Investigation of Anomic Aphasia Cases Using Noam Chomsky's Distinction between Competence and Performance

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Abstract

The main purpose of this research paper is to investigate the effect of the injured brain regions of the patients, who suffer from aphasia. This study is from a linguistic perspective. This will be investigated from various perspectives, specifically *phonology* and *syntax*. As these study cases face major problems especially in these two linguistic aspects. Some of these language deficits prove that the human brain contains a constrained and well-characterized faculty. The function of this faculty is to represent the sentence structure (Dick et al., 2001, p.759). Moreover, this paper represents the various types of aphasia, by focusing on showing the injured areas in the brain after cerebrovascular stroke. This paper presents three cases who suffer from *Anomic Aphasia*. The diagnosis of the patients in this research is conducted within the framework of The Western Aphasia Battery Revised (WAB-R), which is a scale of questions that is used to determine the language deficiencies that the patients suffer from (Gom'a et al., forthcoming). After the application of this test, specific regions in the brain, that are responsible for language production and comprehension, are going to be shown. Moreover, it represents the localization theory and how it is related to the human brain. Finally, it investigates the relation between localization theory and Chomsky's distinction between *Competence* and *Performance*.

Keywords: Aphasia, Brain, Localization theory, Insula, Competence and Performance

0. Introduction

This research paper is divided into six main sections. The first section presents the definition of Neurolinguistics and what is the relation between the brain and language. The second section shows the structure of the human brain and its importance. This section includes two subsections, the first one presents the brain lobes in the left hemisphere that are related to the production and comprehension of language. And the other section shows the most two important regions in the brain's left hemisphere. These two regions are Broca's and Wernicke's areas. The third section displays the definition of aphasia and how it is related to the Central Nervous System (CNS). This section contains one subsection that represents the different types of aphasia. The fourth section investigates the localization theory's definition. This section is divided into four subsections. The first one presents the various brain regions that are related to language. The second and third subsections display the discoveries of the scientists *Broca* and *Wernicke*. The fourth one presents *the Insula* brain region and its importance in the human being's awareness of the outside world. The fifth section presents Chomsky's distinction between competence and performance. And how both of them differ from each other. The last section shows the analysis. This section presents three cases that suffer from *Anomic aphasia*. Then their speech-language deficiencies are analyzed and investigated from a linguistic perspective by using Chomsky's distinction of competence and performance.

0.1 Purpose of the study

The current study attempts to:

1- Investigate the different types of aphasia.
2- Demonstrate that language impairment is resulted from lesions in specific regions in the brain.
3- Show that people with common language impairment suffer from lesions in a specific common part in the brain.
4- Apply Chomsky's distinction between *Competence* and *Performance* on patients that suffer from Anomic Aphasia.

0.2 Research Questions

1- What are the different types of aphasia?
2- How is the WAB-R going to be applied to assess adult patients with aphasia?
3- What are the language impairments that the brain's lesions lead to?
4- What is the relation between aphasia and Chomsky's distinction between *Competence and Performance*?

0.3 Hypothesis statement

The study hypothesizes that if people from different ages suffer from the same type of aphasia and injured in the same region in their brains, they have, to a great extent, the same language impairments. This is deduced by using Western Aphasia Battery Revised (WAB-R). (WAB-R) is a scale of questions that is used for imposing the adult's language function to discern the presence, degree, and type of aphasia.

The design of the Western Aphasia Battery (WAB) was initially made based on the clinical and neuro-linguistic standards, ideas, and subtest's structure created by Goodglass and Kaplan for the Assessment of Aphasia and Related Disorders. (WAB) was originally an unpublished test by Andrew Kertesz in 1968. Throughout the following 14 years, Kertesz and his partners distributed a set of articles in which the test was portrayed. The articles contained detailed description of the theoretical and clinical foundations of the test, injury characteristics and other data about the participants in the test. After the publishing of the test, it was isolated from the content, which was presented on paper, and was published as the first Western Aphasia Battery in 1982 (Kertesz, 1979). In 2006, Pearson Assessment reunited the text and test as the Western Aphasia Battery-Revised (WAB-R), adding trial of perusing and composing of sporadic words and non-words, and refreshing scoring directions (Turkstra, 2018).

1. Neurolinguistics

Language is mainly related to the brain. The brain is the main organ that is responsible for the language. The language is located in specific areas of the left hemisphere in most of the normal adults. This special branch of linguistics is called *Neurolinguistics*. *Neurolinguistics* investigates the

physical structure of the brain and its relationship with the production and comprehension of language (The Editors of Encyclopedia Britannica, 2015).

Neurolinguistics history is introduced in the modern period, starting from 1960s. Consequently, an overview of studies and theories appeared as they were discussing the impacts of brain injuries on language behavior. Until the 19th century, when a single case of brain injury was recorded. *Franz Joseph Gall* began to search about the localization of mental capacities in the brain, especially *language*. In the beginning, the language was only viewed as producing and understanding words. In the 20th century, aphasiologists started examining grammatical and phonological issues, and its relation to aphasia. The aphasiologists' interest in linguistic aspects of language led to the rise of *Neurolinguistics* as a scientific discipline (Eling, 2015).

Neurolinguistics is the investigation of the neurological processes that are responsible for the storage and usage of language. Although it has been determined that the language faculty is located in the left half of the brain for the right-handed people, a discussion remains concerning whether there are individual aspects of language that are corresponded with various specific regions of the brain (The Editors of Encyclopedia Britannica, 2015).

Using language is considered an important thing that is as essential as food and water. We use the language to exchange information, make relations with the others, and create art. Human beings and animals can communicate successfully, but they communicate differently. Different animals have their own codes to communicate with each other. These codes can indicate, for example, that there is danger, and they have to watch out, a readiness to mate, or the presence of food. Such interchanges are ordinary acts that do not have a formal structure like the one that people use when they articulate sentences (Cohut, 2019).

Conversely, human language has two distinctive functions. These are:

1) ***Compositional***, which means that it permits speakers to communicate by forming sentences involving subjects, verbs, and objects.

2) ***Referential***, which means that speakers use it to exchange information with one another about people or objects and their places or activities (Cohut, 2019).

2. The structure of the human brain

This section presents the structure and function of the brain of the human being. The brain is a three-pound organ that controls all the body's functions. The brain governs numerous things such as wisdom, creativity, feelings, and memory. The brain is secured inside the skull. It consists of the cerebrum, cerebellum, and brain stem (Hines, 2018).

