Cognitive Changes Following Stroke

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Outline

- Overview of Neuropsychology and Neuropsychological Assessment
- Premorbid Functioning
- Brief Overview of Neuroanatomy
- Cognitive Domains & Post-stroke Cognitive Changes
- Complexity of Cognitive Processes

Take-home message “To Do Tomorrow”

- Collect enough data to put a plan in place
  - It’s fine to not immediately have all the answers
- Consider the difficulties that may not be obvious while in hospital/controlled environment
- Don’t make immediate assumptions upon hearing a diagnosis

What is Neuropsychology

- Assessing the behavioural expression of brain dysfunction
- Grew from the 19th century acceptance that we could make controlled observations of human behaviour
- Developed after WWI to screen and diagnose brain injured and behaviourally disturbed service men
- Previously used in diagnosis
  - Less relevant for this due to improvements in medical imaging

What is Neuropsychology

- An assessment of:
  - Emotional functioning and mental health
  - Social interactions and behaviour
  - Premorbid functioning and history
  - Current patterns of behaviour

- Cognitive testing

The Process of Neuropsych Assessment

- Concussion screen
  - Around 5 hours (2-3 hours of testing)
- Standard neuropsychological assessment
  - Around 7 hours (3 -4 hours of testing)
- Complex neuropsychological assessment
  - Around 12 hours (5-6 hours of testing)

Reasons for a Neuropsychological assessment

- Diagnosis
  - Most relevant for progressive processes (e.g., dementia) or
  - Prodromal period (e.g., Huntington's)
- Assessment of the impact of a known injury
  - What impact is this having on behaviour and cognition
- Patient care
- Treatment planning and rehabilitation
- Performance validity

Interpreting the Assessment

- Normed data comparing the person to the Average in their age group
- Gold standard is 1.5 standard deviation from the normal
  - Normal = age equivalent
  - VERY IMPORTANT that this takes into account their estimated premorbid functioning
- Compare results of each cognitive domains (strengths and weaknesses)

Complicating factors in cognitive assessment

- Comorbidity and complex presentations
- Behavioural barriers to testing or non-motivated client
- Predicting recovery
- Over-testing

Pre-morbid Functioning

- Crucial to make any conclusions of change
- Based upon a range of information
- Relies on aspects of thinking that are resistant to change

Right handed, Left handed, Ambidextrous

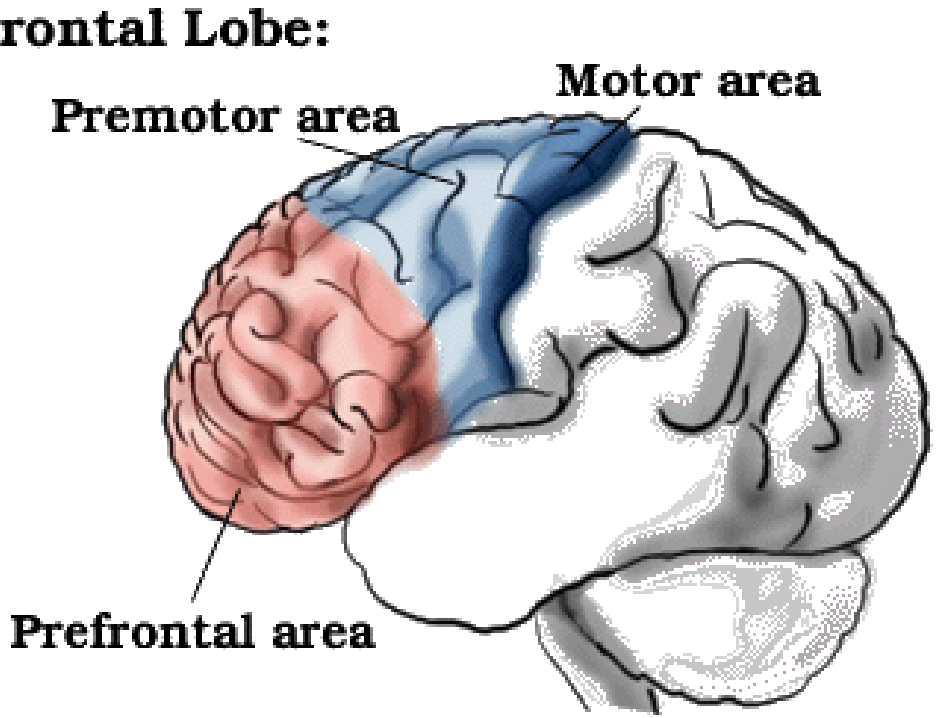
- Relationship between handedness and language centres in the brain
- Always important to consider through assessment

Neuroanatomy – Frontal Lobes

"The human prefrontal cortex attends, integrates, formulates, executes, monitors, modifies, and judges all nervous system activities" (Stuss and Benson, 1987).

