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Exploring Linguistic Impairments of the Patients of Broca's Aphasia and Wernicke's Aphasia in Bangladesh

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Abstract

Language performance of human beings is inseparably related to their brain. There are some specific areas in the brain that are responsible for language understanding, organizing and producing. Broca?s area and Wernicke?s area are two such types of crucial areas of the brain which are, if affected or injured, responsible for linguistic problems, respectively known as Broca?s Aphasia and Wernicke?s Aphasia. Aphasia is a disorder of communication that impairs a person?s ability to use and comprehend language. Broca?s Aphasia is recognizable when the person affected has a difficulty in speech production, writing and finding specific words. A patient of Wernicke?s aphasia may produce normal speeches but they are nearly nonsensical and irrelevant. His/her difficulty is in comprehending others? messages. The present study has investigated the linguistic behavior of some patients of Broca?s Aphasia and Wernicke?s Aphasia in Bangladesh and shows proximity of the empirical findings with the theoretical claims.

Index terms— neurolinguistics, brain, left hemisphere, broca?s area, wernicke?s area, aphasia, broca?s aphasia, wernicke?s aphasia, linguistic behavior etc

1 Introduction

anguage comprehension and production of human beings are subject to some conditions. They are mostly neurological, hence, the term 'Neurolinguistics' has emerged.

The materials of language production are received from the outside source, re-organized and then produced. The whole process is performed in the brain by various component parts of it. Among them Broca's area and Wernicke's area are the most prominent parts. People suffer from various types of linguistic deficits, known as aphasia, if these two parts of the brain are injured. Lesion in these two distinct areas results in distinct linguistic deficits. That is, injury in Broca's area results in distinct linguistic deficiencies, which are different from the deficiencies resulting from the lesion in Wernicke's area. The former type of linguistic deficiency is known as Broca's aphasia, and the latter Wernicke's aphasia. The paper presents these theoretical claims about the linguistic behaviors of the patients of aphasia, their relevant evidences, and some more related points in the context of Bangladesh through carrying out field works.

2 II.

3 Literature Review a) Neurolinguistics

Neurolinguistics is the study of the relationship between language and brain (Yule 2006, p. 137). It is the study of biological and neural foundation of language **??**Fromkin et al., 2004, p. 34). Neurolinguistics is the interdisciplinary study of language processing in the brain, with an emphasis on the processing of spoken language when certain areas of the brain are damaged. So, simply, neurolinguistics deals with the relationship between language and the brain.

4 b) The Human Brain

The brain is the most crucial component of the human body. The adult human brain weighs on average about 3 lb (1.5 kg). The brain consists of approximately 10 billion neurons and billions of interconnected fibers. The surface of the brain is the 'cortex' or 'grey matter' consisting of billions of neurons. Under the cortex is the white matter, lots of connecting fibers. The brain is composed of cerebral hemispheres: right hemisphere and left hemisphere. These hemispheres are joined by corpus cullosum. It has contra lateral function. The right hemisphere controls the left side of the body and the left hemisphere controls the right side of the body. **??**Fromkin et. al., 2004, 34) c) Broca's Area Broca's area is named after a French surgeon Paul Broca. He discovered the Broca's area in 1861 after studying the brain of a deceased patient who had suffered from speech impairment. This finding was first used to argue that language ability is located in the left hemisphere (Yule 2006, p. 139). The Broca's area is located in the left frontal lobe and controls speech production and facial neurons. It works for language output. In the figure-1 the part-4 is shown as Broca's area.

5 d) Wernicke's Area

Carl Wernicke discovered the Wernicke's area of the brain around ten years later after the Broca's area had been discovered. It is the posterior portion of the left temporal lobe. Wernicke's area is involved in the understanding of speech. It works for language input. In the figure-1 the part-3 is shown as Wernicke's area.

6 e) The Motor Cortex

The motor cortex is close to Broca's area. It controls the articulatory muscles of the face, paw, tongue and larynx (Yule 2006, p. 139). In the figure-1 part-5 is indicated as the motor cortex.

f) The Arcuate Fasciculus

The Arcuate Fasciculus is a bundle of nerve fibers. It was also one of the Wernicke's discoveries (Yule 2006, p. 139). The Broca's area is connected by the arcuate fasciculus to the Wernicke's area (Figure 2). The identified four components of the brain above are related to the idea that specific aspects of language ability are crucially related to specific locations in the brain. It is called localization view. According to this view, the brain activity involved in hearing a word, understanding it, then saying it, follow a definite pattern. The word is heard and comprehended via Wernicke's area. This signal is then transferred via the arcuate fasciculus to Broca's area where preparations are made to produce it. A signal is then sent to part of the motor cortex to physically articulate the word (Yule 2006, p. 140).