Numerous linguists contradict with the assumption that our brain pictures everything that is related to speech or comprehension. They stress that when we communicate using a proper language, we are not fully aware and conscious of all aspects of the language and rules that determine the language validity. When we talk or understand ordinary words and sentences, the system that governs rules of the language is operative, as we never have conscious mental pictures of these rules. Subsequently, we should accept that standards of language and principles of lexical word relations can be best described as an *abstract system*. This framework is like all the other rules' frameworks, such as the framework for learning chess. At a certain point, when we become familiar players of chess, we play without deliberately focusing at any second on guidelines. We rather do them unexpectedly. Thus, grammarians presume that in the linguistic framework, sense additionally is best comprehended spontaneously (Schnelle, 2010).

In another paper which was published in 2018, some cases of aphasia asserted the role of short-term memory in language processing and submitted that the language disability in aphasia includes impairment to cognitive processes that activate and keep up the representation of words. This research paper examined 39 individuals with aphasia and 16 age-matched neuro-typical controls on a test battery for aphasia that asserted the impacts of increased short-term memory and its load on word and sentence processing just as the impacts of linguistic variations on verbal short-term memory abilities. The two concepts, that are tackled in this paper, are specificity of diagnosis and sensitivity to all degrees of aphasia seriousness, including mild aphasia. The analysis showed that how the performance of

the patients, who had mild aphasia and achieved ordinary degree of performance on the Western Aphasia Battery, represented a decrease in a temporal delay condition that is greater than performance of control patients. They also reported fundamental information demonstrating the different impacts of including a time interval before their reaction or between things to be looked at and compared. So, this diminished accuracy for certain cases with aphasia and improved the accuracy for other cases (Martin et al., 2018).

2.1 Brain Lobes

The human brain is divided into two halves, which are the left and right hemispheres. The left half of the brain is considered the *logical brain*, that is related with the language and investigation. The right half of the brain is considered the *creative brain*, that is related with creativity and imagination (Mandal, 2019). They are joined by a heap of strands called *Corpus Callosum* that carries messages from one hemisphere to the other (Hines,2018).

The external layer of the brain is called the *Cerebral Cortex* that gives the brain its wrinkly appearance. The cerebral cortex is separated into two cerebral hemispheres joined by *Corpus Callosum*. Each hemisphere is divided into four lobes: *frontal, parietal, temporal, and occipital* (Lobes of the brain, 2018).

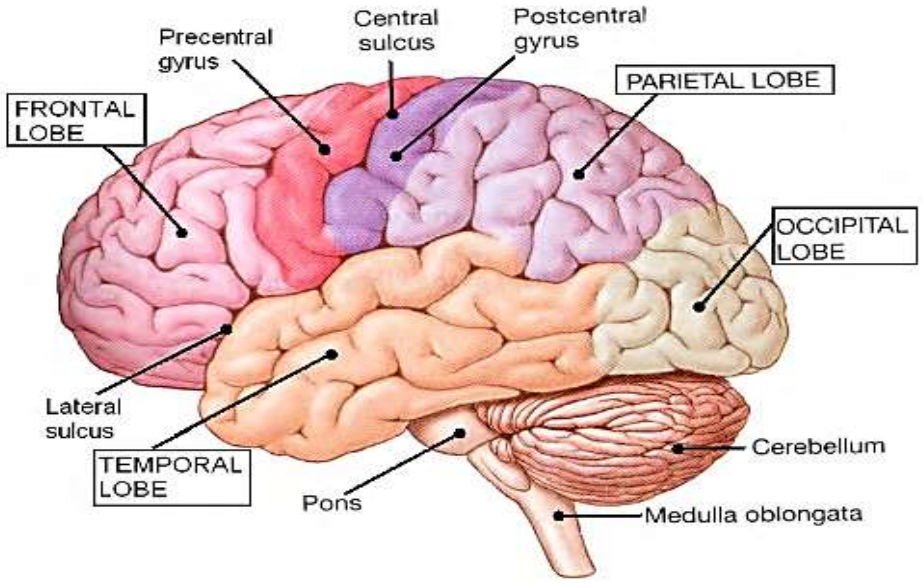

Figure 1. Brain's four main lobes (Alzaidi, 2009)

In spite of the fact that most of the brain functions are related to various areas over the whole brain regions, it is still true that every region in the brain is responsible for a specific function (Lobes of the brain, 2018).

2.2 Broca's and Wernicke's areas in the brain

There are two essential *language focuses* in the brain, which are both situated on the left side of the brain. These are *Broca's area*, which is related to speech production. And *Wernicke's area*, whose fundamental job is to understand discourse. If an individual has a brain injury that brings harm to one of these regions, it will weaken their ability to talk and understand what is said (Cohut, 2019). Therefore, Broca's area specifically responsible for the *language's syntax,* which is the structure of the language, while Wernicke's area is responsible for the language's semantics, which is the meaning of the language.

3. Aphasia

Aphasia, which is also called *dysphasia*, is a disorder in the comprehension and production of language, and sometimes also in reading or writing. It happens due to head injury, tumor, stroke, or an infection. Symptoms differ according to the injured brain region and the degree of its severity (Aphasia, 2021). It happened due to a recently acquired injury in the Central Nervous System (CNS) (Sarno, 1998, p.25).

Although all mental actions and communication originate from the action of the central nervous system (CNS), but mentioning the CNS is significant in light of the fact that aphasia is not the result of odd usage of language identified with psychogenic or social deviations (Sarno, 1998, p.26).

Aphasia can be mild or serious. If somebody wants to communicate with the patient, it will be practically incomprehensible, or it tends to be mild. But the aphasic patients are not acting like kids. Their linguistic abilities might be affected in just one aspect of language use, for example: *the ability to recover the names of the objects*, *or the ability to assemble words into sentences*, *or the ability to read*. The most common effect is that numerous aspects of communication are disabled, and only a few channels remain available for just restricted exchange of communication.

3.1 Types of Aphasia

There are several types of aphasia that can be classified according to several elements, for example ***Fluent*** or ***Non-fluent***, ***Impressive*** or ***Expressive***. Or according to the injured part in the brain ***Posterior*** or ***Anterior***. This research paper focuses on ***Fluent*** or ***Non-fluent*** classification. The ***Non-fluent*** types are: *Global, Broca* and *Transcortical Motor*, while the ***Fluent types*** are: *Wernicke, Transcortical Sensory, Conduction* and *Anomic*. The lesion is found in the posterior area of the brain in fluent aphasias, while it is found in the anterior area of the brain in non-fluent ones. Nonetheless, global aphasia has severe injuries, including the anterior and posterior parts of the cerebral arteries' area (Laska, 2007, p.10).