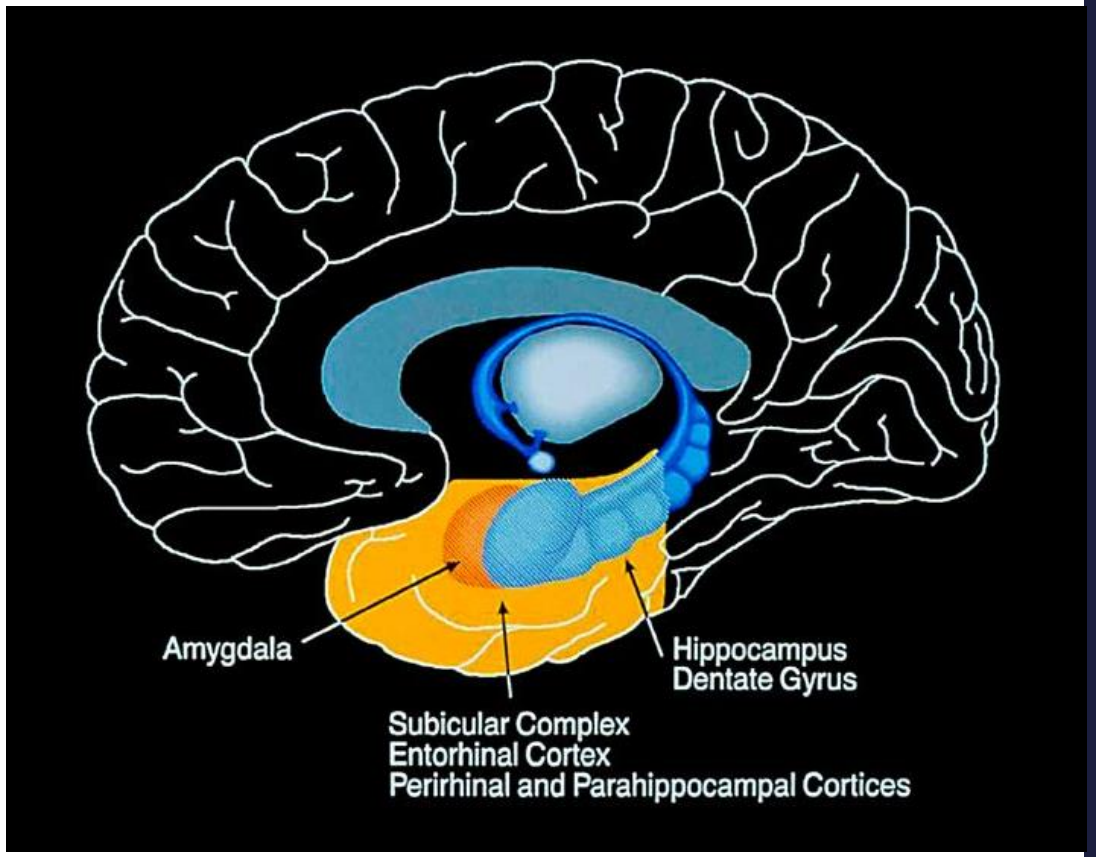
Neuroanatomy – Frontal Lobes

- Primary motor area
- Premotor area
- Prefrontal cortex



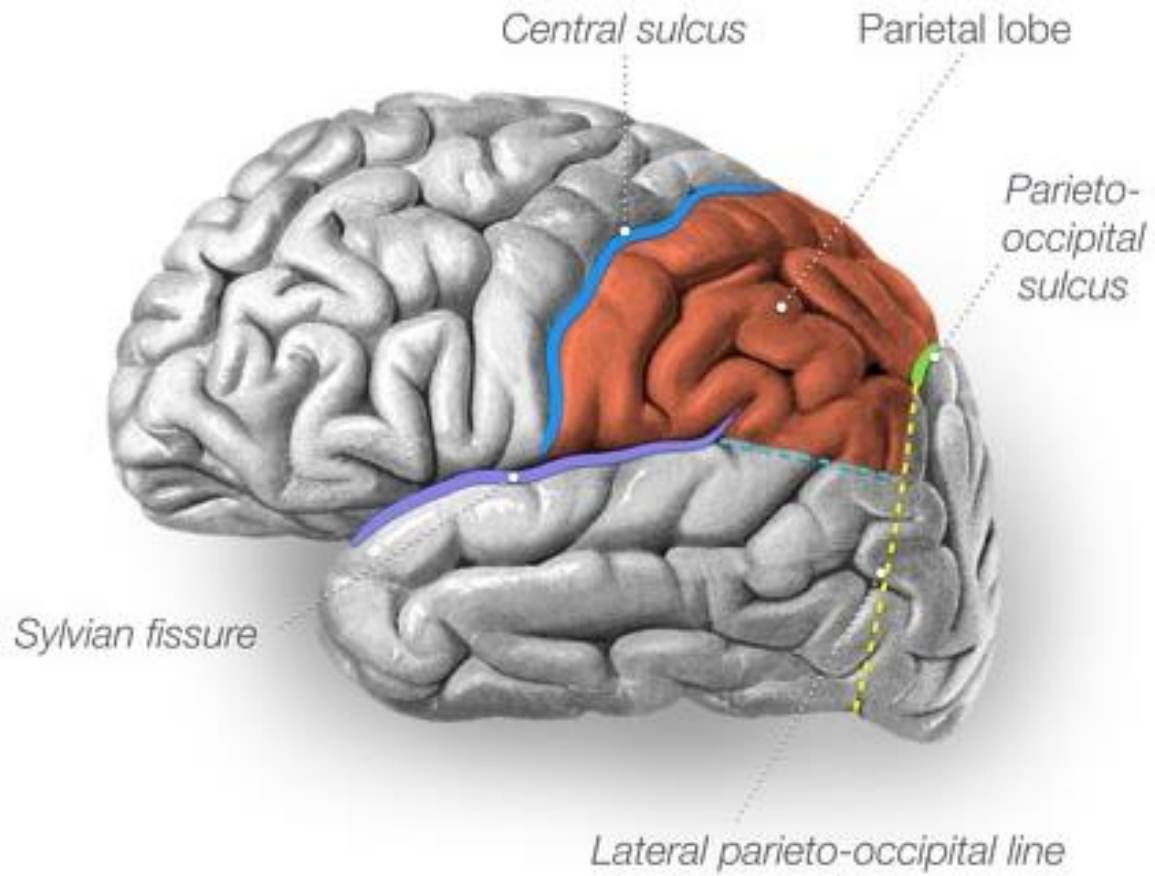
Neuroanatomy – Temporal lobes

- Auditory information, understanding spoken information
- Complex vision
  - Perception of movement
  - Recognition of faces
- Emotion and motivation
- Learning and memory
- Medial temporal lobe contains the hippocampus, and the hippocampal complex



