Neuropsychology Hons June Exam 2021 Memo

Question 1

Provide a detailed discussion of the temporal lobes. In your answer mention the localization and basic anatomy of the temporal lobes. Give a functional exposition and discuss the effects of brain damage to these areas. Refer to the case of H.H., give a philosophical perspective to your answer and refer to other case studies and to measuring instruments.

[100]

Memo:

Students are expected to address the following aspects:

(An approximation of the weight (in %) of the issues to be addressed is provided in brackets. These issues will not be evaluated individually and no individual points for sections will be given. The overall balance of the essay is important, yet at Honours level the students are free to focus on areas they regard as more interesting or important).

1. An exposition of the localization of the temporal lobes and a description of their afferent and efferent projections (10)
2. A discussion of the most important functions of the temporal lobes (10)
3. A brief or extended discussion of the deficits associated with injury to the temporal lobes (40)
4. Reference to and a brief discussion of the case quoted and further reference to additional cases (10)
5. A brief reference to one or two psychometric instruments used to evaluate temporal lobe functioning (10)
6. A brief reference to the implications of neuropsychology for a view of man and the world (depth perspective) (10)
7. In addition to the above, answers are expected to reflect a clear framework. An introduction and conclusion to the answer is required. Error free use of language and good paragraphing are required (10)

Question 2

Briefly discuss the three theories that represent the dominant lines of thinking in cognitive neuroscience regarding emotion Using your discussion on these theories as a background, critically discuss the concepts of cognitive asymmetry in emotional

processing and social cognition and where applicable supply relevant examples to support your answer.

[100]

Memo:

1. Neuropsychological Theories (40)

**Marks will be awarded for mentioning and discussing each of the following three theories. Students should supply a brief overview of the information supplied here but they show the ability to focus on the core ideas in each theory.*

- ***Appraisal theories***
  - Our emotions are extracted from our appraisal of internal and external events, which causes an affective response.
  - William James argued that an emotion consists of a change in body and brain states in response to the evaluation of a particular event, for example, fear.
  - Damasio's **somatic marker hypothesis**: when a person is confronted with a stimulus of biological importance, the brain and the body change as a result.
  - Damasio would call the physiological changes in response to a fearful situation "somatic markers."
  - Damasio's theory encompasses a broad range of bodily changes. For example, there may be a change in motor behavior, facial expression, autonomic arousal, or endocrine status as well as neuromodulatory changes in how the brain processes emotional information and other information.
  - Hence, for Damasio, emotions engage those neural structures that represent body states and those structures that somehow link perceptions of external stimuli to body states.
  - Somatic markers thus are linked to external events and influence cognitive processing.
  - Damasio's theory uniquely specifies that the neural control of emotions includes both the brain structures that represent body states and the activity of neuromodulatory activating systems that link them and can produce global changes in neural processing, including, at the extremes, depression or mania.
  - A key aspect of Damasio's somatic marker hypothesis is that emotion is fundamental to the individual's survival within a particular environment.
  - Damasio's theory emphasizes that emotion is not only a fundamental experience for all higher animals but also a necessary one in order for humans to make rational decisions—especially in situations in which a person faces risk or conflict.
  - People with reduced emotions, such as frontal-lobe patients, thus show impairments in personal or social matters, especially when they include possible risk or conflict.
  - The role of our emotions, especially subtle emotional states, is obviously not always conscious, and thus we may be unable to account for why we behave in certain ways.

