

REFLECTIONS ON LEARNING AND MEMORY IN LIGHT OF THE EXECUTIVE FUNCTION OF MEMORY

REFLEXÕES SOBRE A APRENDIZAGEM E A MEMÓRIA À LUZ DA FUNÇÃO EXECUTIVA DA MEMÓRIA

REFLEXIONES SOBRE EL APRENDIZAJE Y LA MEMORIA A LA LUZ DE LA FUNCIÓN EJECUTIVA DE LA MEMORIA



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ABSTRACT

Animals in the natural environment face multiple challenges in order to survive. One of the most fundamental is obtaining food, and for this task to be effective they must remember the places they have previously explored. Successfully solving this task requires a system of memory and attention. “Attention is understood as the mechanism that activates the processes involved in the processing of information, participates in and facilitates the functioning of all cognitive processes, regulating and exerting control over them.” (García, 1997; Rosello, 1998; Ruiz-Vargas, 1987). Attention is a selective process of receiving information that controls the threshold of our cognitive system and also performs alert functions, being involved in educational learning and study processes, participating as an alert mechanism in high-risk professions, in the concentration and focus of research, and in memory and learning, among others.

Keywords: Memory. Natural Environment. Attention. Thought.

RESUMO

Os animais no ambiente natural enfrentam múltiplos desafios para sobreviver. Um dos mais fundamentais é a obtenção de alimento e, para que essa tarefa seja eficaz, eles precisam lembrar os lugares que já inspecionaram. Resolver adequadamente essa tarefa requer um sistema de memória e atenção. “Entende-se por atenção o mecanismo que ativa os processos que intervêm no processamento da informação, participa e facilita o funcionamento de todos os processos cognitivos, regulando e exercendo controle sobre eles.” (García, 1997; Rosello, 1998; Ruiz-Vargas, 1987). A atenção é um processo seletivo de recepção de informações que controla o limiar do nosso sistema cognitivo e também desempenha funções de alerta, estando envolvida nos processos educacionais de aprendizagem e estudo, atuando como mecanismo de alerta em profissões de alto risco, na concentração e focalização de pesquisas, na memória e na aprendizagem, entre outros.

Palavras-chave: Memória. Meio Natural. Atenção. Pensamento.

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RESUMEN

Los animales en el medio natural se enfrentan a múltiples problemas para sobrevivir. Uno fundamental es el abastecimiento de alimento, para que dicha tarea sea eficaz ellos tienen que recordar los lugares que han inspeccionado. Resolver esta tarea adecuadamente requiere de un sistema de memoria y atención. “Se entiende por atención al mecanismo que activa los procesos que intervienen en el pensamiento de la información, participa y facilita el trabajo de todos los procesos cognitivos, regulando y ejerciendo un control sobre ellos”. (García, 1997; Rosello, 1998; Ruiz-Vargas, 1987). La atención es un proceso selectivo de recepción de información que controla el umbral de nuestro sistema cognitivo y además cumple funciones de alerta, implicado en los procesos de aprendizaje educativos y de estudio, participa como alerta en profesiones de alto riesgo, en la concentración y focalización de investigaciones, memoria y aprendizaje entre otros.

Palabras clave: Memoria. Medio Natural. Atención. Pensamiento.

1 INTRODUCTION

The three most important functions are to select information, control limited capacity, and keep physiological, emotional, and neurological processes activated and alert.

Attention is divided into three mechanisms, selective, divided and sustained attention.

The selectivity of attention can be easily shown in studies that indicate that we focus only on some details of our interest, and add what is missing based on what we remember.

In general, the complex process of attention is a mechanism that integrates and involves feelings, emotions and physiological structures that allow our mind to access all existing stimuli, it gives us the possibility of selecting, distributing and giving our own meaning to each thing, object or place in order to be able to discriminate how pleasant and interesting a certain event seems to us. In order to effectively guide our individual tastes, aspirations and potentialities and insert ourselves socially better directed.

What kind of capacity is attention? Psychologists have not yet agreed on this, some consider that attention is only one aspect of perception and other cognitive abilities.

