



## **The disorder of the executive functions (inhibitory control, mental flexibility, and planning) and its reflections on the oral language**

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**Abstract:** This study aims at showing the implication of the disorder of the executive functions (inhibitory control, mental flexibility, and planning) on the oral language because they are the security valve of the higher mental abilities. Thus, any nervous injury may lead to a deficit in one of the levels of the executive functions which, in turn, leads to change in the linguistic behavior of the human. Hence, what is the relation between the executive functions and the oral language? How does the latter get affected by the disorder of these functions? And what are the linguistic symptoms resulting from that?

**Key words:** *language; executive functions disorder; oral language*

### **1. INTRODUCTION**

Language is a means of communication and understanding between people. Children react to the language they hear before developing the ability to use it. The baby cannot transmit a message using the language but can use his throat to make sounds that have special tones that express what he wants (Nouabssia & Qtawna, 2015, p.16).

Oral language is the ability to produce and understand verbal message. It is about producing vocal output of words from the brain. To achieve this, there must be a goal for communication and a choice of information to be said that is linked coherently with the speech context and form of exchange. The linguistic comprehension manifests in the set of operations that allow understanding the

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ideas of the speaker starting from the heard terms (Hurray & Kharbach, 2015, p.50).

Language is strongly linked to the central nervous system, which is the most complicated and is considered the center of the executive functions. Therefore, any injury in this system, especially the frontal lobe, would negatively affect the language functions and components, namely understanding and linguistic achievement. This causes linguistic troubles at all the language levels for the Alzheimer and aphasia patients. Because Broca's area is located in the frontal lobe, any injury may lead to disorder in the executive function, which troubles oral language due to the fact that the two areas are close to each other.

### **Problematic:**

Language is one of the processes of mental growth, as shown by Piaget and his theory about the role of language in the development of the mental processes of the child. Under these processes, there are executive functions that are the main determinants for maintaining the independence and the behavior's steadiness (Tlemceni, 2021, p.1374). We can define them as a set of mental processes needed for the presentation and monitoring of the behaviors used in the new or complex situations. They are managed by the frontal lobes and manifest in daily behaviors of the human. Their disorder may hinder the daily life (Abdul Qawi, 2011).

Research on the cognitive neural system has found that the executive functions develop at a very early age, and even before the first year of life. Thus, the teacher in the school or the kindergarten must work to develop his learners' executive functions (Ben Hamu, 2021, p.376).

The speaker and the listener need executive functions to organize their thoughts according to the communication situation. Moreover, these functions allow the speaker to choose the right words and stop the unsuitable ones. There are many studies such as those of Evans et al., (2016), Verhoeven (2015), and Vugus et al., (2013) which showed a strong relation between the executive functions and the various linguistic skills such as vocabulary, expressions, and learning the language (Mahmoud, 2019, p. 80). In addition, the disorder of the executive functions affects the linguistic skills according to studies such as that of Khammar (2016) who found that the disorder of these functions (inhibitory control, planning, and mental flexibility) affect the oral language of Broca's aphasia patients, in addition to the study of Kharbach & Daqiche that showed that the disorder of the executive functions leads to difficulties in the oral language of Broca's aphasia patients which manifest in omission of some words, the difficulty

of recalling them, and absence of spontaneous speech leading to the disorder of continuity.

In addition, reading gets affected when the executive functions are disordered, according to the study of Abdul Ghafar & Nechoua that aimed at determining the extent of the disorder of the executive functions in a sample of 3<sup>rd</sup>-year preparatory school students diagnosed with dyslexia compared to those who do not have this disorder. Findings showed that after the application of a set of tests, there were key variations between the two study samples in all the tests that showed the outperformance of the non-disordered people. Thus, the disorders of inhibitory control, planning, and flexibility affect the processes of processing reading.

Besides, the field study of Tlemceni (2011) on a sample of children with autism aged between 5 and 7 showed that there is an impact of the executive functions (inhibitory control and mental flexibility) on the development of the oral language of the child with autism, i.e., any disorder in these executive functions hinders the natural functioning of the oral language with which the child communicates and interacts with his surroundings.

Thus, we find ourselves obliged to grapple with a paramount question that is: what is the relation between the executive functions and the language? How does the latter get affected if the functions are disordered? And what are the linguistic symptoms that result?