- ***Cognitive-emotional interaction theory***
  - Emotions evolved to enhance animals' survival, and as the brain evolved, cognitive and emotional processes grew more and more interrelated.
  - In contrast with Damasio, Joseph LeDoux (2000) has not tried to account for all emotions but rather has chosen one—namely, fear—as an exemplar of how to study brain–behavior relations in emotion.
  - In LeDoux's view, all animals inherently detect and respond to danger, and the related neural activities eventually evolve to produce a feeling—in this case, fear.
  - An important implication of LeDoux's theory is that our fear system includes both unconscious fear responses and conscious awareness of feeling fear.
  - He presumes, however, that the neural system underlying fear is similar in both unconscious and conscious responses and that the neural basis of fear can be studied by using a model system, which is fear conditioning.
  - Most behavioral studies of fear employ classical conditioning.
  - The key brain structure in developing a conditioned fear is the amygdala, which sends outputs to stimulate hormone release and activate the ANS and thus generates emotion that we interpret in this case as fear.
  - Damage to the amygdala interferes with fear conditioning.
  - People with temporal-lobe damage that includes the amygdala are impaired at fear conditioning, and imaging studies show activation of the amygdala during fear conditioning.
  - How does the amygdala "know" that a stimulus is dangerous? LeDoux proposes two possibilities. Both implicate neural networks, one genetically evolved and one shaped by learning.
  - Genetically based neural networks in the amygdala evolve with the animal
  - Neural networks based in the amygdala likely also learn from experience about dangerous stimuli for which evolution could not prepare us.
  - LeDoux proposes that these circuits in the amygdala interact with cortical circuits to influence affective behavior.
  - An important aspect of fear is context: a particular stimulus can be dangerous in one setting but not in another, and this distinction is clearly important to our behavior.
  - The extreme power of fear-related events to affect cognition suggests that evolution has crafted a powerful mechanism for forming such associations.

- ***Cognitive asymmetry***
  - Because significant asymmetries exist in a variety of cognitive functions, it follows that related emotional systems also must be lateralized.
  - This idea can be traced back at least to the 1930s, when clinicians reported detailed observations of patients with large unilateral lesions, noting an apparent asymmetry in the effects of left- and right-hemisphere lesions on emotional behavior.
  - Kurt Goldstein (1939), who suggested that left-hemisphere lesions produce "catastrophic" reactions characterized by fearfulness and depression, whereas right-hemisphere lesions produce "indifference."
  - The right hemisphere normally plays a major role in producing strong emotions, especially emotions regarded as negative, such as fear and anger.

- Gainotti notes that the two sides of the brain play complementary roles in emotional behavior, the right hemisphere being more engaged in the automatic components of emotion and the left hemisphere in the overall cognitive control of emotion. The left hemisphere is presumed to have this general control because of language.
- Evidently, the speaking left hemisphere can make logical inferences about sensory events that the nonspeaking right hemisphere cannot make.
- Gainotti applies this general idea to emotion and concludes that the right hemisphere generates emotional feelings, whereas the left hemisphere interprets these feelings, presumably through its language abilities, and produces a conceptual (cognitive) level of emotional processing (affective behavior).

2. Asymmetry in Emotional Processing (30)

- Cerebral asymmetry - the possibility that the two hemispheres play complementary roles in controlling emotional behavior.

- ***Producing emotional behavior***
    - Mood is inferred largely from affect—facial expression, tone of voice, and frequency of talking—and so it is sensible to measure these behaviors first in analyzing emotional behavior in brain-damaged people.
    - Left-hemisphere lesions, especially left-frontal-lobe lesions, produce a flattening of mood and in many people an appearance of depression, especially after strokes that produce language difficulties.
    - Facial expression is among the most obvious cues to emotion in humans, and overall, studies of neurological patients find a reduction in the frequency and intensity of facial expressions in people with anterior lesions relative to those with more-posterior lesions.
    - In contrast with the reduction in facial expression from both left- and rightfrontal-lobe lesions, the effects of side of the lesion on spontaneous talking in frontal-lobe patients differ. Right-frontal-lobe lesions appear to increase talking markedly, whereas left-frontal-lobe lesions decrease it.
    - Spoken language carries two types of information: **content** and **prosody**. Typically, content is a function of the left hemisphere, and there is reason to suspect that tone of voice is a function of the right.
    - **Aprosodia** – absence of tone in speech.
    - **Motor aprosodia** - an inability to produce affective components of language, is proposed to result from damage to Broca's area in the right hemisphere.
    - **Sensory aprosodia** - a deficit in interpreting the emotional components of language, is presumed to result from damage to the region in the right hemisphere analogous to Wernicke's area.
    - Ross and Monnot (2008, 2011) used the Aprosodia Battery to assess stroke patients and found that although both left- and right-hemisphere lesions affect prosody, different patterns of deficits follow left- and right-side brain damage.