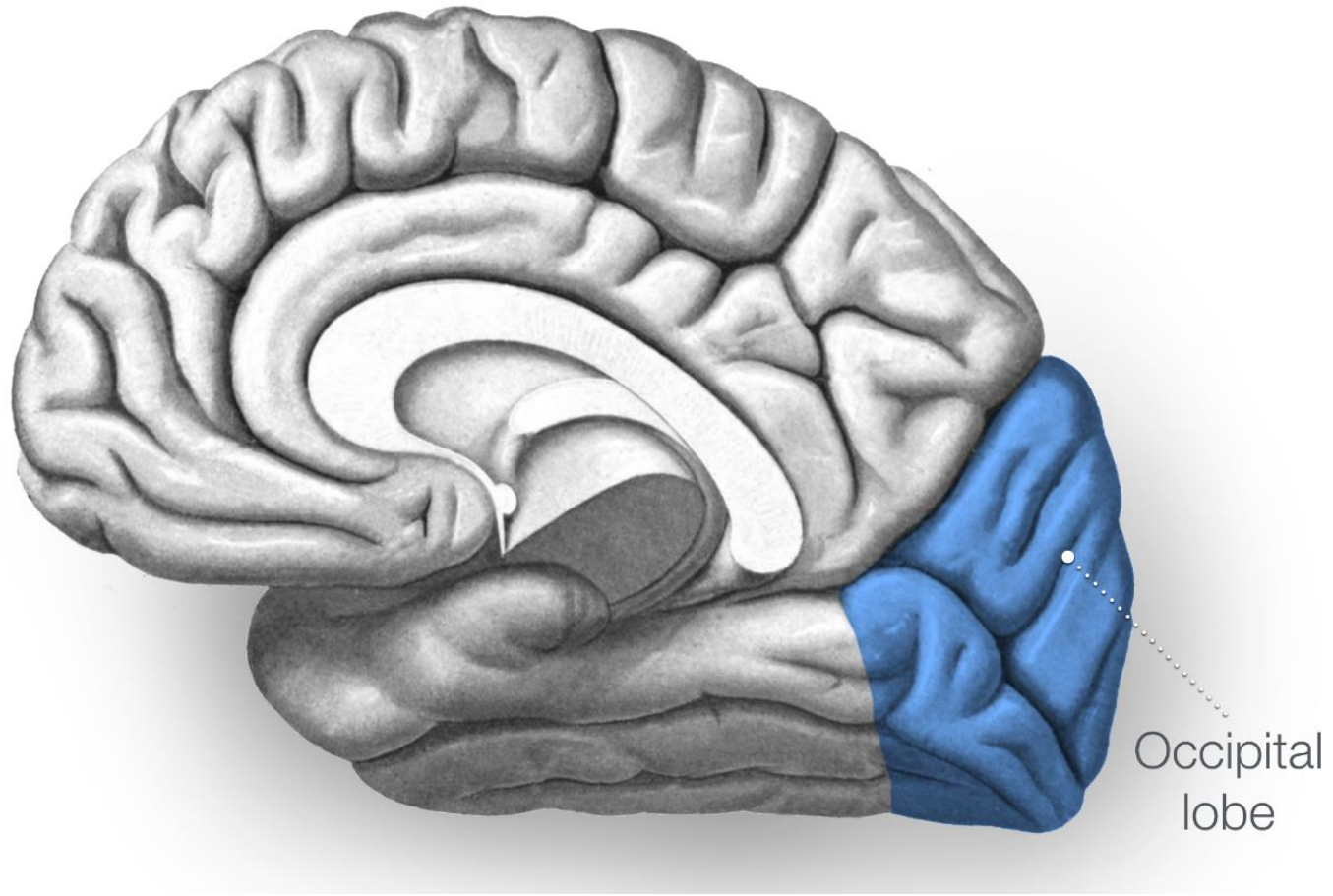
Neuroanatomy – Parietal Lobes

- Primary somatosensory area
- Touch and body location information
  - Important for coordinating movement
- Kinaesthetic and vestibular functions



