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Investigation of the memorization process

Abstract

Memorizing involves many processes that are not fully known. This research area is just as exciting for contemporary scientists as well as it was for the ones in antiquity, considering the crucial importance of memory in human life and personality. In the last decades important steps in the knowledge of the memorization process were made by cognitive neuroscience. The paper focuses on the analysis of this process with references to its early known beginning. The study first analyses this topic in Plato's work and continues with opinions of other scientists/philosophers. Analogies between earlier and current theories, including dynamic aspects of the store, retain and recall of information, drive us to a personal point of view referring to the interpretation of Plato's book, The Republic; therefore, new directions of investigation referring to the entities and processes from human body can occur in the next future.

Keywords

Memory, History, Plato

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1 INTRODUCTION

Using a general description, memory is the capacity of the nervous system to store, retain and recall information.

It was considered that reptiles had a brain totally biologically pre programmed, that there is no possibility to learn new behaviours, which is probably why they disappeared, not being able to adapt to new situations [1].

The man has a brain with biological inscriptions, but above this there is the median brain (the limbic system) and over this one is the cortex. The limbic system allows learning and memorisation, in fact representing a start in the process of memorisation. The cortex will catch up and cast the perception of human brain. The human's cortex is split in two parts, named the left hemisphere and the right hemisphere. The left hemisphere is the main responsible with receiving and producing the language and the right hemisphere coordinates images and analogies. It is supposed that in the left hemisphere there is a digital modification of the language, unlike the analogue method used by the right hemisphere. The left hemisphere is responsible of detailed analysis, sequential logics and the right hemisphere makes an overall image, identifying images [2].

2 BRIEF LOOK ON THE HISTORY OF MEMORIZATION PROCESS

Philosophy, the main goal of study in Academia in ancient times, was focused, between others, on the 'Theory of Ideas'.

Human natural evolution can be considered as a development of analysis and perception abilities of different aspects existing in the surrounding area. The seed of the theory of perception appears first in Plato's work [3].

Plato is one of the greatest philosophers of all times, known as the most skilful person in the organisation of ideas. He believed that the eyes are bounded to astronomy and that the ears are bounded to harmonic movements: 'there are chances, I say, that as eyes are attached to astronomy (astronomy that assures the movement of what has deepness) ears are attached to harmonic movements in the same way and that these knowledges to be sisters, as the Pythagoreans say it and us, Glaucon, we agree with them'. Also he considers that the visual fire coming from the eyes unites with light to allow to the movement of objects to go to sensorial [4].

Plato considers representation the first activity of thinking, without confusing the impression of sensations with the right judgement. In his opinion, idea begins from the multitude of senses and becomes a unity during the right judgement when we remember what the soul once saw, in the earliest time, at the beginning of the world [5]; this is also presented in the Solomon' judgements, in the Bible [6].

Plato used the allegory of the cave to present us our nature referring to education and ignorance, during a fictional dialogue between Socrates and Plato's brother, Glaucon. The representations formed in our brain represent the result of a simulation of objects. This is why people from the cave tightened to legs and backheads are bound to watch shadows of other beings, projected on a wall, due to fire [7]. Now it is established that this simulation of objects, the representation of different shapes, is dynamic and the process of memorization for a longer period depends on their stability.

In order to learn fast, for storing up different things apprehended on a period of time as long as possible, in order to maintain a good judgment, Plato considered that the man's mind must have 'a good thick of wax, smooth and kneaded to the right consistency', so that the information is imprinted easily and deep, as seal in wax [4].

Nowadays, as in ancient times, it is used the comparison between the printing of an image of a coin or a seal into a piece of clay, and on the other hand the concept of neuroplasticity, referring to the reorganization of the neural circuit in the brain during the formation of new knowledge, due to sensory stimulation or experience [8].

However, it was recently proved that not only the nervous cells of the brain – neurons –, but also the glial cells contribute to the memory formation [9]. The glial cells, which form myelin, were discovered in the 1800s, and received this name after the Greek word which means glue. They sustain the nervous cells, feed them and participate to the process of thinking. The exact process is not known yet. The octopus, the cleverest of the invertebrates has no brain; its memory is due to glial cells [10]. One thing to be noted is that the inferior parietal area of Einstein's brain is 15% bigger than usual; this area is responsible of mathematical thinking, visual spatial knowledge and the imagery of movement; the number of glial cells in left parietal lobe is greater as usually; this lobe is responsible of the association, incorporation and synthesis of information from many regions of the brain [11].

Considering the storage of information during childhood, Plato writes that young people are not capable of differentiating what is allegoric; they will maintain intact in their minds all ideas received at that age [7].

Robert Hooke presents memorized ideas as distinct materials situated on spirals or coils of the brain [12].

In [12] also it is presented a synthesis of the theories referring to 'how a *trace* might represent past experience', using local representations but also 'different *distributed* models of memory traces'.

Relative recently it was discovered that the pineal gland is an endocrine gland that produces the melatonin hormone; the quantity of melatonin decreases during daylight and increases during night [13]. If the pineal gland has barely been analyzed by nowadays scientists, in the past it was considered to be a connection between the physical world and the spiritual one, and also it was called the third eye. Descartes gives great importance to pineal gland in the process of memorization [14].