### **General deduction:**

Since the language is a complex neural activity that needs the executive functions which allow the speaker to choose the suitable words for the context, stop the unsuitable ones, coordinate the ideas, and shift from one idea to another with flexibility, there is a direct relationship between the language and the executive functions as their disorder leads to the deterioration of the linguistic skills either in the comprehension or production. This goes with the study of Zellal on aphasia which found a disorder in the times of inhibitory control, choosing, and editing. This explains that the communication types and distribution of physiological times that are meant for the control of language are pathological.

Thus, the editing time is excessive (wrong productions, pidgin words, flexibility in control) as the language gets out of the patient's control, and the stopping time is excessive and manifests in very limited productions, leading to omissions of the suitable words (Zellal, 2013, p. 15).

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As a consequence, the speech therapist must take into consideration the role of the executive functions when diagnosing or treating the neural or cognitive disorder, which has a big role.

### **Definition of the study vocabulary:**

#### **1. Language:**

##### **1.1 Definition:**

Humbolt sees that language is both an individual and collective product at the same time. It is a form and content, a tool and a topic, a fixed system and a developed mechanism, and an objective phenomenon and a self-reality (Aiasra, 2011, p.23).

According to Estian, oral language is the ability to produce and understand linguistic message. The linguistic production is the vocal production of words starting from the brain. In order to achieve this, there must be an intention behind the communication and a choice of the information to be told. These information need to be linked coherently in the speech context with the external exchange. The linguistic understanding manifests in the processes that allow understanding what is heard (Hurray, Kharbach, 2015, p. 50)

We can give many definitions to language such as:

- A system of communication between two parts.
- A system of exchanging feelings and emotions between people.
- A means of expressing the needs, opinions, and truths between people.
- A hazardous system of phonetic symbols that are used to exchange ideas and feelings between the members of a homogenous linguistic group (Al Khawli, Mohamed Ali, 2015, p.12)

**1.2 As for the definition of the oral language**, according to Edward Sapire, it is a communication tool, not instinctive one, used to express ideas, feelings, and desires through a system of symbols aimed at this goal (Dalila Adda, 2016-2017, p. 15).

##### **1.3 Characteristics of the language:**

The language has general characteristics that are:

- 1- It is human.
- 2- It is mainly vocal (a tongue by nature).
- 3- The language develops through its vocabulary because the vocabulary grows with the experiences of the language speakers.
- 4- The language is affected by the immediate social context.

5- The speech language is generally accompanied by a body language (Al Khawli, Mohamed Ali, 2015, p. 23-24)

#### **1.4 As for the language levels, they are shown in this table**

*Table (01): The language levels and what they focus on*

No	Level	What is focused on
1	Phonemic	The correct use of the sounds according to the area and way of pronunciation
2	Phonologic	The coordination of sounds in the brain
3	Morphologic	The word structure from the inside
4	Syntax	Sentence structure and word order
5	Semantic	The literal meaning of phrases and sentences
6	Pragmatic	Meaning in context discourse

**Source:** Sartawi, 2000, p.35.

#### **1.5 This language has many functions that can be summed up as:**

- A tool to express the feelings and emotions and an important tool for the harmony between man and his environment.
- It determines the product of the human thought and provides the human with the symbols and meanings.
- It plays the role of learning, acquiring the information and experiences, and reading and writing.
- It is a tool to install the ideas and transmit them between the members of the society.
- It distinguishes man from the animal and makes him different.
- It is an important measurement tool relied on in questionnaires and personal interviews. It allows diagnosing the diseases according to its ability of thinking and expression.
- It is an effective tool in registering the accidents and experiences that man lives. Thus, it is a tool for saving history and patrimony and links the past to the present (Miroud, 2008, p.40)

#### **1.6 The neural anatomic base of the language:**

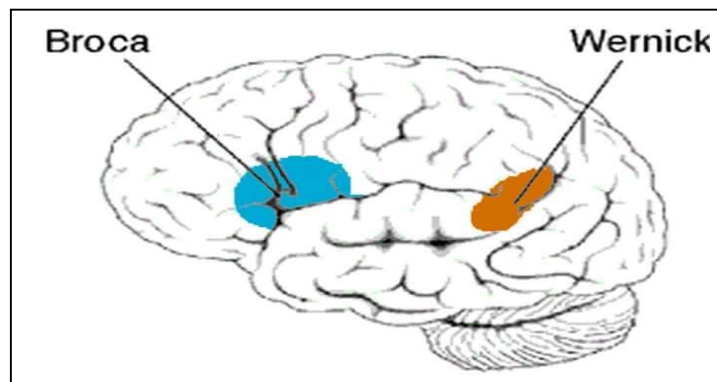
The main language components are located in the left hemisphere known as speech area that includes Broca's, Wernicke's areas, supramarginal gyrus, angular gyrus, and the long connecting paths that link the numerous linguistic centers. We find that:

- Broca's area is responsible for the pronunciation programming.
- Motor cortex activates the speech muscles.