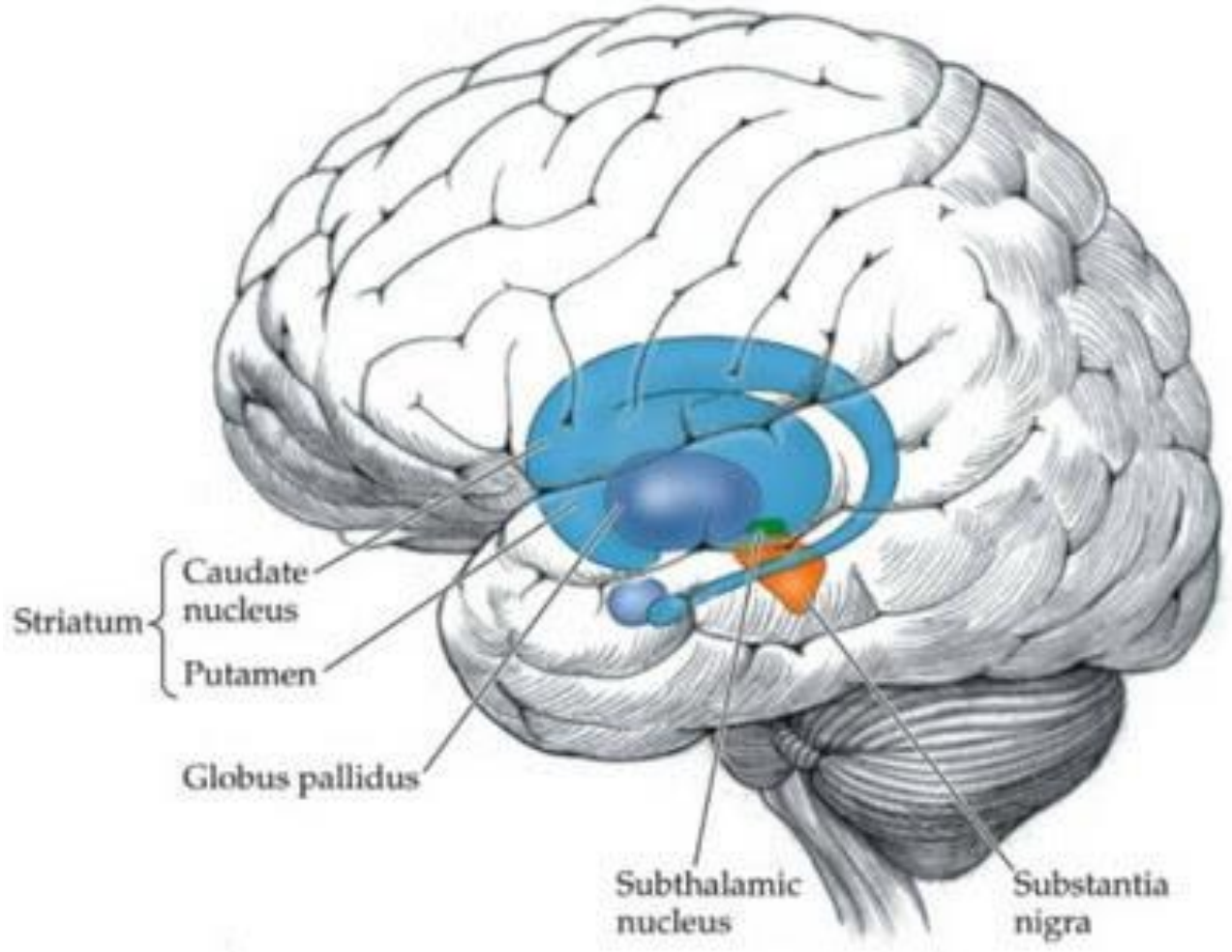
Neuroanatomy – Occipital lobes

- Visual Information
- Visual discrimination



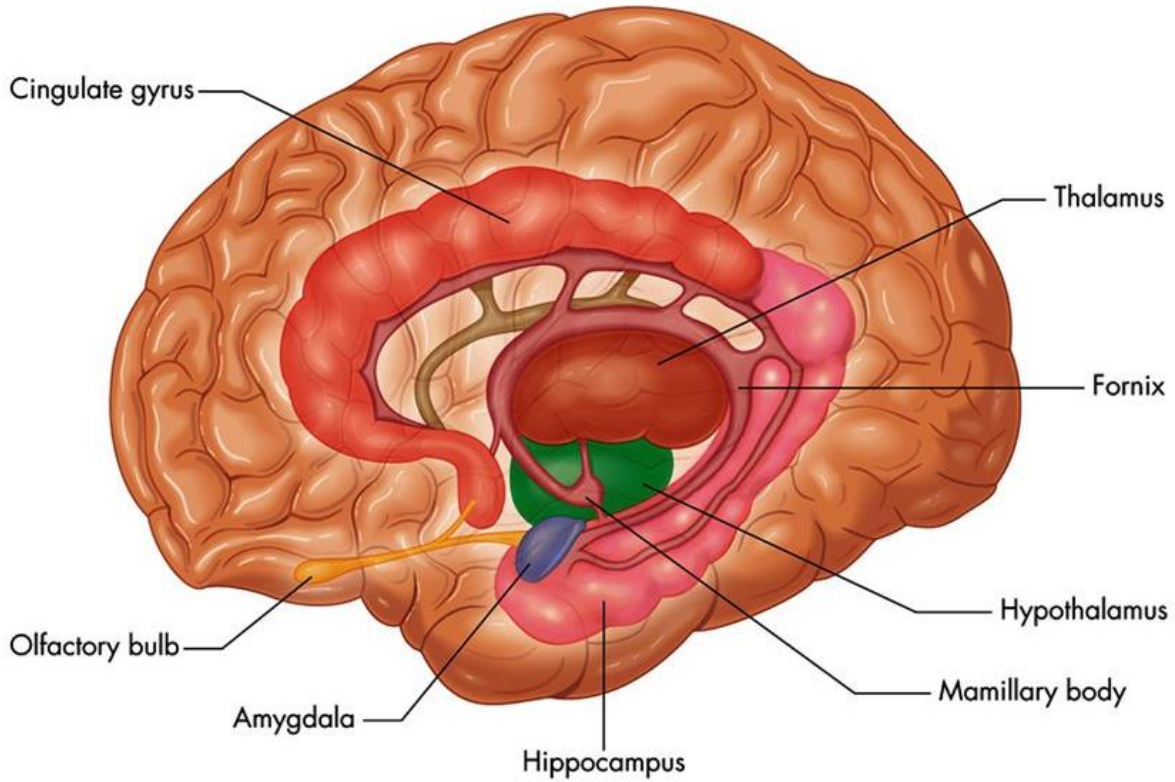
Neuroanatomy – subcortical structures

- Basal Ganglia
- Pituitary gland
- Limbic System
  - Cingulate gyrus
  - Thalamus
  - Hypothalamus
  - Mamillary Body
  - Hippocampus
  - Amygdala
  - Olfactory bulb



