The Investigation of Anomic Aphasia’s cases by using Noam Chomsky’s distinction between Competence and Performance

Samar Hassan Ibrahim Hawash*

Prof. Wafaa Batran Wahba**
Prof. Ramez Reda Moustafa***
Dr. Tamer Mahmoud Roushdy****

Abstract

The main purpose of this research paper is to investigate the injured brain regions of patients, who are suffered from aphasia, 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. By using 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. And 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.

Key Words: Aphasia- Brain- Localization theory- insula-Competence and Performance

* An MA Research Department of English Language and Literature, Faculty of Women for Arts, Science and Education, Ain Shams University. Samarhassan987@women.asu.edu.eg

**Professor of Linguistics, English Department, Faculty of Women for Arts, Science and Education, Ain Shams University.

***Professor of Neurology, Neurology Department, Faculty of Medicine, Ain Shams University.

**** Lecturer of Neurology, Neurology Department, Faculty of Medicine, Ain Shams University.
Purpose of the study:

The current study attempts to:

1- Investigate the different types of aphasia.

2- Demonstrate that certain language impairment is resulted from lesion in specific region in the brain.

3- Show that people with common language impairment are suffered from lesion in a specific common part in the brain.

4- Apply Chomsky's distinction between Competence and Performance on patients that suffer from Anomic Aphasia.

Study 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?

Hypothesis statement:

The study hypothesizes that if people from different ages suffer from the same type of aphasia. And they are 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.

Sample of Analysis:

Study Sample:

A sample of three patients is selected to apply the WAB-R on. It is 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.

**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.

**Site 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.

**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.

**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.

1. Neurolinguistics:

Language is mainly related to the brain, not to the tongue, lip, ear, or hand. 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 and communication is considered 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. As different animals have their own codes to communicate with each other to 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 features. 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 function. 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 by 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, p.3).

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 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).
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 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 happens due to a recently acquired injury in the Central Nervous System (CNS) (Sarno, 1998, p.25).

In spite of the fact that obviously 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. As if somebody wants to make communication with the patient, it will be practically incomprehensible, or it tends to be mild. But the aphaesic 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*. Or 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 finding difficulty in 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 stops, 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 think about the exact word and rather depicts or gives related information about the word. Anomic aphasia additionally can be seen chronically as people who recuperate from different types of aphasia. 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, Fridrikksson, & 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 and examining them (Sparks, 2020).

One of the outstanding and first famous cases that were examined previously in 1848 is that of Phineas Gage, who was working in a rail line. When he suddenly encountered an accident that 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 endured this difficulty, he encountered 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. As it was believed that the injured area was responsible for the character (Sparks, 2020).

Figure 3. A picture represents Gage’s brain after the accident (Brain injury of Phineas Gage, n.d.)
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 bilaterally 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).
4.2 Paul Broca’s first discovery:

First studies that were interested in recognizing the various regions of the brain that are related with language, began in 1861. Paul Broca, a French neurosurgeon, examined the brain of a deceased patient who had language issues. Although he 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 by using his writing skills. 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 is a sizable injury in the left inferior 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

**Figure 4. The brain regions that are related to language** (Suri, 2021)
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 with 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 locates 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 make 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).

![Insula in the brain](image)

*Figure 5. 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 back 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 explains the difference between competence and performance. He defined the competence as the essential and fundamental information 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 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, p.4-10).

6. Analysis:

In this research, the analysis of three cases that suffer from Anomic aphasia, are represented. 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 consist of various sections that test the competence and performance of the patients.
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.

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.

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.

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.

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.

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.

The seventh section is *Naming*. The patient is presented with real objects and he/she is asked to name them.

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.
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*.

### 6.1 The first patient:

#### 6.1.1 Phonology:

The first patient is a male, when he is asked about his job, he says:

1) /bʃtayal haga:t kitir/  
   *work things a lot*  
   “I work a lot of things.”

   *(Actual Language Data)*

2) /bʃtayal sawwaq/  
   *work driver*  
   “I work as a driver.”

   *(Word-by-word gloss)*

   But he faces difficulty in pronouncing the voiceless alveolar fricative /s/ sound in /sawwaq/. He says it as /waq/ without the /s/ sound in the initial position.

   In the *Repetition section* of the WAB-R, when he is asked to repeat the word *sri:r* ‘Bed’. He again faces the same difficulty in pronouncing the voiceless alveolar fricative /s/ sound in initial position and he says it as /ri:r/ instead of /sri:r/.

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

3) /xamsah w rbi\text{\texttwiddle{}}i:n/  
   *five and Forty*  
   “forty five.”