3 REMINISCENCE

Reminiscence represents a refresher of information after a long period; it depends of a good memory, but the manner in which we learn is very important, as well as arranging the information. The period of sleep, or any other activity which seems a break from learning, even the change of the area of study, helps the right hemisphere of the brain to clear up the information.

Plato's work is filled with methodological rules for scientific study. What he loved the most, as he writes himself, were the divisions and collections: 'Believe me, Phaedrus, I am myself a lover of divisions and collections, that I may gain the power to speak and to think, and whenever I deem another man able to discern an objective unity and plurality.' [5]

However, Descartes is the first who approaches these methodological rules in his works, such as 'Rules for the direction of the mind', 'Discourse on Method' and 'Meditation'.

Descartes brings forward the organisation of thinking, so that three of four simple rules that he enumerates in description of the process of investigation of the unknown refer to the process of organisation: the division of each problem difficult to study in simpler parts, the ordering of the thoughts from simple and easy to complex and the overall view.

'The second (rule), to divide each of the difficulties under examination into as many parts as possible, and as might be necessary for its adequate solution.' [15]

'The third, to conduct my thoughts in such order that, by commencing with objects the simplest and easiest to know, I might ascend by little and little, and, as it were, step by step, to the knowledge of the more complex; assigning in thought a certain order even to those objects which in their own nature do not stand in a relation of antecedence and sequence.' [15]

The forth rule refers to complete enumerations and general view on the subject: 'And the last, in every case to make enumerations so complete, and reviews so general, that I might be assured that nothing was omitted'. [15]

Organization is necessary in the process of recall of information, because information is transferred from the short term memory to the long term memory.

Referring to forgetting, Plato says that the information is taken by time somewhere else [7].
Aristotle, Plato's student, refers at the connection between recall and the positioning in time of information: 'But the point of capital importance is that (for the purpose of recollection) one should

cognize, determinately or indeterminately, the time-relation (of that which he wishes to recollect)' [16].

To recall information from memory is necessary 'to gather from deep furrow, from the bottom of the mind, where precious advice grows' [7]. Because for a deep furrow is necessary to bevel the ground, the analogy makes us think at the spirals – bases for ideas – from Hook's theory.
Plato proposes some methodological rules to recall information stored long time before: 'I must first of all run over the narrative in my own mind and then I would speak (...); on my way home, yesterday, I communicated the tale to my companions as I remembered it; and after I left them, during the night by thinking I recovered nearly the whole it. (...) As soon as the day broke, I rehearsed them (...) to my companions (...).' [4]

It is known to each teacher or to any other person who wishes to transmit information to others, that teaching develops the capacity of the speaker to solve problems even during his speaking, sometimes surprising himself of the capacities of his brain; the same thing is presented by Plato in the second rule. Also, it is known the saying 'To take counsel on one's pillow', which advices through folk wisdom to take important decisions after a delay of a night.

4 NEW INTERPRETATION OF THE REPUBLIC OF PLATO

After having investigated a part of Plato's work with the purpose of summarizing the memorization process, I concluded that his book, *Republic*, has as main subject not the state as a collection of citizens and their interactions, but the human body, with all its constituents and processes, in the ideal manner. For such reason appear the well known Plato's contradictions. Even Plato wrote that the subjects present many contradictions.

For example, he describes a kind of warriors, the guardians of the city, with a 'temperament in a high degree both passionate and philosophical', who have a strange behaviour. They must be 'gentle to their friends and fierce with their enemies', 'trained in gymnastic and music', the women with their natures 'assimilated and brought into harmony with those of the men' and 'all wives and children were to be in common'. Also some children will assist to the battles of their parents with the scope to memorize the enemies and the battle until they grow up. The leaders will be philosophers who love wisdom more than anything and can fight to keep the laws and the institutions of the city; they necessarily must have a good memory, and for that to be full of measure and grace; also to know very well the nature of each image and to find the real object that represents it, they must descend in the common house, in the darkness.

On the other hand, in the human body the immune system fights against pathogen agents but can also auto damage the self body. For example, it is known that stress and the discomfort that may occur at the beginning or during studying bring the initiation from the limbic system of the hormones of stress that block the ideas [2]. Also, there are lymphocytes which memorize pathogen agents (for example: the T and B cells) so that they can remember the same kind of pathogens at a new attack. It was proved that the white blood cells of the immune system contribute to the memorization process [17] and furthermore, the melatonin, called the hormone of darkness, interacts with the memory and immunity system, but the processes are not clear yet.

5 CONCLUSIONS

The works of great philosophers and scientists of antiquity, and others, sometimes remain in the shadow of the appellation *classic* not necessarily because there are wrong theories, but because a great part of them is not understood for different reasons; one of them is allegory as manner of presentation.

In this paper the author tried to make a once-over in the processes of memorisation and remembering especially from the works of known philosophers, and comparing them with the results of actual studies. In the conclusion of this study I propose a new interpretation of Plato's work, Republic, not as a collection of citizens and their interactions, but as a human body, with all its entities and processes.

A thorough interdisciplinary study can offer different results than the ones found so far on the content of the other works.

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