We choose what we will see or what we will hear in anticipation of the structured information that this will provide us. Only the episodes to which attention is paid are anticipated, explored and recorded; In other words, the act of perceiving requires selectivity.

Selectivity of attention can be easily demonstrated, one way to do this is by recording people's eye movements when they look at paintings or photographs. Studies of this type indicate that we concentrate only on a few details; Then, based on these signs, we put in what is missing, perhaps based on memories.

Evidence supporting attention selectivity also comes from studies of divided attention. People can learn to perform two complicated tasks at the same time, but there are well-defined restrictions. In general, the capacity of care depends on the resources that are necessary for the work to be carried out. If few resources and conscious control are required, a person can carry out other tasks simultaneously. If the work undertaken is far from being automatic, it will need a large part of the attention of the person who performs it. If you want to perform two difficult tasks at the same time, you need to practice one of them first until it becomes relatively automatic and demands little attention.

The environment in which we live is complex since it includes a large amount of information that we must attend to and sometimes requires us to respond to more than one piece of information simultaneously.

When attentional and memory processes are set in motion, we are more receptive to events in the environment and we perform an activity or task more effectively, even if it requires more effort.

Through attention we are informed of the physiological and pathological modifications of our internal environment, whether physical or mental.

Attention does not work in isolation, but is directly related to other psychological processes such as memory.

2 THE BIOLOGICAL VIEW OF MEMORY

With the advances that neuroscience has been making about the functioning of memory, the view that it is simply a storage or retrieval of data is changing to give a more active and dynamic role to the process of memorizing.

Currently, neuroscientists have identified the existence of different types of memories, either through research or by recognizing them in people affected by injuries or illnesses suffered.

Knowledge of how memory works tells us about the role that experience and practice play in the process of learning and memorizing by modifying neural structures. On the one hand, there is a direct relationship between the number of experiences that are involved and the complexity of the environment with the number of structures that change in the brain; and on the other, practice increases the ability to learn and memorize. It is also known that learning and memory not only affect the number of synapses, but also change the structural dynamics of the brain by modifying the support cells, astrocytes, and blood capillaries that provide sustenance to neurons.

Memory is considered as a "storehouse" of information and from which data are evoked when required.

It allows us to look biologically at the mental processes that take place in the brain, suggesting that creative activities such as language, music and art are functions in which specialized neural circuits from different regions of the brain intervene, which are made up of nerve cells, neurons. Taking this biological perspective of the processes that are linked to learning and memorizing, we can say that learning collects stimuli from the environment through different neural circuits that are then passed through to be collected in the different neural networks, the memories.

Memory carries out a process of neural "manipulation" to store information in the different neural networks, so that finally through a process of evocation different circuits and nerve networks are related to show a behavior or solve the solution of a problem. This biological view allows us to glimpse a more active role of memory in this entire stage of processing and retrieval of information more than a simple "store", since it is a series of

spatio-temporal neural interactions between the different memories for a response to the environment.

3 MEMORY IN AN EXECUTIVE ROLE

The executive function of working memory reflects in some way the interest of the educational field in finding in our brain the center that has the ability to mentalize or perform metacognitive functions, the control of processes on products, the planning of goals and the maintenance of attention on important tasks. Working memory manages information by manipulating and maintaining it to accomplish a task, and plans and organizes goals as the situation requires. This memory goes through continuous updating and reorganization to fulfill the proposed tasks, it is also involved in mechanisms of unconscious processes that allow us to find solutions to problems after a good night's sleep. Working memory, in addition to storing information in long-term memory, operates the elements of information to guide behaviors. Researchers have found evidence of executive control of working memory in many cognitive functions, including: memory updating, receiving and evaluating sensory information to transfer it to and retrieve from long-term memory, and deciding which memories are needed for which tasks; the establishment of goals and plans, recording the goals, planning them in advance how to achieve them and establishing their priorities; task switching, monitors external signals for information that indicates the need to switch from one task to another; and the selection of stimuli and inhibition of responses, allowing the selection of a stimulus to be evaluated and a habitual response to be inhibited, to shift attention to a new alternative that responds to a specific context.