Figure 1

7 h) Lateralization

The paired structures of the brain are not exactly symmetrical and often differ in their size, form, and function, this phenomenon is called lateralization. When a function is lateralized, it means that one side of the brain exerts more control over this function than the other does. "There is evidence in neurological research that as the human brain matures certain functions are assigned-or 'lateralized'-to the left hemisphere of the brain and certain other functions to the right hemisphere" **??**Brown 1993, p. 53).

8 Aphasia

The relationship between the brain and language has been recognized for a very long time. The ancient Egyptians recorded reports of head injuries that resulted in the loss of speech, the phenomenon we now know as aphasia. **??**Foss and Hakes 1978, p. 350) Aphasia is a disorder that results from damage to the portions of the brain that are responsible for language comprehension and production. Aphasia is defined as an impairment of language function due to localized brain damage that leads to difficulty in understanding and/or producing linguistic forms (Yule 2006, p. 142). Boca's Aphasia and Wernicke's aphasia are two most significant types of aphasia.

9 Broca's Aphasia

The linguistic deficit caused by the damage in Broca's area is called Broca's aphasia. People with Broca's aphasia have damage to the frontal lobe of the brain. There are some significant symptoms of Broca's aphasia.

Patients of Boca's aphasia typically understand the speech of others well. The amount of speech is reduced and articulation is distorted, speech is often slow and labored. They show frequent omission of functional morpheme (articulation, preposition) and inflection (plurals, past tense-'ed') (Yule 2006, p. 142 and Foss and Hakes 1978, p. 355) and omission of small words such as: 'and', 'the' etc. Their speech is often linked to telegraphic speech-consists of only noun and verb. They have inability to put together sentences that are grammatically complex and difficulty in writing and reading. Because of their awareness of problems, individuals with Broca's aphasia suffer from depression.

10 i) Wernicke's Aphasia

The linguistic deficit caused by the damage to Wernick's area is called Wernick's aphasia. Wernick's aphasia shows no disfluency in speech, but rather super fluency **??**Foss and Hakes 1978, p. 355. This aphasia results

in difficulties in auditory comprehension. The patient suffers from difficulty in finding correct words. Speech is very fluent but difficult to make sense (Yule 2006, p. 143) Words are mingled up like the vegetables in a salad. Individuals with Wernicke's aphasia exhibit fluent, effortless speech.

Their sentences are syntactically correct with normal intonation and stress. Individuals with Wernicke's aphasia often produce jargon and nonsense words **??**Fromkin 2004, p. 37). Verbal output is often lacking in content (Geschwind 1972, cited in Foss and Hakes 1978, p. 355) filled with circumlocutions (talking around a word) **??**Foss and Hakes 1978, p. 355) and indefinite words. Individuals rarely notice their errors and talk at length. Those with Wernicke's aphasia also write effortlessly. Similar to their speech, although syntax is accurate, written language is devoid of content. Because of their inability to understand their deficits individuals with Wernicke's aphasia do not struggle with depression. Individuals with Wernicke's aphasia often display short-time memory, that is, they often forget what they have done few hours ago.

11 III.

12 Objectives

The present study intends to investigate the ways of speaking and other cognitive behaviors of the patients of Broca's aphasia and Wernicke's aphasia. The paper exhibits the patients' dealing with language, based on the theoretical underpinning of language and human brain. This study consists of the following objectives:

? How do the patients of Broca's aphasia speak and manage other linguistic behaviors? And, ? How do the patients of Wernicke's aphasia speak and deal with other cognitive behaviors?

IV.