- They concluded that affective prosody is a dominant and lateralized function of the right hemisphere. They also found a decline in accuracy of prosody processing in aging, which they took as evidence for a general decline of right hemisphere cognitive functions in aging.

- ***Interpreting emotional behavior***
  - The importance of **interpretation symptoms** in understanding personality change after injury has led to the development of a variety of clinical tests of emotional perception.
  - Right-hemisphere lesions produce deficits in a range of measures, especially including comprehending humor, as well as judging mood, both in tone of voice and facial expression.
  - Not only do right-frontal-lobe patients fail to comprehend humor, in our experience, their efforts at humor exhibit a perverse aspect.
  - Patients with lesions of the right temporal or right frontal lobe or both have difficulty recognizing facial expressions.
  - Facial expressions appear not to be a single stimulus category; rather, different expressions may be processed separately in the brain, e.g. expressions of disgust processed in gustatory cortex.

- ***Temporal-lobe personality***
  - The general clinical impression is that temporal-lobe patients exhibit a clear personality change.
  - For example, humorless sobriety, dependence, and obsession.
  - Right- and left-temporal-lobe patients could be distinguished: the right-temporal-lobe patients were described as more obsessional, and the lefttemporal-lobe patients as more concerned with “personal destiny.”
  - ***Student must supply examples when discussing this section.**

3. <u>Social Cognition (30)</u>

- **Social neuroscience** seeks to understand how the brain mediates social interactions.

- ***Cerebral lesions in humans***
  - Frontal and temporal lesions in humans result in deficits in producing facial expressions and social speech, impair the perception of facial expressions and emotions relative to specific social contexts, and change personality.
  - Lesions to the insula not only increase pain threshold but also impair the ability to recognize pain in someone else.
  - Amygdala lesions impair the recognition of fear in others.
  - Bilateral damage to the ventromedial prefrontal region produces grave impairments of social conduct, decision making, and emotion processing.

- Such patients are also described as having poor judgment regarding their personal and occupational affairs and making poor decisions in laboratory tasks designed to measure complex decision making.
- Isolated case histories suggest social changes related to lesions in the temporal–parietal junction (TPJ) and anterior cingulate cortex.

- ***Social neural networks***
  - Four social related brain networks:

    1. Amygdala network. Including the orbitofrontal cortex and temporal cortex as well as the amygdala, this network's functions range from triggering emotional responses to detecting socially relevant stimuli.

    2. Mentalizing network. This collection of structures related to thinking about the internal states of others includes the superior temporal sulcus and anterior temporal cortex, providing a mechanism for understandingothers' actions.
    3. Empathy network. Structures recruited when individuals empathize with others include the insula and cingulate cortex. The empathy network can attribute intentions to others, something we humans do automatically. Indeed, humans seem compelled to attribute intentions and other psychological motives even to nonhumans and abstract animations.
    4. Mirror/stimulation/action–perception network. Activated when observing the actions of others, this network includes the mirror neuron systems of the parietal and premotor cortex and is also thought to be involved in developing our concept of self.

- ***The self and social cognition***
  - Humans are aware not only of the actions and intentions of others but also of their own: **we are self-aware.**
  - Two distinct neural networks in frontal-lobe structures appear to be critical for generating the "self": (1) a **right frontoparietal network** that overlaps the mirror/stimulation/action–perception network, and (2) a **cortical midline network**.
  - Humans and apes have a unique ability to recognize themselves—the **self-face** in a mirror.
  - The right hemisphere of a split-brain patient can recognize the self-face, and the physiological reaction to the self-face is greater for the right than the left hemisphere.
  - Both imaging and patient data provide evidence that a right frontoparietal network controls recognition of the self-face.
  - Because the frontoparietal mirror neuron network and the medial frontal network seem to be involved in self–other representations, they likely interact to maintain self–other representations across multiple neural domains.

