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EMOTIONS AND MEMORY INTERTWINED: A HISTORICAL PERSPECTIVE

(LA VINCULACIÓN ENTRE MEMORIA Y EMOCIÓN DESDE EL PUNTO DE VISTA HISTÓRICO)

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ABSTRACT

Both in every day life and in scientific work it has always been indisputable that emotions and memory are closely related to each other. However the specifics and precise nature of the interrelationship still remain controversial even today. For example, it is not yet sufficiently resolved in which way different factors, such as the intensity or type of emotion, can influence memory.

Here the principal psycho-physiological approaches are presented, which detail the interrelationship between emotions and memory, and which were developed from the 16th century to the 19th century when experimental memory research was first begun by Hermann Ebbinghaus. Assuming that emotions and memory are linked by a common physiological mechanism, scientists have long postulated the existence of mediating factors. In the 16th century, Philipp Melanchthon and Timothy Bright supposed that the degree of moisture and the temperature in the brain were such mediators. Juan Huarte, however, was convinced that the amount of light in the brain ventricles was the link between emotions and memory. In the 17th century, Rene Descartes and Thomas Willis emphasized the importance of the size of special brain pores as the mediating factor whereas in the second half of the 18th century, Charles Bonnet and David Hartley explained the relationship between emotions and memory as vibrations of brain fibers. All these propositions were based on concrete analogies derived from physics, and were mainly accepted only because of their plausibility. Empirical methods to disprove them did not exist. At the beginning of the 19th century Franz Josef Gall's doctrine became increasingly influential. He assigned different mental functions to different cortical areas, and thus viewed emotions and memory as separate entities. This might be one reason why the concept of memory and emotions as being intertwined functions fell into disuse until Hermann Ebbinghaus, Theodule Ribot, and Theodor Ziehen among others, once again emphasized that the two processes are linked. From a historical point of view Rapaport's conviction that an overhasty physiological analysis of emotions prevented researchers from recognizing the relationship between emotions and memory must be rejected.

Keywords: Emotion, Memory

That an intertwined relationship between emotion and memory exists has always been clear yet, despite this, the link between the two processes has only been minimally investigated. To effectively research this topic has proved to be an arduous task, as the psychology of memory mainly consists of a large body of assumptions about the recall and storage of information. Researchers are confronted with a similar problem in studies of the psychology of emotion. Scherer (1990) complained about the wildly expanding quantity of theoretical suggestions. The common solution has been to singularly analyze these phenomena, followed later by analysis of the interrelationship; however my presumption is that the function of memory can only be clarified in a satisfactory way with a simultaneous consideration of emotional factors. If we assume that the importance of an object or event to an individual is metamorphosed into an emotion, and we assume that memory works selectively by storing the information which is relevant to that person, then a close interrelationship between memory and emotion must be a natural consequence.

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1. INTENSITY OF EMOTIONS AND MEMORY PERFORMANCE

Amongst other authors Thomaso Garzoni (1549-1589), Francis Bacon (1561-1626), Johann Heinrich Alsted (1588-1638), Marius D'Assigny (1643-1717), Johann Georg Krünitz (1728-1796) and John Stuart Mill (1806-1873) studied the interrelation between a heightened emotional state and memory performance. Krünitz (1779) was convinced the average individual knew that an excess of voluptuous lust debilitated the power of memory, but the knowledge of such a loss did not change man's behavior. Although his theory was principally concerned with the decline of memory performance due to heightened emotions, it is not in opposition to the generally held opinion that at lower emotional intensities a positive correlation between the intensity of emotion and memory performance exists. According to Thomaso Garzoni (1589), the better memory of children is a result of untroubled, care-free lives; and, on the other hand, a child's limited knowledge of life allows for more „new experiences" which produces more intensified emotions such as pleasure, anger, or sorrow; thereby the preservation of the perceived information is enhanced. These two view points don't exclude each other. The first outlines a general condition favorable to the storage of information whereas the second points to the development of emotions caused by the newness of the saved matter itself. According to Johann Heinrich Alsted (1630), conditions for optimal memory processes exist when the bodily humors and the „*spiritus*" change because of moderate arousal by emotions such as pleasure or hope. As a consequence, too much or too little emotional arousal would hinder memory processes. Here the interrelationship between emotional arousal and memory performance can also be described as having an up-side down U shaped relationship. Alsted, as well as Sebastián Izquierdo (1659), also recommended that the users of the Loci-Technique should choose pictures which produce an emotional response.