Anomic aphasia is a type of language disorder. It happens due to a brain injury that usually occurs in the left half of the brain. Anomic aphasia can be shown in having difficulty saying specific intended words. The anomic patients usually face difficulty in retrieving nouns, and sometimes verbs, while they form a sentence structure. On the other hand, the grammatical structure remains intact. While they are trying to retrieve a certain word, this sometimes leads to long pauses, insertion of filler words, or choosing wrong words/ *paraphasias* during their speech with another one or during doing any other activity, such as naming pictures. Additionally, *circumlocution* is common with patients who suffer from anomic aphasia. circumlocution means that the speaker cannot get the exact word and rather depicts or gives related information about the word. This shows that all the anomic aphasia's symptoms and neural correlates can vary (Raymer, 2011). Although Anomic aphasia can be easily recognized from other aphasia types, but there is no specific brain region, that if it is harmed, can be related to Anomic Aphasia from all the other types of aphasia (Yourganov, Smith, Fridriksson, & Rorden, 2015).

4. Localization theory

Localization theory of the brain means that specific regions in the brain are responsible for certain abilities and functions, for example *language, memory…etc.* Recently, this theory was confirmed by neuro-imaging studies. However, it was examined many times previously by the usage of case studies (Sparks, 2020). *Paul Broca*, a French neurosurgeon, was the first one

discovered the localization theory. He proved that a specific location in the brain is associated with a certain function (Ardila, 2014, p.14).

One of the outstanding and first famous cases that were examined previously in 1848 was that of *Phineas Gage*, who was working in a rail line. When he suddenly had an accident; an iron rod penetrated his skull and removed most of the left frontal lobe of his brain. The rod entered Gage's head just beneath his upper left cheekbone and out from the top of his forehead (Gearhart,2020). Although Gage survived this accident, he had a change in his character, for example, *loss of inhibition and anger*. This change in Gage's character acts as proof of the localization theory. It was believed that the injured area was responsible for the change in Gage's character (Sparks, 2020).

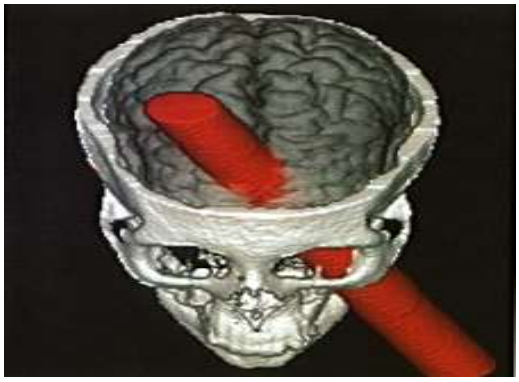

Figure 2. Gage's brain after the accident (Whitehead, 2006, p.10)

4.1 The Human brain regions that are related to language

There are brain regions that are presented in both, the left and right hemispheres such as *visual* and *auditory cortex*. They are called *bi-laterally* areas, which means that they are represented in both hemispheres. But there are specific few brain regions in the dominant language hemisphere, which is the left hemisphere, are more integrated in issues related to language and speech. These areas are:

4.1.1 The Visual Cortex: It is an area in the brain, which is a part of the cerebral cortex that is responsible for visual information and data (Mandal, 2019).

4.1.2 The Auditory Cortex: It is another part in the brain, which is also found in the cerebral cortex that is related to sounds and audible information (Mandal, 2019).

4.1.3 Wernicke's area: which is an area in the temporal-parietal junction in the cerebral cortex that is responsible for speech comprehension whether written or spoken. This area is named after *Carl Wernicke*, a German neurologist who discovered it and concluded that it is the area that is associated with how words and syllables are articulated and uttered (Mandal, 2019).

4.1.4 Broca's area: which is a region in the frontal lobe in the left half of the brain that is associated with speech production. The area is named after *Pierre Paul Broca*, who discovered it and concluded that it is the brain region that is responsible for speech production after examining two patients with injuries in common in this area. (Mandal, 2019).

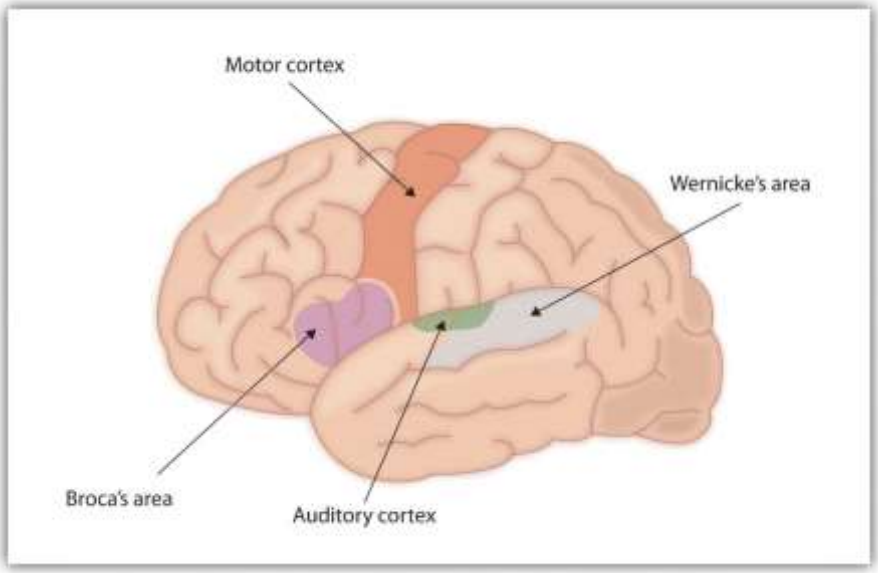

Figure 3. The brain regions that are related to language (Suri, 2021)

4.2 Paul Broca's first discovery

Early studies that investigated the various regions of the brain that are related to language, began in 1861. *Paul Broca*, a French neurosurgeon, examined the brain of a deceased patient who had language issues. Although the deceased did not have any trouble in understanding the spoken language or any disabilities in his mouth or tongue that may have affected his ability to talk, he could neither say a full sentence nor express his thoughts through writing. The only understandable sound that he could say was *Tan*, which Broca used to call the patient with as well (Ardila, 2014, p.14).

