

Memory and Forgetfulness: Two Opposite Investigations from Neuroscience or Psychoanalysis

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Abstract

There are thousands of works devoted to human memory, from the time of ancient Greece (Aristotle [1]) to the present day. Among these, we can cite speculative and then psychoanalytic approaches. The development of neurosciences and the ensuing electrophysiological or medical imaging techniques allow us insights into the ways information processing is specialized. In addition, the biochemistry and pharmacology of memory gradually unveil the neurotransmission systems and the receptors that are involved, at the level of synapses, in the structural changes establishing long-term neuronal circuits [17]. With its development, neuroscientists believe that they can explain the whole brain behavior, including the memory process.

Paul Ricoeur [20] developed a philosopher's point of view about memory, as compared to the scientific approach of neurosciences. Then, following Paul Ricoeur's work, the philosopher's point of view is explored, which adds sensitivity, though and humanity to the technical brain.

The link between these two type of memory is presently still difficult to prove and establish.

Keywords: *Memory; Forgetfulness; Neuroscience; Psychoanalysis*

A few questions: An attempt to define memory

How can we create memory? How is memory "acquired"? A partial answer can be that it is to make a person to "live" a STORY.

For men, memory can be collective or individual in spite the fact that Eustache [8] claimed that it is only collective.

Memory is "I remember". Do "men deprived of memory" exist? Apparently not.

Should we remember our personal, collective story? Not all our recollections are fake, far from it!

If, first of all, we want to venture towards a technical approach to individual memory, we can define it as follows: "Memory is a biological and psychic activity that makes it possible to store, preserve, and retrieve information". Synonyms are "reminiscence" or "recollection".

This definition is often used in cognitive psychology: the cognitivist current usually includes in the term memory the processes related to encoding, storing, and retrieving mental representations.

In ancient Greece, memory was of such great importance that Mnemosyne, goddess of memory, was the mother of nine muses, goddesses who presided over knowledge: Clio was beneficial to history; Euterpe to music; Melpomeni to tragedy; Erato to poetry; Ourania

to sciences... There was a cult of Mnemosyne, and people who wanted to improve their memory went on thermal cures deemed to be beneficial...

As regards the modal model of memory: the most influential structural model of memory is the modal model, which divides memory into three subsystems: a sensory record, short-term memory, and long-term memory. In the memory of actions and motor coding, the action benefits from a triple coding: verbal, imaged, and motor.

As regards neuroscience: Neural plasticity is fundamental to explain the various forms of memory. We can note that the term “plasticity” was wisely/appropriately borrowed from the mechanics of materials. The Hebb rule, also called theory of neural networks, was established by Donald Hebb in 1949 [13]: it is used as one of the most important mechanisms underlying memorization. Zones of convergence-divergence are likely places of recording and reproduction of recollections and of other forms of long-term memory.

As regards psychoanalysis: in psychoanalysis, the term memory is connected to metapsychology and in the first place to the first topic and thereby to the notion of the unconscious, of repression. Metapsychology is the set of theoretical concepts formulated by Freudian psychoanalysis since the “Project for a Scientific Psychology” (written in 1895 and published in 1948) [11], “The Interpretation of Dreams” in 1900 [9] and “Instincts and their Vicissitudes”, “Repression” and “The Unconscious” are three texts dating back to 1915, until “Some Elementary Lessons in Psycho-Analysis” in 1940 [10].

How does memory work

The rise of cognitive neuroscience

Foreword: In 1949, the elite of Medicine honored the Portuguese physician Egas Moniz, Nobel Prize for his work on “pre-frontal leu- kotomy applied to the treatment of certain psychoses and mental disorders”, later renamed lobotomy. How did it happen that this sinister removal of a part of the brain passed through the filters of the Academy?

In the last 50 years, neuroscience has developed considerably thanks to technical progress allowing for very accurate indirect measurements of the activity of our brain (or that of animals). In parallel, cognitive sciences, with the theory of information processing (a model considering the human mind as a complex system that processed perceived information), have become the discipline that addresses the functioning of human or artificial knowledge, but “still have fuzzy outlines” [3].

Neuroscience or cognitive science?

The history of neuroscience is based primarily on the history of neurons. Following the introduction of the concept of the neuron as a nerve cell by Waldeyer in 1891, a branch of experimental physiology, namely neurophysiology, was created in England in the 1930s. A first wrangle (others followed) opposed the proponents of neurological physiology to those of neuronal physiology until neurobiology imposed itself in the 1950s (by focusing research on the cellular level instead of nervous circuits). This led to the birth of neuroscience in 1969, with the creation of the American neuroscience society (its French counterpart was created in 1988).