Another interesting aspect is the location of the executive center of working memory. Neuroimaging shows studies in which neural functions of the frontal cortex are linked to working memory performances. This strengthens the idea of an active role of memory, since the frontal cortex, on the one hand, is the region that would be best connected to fulfill all these tasks and on the other, it has all the inputs and outputs necessary to develop an executive function on cognitive and operational control over selective attention. (Geake, 2009).

With what we have just seen about the executive role of memory, the question arises: could we continue to think that memory is only limited to the storage of information? It is clear that no, we would have to look at the concept of learning and memory in a different way.

4 THE BIOLOGICAL VIEW OF MEMORY

With the advances that neuroscience has been making about the functioning of memory, the view that it is simply a storage or retrieval of data is changing to give a more active and dynamic role to the process of memorizing. The use of neuroimaging technologies such as fMRI (functional magnetic resonance imaging), PET (positron emission tomography), EEG (Electroencephalography) and MEG (Magnetoencephalography) is allowing us to know how the brain works, to stop being that black box of a few decades ago in which it was filled with data and information that was not used. and open up a different look at the concept of memorizing and with it that of learning.

Currently, neuroscientists have identified the existence of different types of memories, either through research or by recognizing them in people affected by injuries or illnesses suffered. (Gluck, Mercado, & Myers, 2009). In the book *The Brain and Learning* by Jossey-Bas, it is mentioned that memory is not a unitary construction, it is where the characteristics of learning are related to the ability to remember, which is not a passive event, but is a series of events that organize memories in a sequence that makes sense. He considers memory as a phenomenon that encompasses the entire brain. In addition, he argues that the brain structures linked to the learning of mathematics differ from the learning of reading and learning to play the piano. The same is true for memory systems linked to these activities and that take place at different times. Likewise, remembering who you are or remembering where you are from, activates different memories in the brain in separate regions.

Knowledge of how memory works tells us about the role that experience and practice play in the process of learning and memorizing by modifying neural structures. On the one hand, there is a direct relationship between the number of experiences that are involved and the complexity of the environment with the number of structures that change in the brain; and on the other, practice increases the ability to learn and memorize. It is also known that learning and memory not only affect the number of synapses, but also change the structural dynamics of the brain by modifying the support cells, astrocytes, and blood capillaries that provide sustenance to neurons.

Memory is considered as a "storehouse" of information and from which data are evoked when required. Eric Kandel, Nobel Prize in Medicine in 2000, defines it as "the ability to acquire and store extremely diverse information, from the trifles of everyday life to complex abstractions of geography and algebra. Thanks to this ability we can solve problems by evoking different experiences" (Kandel, 2007). Kandel mentions that with the birth of cognitive neuroscience, about 40 years ago, it was possible to link the strategies used in psychology with biological methods to study the brain. It allows us to look biologically at the mental

processes that take place in the brain, suggesting that creative activities such as language, music, and art are functions in which specialized neural circuits from different regions of the brain are involved, which are made up of nerve cells, neurons (Kandel, 2007). Taking this biological perspective of the processes that are linked to learning and memorizing, we can say that learning collects stimuli from the environment through different neural circuits that are then passed through to be collected in the different neural networks, the memories. Memory carries out a process of neural "manipulation" to store information in the different neural networks, so that finally through a process of evocation different circuits and nerve networks are related to show a behavior or solve the solution of a problem. This biological view allows us to glimpse a more active role of memory in this entire stage of processing and retrieval of information more than a simple "store", since it is a series of spatio-temporal neural interactions between the different memories for a response to the environment.

5 MEMORY IN AN EXECUTIVE ROLE

One of the memories that led me to start this reflection and rethink that they have a more active role in cognitive processes and therefore in learning, is undoubtedly the executive function of working memory, which has been defined "as the center of the cognitive construct that sustains general intelligence and creative thinking" (Geake, 2009).