Broca decided to autopsy Tan's brain, he found out that there was a sizable injury in the left anterior frontal cortex. Therefore, Broca examined the brains of other eight distinct patients, every single one of them had comparable language lacks alongside injuries in their left hemisphere. This drove him to state his first explanation "we speak with the left hemisphere" (Prins and Bastiaanse, 2006, p.763). Then he was certain about the presence of the *language focus* in the anterior part of the frontal lobe of the left hemisphere, which was later known as *Broca's area*. This was the main brain region that is related to language ability. Later, any lesion that happened in the anterior part of the third frontal gyrus in the brain was recognized as *Broca's aphasia* because the lesion occurs in Broca's area in the brain (Prins and Bastiaanse, 2006, p.763).

4.3 Wernicke's discovery

Ten years after Broca's discovery, specifically in 1874, Carl Wernicke, a German neurologist, found that another area in the brain is responsible for language comprehension. This area is located in the posterior part of the left temporal lobe. People who have an injury in this brain region can speak, but their speech is incomprehensible, and it is incoherent and makes no sense (Ardila, 2014, p.15-16).

4.4 Insula

The insula is a small area of the cerebral cortex, that is concealed inside a prominent fissure, that is called *Lateral Sulcus*. That is why it was generally unnoticed for so long. It is a huge fissure that isolates the frontal and parietal lobes from the temporal lobe. However, neuroimaging studies examined the patients with harm to this region, they found that this brain region plays a role in various everyday activities (Liang, Mouraux, & Iannetti, 2012, p.1).

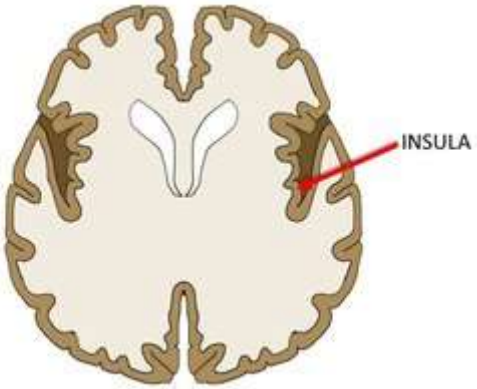

Figure 4. Insula in the brain (Know your brain, 2013)

The insula is responsible for these apparently disparate things since it encourages our concept of self-awareness. It includes the awareness of our bodies and feelings, and how they interact to make our impression of the current moment and incident (Craig,2009).

The possibility that the insula is engaged with the development of our awareness of the present moment can be returned to what is exactly known as the "*Somatic Marker Hypothesis*" (Craig,2009). It is discovered by *Antonio Damasio* during the 1990s. According to the Somatic Marker Hypothesis, people use substantially their bodily signals to assist them with making decisions, for example a nausea in your stomach when you walk around in a dark side street at evening time may make you adhere to the bright main street. *Damasio* proposes that the insula plays a significant role in the preparing of these bodily sensations and then they affect our awareness and decisions making (Craig,2009).

5. Noam Chomsky's distinction between Competence and Performance

Chomsky explained the difference between *competence* and *performance*. He defined the *competence* as "the speaker-hearer's knowledge of his language" (Chomsky, 1965, p.4). Competence is the essential and fundamental knowledge that each speaker and audience have about the language of their own community. As indicated by Chomsky's definition, competence is regarded as a mental or psychological property, that cannot be seen. On the other hand, *performance* according to Chomsky is "the actual use of language in concrete situations" (Chomsky, 1965, p.4). Performance implies a genuine useful communicative activity of listening or speaking. As indicated by this differentiation, *performance* is considered a separated, fragmented, and false portrayal of what individuals know about their language (Chomsky, 1965).

6. Analysis

In this research, the analysis of three cases that suffer from *Anomic aphasia* are presented. This study focuses on two aspects: *phonology* and *syntax*. Each patient is subjected to Western Aphasia Battery Test (WAB-R), which is a scale of questions that consists of various sections that test the

competence and performance of patients. The three cases were asked the same questions and the same test applied to all of them. The research just focused on the sections that each patient had difficulty with.

6.1 Study Sample

A sample of three patients is selected to apply the WAB-R on. Their native language is Arabic, and they are not well-educated. Two of them are males, and one is female. Their ages range from 40 to 50 years old. This sample of patients is chosen to prove that lesions in specific brain regions are the main cause of specific language and speech impairment. AFTER FORMAL WRITTEN ENDORSEMENT FROM THE PATIENTS, they approve to participate in this research and to be questioned by the researcher.

6.2 Study Design

The study design is the framework that has been created to find answers to research questions. The study type is *descriptive, experimental, review and meta-analytic*, and subtype is *research problem, hypothesis independent and dependent variables, and experimental design*.

6.3 Location of the study

It is an interdisciplinary work between Faculty of Medicine, Neurology department, Ain Shams University and Faculty of Arts, English department, Linguistics field, Ain Shams University.

6.4 Study Tools

Magnetic Resonance Imaging (MRI) is used to examine the lesioned regions in the patient's brains. Moreover, the Western Aphasia Battery Revised (WAB-R) scale of questions, which is translated into Egyptian Arabic, is used to examine aphasic patients, to identify the type of aphasia and the degree of its severity to be categorized properly. The patients were asked the same questions and were shown the same set of pictures to describe.

6.5 Sections of (WAB-R) Test

First Section	The first section of the WAB-R is the *Conversational Questions within the Spontaneous Speech part*. In this section, the patient is asked several questions about ***his name, job, address…etc***. And he has to interact and reply to these questions.

Second Section	The second section is *Picture Description- Spontaneous Speech Content and Fluency section.* In this section, the patient is shown a picture of a family in a market buying fruits and vegetables. And he/she is asked to describe the picture in front of him/her.
Third Section	The third section is *Yes/No Questions of the Comprehension.* In this section, the patient is asked yes and no questions. And he/she has to reply either by only yes or no.
Fourth Section	The fourth section is *Auditory Comprehension of Words.* In this section, the patient is asked to point to real things presented in front of him/her at first. Second, the patient is asked to point to things printed on papers including ***shapes, colors, letters, numbers…etc***. Third, he/she is asked to point to surrounding objects. And finally, he/she is asked to point to specific body parts.
Fifth Section	The fifth section is *Sequential Commands of the Comprehension.* In this section, the patient is asked to do successive orders. At first, he is asked to do just one order. Then, the patient begins to be asked to do more than one successive order.
Sixth Section	The sixth section of the WAB-R is

	Repetition. In this section, the patient is asked to repeat what has been just said. At first, he/she is asked to repeat just one word. Then, he/she is asked to repeat phrases and sentences.
Seventh Section	The seventh section is *Naming.* The patient is presented with real objects, and he/she is asked to name them.
Eighth Section	The eighth section is *Completing the Sentences section.* In this section, the patient is listening to part of sentences, and he/she is asked to complete these sentences with proper words.
Ninth Section	The ninth section is the *Words' Fluency*. The patients are asked to name as many animals as they can.