   *(Idiomatic Translation)*
When he tries to repeat *xamsah* ‘five’, he cannot say /xamsah/ and he says it as /xamah/ without the voiceless alveolar fricative /s/ sound in medial position.

He also finds 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 faces the same problem. And the lesion in his brain led him to find a difficulty in pronouncing the voiceless alveolar fricative /s/ sound in all positions initial, medial, and final positions.

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

4) /maʕlaʔit kɔʃari/  
   *spoon*  *koshry*  
   “Koshry’s spoon.”

But he finds a difficulty in uttering the voiceless fricative /ʃ/ sound in medial position in the word /kɔʃaril/, he says it as /kɔɾil/. He finds the same difficulty of /ʃ/ sound in saying the word /mʃbk/ ‘clip’. He says it as /mbk/. Therefore, he also has a problem in saying the voiceless fricative /ʃ/ sound.

In *Completing the Sentences section* of the WAB-R, when he is asked “where do the nurses work?”. He says:

5) /mɔstaʃfa/  
   *hospital*  
   “in the hospital.”

In 5), it is noticeable his real difficulty when the /s/ and /ʃ/ sounds follow each other as he found great difficulty in uttering the word *mɔstaʃfa* ‘hospital’. He is trying to say it but, in the end, he cannot.

To sum up, for some people, the /s/ and /ʃ/ sounds the same, but they are not identical. Both are voiceless, short, and clear consonants. However, the position 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 is realized that when he is asked about his name by saying “Is your name Mohi?”, he said “Yes”. Then, he tries to repeat his name again, but he finds difficulty in pronouncing voiceless pharyngeal fricative /h/ sound in his name /mɔhi/, and he replaces the /h/ sound by using /h/. He uttered it as / mɔhi/.

Also, when he is showed a bracelet and is asked to recognize it, he also says the word without the /h/ sound, and he replaces it by /h/. He says /hazaza/ instead of /hazaza/. Therefore, it is noticed that he has a problem with the voiceless pharyngeal fricative /h/ sound.

In another example, when he is asked “Does the month Ramadan come before the month Rajab?”. He answers the question properly, but he tries to repeat the same question again and he finds difficulty in pronouncing the voiced velar stop /g/ sound in medial position as in the word /ragab/, He utters it as /ra:b/.

Furthermore, in the word *finga:n* ‘cup’. He again finds difficulty in saying the voiced velar stop /g/ sound in medial position and he totally drops it as in the previous example.

Also, when he is asked to name as many animals as he can in the *Words’ Fluency section* of the WAB-R, he says *gamal* ‘camel’. But again, he totally drops the voiced velar stop /g/ and says it as /amal/.

To sum up, this patient suffers in general from a problem in pronouncing the voiceless fricative sounds /s/, /ʃ/, and /h/ as it is illustrated in the previous examples that assures the patient’s problem with voiceless fricative. He deals with this problem either by dropping the sound totally from the word, or by replacing it by another sound. He also has a problem in pronouncing the voiced velar stop /g/ sound.
6.1.2 Syntax:

From the syntactic perspective, in the section of *Picture Description-Spontaneous Speech Content and Fluency* of the WAB-R, when he is asked to describe a picture that it is presented to him. He begins to say different separated words but not in the form of a sentence. Then he utters a phrase, he says:

6) / sit w ?ibnaha: al-søyjar/
   woman and her son young
   “woman and her young son.”

Then he pauses by saying many odd words and he finishes the description by saying another phrase by saying:

7) /al-ti:n w al-fakha/
   the fig and the fruits
   “fig and fruits”

When he is asked to repeat the following sentence:

8) /taba:x al-hlwja:t ka:n mabsu:t/
   cook desserts was happy
   “the desserts cook was happy.”

He only repeats the second part of the phrase *kan mabsu:t* ‘he was happy’. But he cannot say the first part of the sentence and faces the same difficulty with uttering the voiceless alveolar fricative /s/ in medial position in the word /mabsu:t/. In general, he cannot repeat the sentence as a whole unit, he just repeats the part that he can understand, but he cannot 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 is considered 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 is innate, but his main problem is in the performance according to Chomsky’s theory.
because he is injured in his frontal lobe, which is responsible mainly of the 
executive functions, including speech. But his temporal and parietal lobes are 
intact. Therefore, he does not face a difficulty in understanding. He understands the 
speech that is introduced to him properly and he is trying to respond to it, but he 
takes time until he finds the proper answer. He faces a difficulty in forming 
phrases. He is not able to form a full grammatical sentence structure. It is obvious 
that he suffers from difficulty in finding words. He also has some problems in 
uttering certain sounds such as the /s/, /ʃ/, /h/ and /g/.