The “neuroscience” disciplinary field concerns the study of the functioning of the nervous system from the most elementary aspects (molecular, cellular, synaptic) to the most integrative ones that deal with the behavioral and cognitive functions (see the French CNRS website). Neuroscience historically started with the study of mental functions affected by pathologies. It was based on Gall’s hypothesis, which postulated at the beginning of the nineteenth century that the brain was separated into different organs, and each controlled one of the faculties of the mind. This idea corresponded to cerebral localization (a given mental function corresponded to one area of the brain). It is still very present in research today, even if scientists are currently investigating the hypothesis of a mental function that comes from cooperation of several neurons organized into networks not always located at the same place in the brain [24].

A little bit of neurology to better understand it all Cognitive or cognition (knowledge) sciences form a field at the interface of neuroscience, psychology, linguistics, and artificial intelligence (some add anthropology, philosophy or epistemology, see [25]), Therefore this field belongs to both the natural and human sciences [24]. The notion of cognition is at the root of cognitive science. It dates back to the mid-XXth century and refers to the bio- logical function producing and using knowledge. It includes modes of operation (called mechanisms, procedures, processes, algorithms) of different kinds that are processed by specialized and controlled modules. From the point of view of cognitive science, neuroscience is one field amongst others of the study of cognition, just like cognitive psychology. Cognitive neuroscience can therefore be defined as a “set of disciplines whose purpose is to establish the nature of the relationship between cognition and the brain” [24]. To go further, Chamak (2011) [3] drew a historical summary of the birth of cognitive sciences and discussed the different disciplines involved [5,6].

Neuro-imaging as the fundamental tool of cognitive neuroscience The advances in neuro-imaging of the last few years give us the illusion of seeing brain activity in real time, which paves the way for many speculations. A method widely used in neuro-imaging is the subtractive method: two different tasks performed by a same person, involving or not a given mental process, are compared, and the brain areas that show differences in activation between these two tasks are recorded. The hypothesis is then to consider that the activated brain areas are involved in the mental process under test. In cognitive neurosciences, only non-invasive imaging methods are used. These are indirect methods involving measurements of the electrical or magnetic activity of the brain by electroencephalography (EEG) and more particularly the above-mentioned potentials (ERP for event-related potential), and magnetoencephalography (MEG), or measurements of blood flow by functional nuclear magnetic resonance imaging (fMRI) and positron emission tomography (PET scan).

Medical imaging rather shows the defects of the brain, which does not have a corpus callosum, i.e. “cables” that connect the two brain hemispheres and make them communicate; the two hemispheres function as two independent “hard drives”.

The neurons of memory [22]

In his very recent article (October 2017), Alcino J Silva analyzed how one recollection followed from another. He supported the following theory, “Observing recollections forming in the brain and even seeing two recollections being related is now possible thanks to new types of microscopes”.

Our memories depends on our ability to remember the details of the world: a child’s face, a duck, a lake...

The field of neuroscience is currently tackling a fundamental question: how does our brain connect our recollections with one another across time and space? So far, most of research about memory has focused on how we acquire, store, revive, and alter our individual recollections. But most recollections are not unique, isolated entities. We know that the recalling of one recollection revives another.

To study the way recollections are associated, the discovery of “neural allocation” was a determining step forward [22]. The authors found that the brain uses specific rules to assign fragments of new information to different groups of neurons in brain regions involved in building up memory.

Alcino J Silva concluded with these words: “Perhaps understanding these phenomena will one day help us develop treatments for memory disorders seen in diseases such as depression, age-related cognitive decline, schizophrenia or bipolar disorder? One thing is certain: research on the formation of recollections is now less constrained by the range of available techniques than by the limits of our imagination”.

More neurons for a tidier memory [15]

For centuries, it was believed that the adult brain could not make new neurons. After all, as the brain stores information in specific networks of nerve connections, one might think that the random introduction of inexperienced cells into these networks would paralyze our ability to encode and correctly retrieve information, and thus spread confusion among our recollections.

By carefully examining brains from rodents, monkeys and even adult humans, researchers showed that new neurons continue to appear throughout our lives in two brain regions: one is involved in smell (Proust madeleine!), and the other, the hippocampus, is involved in learning, memory, and emotions.

Since then, neuroscientists have questioned the exact function of these new neurons. And while their role in the olfactory system is still somewhat obscure, the hippocampus has begun to reveal its secrets.

The work of Kheirbeck and Hen's team [15] and others suggest that newly-formed neurons help record recollections in a way that individualizes them and prevents them from being superimposed. This discovery could lead to new approaches to treat anxiety disorders, including post-traumatic stress disorders, because people with these disorders have difficulty in describing the difference between true fear situations and danger-free situations.