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- Arcuate fasciculus is responsible for transporting the linguistic information from the rear to front areas.
- Wernicke's area is responsible for the oral language understanding.
- Angular gyrus works on the complementarity of the visual, acoustic, and touching data and the symbolic complementarity of reading.
- Corpus callosum works on transporting data between the two hemispheres.
- Sub- cortex areas are responsible for naming and recalling mechanisms and language and speech mechanisms (Kobba, 2009, p.272)

*Figure (01): the oral language areas in the brain*



Source: <https://www.techno-science.net/actualite/premiere-etude-aire-broca-chez-hommes-fossiles-N12965.html>

## **2. The executive functions:**

### **2.1 Definition**

They are among the main roles of the frontal lobe. They refer to a set of abilities through which the individual can engage in an intentional and active behavior that serves the self successfully. This includes a set of processes that are: organizing the self, sequencing of the behavior, flexibility, response stop, and behavior organization (Abdul Qawi, 2017, p.321)

The scientists did not reach a common definition because in psychology they refer to the directive functions that allow the execution of a specific task and the definition of the goal or desired aims and the suitable strategies through controlling their conduct and results. They are related to the higher functions (monitoring) that interfere with cognitive activation (Djaafar, Cherif, 2010, p. 42).

Welsh defines these functions as he ability to retain a suitable orientation to solve problems in order to determine a future goal. This orientation must allow for planning, strategy, controlling emotions, organized research, and change of actions ((Abdul Wadud, 2016, p. 11).

According to Anderson, they are the necessary and required skills for any intentional behavior of a specific goal (Abdul Qawi, 2011, p. 277)

Thus, they are the set of operations and conducts whose main mission is making the conformity of the individual with new urgent situations when the routine plans are not sufficient.

There is a set of cognitive functions under the thought, such as calculation, reasoning, judgment, meaning formation, abstraction, generalization, planning, and organization. These operations take us toward the notion that the executive functions are made up of the abilities that enable the individual to engage in an intentional and active behavior that serves the self successfully (Kahla, 2012, p. 138).

### **2.2 Types of executive functions:**

The scientists mentioned many special types of executive functions. We shall mention in the last point some common points. We find:

**Inhibitory control** which is an activity oriented towards a goal that happens simultaneously with the automatic activation operations of the content of the consciousness. It includes attention, memory, and linguistic processing (Abdul Wadud, 2016, p. 53).

**Mental flexibility** indicates the ability to control our attention to things that we want and transform into another situation when necessary. It is divided into:

**Reactive flexibility** is the ability to change behavior according to the external changes.

**Automatic flexibility** means producing different responses in a specific context that does not require modifications (Bargue, 2013, p.46).

**Planning** is one of the necessities of taking a decision, organizations, and performance. It is an aspect of cognitive control. It is defined as a dynamic transformative process that includes the consciousness or the intentional succession of the actions that are oriented towards achieving some of the problem goals insisting on the continuous change in the relation between the plans and actions (Abdul Wadud, 2016, p.48)

### **2.3 The anatomic aspect of the executive functions:**

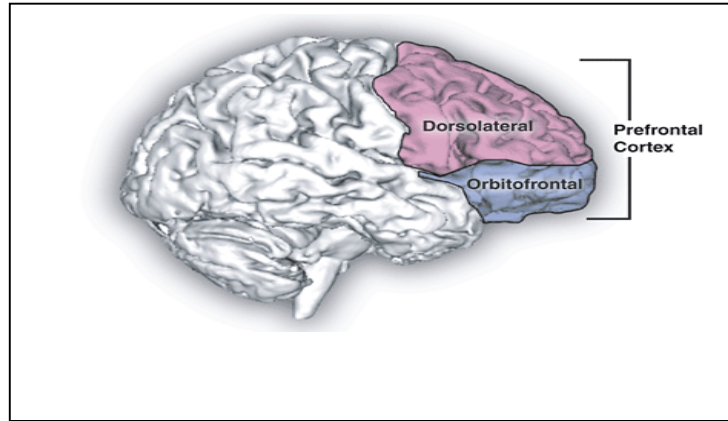
The frontal lobe plays a key role through its connection with the cortex area. If there is a trouble in the circles that link these areas, there will be a disorder in these functions. These areas are the most affecting for the executive functions:

- 1- Rear and front side area;
- 2- Upper and lower side areas;
- 3- Upper lower area of the inner side with the cingulated gyrus.

