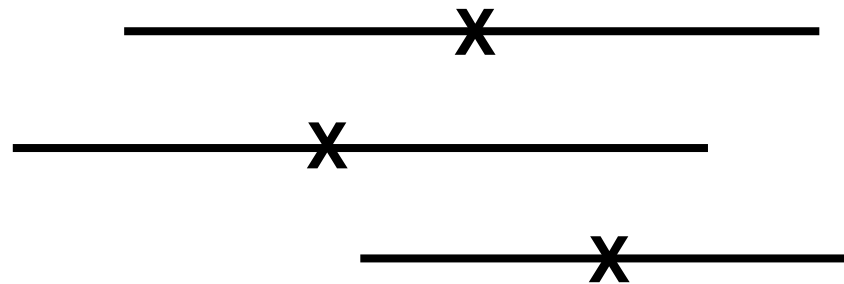
Sensory inattention

Sensory inattention (“extinction”) – related sign

Test by bilateral stimulation of visual fields (moving one or both fingers) – ipsilesional stimulus “extinguishes” the other stimulus from conscious awareness (ensure visual fields intact before testing)

- **Bedside tests of neglect:**

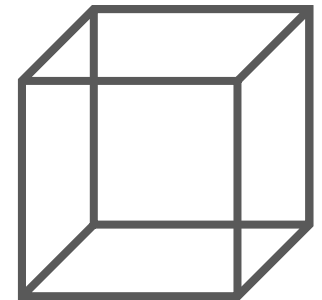
- Line bisection
- Clock face
- Double-headed daisy
- Letter cancellation task



Other perceptual deficits

Anosognosia – inability to recognise disability (typically left hemiplegia)

- Usually non-dominant parietal lobe lesions
- Disorder of attention



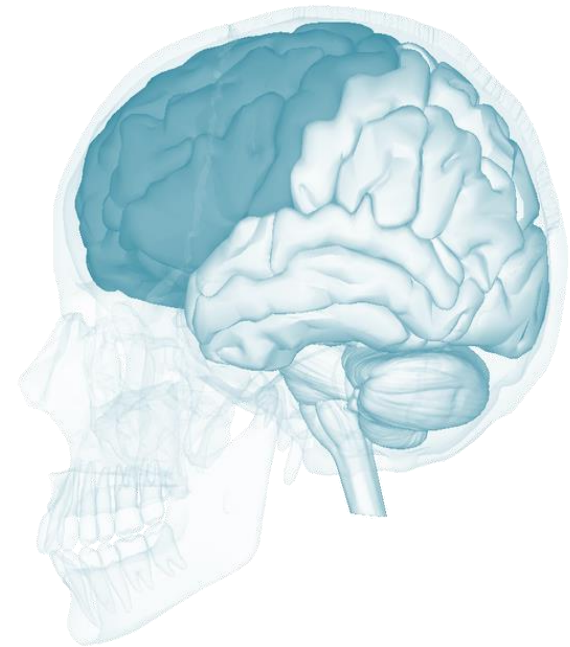
Constructional (& dressing) dyspraxia

- Technically not an apraxia
- Due to impairments in VS processing
- Left hemisphere damage – simplified drawings
- Right hemisphere damage – misaligned/expanded

Frontal lobes

- Motor
- Speech
- Personality
- “Executive function”

- 3 clinical syndromes typically described



Dorsolateral PFC

“Disorganised”