Question 3

A 70 year old man is brought to the clinic by his son, who explains that his father has been getting gradually and progressively more forgetful over the past few years. The patient has also forgotten recent important events, such as the passing of his beloved dog. Recently, he has experienced episodes of getting lost while walking home from the grocery store, which is a few blocks away from his home. The patient explains that he can still remember the “good old times”, and still enjoys going to the community rec center to play backgammon with his friends. His son notes that he now manages his father’s finances, and is also in charge of coordinating his health care. The patient is only able to recall 2 out of 5 objects on the short term memory recall test. His past medical history is unremarkable: he has no history of head trauma, does not take any medications, and denies using alcohol or illicit drugs.

1. From your understanding of intellectual decline identify the patients likely diagnosis and from the brief history above motivate/substantiate your answer including providing the areas of brain functioning effected. (20)

2. Describe to your patient’s son the following:

a. The possible known or researched causes of the disorder. (10)

b. The pathological changes one can expect to see in the brain. (20)

c. The progressive neurobehavioural & psychosocial deficits anticipated. (30)

d. Implications regarding the course and management of the disease.(20)

Memo:

(1) Dementia of the Alzheimers Type

WAIS Subtests differentiate between DAT and VaD

• DAT

– Marked impairment - digit symbol & block design

– Moderate impairment – object assembly,

similariGes, digit span, informaGon & vocabulary

• Severe deficits in memory performance, incl. loss of

info about objects & object names

• DEMENTIA: POOR LEARNING, RETENTION, RECALL &

RECOGNITION

(2) (a) Causes: unknown but research suggests the following
– Accumulation of tau protein

– Genetic predisposition

– High levels of aluminum in the brain (not all DAT sufferers

exhibit high aluminum levels

– Immunological abnormalities – antibodies against brain tissue

– Poor blood circulation – decline of blood flow to brain enhanced

without compensation of more efficient oxygen uptake

– Slow virus

• Can only be confirmed by biopsy or autopsy identifying

presence of neurofibriallary tangles (in much higher proportion to

normal aging persons)

• Higher density -> greater psychological disturbance

• (b) Increased presence of brain atrophy

Brain atrophy (increased width of sulci and dilation of ventricles)

• Neuritic Plaques resulting from accumulation of tau protein in the cortex -> cog. Deterioration

• Neurofibrillary tangles on cerebral cortex and hippocampus (possibly related to tau protein)

Neocortical changes (assoc. with decline in higher order fx)

 most extensive degeneration found in posterior parietal,

inferior temporal & limbic cortices

• Limbic system (assoc. with emotion, behaviour, memory & drives) severe degenerative changes

Cell and neurotransmitter degeneration and shrinkage

Slow onset with steady, gradual progression

• (c) Impairments in following areas of cognitive Fx:

– Concentration

– Memory

– Orientation

– Social functioning

– Self-care

(d) Early to middle stages - progressively declining:

• Compensation to hide losses & avoid embarrassment

• Forgetfulness

• Loss of abstract thinking with difficulty understanding

• As DAT progresses, increased difficulty to remember

new info and forget names, numbers etc

• If tasks interrupted, they may be left unfinished and

be forgotten -> danger e.g. stove left on

• Confusion and disorientation

• Depression due to realization of decline

Middle to later stages: • memory loss for past and recent events

• Speech and language -> impoverished, concrete, tangential

• Inarticulate & difficult to understand -> muteness

• Loss of insight • Depression alleviates

• Poor judgment, impulse control, and disinhibition

• Poor self-care

• Personality changes (increased aggression/withdrawal)

• Rapid changes in emotion

• Psychotic symptoms (incl. paranoid delusions, VH)

• Vegetative presentation mute, incontinent etc