

Critically evaluate the role of neural structures in subserving

[Psychology](#)



The formation of the top of the brain includes the left and right cerebral hemispheres that are covered by a thin cortex, the cerebral cortex. This cortex is the surface of the brain and it is comprised by four lobes in each hemisphere, frontal, temporal, parietal, and occipital lobe. Research on the brain has concluded that each area of the cortex controls a number of functions. The parts of the cortex that receive information from the body or the environment are located in the back of the brain. The middle area of the brain relates to the movement of our body and the areas known as association areas control language, thinking and memory (Carroll, 1999, Yule, 1996).

The part of the spinal cord that continues into the brain is the medulla and it is responsible for vital functions such as breathing. Above the medulla is located the cerebellum. Cerebellum cooperates with the spinal cord in order to achieve precision (Bradshaw, Mattingley, 1995).

Furthermore cerebellum and medulla receive information by the thalamus, which is located at the top of the brain stem. Thalamus also receives information from the body and redirects it to the other parts of the brain. Under the thalamus is located the hypothalamus, that is related with normalization of the body's internal functions, like hunger, thirst sex and temperature. The limbic system is formed of similar cells bodies from the thalamus, hypothalamus and an above part. Aggressiveness is correlated with the amygdala that helps in its expression, in contrast to a similar structure, the septum, that restrains aggression. Memory is related to a third part of this system, the hippocampus (Bradshaw, Mattingley, 1995).

These aspects of brain cooperate in order to perform psychological processes. Space deficiency in this study leads to examination of language and memory only.

Sounds, their written symbols -words- and gestures combined in various ways constitute language. Phonology refers to the system of sounds that are used by a language. More specifically, it is consisted of phonemes, namely the basic sound units of the language together with rules about the way these phonemes are combined in order to form words and the way words, phrases and sentences are properly intonated. The second component of language, semantics, includes word meanings and word combinations. Apparently, language comprehension is impossible, if knowledge of particular words and their definitions as well as the understanding of the way words are used and combined into sentences and phrases are absent.

Grammar refers to a language's structure and is further divided into two major aspects: morphology and syntax. Morphology is the study of morphemes or a language's smallest units of meaning - prefixes, suffixes, and root words. It also includes rules about the proper combination of these units. The way in which words are combined into sentences is specified by syntax. For instance, every language is based on a system of syntactic rules that are used for expressing grammatical relationships like possession, juxtaposition of subject and object, negation and interrogation. And finally, pragmatics describe appropriate language use in certain contexts. Therefore, pragmatics involve the social aspect of language for effective communication

(Carroll, 1971; Durkin, 1995; Hetherington & Parke 1999; Matlin, 1998; McCarthy, 1971; Smith et al., 1999; Stern, 1971).

Brain damage may cause disorders of language. These disorders are described by the term aphasia (Geschwind, 1992). Aphasias may vary, depending which aspect of language is problematic (talking, understanding, writing, reading). In addition, the extent of aphasia may vary from small inability (recognizing words) to extended disorder. Strokes are the most common cause of aphasias although head injury from accidents or people suffered violence have similar effects (Yule, 1996).

The first study of the relationship of aphasia to the brain began by Paul Broca in 1861. He was the first that proved aphasias are related to specific lesions, and that damage to a part of the brain, the anterior speech cortex that is situated in the left hemisphere, was responsible for the aphasia. This type of aphasia makes extremely difficult the production of speech, that is "the aphasic produces little speech, which is emitted slowly, with great effort, and with poor articulation" (Geschwind, 1992, cited in Kosslyn & Andersen, 1992, pg. 635). In addition he concluded that if damage occurred to the corresponding part in the right hemisphere, the effects were not the same. The part of the brain that he discovered to cause this disorder was named Broca's area and the type of aphasia that occurs by damage in that area, Broca's aphasia (Geschwind, 1992, Yule, 1996).

Another important researcher for the study of aphasias is Carl Wernicke. In 1874 he published his work and argued that damage to the posterior speech cortex, that is now called Wernicke's area, produces different linguistic

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disorders from the disorders in Broca's area. Moreover the Wernicke's aphasic talks rapidly and without struggle, but their speech is, due to its rapidness and the patient's little comprehension is senseless and contains little information (Geschwind, 1992, Yule, 1996).

Patients with pure alexia without agraphia lose the ability to read. However they are able to write, but cannot read what they have written. This disorder derives from destroyed left visual cortex

Aphasics also show reading disabilities in addition to their linguistic disorders. In some cases the reading disabilities are the only symptom. Dyslexia generally refers to reading impairment and has separate forms (Thompson, 2000; Holmes 1978; Lipson & Wixson, 1997):

One type of dyslexia is developmental dyslexia. It describes people with normal to high intelligence that have reading problems without any identified brain damage. Acquired dyslexia describes people who have reading disabilities due to some known brain damage, although it is not always known where the damage is (Rayner & Pollatsek, 1989; Thomson, 2000; Van Orden, Jansen Op De Haar & Bosman, 1997; Zesiger & DePartz, 1997)

Furthermore acquired dyslexias are distinguished to :

* Surface dyslexia. Surface dyslectics show an impairment in reading only irregular words. The research showed that this behaviour occurs because surface dyslectics are trying to apply grapheme phoneme rules.