In the given examples, they are going to be represented on three levels: The first level is the *actual language data*, the second level is *word-by-word gloss*, and the third level is the *idiomatic translation*.

6.6 The first patient

6.6.1 Phonology

The first patient is a male. When he was asked about his job, he said:

1) [bʃtaɣal ħaga:t kiti:r] ***(Actual Language Data)***
work things a lot ***(Word-by-word gloss)***
"I work a lot of things." ***(Idiomatic Translation)***

When the same question was repeated, he says:

2) [bʃtaɣal sawwa:q]
work driver
"I work as a driver."

But he faced difficulty in pronouncing the voiceless alveolar fricative /s/ sound in /sawwa:q/. He said it as /wa:q/ without the /s/ sound in the initial position.

In the *Repetition section* of the WAB-R, When he was asked to repeat the word *sri:r* 'Bed'. He again faced the same difficulty in

pronouncing the voiceless alveolar fricative /s/ sound in initial position and he said it as /ri:r/ instead of /sri:r/.

The same difficulty was repeated again in /s/ sound in the following phrase when he tried to repeat it:

3) [xamsah w ʔrbiʕi:n]
five and Forty
"forty five."

When he tried to repeat *xamsah* 'five', he could not say /xamsah/ and he said it as /xamah/ without the voiceless alveolar fricative /s/ sound in medial position.

He also found the same problem in pronouncing voiceless alveolar fricative /s/ sound in final position as in the word *bas* 'only'.

Therefore, it is clear from these several examples that he faced the same problem. The lesion in his brain led him to have a difficulty pronouncing the voiceless alveolar fricative /s/ sound in all positions *initial*, *medial*, and *final*.

In the section of *Comprehension* of the WAB-R, when he was shown the spoon, he named it as:

4) [maʕlaʔit kɔʃari]
spoon *koshry*
"Koshry's spoon."

But he found difficulty uttering the voiceless fricative /ʃ/ sound in medial position in the word /*kɔʃari*/, he said it as /*kɔri*/. He found the same difficulty of /ʃ/ sound in saying the word *mʃbk* 'clip'. He said it as /mbk/. Therefore, he also had a problem in saying the voiceless fricative /ʃ/ sound.

In *Completing the Sentences section* of the WAB-R, when he was asked "where do the nurses work?". He said:

5) [mɔstaʃfa]
hospital
"in the hospital."

In 5), it is noticeable that his real difficulty was when the /s/ and /ʃ/ sounds followed each other. As he found great difficulty in uttering the word *mɔstaʃfa* 'hospital'. He was trying to say it but, in the end, he could not.

To sum up, for some people, the /s/ and /ʃ/ sound the same, but they are not identical. Both are voiceless, short, and clear consonants. However, the

location for these two sounds is quite different. Therefore, this patient finds difficulty in pronouncing these two voiceless and fricative sounds, that lead him to drop them completely.

In the second section, *Yes/No Questions of the Comprehension* of the WAB-R, it was realized that when he was asked about his name by saying "Is your name Mohi?". He replied "Yes". Then, he tried to repeat his name again, but he had difficulty pronouncing the voiceless pharyngeal fricative /ħ/sound in his name /mɔħi/. Hence, he replaced the /ħ/ sound by using /h/. He uttered it as [mɔhi].

Also, when he was shown a bracelet and was asked to recognize it, he said the word without the /ħ/ sound. He replaced /ħ/ sound by /h/. He says /hazaza/ instead of /ħazaza/. Therefore, it is noticed that he had a problem with the voiceless pharyngeal fricative /ħ/sound.

In another example, when he was asked "Does the month *Ramadan* come before the month *Rajab*?". He answered the question properly. But he tried to repeat the same question again. He found difficulty pronouncing the voiced velar stop /g/ sound in *medial* position as in the word /ragab/, He uttered it as /ra:b/.

The same problem was repeated in the word *finga:n* 'cup'. He again found difficulty in saying the voiced velar stop /g/ sound in medial position and he totally dropped it as in the previous example.

Also, when he was asked to name as many animals as he can in the *Words' Fluency section* of the WAB-R, he said *gamal* 'camel'. But again, he totally dropped the voiced velar stop /g/ and said it as /amal/.

To sum up, this patient suffered from a problem in pronouncing the voiceless fricative sounds /s/, /ʃ/, and /ħ/ as it was illustrated in the previous examples that assure the patient's problem with voiceless fricative. He dealt with this problem either by dropping the sound totally from the word, or by replacing it by another sound. He also had a problem in pronouncing the voiced velar stop /g/ sound.

6.6.2 Syntax

From the syntactic perspective, in the section of *Picture Description-Spontaneous Speech Content and Fluency* of the WAB-R, when he was asked to describe a picture that was presented to him. He began to say different fragmented words but not in the form of a sentence. Then he uttered a phrase, he said:

6) [sit w ʔibnaha: al-sɔɣjar]
woman and her son young
"a woman and her young son."

Then he paused and said many odd words. He finished the description by saying another phrase:

7) [al-ti:n w al-fakha]
the fig and the fruits
"fig and fruits"

When he was asked to repeat the following sentence:

8) [taba:x al-ħlwja:t ka:n mabsu:t]
cook desserts was happy
"the desserts cook was happy."

He only repeated the second part of the phrase *kan mabsu:t* 'he was happy'. But he could not say the first part of the sentence and faced the same difficulty with uttering the voiceless alveolar fricative /s/ in medial position in the word /mabsu:t/. In general, he could not repeat the sentence as a whole unit. He just repeated the part that he could understand, but he could not remember the whole sentence.

To sum up, after analyzing the patient's language by using form 1 of the WAB-R scale; the patient's score was 77.1. This score presents that the patient is within mild severity. After checking his MRI results, MRI shows multiple lacunar infarcts along deep perforators of left middle cerebral artery, *external capsule*, *insular ribbon*, and portions of *anterior frontal lobe*.