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These areas indicate the existence of a frontal attention system that focuses on the importance of the frontal lobe and the front areas of the brain in the process of attention (Kahla, 2012, p. 149).

Figure (02): The neural areas responsible for the executive functions in the frontal lobe



Source: [https://en.wikipedia.org/wiki/Executive\\_functions](https://en.wikipedia.org/wiki/Executive_functions)

### **2.4 The importance of the executive functions:**

They work on the organized orientation towards solving a specific problem and maintaining the mental readiness to solve these problems in the future in the long or short terms. Furthermore, they work to manage the behavior of inhibitory control and activation in the sequence of the individual's responses with the flexibility of the verbal organization of the self and the good use of the strategies and plans (Abdul Qawi, 2017, p. 321).

In addition, these functions are considered important for performance in the various aspects of life and scientific activities. They help in organizing the individual's behavior in the light of his previous knowledge, experiences, current situations, future expectations, the individual values, and then achieving the goals. Creating an aspect of motivation and readiness helps acquiring flexibility in performance and allows changing the strategies and adaptation with the changes in the various situations. In general, they have a key role in life and are considered a form of developed behavior of the general response to the special. They conform to the situations, try to adapt the individual with the situations, and help thinking, planning, adapting with the changes, and executing the new plans to reach the goals in specific circumstances (Hamdan, 2019, pp. 32-33).

### **3. The relation of the language with the executive functions:**

This relation manifests in:



**a. The anatomic aspect:** the prefrontal cortex is one of the components of the complex neural network. It virtually includes distinct models that are linked to cortex and sub-cortex areas. Thus, the role of this area is making active processes where the sensor data are so simple in order to magnify the effective behavior. The frontal lobe is responsible for analyzing and interpreting sensor data and controlling responses.

Due to the fact that the prefrontal and frontal lobes are a center for many abilities such as memory and attention –as shown in the studies conducted on different patients- the damage in these areas may lead to a disorder in many functions such as reasoning, active memory, and the executive functions (Abdul Wadud, 2016, p.20).

The nervous system has a role in producing and understanding the language. The central nervous system receives the nervous beats emerging in the ear and leads them through the acoustic neuron to the hearing and understanding area at the temporal lobe of the brain where the vocal signs are registered, analyzed, understood, and stored in the memory. On the other hand, other areas above the collateral fissure in the frontal lobe produce speech with what suits the different situations. The executive functions have the same nervous areas as the latter whose role is organizing and controlling the movements of the mouth, face, and the eyes from one side, and controlling and planning information from another side. Thus, any damage at the level of the executive functions affects language and vice versa due to the near position of the two areas from the nervous side and the cognitive structure of the two functions. Thus, the central nervous system plays a key role in the symbolic control of language (Zaki, 2010, p. 67).

**b. From the linguistic side:**

Bishop, Nation, & Patterson (2013) suggest three models that explain the relation between the executive functions and language:

- The process of mastering the vocabulary and semantics requires the activation of much linguistic input. Recognizing the word requires changing the voice layer to inhibitory control the wrong response. Thus, the difference between that activation increases on behalf of the correct way.
- The linguistic ability negatively affects the development of the executive functions because the children resort to using verbal means when performing specific tasks that require the executive functions.
- There are no direct negative repercussions on the cognitive level between the linguistic abilities and the abilities of the executive functions. However, the common genetic factors may explain the relation between these abilities of the children because the late development of frontal lobes may affect the important

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brain areas for the executive functions and the surrounding areas that include the linguistic processes (Dhuha, 2019, pp.84-85).

As for reading and writing, the executive functions affect them equally because the damage may lead to scholarly difficulties that manifest in difficulties in reading, writing, and problem solving.

We find that the difficulty of planning affects hugely the determination of the necessary phases to draw the letter and write in general. Moreover, any problem at the level of control and mental flexibility leads to the impoverishment of the child's lexicon and good use of vocabulary, in addition to the easiness of moving between the scholarly tasks and the ability to solve problems and, thus, a difficulty in adapting with the educational level.

