# Assignment 3: Learning and Memory PSY 306 (Winter 2021)

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**Instructions:** Please write your own responses and do not copy or lift text/code from any source. If you are referring to credible external sources other than the attached paper for your answers, please cite those sources (within the body of text and the provide a reference list at the end) in the APA citation format (https://www.mendeley.com/guides/apa-citation-guide). Word limits given are indicative and less than the indicated numbers may also be used.

**Please download this MS word question-cum-response template to TYPE your answers and feel free to add sheets as required. Convert this document to a PDF and rename the file: name_roll no. before submitting. Please note that answers in this template only will be evaluated and hand-written or scanned answer sheets will not be evaluated. Please submit only ONE PDF and no extra files as it increases the time to evaluate them. DO NOT change the basic structure of the template. DO NOT remove the marks assigned for each question.**

**[Strict deadline for submission: 24 April, Saturday, 11:30 PM]**

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**Q1) Please read the attached article on Working Memory by Baddeley 2010 and answer the following. Please refer to other credible sources (if needed) to answer but be sure to cite them. [Total word limit ~ 700 words (including sections A-B)]. Begin each sub-section of a question in a different paragraph.**

**A) Explain Atkinson and Shiffrin's model of memory. What was the basis or evidence that led to the formulation of the Atkinson and Shiffrin's Model? Briefly explain the drawbacks of the Atkinson and Shiffrin's model of memory [4 + 3 + 3 points]**

According to their model the memory consists of a series of storage systems in which data flows from the outer environment to a series of temporary perceptual buffers,(which seem to be part of the perceptual process) before being transferred to low space capacity memory(short term) which is being finally passed to long term memory. According to Atkinson and Shiffrin's model this short term memory serves as the working memory. This part only regulates the information flow to and from the long term memory.This memory therefore plays a very important role in cognition and learning.

The model was based on an approach of cognitive neuropsychology.This includes applying methods and concepts of cognitive psychology to people with impairment in the brain. Because of a few very influential cases and many other cases of impairment in the brain, scientists were able to better understand memory and give theory on its working. Atkinson and Shiffirn's model was one of them.

The major drawbacks of the model:
> According to their model, long term learning is mostly dependent on maintenance of short term memory. It means it is kind of guaranteed that there will be long term learning if there is good maintenance of short term memory. This was proved to be wrong as it was found that other factors also have a major effect on long term memory and its formation.
> According to their model, a person would not be able to learn if there's a problem in their short term memory. As it is the short term memory because of which a person finally is able to learn for the long term. This was proved to be wrong as there were patients whose short term memory were hampered but were showing normal long term memory formation.

**B) Explain the Baddeley and Hitch's Multi-Compartment Memory Model. Elaborate the Phonological Loop in the above model with descriptions of 'Phonological Similarity Effect' and 'Word length Effect'. Outline two differences of the above model from Atkinson and Shiffrin's model. Briefly describe the Cowan's Memory Model by citing similarities and differences from the Baddeley and Hitch's model [3 + 3 + 2 + 2 points]**

They proposed a model consisting of three components.It consisted of an management system which controls attention(the central executive), this was supported by two short term distinct and independent storage mechanisms, one for visual information(The visuo-spatial sketchpad) and one for phonological material(the phonological loop).

Phonological loop is a part of the model which deals in the form of audio or video of language data.It consists of two important features. The first is a very short kind(about 2 seconds) where speech-like info is stored. Second is the method of refreshing those pieces of information by real time oral or subvocal practice.
When sounds of a list of words are very similar, immediate recalling is very much hampered. This is a phonological similarity effect. While similarity in meaning has a very little effect on recalling.
If the length of a word in a list is increased or it takes more time to spell the words in the list than the immediate recalling is declined, this is known as word length effect.

Two differences of above model from Atkinson and Shiffrin's model are:
>In the above model they modified the idea of a single system with one that includes at least three distinct and linked(interacting) subsystems.
>The above model is capable of parallel processing which discarded the idea of a system of consecutive stages.

Cowan proposed a model where he defined working memory as a process in the brain(cognitive process) that keeps information in an unusual open(accessible) state. This model also talked about the process of rehearsing which was very similar to Atkinson and Shiffirin's model, but this model took the working model as different from short term memory. This model was more focused on attention rather than short term memory as Atkinson and Shiffrin's model.

**Q2) Please watch the attached video by Prof. Neil Burgess (Institute of Cognitive Neuroscience, University College London) and answer the following questions based on your understanding of the video.**