It can be concluded that the patient's competence to a great extent was intact. But his main problem was in the *performance* according to Chomsky's theory because he was injured in his frontal lobe, which is responsible mainly of the executive functions, including *speech*. But his temporal and parietal lobes were intact. Therefore, he did not face a difficulty in understanding. He understood the speech that was directed to him properly and he was trying to respond to it, but he took time until he found the proper answer. He faced a difficulty in forming phrases. He was not able to form a full grammatical sentence structure. It was obvious that he suffered from difficulty in finding words. He had also some problems in uttering certain sounds such as the /s/, /ʃ/, /ħ/ and /g/.

6.7 The second patient

This patient also suffered from *anomic aphasia*. He is a male. The same WAB-R test was applied to this patient to analyze his language and discover his language's deficiencies.

6.7.1 Phonology

In the *Picture Description section* of the WAB-R, he was asked to describe the picture presented in front of him. It is a picture of a family in a market buying fruits and vegetables. One of the short phrases that he used to describe the picture was:

9) [magmɔʕt ʔawla:d]
group boys
"A group of boys."

The patient found difficulty in pronouncing the voiced velar stop /g/ sound in *medial* position as in the word *magmɔʕt* 'group'. He pronounced /magmɔʕt/ as /mamɔʕt/.

10) [ʔal-walad fjhɔm ʕaiz jaxɔd ʔal-ħaga:t dih]
the boy among them wants to take the things these
"This boy wants to take these things."

The patient faced again difficulty in pronouncing the voiced velar stop /g/ sound in *medial* position as in the word *ʔal-ħaga:t* 'the things'. He pronounced /ʔal-ħaga:t/ as /ʔal-ħa:t/. He tried many times to pronounce it, but he could not.

To conclude, this patient did not face a major difficulty in pronouncing most of the sounds. His main problem was only in the voiced velar stop /g/ sound. But his pronunciation of the other sounds remained intact. He faced little difficulty in pronouncing the fricatives /s/ and /ʃ/.

6.7.2 Syntax

When he was asked some questions from the section of *Conversational Questions within the Spontaneous Speech part* of the WAB-R, as for example "Why are you here in the hospital?". He answered by saying:

11) /ʕandi ʔmra:d fi al-ʕamod al-faqri/
I have diseases in the spinal cord
"I have diseases in the spinal cord."

That was not the main reason for his stay in the hospital, which showed that he either did not realize his mental problem which was aphasia, or he might realize his mental problem. But he could not remember the specific body part, that was the reason of his sickness, which is his brain. Therefore, he used one of the related body parts, that is his spinal cord.

In the *Picture Description section* of the WAB-R, he was asked to describe the same picture that was presented to all of the patients. He began describing the picture by saying simple short phrases.

12) [magməʕt ʔawla:d]
group boys
"A group of boys."

13) [ʔal-walad fjhəm ʕaiz jaxəd ʔal-ħaga:t dih]
the boy among them wants to take the things these
"This boy wants to take these things."

14) [ʕaiz jdiha li mamtəh]
He wants give to his mother
"He wants to give it to his mother."

Then he completed by saying phrases which were not related to the picture. He said:

15) [ʕaiz jaxəd msln tʕmiah]
he wants take for example falafel
"for example, he wants to take falafel."

16) [fih hina: sma:d]
there is here fertilizer
"there is a fertilizer here."

Therefore, he talked about other stuff that was out of context and not related to the picture. His response to the *Conversational Questions of Spontaneous Speech* was correct and almost a full description of the image. He faced a mild degree of difficulty in finding the proper words. He also faced difficulty in uttering some words which may contain some jargon. Sentences were somehow complete, but they were out of context.

In *Yes/No Questions of the Comprehension section* of the WAB-R, most of the time he repeated what was said to him, and the question had to be

repeated for him two or three times to be able to answer it. Therefore, it was noticeable that he found difficulty in perception and that is why he was taking time to understand what was said to him. As for example:

17) ***-Researcher:*** [ʔnta sakin fi ʔal-tgmɔʕ ʔal-awl?]
you live in settlement first
"Do you live in first settlement?"

=Patient: [al-tgmɔʕ?]
settlement
"settlement area?"

-Researcher:
[gawb b ʔah ʔaw laʔ… sakin fi ʔal-tgmɔʕ ʔal-awl?]
reply by yes or no… live in settlement first
"reply to me by Yes or No. Do you live in first settlement?"

-Patient: [al-tgmɔʕ bas fi skn haʔɔlɔh]
settlement but in residence I will say it
"in settlement area but there is residence that I will say it."

There were other questions that he repeated as if he was taking time first to understand them.

18) ***-Researcher:*** [ʔal-waraʔ biṯhrʔ fi ʔal-na:r?]
the paper burns in the fire
"Does the paper burn in fire?"

=Patient: [ʔal-waraʔ biṯhrʔ fi ʔal-na:r?]
the paper burns in the fire
"Does the paper burn in fire?"

-Researcher:
[gawb b ʔah ʔaw laʔ… ʔal-waraʔ biṯhrʔ fi ʔal-na:r?]
Reply by yes or no…the paper burns in the fire
"Reply to me by Yes or No. Does the paper burn in fire?"

=Patient: [ʔal-waraʔ bitaʕ ʔal-gine:nah?]

The paper of the garden
"The paper of the garden?"

-Researcher:
[gawb b ʔah ʔaw laʔ… ʔal-waraʔ biṯhrʔ fi ʔal-na:r?]
Reply by yes or no…the paper burns in the fire
"Reply to me by Yes or No. Does the paper burn in fire?"

=Patient: [ʔah, ʔal-waraʔ biṯhrʔ fi ʔal-na:r]
Yes, the paper burns in the fire
"Yes, the paper burns in fire."

Moreover, when *comb, book, and pen* were presented in front of him, he was told to do successive orders according to the orders in the *Sequential Commands of the Comprehension section* of the WAB-R. It was realized that he found difficulty to follow these successive orders. For instance, when he was asked to point to "the comb by using the pen", he pointed to "the book by using the comb". Furthermore, when he was told to point to "the comb by using the book", he did the opposite as he pointed to "the book by using the comb". Another example, when he was told to "put the pen on the book and give it to me", he "puts the comb on the book and gave it to me". Therefore, it was concluded that he did not have a full deficiency in the comprehension, but he took time to understand and at the same time could not understand more than one thing at the same time.

In *Completing Sentences of the Naming and Word Finding section* of the WAB-R, he completed most of the sentences with the same response. For example, when he was asked to complete this sentence:

19) ***-Researcher:*** [al-zarʕ……...]
the grass
"the grass is……."