6.2 The second patient:

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

6.2.1 Phonology:

In the Picture Description section of the WAB-R, he is asked to describe the 
picture presented in front of him. One of the short phrases that he uses to describe 
the picture is:

9) /magmɔʃt ʔawla:d/
    group boys
   “A group of boys.”
   The patient finds difficulty in pronouncing the voiced velar stop /g/ sound 
in medial position as in the word magmɔʃt ‘group’. He pronounces /magmɔʃt/ as 
/mamɔʃt/.

10) /ʔal-walad ʕjɔm ʕaiz jaxɔd ʔal-ħagaːt dih/
    the boy among them wants to take the things these
   “This boy wants to take these things.”
   The patient faces again difficulty in pronouncing the voiced velar stop /g/ 
sound in medial position as in the word ʔal-ħagaːt ‘the things’. He pronounces 
/ʔal-ħagaːt/ as /ʔal-ḥaːt/. He tries many times to pronounce, it but he could not.
To conclude, this patient does not find a major difficulty in pronouncing most of the sounds. His main problem is only in the voiced velar stop /g/ sound. But his pronunciation of the other sounds remains intact.

6.2.2 Syntax:

When he is 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 ʔmraːd fi al-ʕamod al-faqrī/
   I have diseases in the spinal cord
   “I have diseases in the spinal cord.”

That is not the main reason for his stay in the hospital, which shows that he either does not realize his mental problem which is aphasia, or he may realize his mental problem. But he cannot remember the specific body part, that is the reason of his sickness, which is his brain. So that he uses one of the related body parts, that is his spinal cord.

In the *Picture Description section* of the WAB-R, he is asked to describe the picture presented in front of him. He begins describing the picture by saying simple short phrases.

12) /mgaːʃt ʔawləːd/
   group boys
   “A group of boys.”

13) /ʔal-walad fحرف ذاى jaxəd ʔal-hagat dih/
   the boy among them wants to take the things these
   “This boy wants to take these things.”

14) /ذاى jdiha li mamtcoh/
   He wants give to his mother
   “He wants to give it to his mother.”

Then he completes by saying phrases which is not related to the picture. He says:

15) /ذاى jaxəd mṣln tʃmiah/
he wants to take for example falafel
“for example, he wants to take falafel.”

16) /fih hina: smaːd/
there is here fertilizer
“there is a fertilizer here.”

Therefore, he talks about other stuff that are out of context and not related to the picture. His response for the Conversational Questions of Spontaneous Speech is correct and almost a full description of the image. He faces a mild degree of difficulty in finding the proper words. He also faces difficulty in uttering some words which may be accompanied by jargon. Sentences are somehow complete, but they are out of context.

In Yes/No Questions of the Comprehension section of the WAB-R, most of the time he repeats what is said to him, and the question has to be repeated for him two or three times to be able to answer it. Therefore, it is noticeable that he finds difficulty in perception and that is why he is taking time to understand what is said to him. As for example:

you live in settlement first
“Do you live in first settlement?”

=Patient: / al-tgmɔʃ? /
settlement
“settlement area?”

-Researcher:
/gawb b ʔah ʔaw laʔ… sakin fi ?al-tgmɔʃ ?al-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-tgmɔʃ bas fi skn haʔɔhʃ/
    settlement but in residence I will say it
    “in settlement area but there is residence that I will say it.”
There are other questions that he repeats as if he is taking time first to understand them.

18) -Researcher: /ʔal-waraʔ bithrʔ fi ʔal-naːrʔ /
    the paper burns in the fire
    “Does the paper burn in fire?”
=Patient: /ʔal-waraʔ bithrʔ fi ʔal-naːrʔ /
    the paper burns in the fire
    “Does the paper burn in fire?”

-Researcher:
/gawb b ʔah ʔaw laʔ… ʔal-waraʔ bithrʔ fi ʔal-naːrʔ/
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 bitaʃ ʔal-gineːnahʔ /
    The paper of the garden
    “The paper of the garden?”

-Researcher:
/gawb b ʔah ʔaw laʔ… ʔal-waraʔ bithrʔ fi ʔal-naːrʔ/
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 bithrʔ fi ʔal-naːr /
    Yes, the paper burns in the fire
    “Yes, the paper burns in fire.”