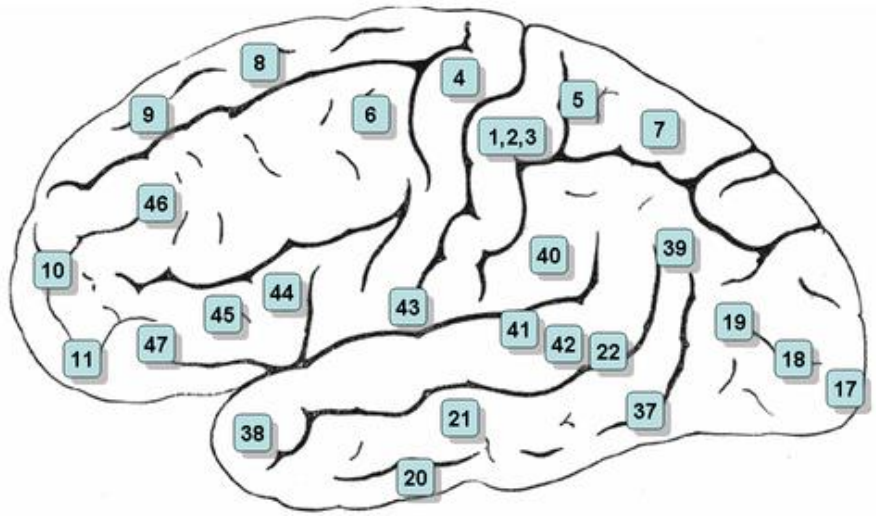
Neuroanatomy – subcortical structures

- Thalamus
  - Major relay centre for sense (except smell)
  - Motor feedback
  - Limbic system (emotion)
  - Physiological arousal, and therefore sleep
- Hypothalamus
  - Appetite
  - Sexual arousal
  - Thirst
  - Processing cognitive and
  - social cues
  - Mood changes