=Patient: [al-zarʕ mɔfi:d]
the grass useful
"the grass is useful."

Also, when he was asked to complete another sentence which was:

20) ***-Researcher:*** [al-sɔkr……]
The sugar
"The sugar is……"

=***Patient:*** [al-sɔkr mɔfi:d]
The sugar useful
"The sugar is useful."

Here again, it was noticeable that he had difficulty in understanding what he is asked to do.

To sum up, it was concluded after checking the results of the WAB-R test that his score is 81.3. This score is considered within mild severity, while the MRI shows restricted diffusion along left internal capsule, caudate, and lentiform nuclei, beside portion of *left frontal areas*.

Therefore, it was apparent that he did not face difficulty in understanding. He understood the speech that was directed to him properly and tried to respond to it. Therefore, his *competence*, to a great extent, was intact. That is because his temporal and parietal lobes were intact that are responsible for understanding. But this patient faced difficulty in perceiving the speech directed to him and took time to comprehend what was directed to him. He was diagnosed as *Anomic patient*, that is diagnosed by word-finding difficulty. He faced difficulty in finding the exact word that he wanted to say that is why he repeated the same word again as a reply to the different questions. He also faced a problem to find another word due to the limitation of his word storage. In addition, when he started to answer the question, he faced another difficulty in forming full grammatical sentences. Therefore, the main problem was in his *performance* as he could not communicate properly by forming complete sentences. He only said separated and fragmented phrases and words. This was because he had a lesion in his left frontal lobe, which is responsible for executive functions, including *speech*.

6.8 The third patient

Finally, this third patient also suffered from *anomic aphasia*, but she was a female. The same WAB-R test was applied to this patient to analyze her language.

6.8.1 Phonology

This patient had difficulty in pronouncing the voiceless pharyngeal fricative /ħ/sound, as in the following examples:

21) [w dih wardah ħilwah aheh]

and this flower beautiful here
"and this is a beautiful flower."

She faced difficulty in uttering the voiceless pharyngeal fricative /ħ/sound in *ħilwah* 'beautiful'. She said the word as /ilwah/.

22) [ʔal-fi:l ʔħjanan ʔħjanan ʔal-fi:l]
the elephant sometimes sometimes the elephant
"the elephant sometimes sometimes the elephant."

In this example, she changed the voiceless pharyngeal fricative /ħ/ to the voiceless glottal fricative /h/ in the word *ʔħjanan* 'sometimes'.

The same exchange between /ħ/ and /h/ was repeated in the following example:

23) [ʔal-fi:l ʔili: huwwa ħajwa:n bita:ʕ ʔal-fi:l]
the elephant who is animal of the elephant
"the elephant who is the animal of the elephant."

Therefore, this patient's main problem was in uttering the voiceless pharyngeal fricative /ħ/. She either omitted it or replaced it by using the voiceless glottal fricative /h/. In regard to the other sounds, she did not face any problems.

6.8.2 Syntax

In *Conversational Questions section* of the WAB-R, when she was asked about her name, she did not respond. But when she was asked several questions after that one, she responded to the previous first question. She also responded with her full name. In every question that was asked to her, she took time to comprehend and took time to express herself by using speech. Therefore, it was realized that she took time to comprehend and then responded to the question afterwards. She had a retardation in comprehension and perception.

Moreover, she repeated a phrase *abɔ gindi* 'her surname' in everything she said. She ended her name by saying the same phrase. When she was asked:

24) ***-Researcher*:** [ʔinti geiti hina ʔabl kidh?]
you come here before
"Did you come here before?"

=***Patient:*** [laʔ]
no
"No"

Then she again repeated the phrase / abɔ gindi /. She also repeated the same phrase when she was asked about her address by saying / abɔ ɣri:b abɔ gindi/.

The act of *redundancy or repetition* is a symptomatic device in determining the different types of aphasia. As it determines the seriousness of motor discourse issues. The aphasic patient repeats the same word, either the word that is said to them, or the one he/she already says. That is why she keeps repeating the same phrase / abɔ gindi / several times.

In *Picture Description section* of the WAB-R, she described everything in the picture by using a few familiar words. She described everything by saying *wardah* 'flower'. Everything that she admired; she used the word /wardah/ to name it. She said:

25) [ʃeifah wardah abɔ gindi]
I see flower abo Gendy
"I see flower abo Gendy."

26) [ʃeifah wardah w wardah]
I see flower and flower
"I see a flower and a flower."

27) [w dih wardah ħilwah aheh]
and this flower beautiful here
"and this is a beautiful flower."

Therefore, it was concluded that she had a problem expressing herself as her mental lexicon became very limited. She lost most of the words that she knew before she has aphasia. That is why she used only few words to refer to many things. She used the word *wardah* 'flower' to describe everything surrounding her. Therefore, it was concluded that her speech is intermittent, mostly consists of single words, with some semi-sentences. She faced a difficulty in finding proper words.

Moreover, it was known that she was educated before she had aphasia, but when she was asked to point to the Arabic alphabet, presented in front of her in the picture, in the *Auditory Comprehension of Words section* of the WAB-R, she could not recognize these Arabic alphabets. She did not also recognize the numbers. Therefore, it could be concluded that most of her previous knowledge of many things is lost. On the other hand, she did not lose other things and

answered them correctly when she was asked to point to *shapes, colors, figures, surrounding objects and her body parts.*

Therefore, it could be concluded that the storage of letters and numbers are in the same location in the brain in the left hemisphere where she had the lesion, while the other things, such as *shapes, figures…etc.* are in another area in the brain specifically in the right hemisphere. Even that the left hemisphere is responsible for verbal things and right hemisphere is responsible of non-verbal ones. Therefore, she lost her knowledge of letters and numbers, while the other stuff was recognized perfectly.

In *Words' Fluency section* of the WAB-R, when she was asked to mention the names of as many animals as much as she could, she only said *ʔal-fi:l* 'the elephant'. She did not mention any other animal except the elephant. She kept repeating the word /ʔal-fi:l/ in many phrases. She dealt with the word /ʔal-fi:l/ as if she referred to various animals.

28) [ʔal-fi:l ʔħjanan ʔħjanan ʔal-fi:l]
the elephant sometimes sometimes the elephant
"the elephant sometimes sometimes the elephant."

29) [ʔal-fi:l ʔili: huwwa ħajwa:n bita:ʕ ʔal-fi:l]
the elephant who is animal of the elephant
"the elephant who is the animal of the elephant."