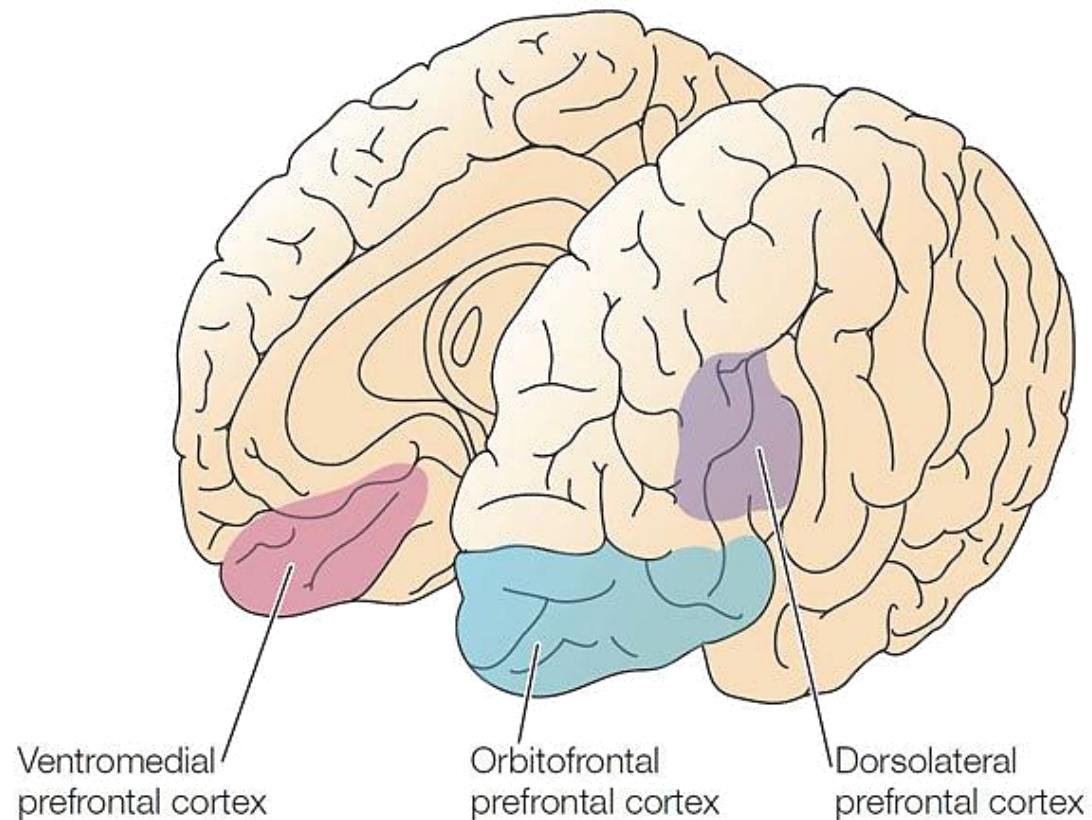
Poor attention

Poor judgement

Poor planning

Poor insight

Rigidity (concrete)



Orbitofrontal PFC

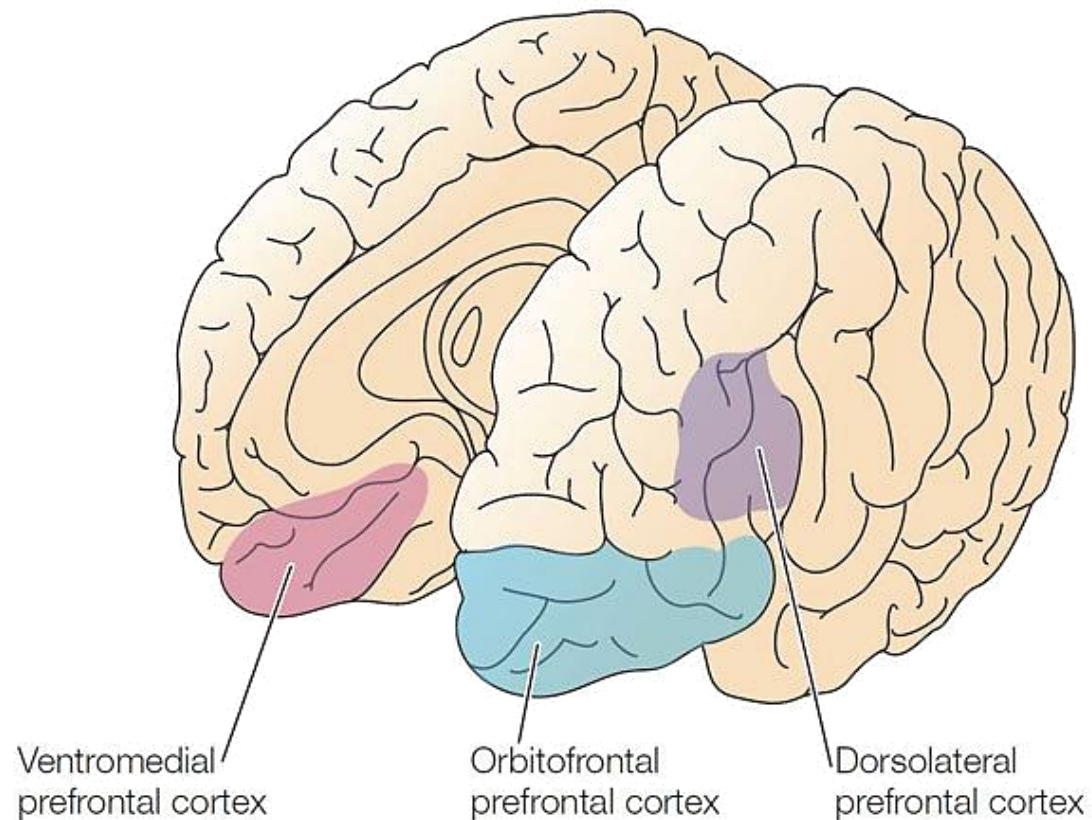
“Pseudo-psychopathic”