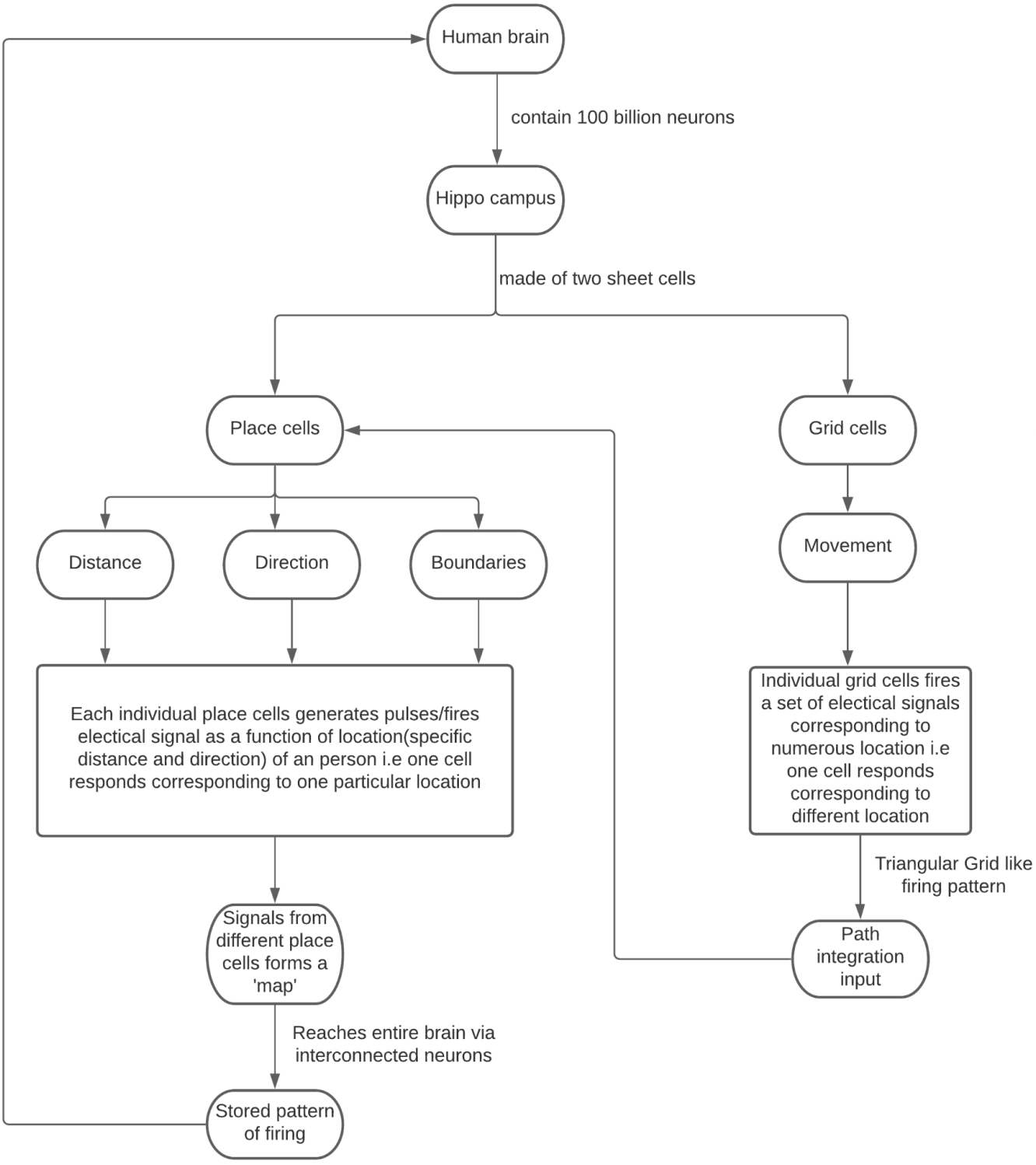
**[All figures/schematics should be properly labelled and should have accompanying captions/legends to provide all information necessary to interpret the same…]**

**A) You are in the library and just found a place in the reading room. You settle down to study when you get a call and must step outside the library to take the call. After finishing the call as you are going back to the reading room your brain helps you navigate to the location in the library that you chose for yourself. Draw a schematic or a flowchart and briefly explain the steps of the neural mechanism which will help your brain remember the location in the library that you chose for yourself and guide you to your destination.**

**[8 points]**

We can explain the phenomena using these steps:
>While entering inside the library the place cells(present in the memory) generate electrical signals corresponding to different distances and directions as well as the walls and boundaries of the library till I reached a place and seated down.
>The firing patterns form a map and reach the entire brain via interconnecting neurons and get stored in the memory part.
>When I walked out again the place cells generate electrical signals in such directions which best matches with the stored firing pattern.
>Path integrating signals sent to the place cells via grid cells which forms a grid firing pattern. These grid cells helped me to use my movement to find out the way out of the library. Similarly above two steps occur while returning back to the library. The set of firings tried to match with the stored pattern of firing.
>Hence both place cells(via direction, distance and boundary detection) as well as the grid cells(via path of movement) together guided me back to my location.

we can understand this using below diagram:


Human brain
contain 100 billion neurons
Hippo campus
made of two sheet cells
Place cells
Grid cells
Distance
Direction
Boundaries
Movement
Each individual place cells generates pulses/fires electical signal as a function of location(specific distance and direction) of an person i.e one cell responds corresponding to one particular location
Individual grid cells fires a set of electical signals corresponding to numerous location i.e one cell responds corresponding to different location
Triangular Grid like firing pattern
Signals from different place cells forms a 'map'
Path integration input
Reaches entire brain via interconnected neurons
Stored pattern of firing

**B) You attended the last campus book fair and bought a book from a stall. If you were to remember that episode how would your brain recreate the visual scene? Briefly explain the neural mechanism. [2 points]**

Place cells in the human brain get activated via dense interconnections. This in turn will reactivate the boundary cells creating a spatial structure of the campus book fair. After which the grid cells will move those viewpoints through that space(spatial structure), head direction cells can then help in defining the viewing direction by acting as a compass based on the viewpoint, through which it will generate an sight of the visual imagery by recreating the spatial structure(campus book fair).