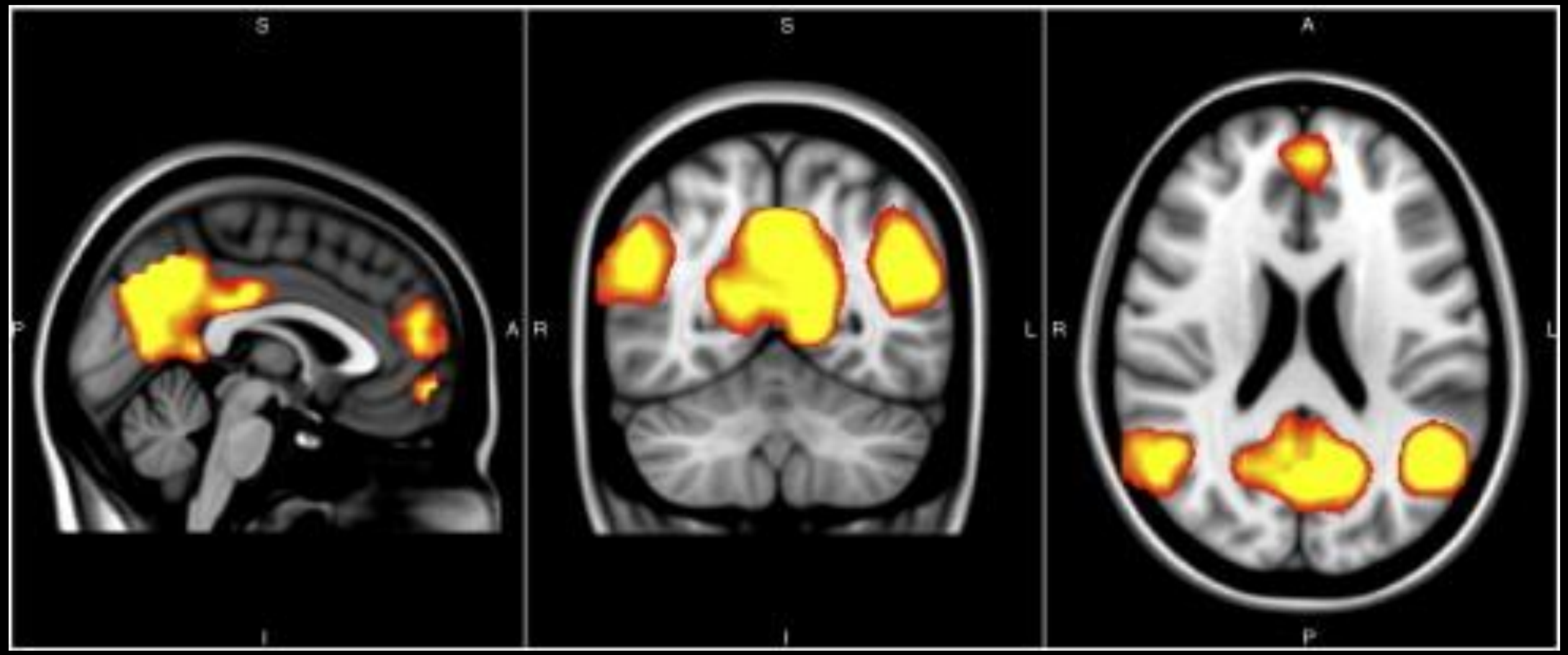


Localisation of stroke, what to see and what should be intact

- Many theorists have divided the brain into functional systems
  - Brodmann's areas the most common of these
- Language most clearly demonstrates hemispheric localisation
- Some findings are consistent based on stroke lesion
  - However, the severity and scope of this may differ
- When there seems to be a discrepancy then care needs to be taken in assessment



Default Mode Network



Memory – Dual System conceptualisation

- Declarative/Explicit
  - Semantic
  - Episodic/autobiographic
- Nondeclarative/Implicit
  - Item specific
  - Procedural

Sensory Memory

- Not strictly memory
- First stage of remembering anything
- Held very briefly (maximum of seconds)

Immediate Memory

- Immediate memory is the first stage of “short-term memory”