* phonological dyslexia. Although phonological dyslectics can read known words, they show disability in reading pronounceable non-words and unfamiliar words.

* deep dyslexia. Deep dyslectics tend to substitute a word with another semantically related word and they are unable to read pronounceable non-words and abstract words (Rayner, Pollatsek, 1989, Bradshaw, Mattingley, 1995).

Memory can be defined as the way in which experience we had in the past can be stored to the brain and how it can be expressed in our future behavior. We should regard memory as a multiple procedure, ability or system. People can develop a variety of memory abilities, according to psychological researches (Anderson, 2000).

* Episodic memory: this type of memory is activated during the recall of personal events that happened in the past of one's life. Apart from recalling the event itself, one usually recalls the time and place of the event, too.

* Semantic memory: this type of memory is rather different than the previous one. Unlike episodic memory, which is personal, semantic memory is common among people within a culture. In addition it is neither linked to a specific event, nor to a place or time. (Ebbinghaus, 1964)

* Procedural memory: as is obvious, this kind of memory is the one responsible for the knowledge of doing certain things (Ellis, Hunt, 1993).

Memory can also be differentiated in primary and secondary. William James, (1890) categorized memory in:

* Primary memory: " the steam of thought, or stream of consciousness". In this kind of memory we store the recent information and stimuli, only for a short period of time.

* Secondary memory: this type of memory is used for a long-term storage of the information that are temporarily stored in primary memory. It is usually harder to recall events and information stored there. Secondary memory is also known to be the " true memory". We could embody episodic, semantic and procedural memory in secondary memory (Schacter, 1996, McClelland, 1996).

Another distinction, which is more acceptable by modern scientists, is the one between short- and long-term memory (Ellis, Hunt, 1993). Apart from recent events and information, in short-term memory (primary memory) we also store the information that is recalled from the long-term memory (secondary memory). A matter in question is whether we should consider short-term memory to be equal with working memory (i. e. the memory that helps us do our daily tasks (Milner, 1999).

How does the memory work? How is it stored? These two questions have troubled the scientists, especially neuropsychologists, for years. Many experiments have been conducted to help answer them. Many of them included removing parts of the brains of animals in order to see if their ability to learn responses was damaged or if they had forgotten responses

they had learned before the removal. Although it is widely known that any part of the brain could be responsible for keeping memory, it is also known that when the temporal lobes, the frontal lobes or the hippocampus are damaged humans are likely to suffer from memory loss (amnesia) (Schacter, 1996).

When a person involved in an accident falls into unconsciousness after hitting their head, they are likely to recover with a loss of memory for events. When this loss of memory refers to events that took place before the accident, we have a case of retrograde amnesia. On the contrary, anterograde amnesia is the memory loss which refers to events after the accident (Schacter, 1996, McClelland, 1996).

Findings of a research by Russell and Nathan (1946) showed that among a thousand cases of head trauma that were examined, 850 were found to suffer from permanent amnesia, which at most of the cases was limited to the last minutes before the accident. The examination of cases of retrograde amnesia showed that there were patients that could hardly remember events which took place days, or even weeks before their injury (Milner, 1999).

Nevertheless, amnesia is not caused solely by direct injuries of the head. Various illnesses can be linked to it, such as cancer, as well as surgery. A good example to that, is a syndrome called Korsakoff's syndrome. Chronic alcoholics with a bad case of malnutrition, leading to the lack of vitamin B1, suffer from that particular syndrome. These patients, though may seem normal when somebody first meets with them (they can remember very well

events that came before their alcoholism), can often ask the same question even right after they have heard the answer or they can tell the same story over and over again.

Along with these symptoms, come usually some episodes of disorientation and confusion (Milner, 1999). It has been shown that the brains of these patients have been extensively harmed in the area of the diencephalons (a collection of infracortical structures) (Eyesenck, 1995). As studies have shown (Parkin, 1999), the neural system which lays within the medial temporal-diencephalic region is responsible for establishing new memories.

The main purpose of this study was to analyze the neural structures and how they relate and support psychological functions. The cerebral hemispheres, the cerebellum and the brain stem are the three main parts of a brain. Each one relates with specific operations and all interact in order to control our vital needs and behavioural responses. The psychological functions that were investigated here were language and memory.

Language has a specific construction, that individuals with brain damage such as aphasias may not interpret, or they may be capable of understanding some aspects of it.

Memory is the psychological fermentation that stores past events, and how this events are recalled in the future as an aspect of our behaviour. Various theories have categorized memory, and numerous researches were conducted in order to find which parts of the brain are related to this function.