Apart from the intensity of emotion, some authors differentiated between the effects of different emotional types. Johann Sp. Herd, Johann Heinrich Alsted and Johannes Buno (1617-1697) felt that the performance of memory was directly related to the type of emotion. Herd (1604) assumed that negative emotions such as sadness, fear, anger etc. *darkened* memory; Alsted thought that admiration and love of a particular subject would aid in learning. Similar to Buno (1680) who wrote his picture Bible (Bilder-Bibel) in such a way which made the learning fun and easy, Alsted emphasized the importance of intrinsic motivation for a good memory performance. He was convinced that people „on stage" experience weakened memory as opposed to being in an isolated place, due to the fear of disappointing expectations. This

memory reducing effect is the result of what is commonly known as *stage-fright*. Charles Bonnet (1775) argued similarly that the fear of failing produced foreign thoughts which derail the original thoughts.

2. PHYSIOLOGICAL EXPLANATIONS FOR THE INTERRELATIONSHIP BETWEEN EMOTIONS AND MEMORY

Eventually these interesting and creative theories were dropped, as more modern trends of physiological research clearly showed the flawed assumptions. In the 20ieth century the physiological aspect of emotion was predominant in psychological research; this dominating view resulted in an obscuring of the non-physiological aspects of the link between emotion and memory. Rapaport (1977) wrote that this perspective hindered the recognition that emotions and memory are inextricably intertwined. He described the investigations from a physiological standpoint as being done too soon, that they needed to follow the combined approach. However, in my opinion, early research trends were characterized by striking psycho-physiological approaches, which were developed to more or less explain the unsystematic observations in every day life.

Many of these old physiological theories were based on the so-called *spiritus* which was assumed to be a glowing and ethereal transmitting substance in the nervous system. From the 16th up to the 18th century there existed the widespread assumption that the heart distills the *spiritus* from the blood. The quality of this *spiritus* would be inferior in times of intense emotion because in such states the normal activity of the heart is changed. Philipp Melanchthon (1497-1560), for example, thought that the heart muscle was expanded by pleasure and contracted by worry. As the *spiritus* was the means of transmitting mental pictures through the brain, the transport of the mental pictures, as well as the memory function which was located in the 4th ventricle of the brain, were impaired by an intense emotion.

The following psycho-physiological models suggest an interrelationship between emotion and memory mediated by special characteristics of the brain, which influence the activity of the *spiritus*. These characteristics are moisture, temperature, brightness or the width of brain pores. In the concept of the vibrating brain fibers, however, the *spiritus* is not a mediator.

2.1 Moisture and Temperature

Emotional reactions were also dependent on the particular temperament. Melanchthon (1553) defined temperament as a specific combination of the four body juices (choleric, sanguineous, phlegmatic, and melancholic). Melancholy, for example, was induced by an abundance of black bile. In sorrow, the health would be damaged by a desiccation of the heart. In this condition the heart produced inferior *spiritus*, too. In concreto the contraction of the heart and the coldness of the melancholic juice surrounding it in times of sorrow impaired the production and distribution of the *spiritus*. As the *spiritus* provided the basis of all brain functions, an inferior quality would lead to impaired memory processes.

Other authors indicated that an abundance of black bile would make the entire body cooler and dryer, leading to a „withering" effect. Nicolas Coeffeteau (1574-1623), for example, noted that in autopsies of melancholics, a heart was not to be found, only fragile, dry skin resembling the leaves about to fall from a tree in autumn. Similarly, according to Juan Huarte (1520-1589), the degree of moisture in the brain influenced memory performance - a moist constitution would be favorable to good memory performance, in contrast to a dryer constitution. Because of its moistening effect, pleasure would improve memory function whereas the drying effect of sadness would weaken memory.

Emphasizing the aspect of susceptibility, J. Sp. Herd (1604) was also convinced that memory processes are influenced by the specific combination of body juices. According to

his position, sanguinic people have a much better memory than melancholic people. On the basis of those physiological assumptions, Herd also recommended changing the combination of body juices by diets and medicines to improve memory.

In contrast, others such as Timothy Bright (1586), argued that melancholy supports the memory process. He described a melancholic person as having a cold and dry constitution, causing a hardness in the brain. This sort of hard and dry brain would not be able to lightly absorb information, however this same hardness enabled the information to be engraved (as in stone), enhancing the memory. Alsted (1630), thought that memory processes were disturbed by strong emotions such as anger, sadness or fear which would dramatically change the temperature of the blood. If the blood became hot, the pictures to be stored in the memory would become blurred as pictures engraved into a wax tablet held over a fire. But if the *spiritus* and blood were frozen, the receiving of pictures would be impaired. The memory worked optimally in a medium temperature.