- Usually thought of as immediate span of attention
- Lasts for about 30 seconds to a couple of minutes
- Rehearsal to keep the memory trace active
  - Any repetitive memory process that lengthens the duration of any memory trace
  - Increases likelihood that information will become permanent

Immediate Memory – Working Memory

- Temporary storage and processing used for problem solving
  - “phonological loop” for verbal information
  - “visuospatial sketchpad” for visual information

Long-term memory

- Consolidation – process of storing information
- “Learning” often requires effortful or attentive activity
- “Incidental Learning” is acquired without directed effort
- Memories are not stored at a single site

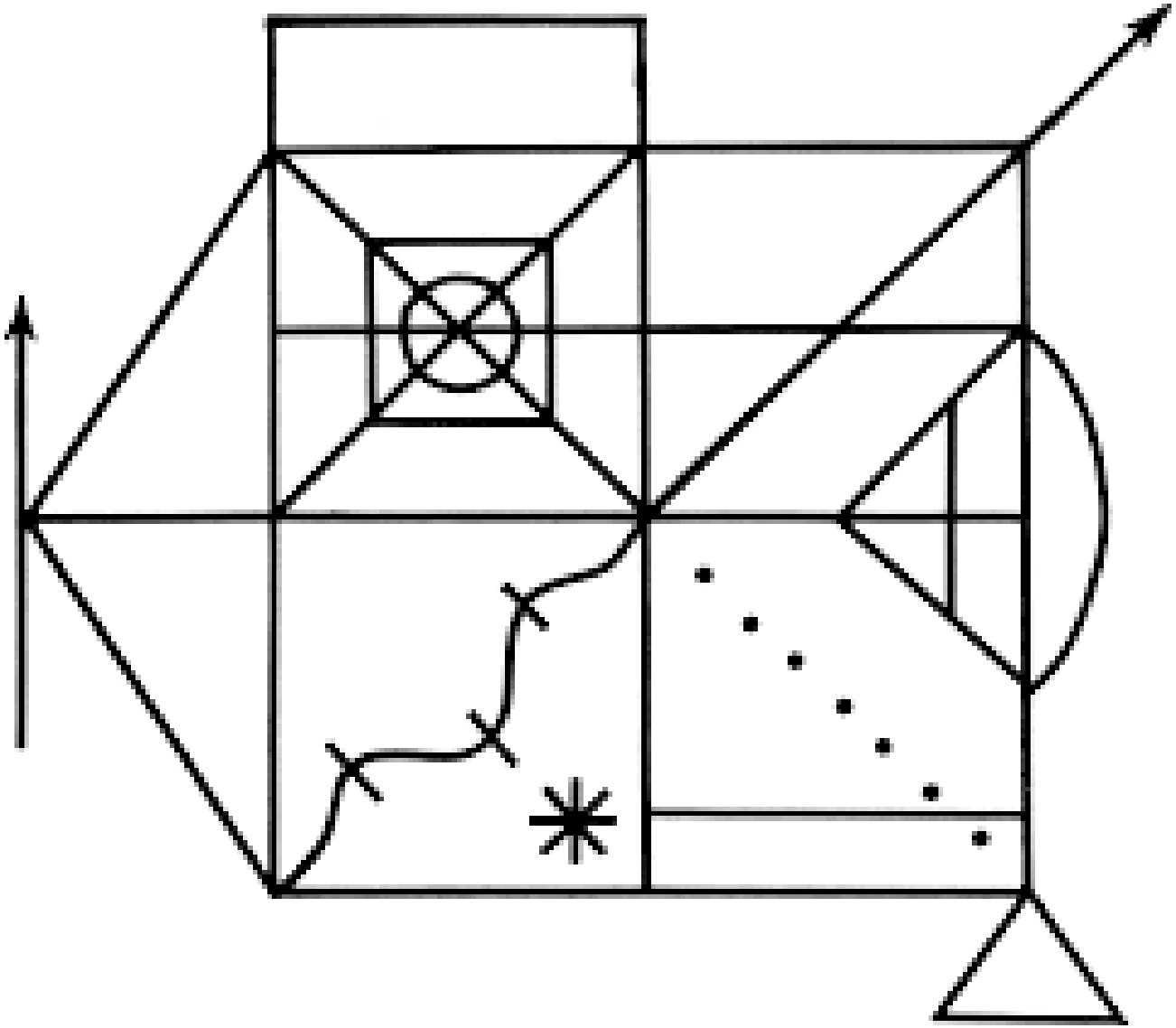
Memory Assessment, and Change After Stroke