Moreover, when comb, book, and pen are put in front of him and he is told to do successive orders according to the orders in the Sequential Commands of the Comprehension section of the WAB-R. It is realized that he finds a difficulty to follow these successive orders. For instance, when he is asked to point to “the comb by using the pen”, he pointed to “the book by using the comb”. Furthermore, when he is told to point to “the comb by using the book”, he does the opposite as
he points to “the book by using the comb”. Another example, when he is 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 is concluded that he does not have a full deficiency in the comprehension, but he takes time to understand and at the same time cannot understand more than one thing at the same time.

In Completing Sentences of the Naming and Word Finding section of the WAB-R, he completes most of the sentences with the same response. For example, when he is 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 is asked to complete another sentence which is:

20) **Researcher:** /al-sɔkr………/  
   The sugar  
   “The sugar is……….”

   **Patient:** /al-sɔkr  mɔfi:d/  
   The sugar useful  
   “The sugar is useful.”

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

To sum up, it is realized 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 is apparent that he does not face a difficulty in understanding. He understands the speech that is introduced to him properly and he is trying to respond to it. Therefore, his competence, to a great extent, is intact. That is because
his temporal and parietal lobes are intact that are responsible for understanding. But this patient faces a difficulty in perceiving the speech introduced to him and takes time to comprehend what is said to him. And because he is diagnosed as *Anomic patient*, that is diagnosed by word-finding difficulty, he faces a difficulty in finding the exact word that he wants to say that is why he repeats the same word again as a reply to the different questions. He also faces a problem to find another word due to the limitation of his word storage. In addition, when he starts to answer the question, he faces another difficulty in forming full grammatical sentences. Therefore, the main problem is in his *performance* as he cannot communicate properly by forming complete sentences. He only says separated and fragmented phrases and words. This is because he has a lesion in his left frontal lobe, which is responsible for executive functions, including *speech*.

### 6.3 The third patient:

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

#### 6.3.1 Phonology:

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

21) */w dīh wardah ħilwah aheh/
    and this flower beautiful here
    “and this is a beautiful flower.”

She faces a difficulty in uttering the voiceless pharyngeal fricative /ħ/ sound in *ḥilwah* ‘beautiful’. She says the word as */ilwah*/.

22) */ʔal-fi:l ʔḥjanan ʔḥjanan 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 *ʔḥjanan* ‘sometimes’.
The same exchange between /h/ and /ħ/ is repeated in the following example:

23) /ʔal-fi:l ʔili: huwwa hajwa:n bitaːʕ 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 is in uttering the voiceless pharyngeal fricative /ħ/. She is either omit it or replace it by using the voiceless glottal fricative /h/. In regard to the other sounds, she does not face any problems.

6.3.2 Syntax:

In Conversational Questions section of the WAB-R, when she is asked about her name, she does not respond. But when she is asked several questions after that one, she responds to the first question, that is asked to her previously. She also responds with her full name. In every question that is asked to her, she takes time to comprehend and takes time to express herself by using speech. Therefore, it is realized that she takes time to comprehend and then responds to the question afterwards. She has a retardation in comprehension and perception.

Moreover, she is repeating a phrase abɔ gindi ‘her surname’ in everything she says. She ends her name by saying the same phrase. When she is asked:

24) -Researcher: /ʔinti geiti hina ʔabl kidh? /
you come here before
“Did you come here before?”

=Patient: / laʔ/
no
“No”

Then she again repeats the phrase / abɔ gindi /. She also repeats the same phrase when she is asked about her address by saying / abɔ ɣriːb 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 / əbə gindi / several times.

In Picture Description section of the WAB-R, she describes everything in the picture by using a few familiar words. She describes everything by saying wardah ‘flower’. Everything that she admires; she uses the word /wardah/ to name it. She says:

25) /ʃeifah wardah əbə gindi/
I see flower əbo Gendy
“I see flower əbo Gendy.”

26) /ʃeifah wardah w wardah/
I see flower and flower
“I see a flower and a flower.”

27) /w dih wardah ɦilwah aheh/
and this flower beautiful here
“and this is a beautiful flower.”

Therefore, it is realized that she has a problem to express herself as her mental lexicon becomes very limited and she lost most of the words that she knew before she has aphasia. That is why she uses only few words to refer to many things and she uses the word wardah ‘flower’ to describe everything surrounding her.

Therefore, it is realized that her speech is intermittent, mostly consists of single words, with some semi-sentences. She faces a difficulty in finding proper words.