30) [ʔal-fi:l ʔili: huwwa ganb ʔal-fi:l]
the elephant who is besides the elephant
"the elephant who is besides the elephant."

31) [ʔal-fi:l ʔili: huwwa abɔ zalumah]
the elephant who has a trunk
"the elephant who has a trunk."

When she was asked to mention another animal, she kept saying *ʔal-fi:l* 'the elephant'. Moreover, it was concluded that she had a problem in forming a full grammatical sentence. She only said incomplete phrases. Therefore, it was concluded that she used one word from the category of animals in her mind to refer to many animals as she did not remember the names of the rest of the animals.

To sum up, after checking the results of the WAB-R test, her score is 71.5 that is considered within moderate severity, while the MRI shows well defined

area of restricted diffusion *along frontal* and *parietal lobes* with involvement of *external capsule* and *insular ribbon.*

Therefore, this patient faced retardation in perception and understanding because she had a lesion in her parietal lobe and insular ribbon that are responsible for perception and making sense of the outside world. But her *Competence* remained intact. She understood what was said to her because her temporal lobe was not injured which is responsible for understanding and memory. Her main difficulty was in her *Performance* as she could not form a full grammatical sentence. She just said fragmented and separated phrases. Moreover, she lost most of her previous knowledge, as she lost her knowledge for all the information that was related to letters and numbers. On the other hand, her knowledge of the *shapes, colors and figures* remained intact. Therefore, her competence just became limited.

7. Conclusion

This study examined three different cases. After examining the results of the WAB-R test, it was found out that they suffered from *Non-Fluent Aphasia*. The first two were *Anomic Aphasia*, while the last one suffered from *Anomic Aphasia* as a clinical impression, which means after the examination of the doctors. However, after further analysis by using WAB-R, the degree of severity is lying between *Anomic* and *Expressive.* But there is no naming from the types of aphasia that describe patients who are not pure *Anomic* and not pure *Expressive.* And after examining the results of the MRI scanning of their brain, it was apparent that they were injured in various brain regions and responses to the WAB-R sub-domains, but they had a common injury in the *frontal lobe* and in the *insular ribbon*, which consequently, according to this analysis, was led to the deficiency in their speech production and retardation in their perception. Although they had other different brain regions that were injured, but all of them had an injury in the *frontal lobe*, and two of them had a common injury in the *insular ribbon*. Therefore, their score scaling of the collective components' analysis according to the WAB-R test indicated that they are *Anomic patients*. But after linguistic analysis, they shared only some common language disorders, but they differed in many others.

It is important to mention that sometimes patients present a severe form of aphasia. Then these patients progress over time and become a milder form. Although the three patients suffer from *Anomic aphasia* and their scores are within mild to moderate severity according to the results of the WAB-R test, but

it is noticed that there are some differences in their brain lesions. This is maybe because the severity is at some time higher than that at the time of the interview and then the patient regresses with time. And due to the limitation of the *cross-sectional interview*, which means the patient is interviewed once, the case is not followed up more than one time to trace the regression of the aphasia severity.

According to the theory of *the Somatic Marker Hypothesis*, which is discovered by *Antonio Damasio*, the *insula* plays a role in our awareness of everything surrounding us. Consequently, it affects our awareness of the spoken language. That is why the cases, who are injured in their insular ribbon, face difficulty in discourse fluency and initiation, the pronunciation of some sounds, meanings, perception of grammatical subordinate sentences. Moreover, they find a difficulty in naming, and repetition (Craig,2009). Therefore, the anterior insular lesions in the predominant left hemisphere disable the speech initiation loop.

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Appendix

Phonemic Inventory

Arabic Script	IPA symbol
الهمزة /أ	ʔ
ب	B
ت	T
ث	Θ
ج	ʒ
ح	ħ
خ	X
د	D
ذ	Ð
ر	R
ز	Z
س	S
ش	ʃ
ش	ʧ
ص	sˤ
ض	dˤ
ط	tˤ
ظ	ðˤ
ع	ʕ
غ	ɣ
ف	F
ق	Q
ك	K
G	G
ل	L

م	M
ن	N
ه	H
و	W
ي	J

Vowels	
ا	a:
ي	i:, e:
و	u:, ɔ:
فتحة ـً	A
كسرة ـٌ	I
ضمة ـٍ	U

The three patients were subjected to Western Aphasia Battery Revised (WAB-R). The translation of the (WAB-R) is obtained from the thesis named *Neurolinguistic Analysis of the Verbal Behavior of Aphasics Adopting the Western Aphasia Battery- Revised* (Gom'a et al., forthcoming).

التحقيق في حالات الحبسة الذرية باستخدام تمييز نعوم تشومسكي بين الكفاءة والأداء

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المستخلص:

الغرض الرئيسي من هذه الورقة البحثية هو فحص مناطق المخ المصابة للمرضى الذين يعانون من الحبسة الكلامية من منظور لغوي. سيتم التحقيق في هذا من وجهات نظر مختلفة ، على وجه التحديد علم الأصوات وبناء الجملة. حيث أن حالات الدراسة هذه تواجه مشاكل كبيرة خاصة في هذين الجانبين اللغويين. تثبت أن الدماغ البشري يحتوي على نظام مقيد ومميز جيدًا تتمثل ووظيفتها في تمثيل بنية الجملة (ديك وآخرون، 2001، ص 759). علاوة على ذلك ، تمثل هذه الورقة الأنواع المختلفة للحبسة ، من خلال التركيز على إظهار المناطق المصابة في الدماغ بعد السكتة الدماغية الوعائية. يتم إجراء تشخيص المرضى في هذا البحث في إطار (The Western Aphasia Battery Revised (WAB-R. وهو مقياس من الأسئلة يستخدم لتحديد أوجه القصور اللغوية التي يعاني منها المرضى (Gom'a et al. , سينشر قريبا). وبعد تطبيق هذا الاختبار ، سيتم عرض مناطق معينة في الدماغ ، مسؤولة عن إنتاج اللغة وفهمها. علاوة على ذلك، فهو يمثل نظرية التوطين وكيفية ارتباطها بالدماغ البشري. أخيرًا، يبحث في العلاقة بين نظرية التوطين وتمييز تشومسكي بين الكفاءة والأداء.

الكلمات الدالة: فقدان القدرة على الكلام، الدماغ ، نظرية التوطين، انسولا ، الكفاءة و الأداء