13 Methodology

This paper is an attempt of empirical studies accomplished by a group of eight members. Qualitative case-study and semi-structured research approach was maintained. A questionnaire was followed. We went to the people concerned, talked directly to them and observed their behaviors. Patients were selected from Dhaka, My men singh, Trishal and Sherpur. Some patients were selected on the basis of familiarity. The rest were contacted on the basis of the information provided by two medical college hospitals (one in My men singh, and the other in Dhaka) and a physiotherapy center in My men singh. Some patients were rural inhabitants and the others were urban. We met twelve patients from them we selected seven (five of Broca's aphasia and two Wernicke's aphasia) for this paper.

We contacted two expert doctors in neurology at Shahid Suhra wardi Hospital, and a physiotherapist in My men singh. Sometimes, all the group-members went on a fixed field work, and sometimes, we were divided into individuals and groups to do so. The interview-language was Bengali. Then it was translated into English keeping the best proximity. Audio recorders and video cameras were used as research materials. After the end of each case-study audio version was converted into the nearest meaningful word version. Necessary notes were taken while consulting the patients and the doctors. In this paper the abbreviations PBA and PWA respectively stand for Patient of Broca's Aphasia and Patient of Wernicke's Aphasia.

V.

14 Data Analysis a) Broca's Aphasia i. Normalcy in language comprehension

All the patients suffering from Broca's aphasia showed the ability to comprehend language. They could understand the linguistic world around them and comprehend the meaning of others' speech. The interviewers talked to them and asked several questions. Their answers were not nonsense rather relevant and meaningful. For example:

The Interviewer : Assalamualaikum (Have peace upon you) PBA1 : Uaalaikum?. (To you also)

The interviewee indicated above was a seventy years old Broca's aphasia patient. He was a welleducated retired naval officer. Three years ago a massive stroke had damaged his brain's Broca's area and made the right side disabled. He was physically very critical and could produce very few words. But the above example shows that his language comprehension ability was normal. When at the end of the meeting one of the interviewers said "We are going, Dadu" he said something like this "Don't say 'going' rather say 'coming'."

The PBA5 was a sixty years old patient. A stroke had damaged his Broca's area and made the right side disabled. When he saw a mobile phone placed before him he asked: "Are you recording my speech?" Some patients showed eagerness to join them when the interviewers were talking to their relatives. It indicates that they could comprehend the message of others' speaking well.

ii. Slow and Labored Speech Some of the patients, who could somehow express, though very few, some linguistic items, showed much labor in producing words and phrases. Four-five seconds required to produce a single word or phrase. Speech thus becomes slow due to labor in articulation.

The interviewer was talking to the daughter-inlaw of the PBA2 about the problems of the paralyzed people. The PBA2 joined them and said about his disabled hands: "Du...du?dununda" (Both of my hands?). [Actually,

one hand]. He wanted to express only a single word 'dunuda' , but it required much labor. The PBA5 showed labored speech though his problem was less than the PBA2's.

The Interviewer : Which side is disabled? The PBA5 : Da.. da..da?daan pash. (Right side).

The Interviewer : Do you require pause in speaking? The PBA5 : A..a?a..atkiee. (Yes, I do).

iii. Distorted and Unclear Speech

All the patients who could produce some words and phrases produced many unrecognizable expressions. The PBA4 was a six years old boy who had been suffering from Broca's aphasia just after the second day of his birth, as a result of the damage in Broca's area due to excessive pressure on the head and the lack of oxygen during delivery. But his physical state was normal. The interviewers requested him to draw a picture. He asked his mother for a pencil but she took times to bring it. With little anger the boy said something that was unrecognizable to them. The mother later explained that he had said, "Why so late?" The interviewer asked the EDN1 about the child's problem and he said that the child would never be completely normal since a permanent damage had occurred in Broca's area during delivery.

The PBA5 could speak more little more than the others. But he expressed many vague, unrecognizable and unclear words and phrases. The vagueness of expression was mainly due to distorted words, and displacement and omission of sounds. The patients felt difficult to produce some sounds. The PBA3 was a forty-five years old patient who had been suffering from terrible speech problem for three years. He showed clear symptoms of distorted, displaced and omitted sounds in his speech. The actual word was khai (I eat). Here /kh/ was replaced by /k/. His wife asked him pointing to a man named Yeasin, "Do you know him?" He answered, "Yeachin". Here /s/ was replaced by /ch/. The PBA2 could not produce difficult sound, especially, those of joint letters (in Bengali). He indicated his right hand and said: "Ede haat nos...[to] hose." (This hand is disabled). Actually, he wanted to utter nosto [disabled] but he could not produce the joint sound /sh+t/, so it was omitted from the word.