Moreover, it is known that she is educated before she has aphasia, but when she is 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 cannot recognize them. She does not also recognize the numbers. Therefore, it can be concluded that most of her previous knowledge of many things is lost. On the other hand, she does not lose other things and answers them correctly when she is asked to point to shapes, colors, figures, surrounding objects and her body parts.
Therefore, it can be concluded that the storage of letters and numbers are in the same location in the brain in the left hemisphere where she has 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 of verbal things and right hemisphere is responsible of non-verbal ones, therefore she lost her knowledge of letters and numbers, while the other stuff is recognized perfectly.

In Words’ Fluency section of the WAB-R, when she is asked to mention the names of as many animals as much as she can, she only says \(\text{ʔal-fi:l} \) ‘the elephant’. She does not mention any other animal except the elephant. She keeps repeating the word \(\text{/ʔal-fi:l/} \) in many phrases. She deals with the word \(\text{/ʔal-fi:l/} \) as if she refers to various animals.

28) \(\text{/ʔal-fi:l ʔhjanan ʔhjanan ʔal-fi:l/} \)
the elephant sometimes sometimes the elephant
“the elephant sometimes sometimes the elephant.”

29) \(\text{/ʔal-fi:l ʔili: huwwa hajwaːn bitaːʕ ʔal-fi:l/} \)
the elephant who is animal of the elephant
“the elephant who is the animal of the elephant.”

30) \(\text{/ʔal-fi:l ʔili: huwwa ganb ʔal-fi:l/} \)
the elephant who is besides the elephant
“the elephant who is besides the elephant.”

31) \(\text{/ʔal-fi:l ʔili: huwwa abː zalumah/} \)
the elephant who has a trunk
“the elephant who has a trunk.”

When she is asked to mention another animal, she keeps saying \(\text{ʔal-fi:l} \) ‘the elephant’. Moreover, it is realized that she has a problem in forming a full grammatical sentence, she only says incomplete phrases. Therefore, it is concluded that she uses one word from the category of animals in her mind to refer to many animals as she does 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 faces retardation in perception and understanding because she has a lesion in her parietal lobe and insular ribbon that are responsible for perception and making sense of the outside world. But her Competence remains intact and she understands what is said to her because her temporal lobe is not injured which is responsible for understanding and memory. Her main difficulty is in her Performance as she cannot form a full grammatical sentence. She just says fragmented and separated phrases. Moreover, she loses most of her previous knowledge, as she loses her knowledge for all the information that is related to letters and numbers. On the other hand, her knowledge of the shapes, colors and figures remains intact. Therefore, her competence just becomes limited.

7. Conclusion:

This study examines three different cases. After examining the results of the WAB-R test, it is found out that they are suffering from Non-Fluent Aphasia. The first two are Anomic Aphasia, while the last one is suffering from Anomic Aphasia as a clinical impression. 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 is apparent that they are injured in various brain regions and responses to the WAB-R sub-domains, but they have a common injury in the frontal lobe and in the insular ribbon, which consequently, according to this analysis, is led to the deficiency in their speech production and retardation in their perception. Although they have other different brain regions that are 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 indicates that they are Anomic patients. But after
linguistic analysis, they share only some common language disorders, but they differ in many others.

It is important to be mentioned that sometimes patients present a severe form of aphasia, then they regress 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*, that 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.

**Phonemic Inventory**

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The three patients are subjected to Western Aphasia Battery Revised (WAB-R) which is obtained from the thesis named *Neurolinguistic Analysis of the Verbal Behavior of Aphasics Adopting the Western Aphasia Battery- Revised.*

### References


The Connections between Thought and Language. (n.d.). Retrieved from https://thebrain.mcgill.ca/flash/a/a_10/a_10_p/a_10_p_lan/a_10_p_lan.html


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

سمر حسن إبراهيم حواش
طالبة ماجستير بكلية البنات للآداب و العلوم والتربية قسم اللغة الإنجليزية و آدابها، جامعة عين شمس

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 مفيد ومميز جدا 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. تعرض هذه الورقة ثلاث حالات من بينن من الحبسة الذرية باستخدام (WAB-R). يستخدم لتحديد أوجه القصور اللغوية التي يعاني منها المرضى. وبعد تطبيق هذا الاختبار، سيتم عرض مناطق معينة في الدماغ، مسؤولة عن إنتاج اللغة وفهمها. علاوة على ذلك، فهو يمثل نظرية التوظيف وكيفية ارتباطها بالدماغ البشري. أخيرًا، يبحث في العلاقة بين نظرية التوظيف وتمييز تشومسكي بين الكفاءة والأداء.

الكلمات الدالة: فقدان القدرة على الكلام - الدماغ - نظرية التوظيف - انسلو - الكفاءة و الأداء