- Efficient memory requires the intact functioning of many brain regions
- Common “memory” complaints include:
  - Word finding difficulty
  - Difficulty learning new information (but denial of memory being an issue)
  - Reduced attention and concentration
  - Impaired information processing speed
  - Deficits in organisation
  - Reduced effort and motivation

Visual Memory

- Recall and recognition both important to explore.
- Recall utilises abstract designs or nonsense figures.
- Recognition reduces the need to draw images, and so can be beneficial when physical limitations are a concern.
- Visual learning measures involve similar elements, but with multiple trials

Complex Visual Design



Verbal Memory

- Recall and Recognition
- List learning tasks
- Story recall/structured recall

Non-structured verbal memory

- Desk
- Ranger
- Bird
- Shoe
- Stove
- Mountain
- Glasses
- Towel

- Cloud
- Boat
- Lamb
- Gun
- Pencil
- Church
- Fish

- RAVLT List B

Orientation

- Impaired awareness of time and place is common
- Covered with formalised mental status examinations
- Important to ascertain early
- Also important to repeatedly check

Attention/Concentration

- Intact attention needed for many cognitive processes
- Looking for some measure of capacity
- Often combined with measures of working memory

Information Processing Speed

- How quickly information can be dealt with by the system
- One of the most common deficits after any damage to the brain
- Flow on effects to most other cognitive functions

Language

- Abstract reasoning
- Word knowledge
- Naming
- Receptive and Expressive language

Visuospatial/Constructional Ability

- Recognition
- Discrimination
- Rotation and problem-solving
- Spatial perception

Executive Functioning

- Problem-solving
- Switching
- Multiple-step problem solving
- Divided attention

Executive Functioning

- Motivation
- Inhibition
- Disinhibition
- Sense of reward

blue orange green red purple

red purple blue orange green

green red purple blue orange

red blue green orange purple

Understanding complex processes

- Neuropsychological knowledge and our knowledge of the brain is limited
- We teach patients about the areas of the brain in order to promote understanding
- BUT….The brain is far more complex than this
- Even if you had a perfect before and after map of an individuals brain prior to injury we still don't fully understand how the brain works
  - Pain
    - Altered by mood, perception, different tolerances
  - Memory – how do we remember?

Complex processes

- Memory traces are not stored in any one area of the brain
  - It is distributed throughout the cortex
  - The more complex the task the more areas of the brain which are likely to be involved
- Consensus view in neuroscience
  - Complex memory tasks, indeed most tasks are likely distributed over wide areas of the brain
  - BUT….specific functions can be localised
- Neuropsychology can identify difficulty in ability (such as memory) but need to be cautious about localising this i.e. it's due to damage to the hippocampus.

Post-stroke Emotional Changes

- Neurological – as a result of damage to parts of the brain
- Secondary effects – in response to the changes brought about by the injury
- Adjustment – just because this is normal does not mean that it will be easy.
  - The experience and process through stages can vary widely between individuals

Take-home message “To Do Tomorrow”

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- Consider the difficulties that may not be obvious while in hospital/controlled environment
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Questions?

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