Disinhibited

Poor impulse control

Explosive outburst

Inappropriate behaviour



Ventromedial PFC

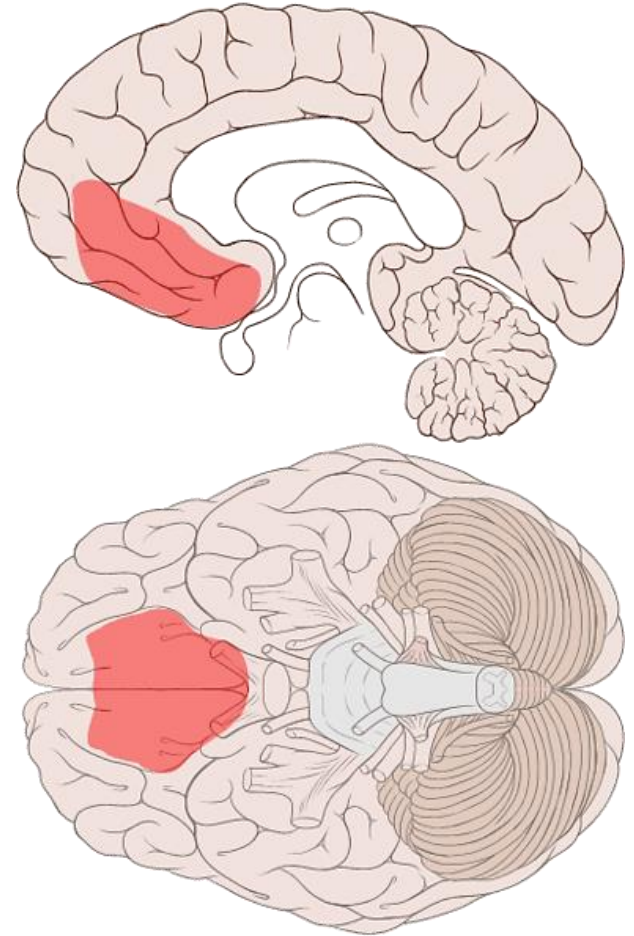
“Pseudo-depressive”

Apathetic

Lack of initiation

Poverty of speech

Lack of social knowledge



Executive Function

Abilities that allow us to plan, adapt, solve, initiate, organise & monitor our thoughts & behaviours

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Executive function

Executive dysfunction is not synonymous with frontal lobe but PFC is essential for normal EF.

May see environmental dependency:

- Perseveration of speech: Palilalia
- Repetition of speech heard: Echolalia
- Utilisation behaviours

Primitive reflexes:

- Grasp reflex
- Pout reflex (tap spatula placed on lips)

Executive Function Tests

Luria task
(motor sequencing)

Go-no-go & conflicting instructions
(inhibitory control)

Alternating sequences
(Set-shifting; perseveration)

Letter (& category) fluency
(initiation; perseveration)

Similarities
(conceptualisation/ abstraction)

Cognitive estimates
(abstraction)

Temporal lobes

Wernicke's
aphasia

Impaired verbal
memory

Impaired non-
verbal memory

Anomia

Alexia

Visual agnosia

Contralateral
upper
quadrantanopia

Prosopagnosia

Anterograde &
retrograde
memory

Temporal lobe syndromes

Klüver-Bucy Syndrome:

- *Hyperphagia / Hypersexuality / Hyperorality / Hypermetamorphosis / Docility / Visual agnosia*
- Bilateral temporal lobe damage (including amygdalae).

