

Student number/ Numéro étudiant -----

## UE Higher Brain Functions

T. Michelet.

3 questions, 1 hour

**“Draw” your answers on page 2 for question 2b and indicate your student number on the top left of this page.**

Unilateral neglect has been described after lesions in many different parts of the brain. Extensive clinical experience shows that the left unilateral neglect which emerges after one hemisphere damage is far more common, more extensive and more lasting than the analogous right unilateral neglect. This has led to the postulation of a model which assumes a hemispheric specialization for directed spatial attention.

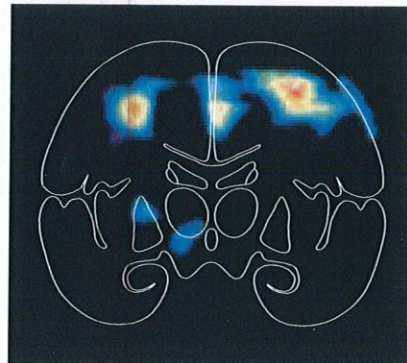
- 1) Which cortical lobe (we will call “B”) is thought to be mainly involved in visuospatial neglect?
- 2) In the figure 1, the fMRI activity of right and left lobe “B” is shown after a subject has been asked to attend to objects in the left visual field (A) or to attend to objects in the right visual field (B).

(A) Attending to the left visual field



Left hemisphere      Right hemisphere

(B) Attending to the right visual field



Left hemisphere      Right hemisphere

Figure 1

- 2 a) Describe these results and explain what does this arrangement implies regarding hemispheric specialization for directed attention.
- 2 b) Based on your answer to question 2a, cross out the lines presented on the figure 2 as if you are a patient with damage to the left “B” lobe (answer on the left panel of figure 2) or with damage to the right “B” lobe (answer on the right panel of figure 2). Justify briefly your answers.

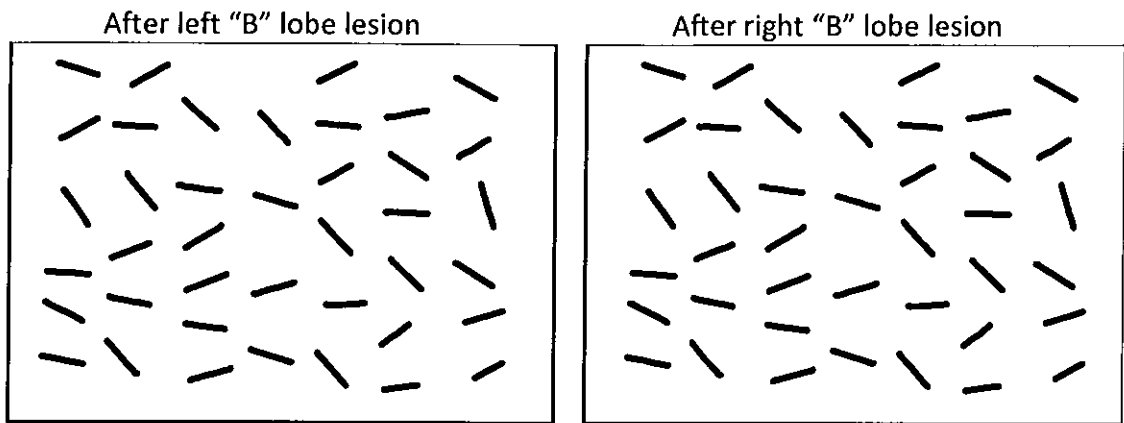


Figure 2

- 2c) Explain what could be the performance in the same task for a patient suffering from a left hemianopsia.
  
- 3) One problem if you are interested in studying the neuronal basis of spatial visual attention is to confound neuronal activity related to eye movement and attentional related activity:
  - 3a) Could you propose an experiment to overcome this problem?
  - 3b) What different sorts (2) of attention this experiment hence involve? Give a brief definition of each.
  - 3c) Explain how, thanks to this kind of experiment you will also be able to study top-down and bottom-up attention. What behavioral measure would you record in order to test the benefit of top-down over bottom-up attention in behavioral task?

**Master Biology and Health,  
Mention Neuroscience, M1 NeuroBIM**

**UE HIGHER BRAIN FUNCTIONS**

**Tuesday 8<sup>th</sup> of January 2019**

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*Please, answer on two separate copies to two out of the four following questions. Each subject corresponds to one hour essay.*

**Subject from Aline Desmedt (duration: 1h00)**

1-Define a “cognitive process” and explain to what extent such process is “complex”, and thus tricky to analyze with traditional approaches.

2-Explain to what extent the two radical positions, which are “dualism/disjunction” and “materialism/reductionism”, necessarily fail to explain such cognitive process. Illustrate these two positions by a schematic representation.

3-Finally, propose a new method that may allow the analysis, and thus the understanding, of this complex process.

**Important: maximum 2 pages.**

**Subject from Etienne Coutureau / Alain Marchand (duration: 1h00)**

In an experiment published in *Current Biology* (2013), Robinson and Berridge examined the effect of primary motivation on conditioned responses. Rats implanted with an intraoral cannula were placed in a conditioning chamber and received 25 presentations of a sound accompanied by the extension of a lever (lever 1) into the chamber. At the end of each 10s-long presentation, a very salty (unpleasant) solution was directly infused inside the mouth. During the same session there were also 25 presentations of a different sound and another lever (lever 2) that were followed by the infusion of a palatable (pleasant) sucrose solution. When the rats received a solution in their mouth, they presented typical orofacial expressions indicating “disliking” or “liking”.