15 v. Telegraphic Speech Based on Noun and Verb

All the patients produced reduced amount of words and phrases consisting of mostly nouns and verbs. There were frequent omission of small words, articles, inflections and functional morphemes. Their speeches were much like telegraphic speeches. The PBA2 showed clear evidence of telegraphic speech. The PBA1 could produce only three or four recognizable words and phrases, most of them consisted of nouns and verbs. The Interviewer asked him, "Do you know my father?" His answer was "Chinbo" [Verb] (Yes, I do). The PBA3 produced more limited words. The interviewer asked him several questions, but most of his answers were too short.

viii. The Interviewer: Do you feel trouble in speaking? The PBA3 : Hm... hm (Yes.. yes).

: Can you eat? : Hm? hm (Yes?yes). : Any problem in walking? : Na? na (No?no).

16 ix. Repetition of Words and Phrases

Due to labor in speech repetition of words and phrases occurred in the patients of Broca's aphasia. In the analysis of the sub-topics above the repetition of sounds, words and phrases in the speeches of the patients has already been shown. Some more evidences are presented below:

The PBA1 could produce very few selected words. Such as 'O Allah go..!'(O my God!), O baba go..! (O my father!). He was uttering these repeatedly. The PBA5 was an interesting fellow though suffering from speech trouble. When the interviewer asked him about his habit of smoking, he made fun of death:

The PBA5 : Mu...mu...mursi, kha..kha..khaye thayei murmu. (I must die, so, why shall I miss smoking?)

He repeated many sounds and words like mu, kha etc. The PBA2's repetition of words was more frequent. Such as:

The Interviewer : Try to eat more. x. Difficulty in Writing and Reading Since the patients of Broca's aphasia, except the PBA4, could not move the right side, they could not write anything (All were right-handed). But the PBA1 showed interest in what the interviewer was writing about him. He tried to approach the interviewer and wanted to read what was being written. His wife said that he could read both Bengali and English though without speech production.

The PBA4 could write his name and address. The interviewers asked him to draw a picture. He drew a picture of the national flag of Bangladesh under the direction of his mother, though he took about 45 minutes to do it.

17 b) Wernicke's Aphasia i. Difficulty in Language Comprehension

Both of the Wernicek's aphasia patients exhibited the loss of language comprehension ability. They could not recognize their language deficit. So, it produced significant effects on their linguistic behavior.

The PWA 1 showed considerable evidence of the lack of language comprehension. She was sixty years old and living with her son's family. A stroke had made Wernicke's area of her brain injured three years ago. The interviewer talked to her on various topics but many of her responses deviated from the topic due to the lack of language comprehension. The interviewer: When will you have your lunch? The PWA 1 : Daal die ekmuth vaat khaise ma? (I ate only a handful of rice with daal).

She could catch the topic of eating but was unable to comprehend the main point of the question. She ended the sentence with more words and was gradually deviating from her original points of speech. She started her speaking with the items of meal she had had, and ended with abusing her daughter-in-law for various reasons. Once she started her speech and she continued without pause about three minutes, and gave no room for the interviewer's intervention.

18 Fluent Speaking with Normal Intonation and Stress, but often with Nonsense Meaning

All the patients manifested their normal ability to speak fluently. They could speak at a stretch without labor and maintain normal intonation and stress. But shockingly, sometimes, their speech contained no contents. Very often their produced utterance carried no message.

The PWA2 once made such type of deficiency while speaking with the interviewer. She was a sixty-five years old poor patient who had suffered from a massive brain stroke. Her medical report showed that the stroke had left a lesion in the left occipital lobe of her brain. She was staying in a hospital in Dhaka. Sufficient interview was not possible due to her mental and physical condition. The interviewer, along with a doctor, met her. The doctor tried to talk to her.

The Doctor : Ma, look at me, how are you? The PWA2 : No, no, that's (indicating something key words of her speech indicated that her speech produced no specific point. But her speaking was fluent according to her age. She had no so labor in speech.