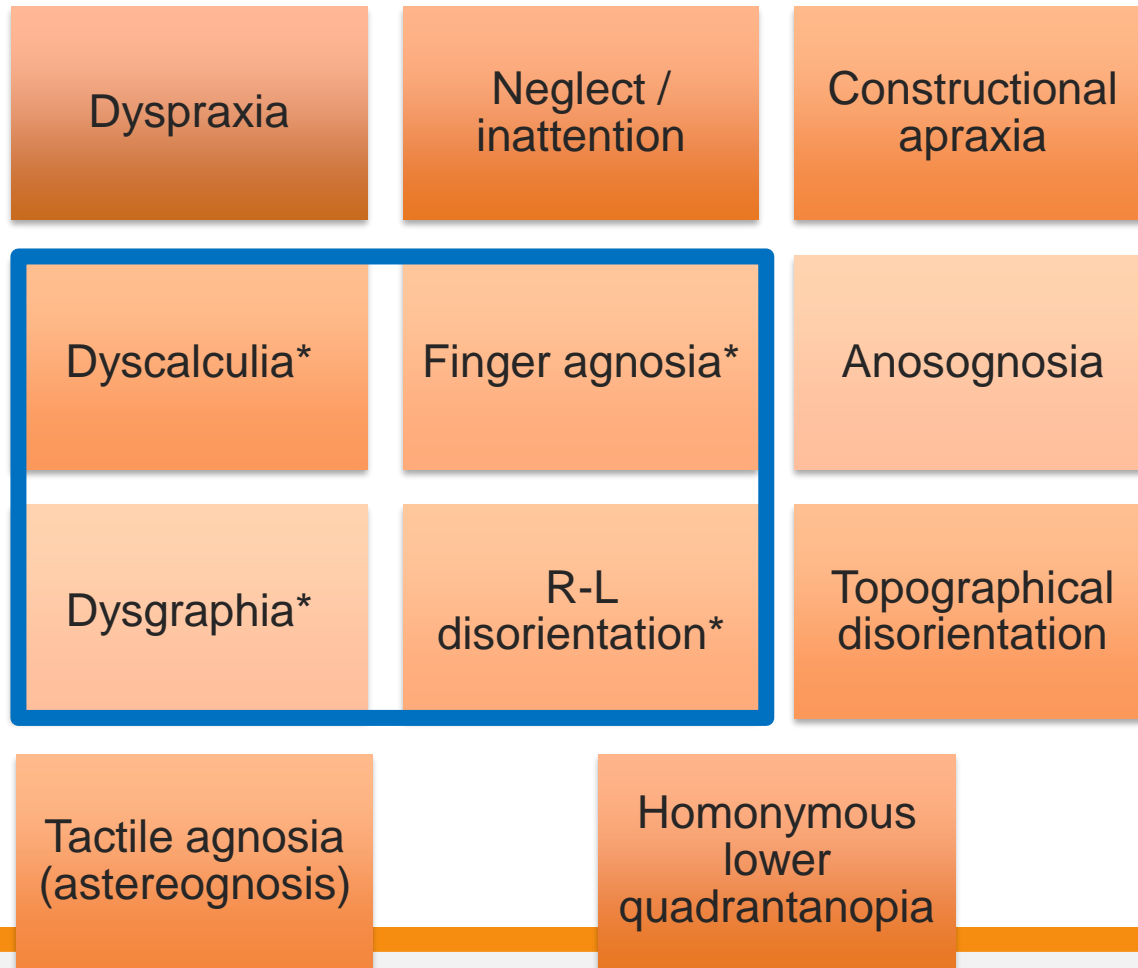
Amnesic syndrome (e.g. Korsakoff's)

- Anterograde memory impairment; variable retrograde
- Preserved digit span and ability to learn new skills (but won't remember learning)
- Can result from malnutrition, infection (HSV), vascular lesions, head injury, hypoxia (including CO poisoning), or tumours etc.

Temporal lobe epilepsy

- *Autonomic sensations / dysphasia / forced thinking / lip smacking / absences*
- *Panoramic memory / depersonalisation*
- *Déjà vu & jamais vu*

Parietal lobes



Occipital lobe syndromes

Contralateral homonymous hemianopia

Prosopagnosia (ventral stream defect)

Bálint's syndrome (dorsal stream defect):

- Simultagnosia
- Optic ataxia
- Optic apraxia

ANTON syndrome (Anton-Babinski):

- Cortically blind
- Visual anosognosia (with confabulation)

Cognitive Assessment

Cognitive assessment tools

More than just a MMSE, MOCA or ACE

- Screening tools with limitations
- Need to take into account educational attainment and what is “normal” function for an individual
- Remember – don’t replace formal neuropsychological assessment

MMSE[©]

MOCA

ACE-III (& Mini-ACE)

6-CIT

AMTS

Terms to understand!