**Question 1** (2 points): Is it a Pavlovian or an instrumental task? Justify your answer.

**Question 2** (3 points): Identify the conditioned stimulus, the unconditioned stimulus and the unconditioned response for each lever.

**Question 3** (3 points): What conditioned reactions do you expect upon presentation of lever 2 (with the corresponding sound)?

**Question 4** (4 points): How do you expect conditioning to distribute between a lever and the corresponding sound?

After conditioning, the authors observed upon presentation of lever 1 (with the corresponding sound) that all rats turned away and retreated to another part of the chamber. On the next day, the rats were tested again in the same situation, but after an injection (deoxycorticosterone and furosemide) which mimicked sodium deficiency (salt appetite), a condition never encountered in laboratory rats but frequent in wild animals. Upon the first presentation of lever 1 (and sound) in the new motivational state, the authors observed an avid approach, accompanied by nibbles and sniffs, as well as orofacial expressions indicating “liking” near the end of stimulus presentation.

**Question 5** (3 points): Why is it important to analyze the response to the first presentation of lever 1 (and sound)?

**Question 6** (3 points): Is this result compatible with a Stimulus-Response or a Stimulus-Stimulus account? Justify your answer.

**Question 7** (2 points): What can you say about reactions such as nibbling (biting) or licking directed toward a lever? How could we test if the lever has acquired properties of an unconditioned stimulus?

**Subject from Thomas Michelet (duration: 1h00)**

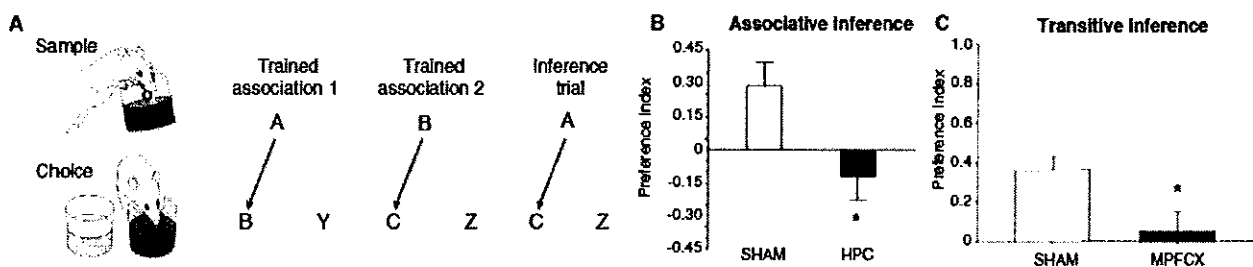
(Answer on attached sheet)

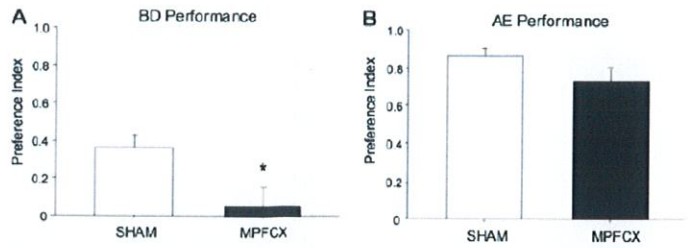
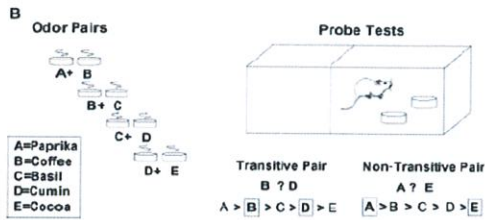
**Subject from Jacques Micheau (duration: 1h00)**

Relational memory belongs to declarative memory system. The group of Howard Eichenbaum has designed protocols aimed at investigating this form of memory in rodents.

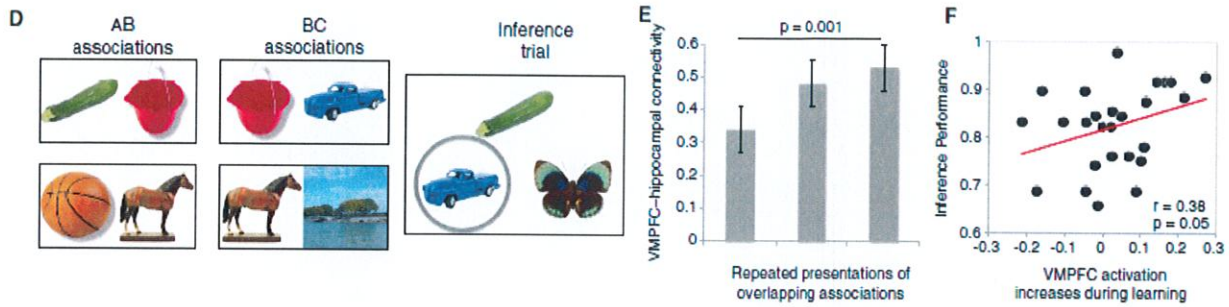
**Question 1** (5 points): define relational memory and precise to what extent relational memory is modelled in rodents.

**Question 2** (5 points): in the following figures the roles of the hippocampus and the medial prefrontal cortex in relational memory have been investigated in two similar tasks. Describe both tasks. In which way are they subserving relational memory? Which first interpretation could be postulated?





**Question 3 (5 points):** a similar task pictured below has been used to investigate relational memory in Human. Describe this task and the data depicted in the figures E and F. Sketch an interpretation.



Current Biology

**Question 4 (5 points):** could you provide further compelling arguments that are strengthening this interpretation? Your response should be precise and detailed. Conclude by giving your opinion on the way brain structures are interacting to sustain a memory function.