Memory of thought

Introduction

Plato: Memory and knowledge

Men are variously marked with a seal.

"Ideas" or impressions that form admittedly leave an imprint inside us, on something believed to be a block of wax that we carry within us.

Forgetfulness occurs when the inscriptions are erased and lost; inequality among men is explained by the volume and quality of the impregnable mass that each of us possesses.

A piece of knowledge disappears if one considers that there is a false opinion and "that one is able to not know what one knows".

The wax memory is the "core" of the soul.

The magic of innumerable fixations is indeed a gift of memory to the human soul.

Freud: writing in the unconscious

The object of the reconstruction of memory by psychoanalytic therapy exists in a written form. In Freud's eyes, a language was originally engraved in the body, at an age when the infant was driven by fits of its impulses. It bears their marks. The deviations and accidents of this natural history turn the body into a text that can or cannot be read.

The basic principle is to stringently separate consciousness from this buried memory made of successive inscriptions.

A partially intelligible memory opens access to the records or archives of the unconscious, it allows for a gradual interpretation of amnesia through recollections.

Bergson: Traces of our life experiences in our involuntary memory

In his chapter on “The two forms of memory” (“Matter and Memory”, p 80 [2]), Bergson highlighted a memory that escapes representations, according to the model of a learned recollection. It reveals itself as a rationalistic prejudice, an ideology hindering the perception of this other, “spontaneous” and immediately perfect recollection. What counts is “the recollection that must not become alien to our past life”, be alienated by all the rest, by external influences.

Bergson singled out spontaneous memory, distinct from remembering, devoted to the learning of the mechanisms essential to our role as social actors.

Benjamin: Memory of strata

Walter Benjamin valued Proust’s search by adding a transcendental aspect into it. Through recollections, our self discovers its own existence by recognizing the stages of awareness of what it does. The search for our ego teaches us that what we remember is the image of the act that marks it out, and that this image is the result of the “thought” that engages in it.

Memory

Memory makes it possible to record information coming from experiences and various events, to preserve them and to restore them. Different neural networks are involved in different types of storage. Better knowledge of these processes improves the understanding of certain memory disorders and opens onto possible future interventions. Memory is based on five systems of repeated memory of these networks and is believed to strengthen or reduce these connections in a second step. As a consequence, the recollection is consolidated or on the contrary forgotten. It is important to specify that forgetfulness is associated with the good functioning of memory, pathological cases excluded. Some works suggest the role of a molecule called PKM zeta in maintaining long-term memory. In animals, it helps maintain modified molecules during encoding and prevents their degradation over time, consolidating networks associated with recollections.

Long-term potentiation is probably the starting mechanism of the learning machinery at the level of synapses, the switches between neurons. The activation of a neuron results in the release of a neurotransmitter such as glutamate. Glutamate serves as a kind of key to open the “lock” of the dendrite (an extension of the neuron input) of the neighboring neuron. A receptor named NMDA is thought to play the role of “memory” at the level of the neuron. When the glutamate key unlocks the NMDA lock, the receiver valve opens and lets magnesium ions out, while calcium ions rush into the neuron. The calcium ion is a messenger that activates a cascade of enzymes and thus allows for receptors to remain open, and in turn for synaptic activity” [18] p.198.

Paul Ricoeur: “Memory, History, Forgetfulness”

Introduction

Reading report by Pauline Seguin [21].

Why Paul Ricoeur? Because he is surely one of the first philosophers who tried to position memory in relation to the neuroscience discourse.

“This new masterpiece by Paul Ricoeur is astonishing in many ways: Paul Ricoeur wrote it more than twenty-five years after his retirement from French university, and eleven years after his last class at the University of Chicago. In addition, this 660-pages book is a formidable philosophical tour de force. He quotes and discusses the ideas of 213 authors” [19].

Influenced by the phenomenology of Husserl [14] (of which he seemed to be a direct heir) and by existentialism, he constructed a philosophy of interpretation by integrating the contributions of psychoanalysis and Freud’s thought, and appeared as one of the major representatives of contemporary hermeneutics. The great questions that landmarked his whole work were will, time, the subject, otherness,

and values, in the perspective of an optimistic Christian humanism. Paul Ricoeur's book [20] raises the question of the representation of the past: what about the enigma of an image that presents itself as the presence of an absent item marked by the seal of earlier times? He intends to give an account of this issue through a triple perspective: the phenomenology of memory, the epistemology of history, and the hermeneutic of the historical condition, where a reflection on the question of forgetfulness is inscribed.

Summary

Corcos [4] proposed a few possible crossroads between psychoanalysis and neuroscience in the field of memory.