- **Face validity**
- **Construct validity**
- **Inter-rater reliability**
- **Test-retest reliability**

Selected brief tools

Mini-Mental State Examination (MMSE) (Folstein, Folstein & Hugh, 1975)

- Quick / widely used / copyright
- Poor assessment of memory, VS, executive function / ceiling/floor
- Sensitivity 0.51-0.79; specificity 0.95 (Brooke & Bullock, 1999; Hancock & Warner, 2011)

Montreal Cognitive Assessment (MOCA)

- Scored out of 30 ($\leq 25/30$)
- Sensitivity 0.94-1; specificity 0.5-0.84 (Smith & Holmes, 2007; Nasreddine et al, 2005)

Abbreviated Mental Test Score (AMTS) (Hodkinson 1972)

- 10-item scale (4-item version AMT-4 used in A&E/AMU) and in 4-AT (delirium test) Cutoff < 8
- Sensitivity 0.81; specificity 0.84 (Incalzi et al, 2003)

6-item cognitive impairment test (6-CIT)

- Inverse scoring ($\geq 8/24$)
- Validated in primary care
- Sensitivity 0.9; specificity 1 (Brooke & Bullock, 1999)
- No cultural bias

Clock drawing test

Clock drawing is a useful supplement to a brief bedside cognitive assessment

Most information obtained by asking subject to:

- draw clock face
- copy a clock face

Clock drawing assesses executive (planning) function as well as visuospatial processing

Type of errors can yield useful information, e.g.:

- Evidence of neglect
- People with AD typically draw larger clocks compared to HD patients (Eknoyan et al, 2012)

Selected neuropsychological tests

ESTIMATED PREMORBID FUNCTIONING

- Test of Premorbid Functioning (TOPF)
- National Adult Reading Test (NART)

CURRENT INTELLECTUAL FUNCTIONING

- Wechsler Adult Intelligence Scale -4th Edition (WAIS-IV)
- Ravens Matrices

ATTENTION/CONCENTRATION

- Digit Span (WAIS-IV) Forwards, Backwards and Sequencing (or if not available the WMS-III subtest).
- Test of Everyday Attention (TEA)

LANGUAGE

- Graded Naming Test
- Boston Naming Test

WORKING MEMORY

- Digit span backwards and sequencing (WAIS-IV)

MEMORY

- Wechsler Memory Scale – 4th Edition (WMS-IV)
- Rivermead Behavioural Memory Test – 3rd Edition (RBMT III)

Selected neuropsychological tests

PERCEPTUAL/VISUOSPATIAL SKILLS AND CONSTRUCTIONAL ABILITIES

- Visual Object and Space Perception Battery (VOSP):
- Clock drawing
- Star/Letter Cancellation (Behavioural Inattention test) – tests of neglect

INFORMATION PROCESSING SPEED

- Symbol Search (WAIS-IV)

EXECUTIVE FUNCTION

Initiation

- Verbal fluency

Sequencing

- Letter Sequencing/Number Sequencing (Trail Making test (TMT); DKEFS)

Inhibition

- Stroop test

Rule Shifting

- Card Sorting tests e.g., WCST

Planning and organising / Problem Solving

- Key Search/Zoo Map (Behavioural Assessment of the Dysexecutive Syndrome, BADS).
- Tower of London

Useful resources

- Montreal Cognitive Assessment (MOCA) available at:
www.mocatest.org
- <https://www.alz.org/professionals/health-systems-clinicians/cognitive-assessment>
- <http://www.psychiatrycpd.co.uk/> Bedside assessment of cognition.
- Rascovsky, K., 2016. A primer in neuropsychological assessment for dementia. *PRACTICAL NEUROLOGY*.
http://v2.practicalneurology.com/pdfs/pn0716_CF_Neuropsych.pdf

Acknowledgements

Please provide feedback/suggestions on this presentation to
Anthony.Peter@lancashirecare.nhs.uk

OA Module: Cognitive Assessment

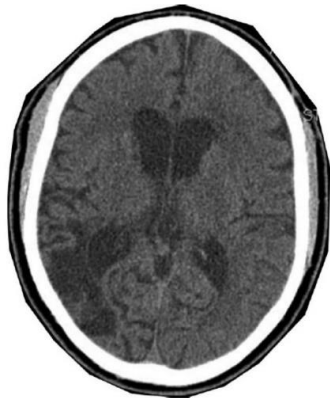
Any Questions?