The examples above, based on the doctrine of juices in the body, are related to Plato's metaphoric description of memory as being a wax tablet. It was supposed that the anatomical counterpart of the wax tablet was the wall of the fourth brain-ventricle. The body juices determined the consistency of this ventricle wall by regulating its temperature and moisture level.

2.2 Brightness

Huarte was convinced that the eye requires light to be able to see colours and shapes. Similarly, the imagination requires the light in the brain to see the pictures stored in the memory. This brightness in the brain stems from the *spiritus* produced by the heart and dispersed through the body. In a state of fear, the *spiritus* flows to the heart, leaving other organs such as the brain cold as well as dark; when the body becomes cold and loses its natural warmth, the voice, the hands and the lower lip shiver. The chill would cause all mental functions to become sluggish. Thus the imagination and memory processes also become slower and less effective, in particular because the pictures are not illuminated by the *spiritus*. In a state of anger however, the heat of the body is excessively increased and the strong illumination in the brain has a blinding effect, impairing the memory recall.

According to Andreas Laurentius (1558-1609) it may happen that melancholic juice, produced in the spleen, can not flow out. The resulting pressure in the spleen warms the melancholic juice so that this hot juice rots and becomes gaseous. This gaseous substance soars to the brain like a dark, dirty and disgusting vapor from a cesspit, and makes the spiritus in the brain black and cold. Consequently mental processes, such as memory and imagination, are disturbed. Other authors such as Thomas Elyot (ca. 1490-1546), Levinus Lemnius (1505-1568), Robert Burton (1577-1640) and Timothy Bright (1586) support a similar concept of melancholy.

The illumination of images in the brain has also been a subject of ancient mnemonic writings. The author ad Herennium, for example, gave advice how to best achieve optimal illumination of the so-called *loci*.

2.3 Pores

The pores, existing in the brain, direct the flow of the *spiritus*. According to René Descartes (1596-1650), the process of involuntary remembering is based on the *spiritus*, which transports the visual image to the surface of the hypophysis. If the image is coupled with an emotion such as fear, the direction of the *spiritus*, through the pores, would be changed. The *spiritus* reflecting the picture on the hypophysis streams in part to the nerves causing a flee reaction, and in part to the nerves which regulate the heart valves. The heart then sends more *spiritus* to the brain which preserves and strengthens the fear by keeping more pores open or by

opening other pores. While flowing through the pores, the *spiritus* causes special movements of the hypophysis which causes the soul to feel fear. This mechanism works for all emotions.

Thomas Willis (1621-1675) also assumed that the close interrelationship between emotion and memory processes is mediated by the directions taken by the *spiritus*. He describes the medulla oblongata as being the main residence of the *spiritus*. From here it streams through cerebral paths to the surface of the cortex or into the surrounding brain substance and produces different ideas. A repeat of a particular cerebral path would evoke a rememberance of the original object coupled with its emotion.

2.4 Vibrations of Brain Fibers

In the 18th century Charles Bonnet (1720-1793) described the close interrelationship between memory performance and emotional processes as being different vibrations of brain fibers. The sensitive brain fibers, when exposed to an object that had evoked an emotion, become more stimulated; resulting in a more vivid rememberance. A very strong emotion, for example passionate love, would suppress all other movements of the fibers. Bonnet said that the imagination doesn't paint more vividly that does a paint brush animated by love; the dominating effect of the emotion is focused on the painting, eliminating all other fiber movement. This demonstrates the selective aspect of emotion, as the recall of a memory is impaired when there is no affinity to the emotional state. Emotions, causing strong vibrations of the brain fibers, support the saving of memories. The stronger the vibrations the more persistently the microsturcture of the fibers is modified, so that the storing process is strengthened. David Hartley's (1705-1775) theory is also based on the movement of brain fibers.

CONCLUSION

Psycho-physiological models based on the doctrine of body juices discuss a central nervous, vegetative and humoral aspect of the interrelationship between emotional processes and memory function. These models suggest a modification of the *spiritus* as well as a modification of the actual memory substance. In the 17th century the importance of the juice doctrine diminished by degrees, although the transmitting function of the *spiritus* was still accepted for long afterwards. Both the theory of the pores, and the brain fiber vibration theory, particulary emphasized processes in the central nervous system. At the beginning of the 19th century Franz Josef Gall's theory became well known and increasingly accepted. He assumed that the different powers of the soul are located in separate areas of the brain cortex, thus supporting the notion of separate locations of emotion and memory processes. But at the end of the 19th century authors such as Hermann Ebbinghaus, Theodule Ribot and Theodor Ziehen once again emphasized the concept that emotions and memory are inextricably intertwined.

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