They concern the possible analogy between the compulsion-to-repeat concept and implicit memory in neurosciences, the similarity between forgetfulness by retroactive interference in neuropsychology and the erasure of traumatic effects through transfer, and the process of transforming repetition into memory, comparable to the transformation of implicit memory into autobiographical memory.

Neurosciences, a reductionist position? By Eve Suzanne [23]

Dualism and neurobiological reductionism

According to neurosciences, all of our mental states come down to the activity of our neurons, that is to say, to chemical reactions. The dualist theory that poses the soul, i.e. consciousness, as immaterial and therefore not reducible to mechanisms such as those to which the body is subjected, is clearly rejected. On the contrary, psychological facts are subjected to the same laws as neuronal facts. Besides, we can speak of eliminative reductionism: psychology will be completely replaced by neurobiology once neurobiology has progressed far enough on the path of knowledge.

Reductionism, as defended by neurobiology, consists in placing consciousness and neurons at the same level. In other words, human psychic life is fully understood based on the neuronal chemical processes that occur in the human brain.

Thus, authors like Jacques Monod or François Jacob in the line of La Mettrie developed an extreme reductionist position based on neuroscience and its spectacular advances.

Thus, according to them our will, our desires, our convictions, all that accompanies and inspires, no interpretation of our dreams... On the contrary, it falls into the same reading grids as consciousness, as one more characteristic of our brain activity. The majority of our neural processes can be described as unconscious.

Spires our acts systematically depends on the organization of our proteins.

Jacob added to this subject and wrote that "between the living world and the inanimate world there is a difference, not in nature, but in complexity". The living is a machine. Monod conceived it as a mechanical machine: for him, a living was a machine controlled by its DNA and the cell was comparable to a small chemical plant. As for Jacob, he rather saw the living as a cybernetic machine (the brain was like a computer, which later supported the theory of artificial intelligence).

Descartes also thought that the difference between the body and the machine was not in nature, but only in the degree of complexity.

The case of psychoanalysis, by Eve Suzanne [23]

Can neurobiology perfectly explain the functioning of psychic life?

The underlying difficulty is to determine which of psychoanalysis or neuro- biology is best able to provide such an explanation.

However, perhaps this opposition was not obvious at first, and perhaps it still is not obvious: Sigmund Freud was convinced that one day biology would finally validate the assumptions on which psychoanalysis and especially the unconscious are based.

Dualism and the unconscious André Green, a former Lacanian (from 1955 to 1967) psychoanalyst was particularly virulent towards certain claims of neuroscience. He was opposed to a fundamental aspect of their approach which placed brain activity and psychic life at the same level and stated that understanding brain activity automatically allowed for understanding of psychic life. In an article written in 1992 [12], the author spoke of “a frenzied denial of the complexity of psychic functioning and in turn of the unconscious [...], by the defenders of the cause of the brain, namely neurobiologists, psychiatrists, and neurologists”. For neurobiologists, all psychological disorders have an exclusively organic cause, otherwise the disease is imaginary.

Against all odds, neuroscience itself restored the primacy of the unconscious thanks to the cognitive unconscious. But far from rehabilitating the Freudian unconscious, the cognitive unconscious was aimed at definitively sending the Freudian unconscious into oblivion. Indeed, in the cognitive unconscious, there is no repressed desire, no interpretation of our dreams... On the contrary, it falls into the same reading grids as consciousness, as one more characteristic of our brain activity. The majority of our neural processes can be described as unconscious.

Perspective and Conclusion

The present text is like a journey through memory. In an anterior work, my knowledge of the memory of certain solid materials led me to seek a continuity with human memory [16]. Let us say it plainly, the memory of materials is easier to understand, since creating defects in their microstructure is sufficient to make them acquire memory.

In my opinion, there is a distance between neuroscience, which is often a technical approach to memory, and “human memory”.

Let us say that human memory and memory in the physical or mathematical sense are not of the same nature. There is no neutral memory!

A decisive contribution was brought by Paul Ricoeur’s famous work “Memory, History, Forgetfulness” published in 2000. Given the energy he devoted to forgiveness, I hardly understand why he did not add this theme to its title. His words about forgiveness appear to me in symbiosis with those of the psychoanalyst Denis Vasse.

Paul Ricoeur made a rather sharp criticism of the neuroscience approach.

Apart from his exchanges with the biologist Jean Pierre Changeux, I found few comments from neuroscientists about Paul Ricoeur’s work [20]. Francis Eustache and his collaborators, although their book “Ma mémoire et les autres” [7] is devoted to the entanglement between individual memory and collective memory, did not make any reference to the writings of Paul Ricoeur [20] on this subject.

One last open question: animals, trees, etc. appear to have memory, like metal materials. What does not have memory?

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