Thank you..... MCQs are next....

OA Module: Cognitive Assessment

MCQs

1. A 67 year old left handed male suffered from a cerebral infarct 5 weeks ago. Here is his CT brain scan result.



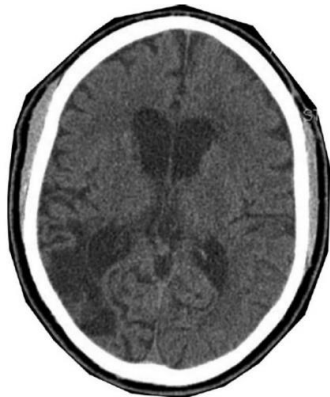
Which of the following tests is most likely to detect the related cognitive deficits?

- A. Abstract thinking
- B. Go-No-Go
- C. Cognitive estimates
- D. Stroop test
- E. Copying a cube

OA Module: Cognitive Assessment

MCQs

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- C. Cognitive estimates
- D. Stroop test
- E. **Copying a cube**

OA Module: Cognitive Assessment

MCQs

2. A 54 year old woman has been falling out with friends and her relationship with her husband is increasingly strained. She has been saying things in social situations that she would have previously found mortifying. Her driving has also become more erratic, often jumping red lights. She has also been involved in a couple of road rage incidents which is very unusual for her.
- A. MOCA
 - B. 6-CIT
 - C. Cornell
 - D. MUST
 - E. MMSE

Which of the following screening tools would be most helpful in picking up associated cognitive deficits?

OA Module: Cognitive Assessment

MCQs

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- A. MOCA
- B. 6-CIT
- C. Cornell
- D. MUST
- E. MMSE

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OA Module: Cognitive Assessment

MCQs

3. A 62 year old woman was referred as the GP was concerned she was depressed. She presents with loss of volition, blunting of affect, axial rigidity and problems with vision. She denies feeling depressed. An MRI brain scan demonstrates the 'hummingbird sign'. **What combination of deficits would you be likely to observe on a cognitive profile?**
- A. Constructional apraxia and prosopagnosia.
 - B. Impaired episodic memory and object knowledge.
 - C. Visuospatial deficits and impaired naming.
 - D. Dyscalculia and tactile agnosia.
 - E. Impaired trail making and effortful, halting speech.

OA Module: Cognitive Assessment

MCQs

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 - C. Visuospatial deficits and impaired naming.
 - D. Dyscalculia and tactile agnosia.
 - E. **Impaired trail making and effortful, halting speech.**

OA Module: Cognitive Assessment

MCQs

4. In Wernicke's aphasia, an assessment of language is most likely to demonstrate:

- A. Effortful speech
- B. Telegraphic speech
- C. Intact repetition
- D. Impaired comprehension
- E. Echolalia

OA Module: Cognitive Assessment

MCQs

4. In Wernicke's aphasia, an assessment of language is most likely to demonstrate:

- A. Effortful speech
- B. Telegraphic speech
- C. Intact repetition
- D. Impaired comprehension**
- E. Echolalia

OA Module: Cognitive Assessment

MCQs

5. A 58 year old gentleman presents with early stages of a semantic variant primary progressive aphasia. Previously a keen amateur cook, he now struggles in the kitchen and keeps asking his wife what various kitchen utensils are for. Cognitive tests show fluent speech and intact repetition. However, the content of their speech is vague with obvious word omissions and substitutions. **Which brain region has been affected by pathological change?**
- A. Medial temporal lobe
 - B. Hippocampus & entorhinal cortex
 - C. Anterior inferior temporal lobe
 - D. Dorsolateral prefrontal cortex
 - E. Cerebellum

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6. A 65 year old woman has been referred to the memory assessment service with forgetfulness causing her significant distress. Her mother had a history of Alzheimer's dementia. She is not sleeping very well and struggles to enjoy her usual hobbies. Her MOCA score was 20/30. During the assessment she often responded with 'I don't know' or gave approximate answers.

Which would be the most appropriate next step?

- A. Re-do the MOCA in 1 week with the support of relatives.
- B. Prescribe low dose benzodiazepines.
- C. Complete a MADRS scale and consider a trial of antidepressants.
- D. Arrange an MRI brain scan.
- E. Complete and ACE-III to look at the cognitive profile in more detail.

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Any Questions?

Thank you