The executive function of working memory reflects in some way the interest of the educational field in finding in our brain the center that has the ability to mentalize or perform metacognitive functions, the control of processes on products, the planning of goals and the maintenance of attention on important tasks (Geake, 2009). Working memory manages information by manipulating and maintaining it to accomplish a task, and plans and organizes goals as the situation requires. This memory goes through continuous updating and reorganization to fulfill the proposed tasks, it is also involved in mechanisms of unconscious processes that allow us to find solutions to problems after a good night's sleep. Working memory, in addition to storing information in long-term memory, operates the elements of information to guide behaviors. Researchers have found evidence of executive control of working memory in many cognitive functions, including: memory updating, receiving and evaluating sensory information to transfer it to and retrieve from long-term memory, and deciding which memories are needed for which tasks; the establishment of goals and plans, recording the goals, planning them in advance how to achieve them and establishing their priorities; task switching, monitors external signals for information that indicates the need to switch from one task to another; and the selection of stimuli and inhibition of responses, allowing the selection of a stimulus to be evaluated and a habitual response to be inhibited,

to shift attention to a new alternative that responds to a specific context. (Gluck, Mercado, & Myers, 2009) (Geake, 2009). For M.C. Etchepareborda, working memory is responsible for channeling the flow of information in the neural system, performing attentional functions, encoding and retaining verbal information, language acquisition and the management of visuospatial information. It would be the one that governs memory systems, distributing the attention assigned to each task to be performed according to the demands imposed on the neural system, the level of experience of the person and the demands of the environment. In addition, to the extent that a task is mastered, less attention will be needed and will allow the execution of other compatible tasks, giving working memory assumes a more dynamic and executive role than a simple data file.

Another interesting aspect is the location of the executive center of working memory. Neuroimaging shows studies in which neural functions of the frontal cortex are linked to working memory performances. This strengthens the idea of an active role of memory, since the frontal cortex, on the one hand, is the region that would be best connected to fulfill all these tasks and on the other, it has all the inputs and outputs necessary to develop an executive function on cognitive and operational control over selective attention. (Geake, 2009).

With what we have just seen about the executive role of memory, the question arises: could we continue to think that memory is only limited to the storage of information? It is clear that no, we would have to look at the concept of learning and memory in a different way.

6 LEARNING VS. MEMORIZING

Let us now look at one of the most widely used definitions of learning, that of John Anderson: "learning is the process by which lasting changes in behavioral potential occur as a result of experience" (Andersen, 2001) (Londoño, 2008). The incorporation of experience is an aspect that we can assign to learning, while in evocation and behavioral change one hardly finds a clear distance between the role of memory and learning. L. Londoño uses the term "durable" to make a difference between learning and memory. He argues that lasting changes over time last in learning while memory does not (Londoño, 2008). If we keep memory as a store of files, this may be true, but as we have seen, the way in which memories interact through an executive center gives it a more active role and management of cognitive processes.

For S. Machado (Machado, et al., 2008) there is a limit between the tasks of learning and memory. Both have an origin in neural plasticity and where learning is a process by which

we acquire knowledge about the environment that surrounds us and memory would be the ability of the individual to retain and use information in different ways and in different periods.

If we also take into account the fact that the executive function of working memory is located in the frontal cortex, it allows us to see that memory has an active role in complex thinking skills and that we could differentiate it from the role of learning. Placing memory as the one that encodes, stores, evokes and manages the information necessary to solve problems or generate behaviors and learning in all the processes and strategies that are linked to the acquisition of information about the environment for memory.

7 CONCLUSIONS

For education, differentiating the role of learning and memory in the educational field would allow optimizing pedagogical strategies aimed at promoting better learning and memorization. Both are processes that are intimately related and that we could place in two different and complementary moments in the series of neural processes through which organisms handle and process the information provided by the senses to adapt to the demands of the environment. Placing learning in a role that has to do with the process of acquiring stimuli and incorporating new experiences for memory; and memory in a more executive role and management of all that information in favor of giving the best response to the environment or the best solution to a problem. To the extent that we discover how the dynamics of neural networks occur in the functioning of the brain during the learning and memorization process, and how this adaptive neuroplasticity occurs to change cognitive capacity, we will be able to better define the areas of learning and memory.

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