### **4. Symptoms of the executive functions disorder on language:**

The frontal lobe plays a key role in the executive functions through its connection to the cortex areas. If the cycles that link these areas are damaged, the functions damage as well. This is known as the frontal lobe syndrome. The damage of the frontal cortex leads to the appearance of a set of behaviorist symptoms characterized with the inability to maintain the mental readiness, disorder in the correlation between verbal and motor behaviors, lack in complex or programmed movements with the appearance of visual thought, and low mental control. Moreover, the damage of the internal frontal cortex leads to symptoms of low motivation, interest, and social communication (Abdul Qawi, 2017, p. 321).

- The disorder of the function of flexibility leads to the continuity symptom and the difficulty of moving from one speech situation to another especially in the structured interviews.

- The disorder of inhibitory control function leads to the echolalia and is responsible for the disorder of the verbal liquidity leading to omission (not pronouncing the whole words) and talkativeness.

- The disorder at the level of the planning function may lead to disambiguation and difficulty of narrating a story; thus, a disorder in speech pragmatics.

### **5. CONCLUSION:**

We tackled an important topic in clinical neurolinguistics and cognitive psychology. Lately, these two domains gave importance to verbal language and its relation with the executive functions namely. Language in its two types, written or oral, affects and gets affected by the executive functions that contribute to the process of the linguistic adaptation of the human in the situations that require choosing the appropriate words and stopping the inappropriate ones. Moreover, it helps increasing the suitable flexibility to move from one speech situation to

another especially during the dialogue, in addition to the constructive planning of the communication process so that it becomes purposeful. Therefore, we wish the upcoming studies would shed more light on this topic especially in diagnosing the linguistic disorders. We must not neglect the executive functions neither in the process of diagnosis nor treatment.

### **BIBLIOGRAPHIE :**

#### **Book & ebook without DOI, ebook without DOI from research databases**

- Abdul Qawi, Sami (2011). *Nervous psychology, principles and evaluation*. 1<sup>st</sup> edition, From the ocean to the Gulf House of publication and distribution, Oman.
- Abdul Qawi, Sami (2017). *The clinical psychological medicology*. 2<sup>nd</sup> edition, Abu Dhabi, the Anglo-Egyptian library.
- Al Aiasra, Rafik Walid (2011). *Language and thought*. 1<sup>st</sup> edition, Jordan, Osama house for publication and distribution.
- Al Khawli, Mohamed Ali (2015). *An introduction to linguistics*. 1<sup>st</sup> edition, Al Falah house for publication and distribution, Jordan.
- Kahla, Olfet Hussain (2012). *Nervous psychology*. The Anglo-Egyptian library, KSA.
- Kobba, Mohamed Ziad yahya, Rossol Lov, & One Pep (2010). *Neurology for specialists in language and pronunciation*. King Fahd library for publication and distribution, Riad.
- Miroud, Mohamed (2007-2008). *Strategies of comprehension of the monolingual and bilingual child*. University of Algiers 2.
- Oda, Dalila (2016-2017). *Adapting Khomsi test for the verbal language evaluation to the Arabic language spoken in the Algerian settings*. University of Algiers 2, Algeria.
- Ben Hamu, Mohamed Abdul Hadi (2021). The relation of the executive functions with the process of reading of the school children. *The professional journal for sport, human, and social sciences*, Vol.8, No° 01.
- Doha, Mohamed Abdul Hakim Mahmud (2019). A program based on the executive functions to develop the vocal and visual awareness and its impact on the social interaction of the linguistically retarded children. *Cairo University*, Egypt.
- Hamdan, Abdul Hafid & Achraf Lotfi, (2019). A training program for developing the executive functions and its effect in reducing the behavior of bullying by intellectual disability children and hearing impairments. *Cairo University*, Egypt.
- Hurray, Amina & Kharbach, Huda (2017). Building a measure for the verbal language of the children with Down syndrome who speak Tamazight. *Unity of Research journal in developing and administering the human resources*, Vol.8, No°2, pp.46-61.
- Sartawi, Abdul Aziz (2000). *Language and speech disorders*. Vol.01, UAE, special education academy.
- Tlemcani, Leila (2021). The effect of the executive functions (inhibitory control and mental flexibility) on the development of the oral language of the child with autism. *Wisdom journal for philosophic studies*, Vol (09), No°.2, pp. 1372-1391.
- Wissam, Jaafar Sherif (2010) . The nature of the executive functions (inhibitory control, mental flexibility, planning) for the schizophrenia patients. *University of Algiers 2*.
- Zella l(2013). Neuroscience language and language . *Journal of slncom laboratory*, N°. 08, University of Algiers