The PWA1 also exhibited fluency in speaking. She started to abuse her daughter-in-law at the end of the interview for various reasons. She was throwing abusive words to her daughter-in-law. Her words, though abusive, were fluent and without labor.

ii. Short-time memory

The patients of Wernicke's aphasia sometimes manifest short-time memory. Sometimes, they cannot remember what they have talked about few minutes ago. The PWA1 showed clear evidence of this problem. The interviewer asked her, "Have you taken your breakfast?" She answered, "No". But her daughter-inlaw told that she had taken her breakfast about half an hour ago. She just forgot that she had taken her breakfast.

19 c) Doctors' Interview

To make the study more substantial two doctors who were experts in neurology, and a physiotherapist were consulted. They shared some significant issues related to Broca's aphasia and Wernicke's aphasia. The EDN1 said: "Brain is the most complicated and mysterious part of the human body." According to him, most of the aphasia occurred due to brain stroke, not only in Bangladesh but also all over the world. He also shared that he could not remember any patient of Wernicke's aphasia. The EDN2 also shared the same opinion. When the interviewer asked him about the reason of the very few number of the Wernicke's aphasia patients, he expressed a realistic view: "You know, a Wernicke's aphasia patient loses language comprehension power and speaks nonsense, common people consider him/her as a patient of mental disorder."

The physiotherapist gave some new ideas. He said: "The possibility of healing from aphasia depends upon the rate of injury in the brain. If the injury is not so serious, complete healing is possible." Responding to the question, "How do you treat your patients?" he answered, "We use speech therapy and facial exercise." He also expressed the view that the rate of healing varies from age to age.

20 d) Final Approach and Some Extra Findings

The present study reveals the data findings' proximity with the theoretical claims'. True, belonging to psycholinguistics, the topic of the study is more related to medical science. That is why the basic points of the theoretical claims remained stable in the data findings. The empirical findings had no irrelevance to the theoretical bases of Braca's aphasia and Wernicke's aphasia. For instance, language comprehension ability in Broca's aphasia is not affected was a theoretical claim, and it showed its manifestation in all the five patients of Broca's aphasia who were interviewed. Likewise, language comprehension ability in Wernicke's aphasia is affected was a theoretical claim, and the patients of Wernicke's aphasia proved it.

In addition the fact of proximity there were some more findings, especially, through the opinions of the doctors about the patients of Wernick's aphasia, in the perspective of Bangladesh. The doctors opined that the number of the patients of Wernicke's aphasia in treatment was very poor in Bangladesh.

It was because, they claimed, for ignorance and lack of awareness common people categorized the patients of Wernicke's aphasia with those of mental disorder. It was a very realistic and relevant claim in the perspective of Bangladesh.

Other socio-psychological factors of the patients were also found. Many patients who were cured and their relatives did not want to meet the interviewers. They technically avoided them. Many of them refused directly, and some of them after knowing the intention switched off their phones. Perhaps, they suffered from inferiority complex and anxiety in their society for their deficiencies. So, they did not want to bring their problems to light. This problem was more visible in the patients of Broca's aphasia. As they were psychologically normal, they

were suffering from depression, frustration and excessive anger. Unlike those of Wernicke's aphasia, they were not ignorant of their deficits. So, depression, frustration and anger overwhelmed their life.

Lastly, happy to mention that, among the seven patients six were receiving good family care. The rest's condition was bad (PWA1). She was rebuking her daughter-in-law because the latter did not take care of her properly.

21 VI.

22 Limitations of he Study

The present study contains some limitations. Such as:

1. The major limitation of this study is that compared with the number of the patients of Broca's aphasia (5), the number of the patients of Wernicke's aphasia (2) was much less. But why this limitation occurred has been indicated earlier in this paper. 2. Except the PBA-1 and the PBA-4 all the patients were nearly illiterate. So, unlike speaking ability, study on reading and writing abilities of the patients of aphasia was not completely satisfactory. 3. All the patients mentioned in the paper were victims of stroke. The patients whose aphasia had resulted from other accidents were not possible to approach. One patient whose aphasia had resulted from trauma was met, but, it was impossible to mention that case in the present paper. 4. Lastly, most of the topics of speaking with the patients were about eating. This technique was followed because speaking about eating proved more comfortable for both the interviewers and the patients.

The study could have been more representative if all these issues were resolved.

23 VII.

24 Conclusion

Human brain is really a mysterious organ. It controls, along with other crucial functions, linguistic attitudes of human beings. If the specific parts of the brain are injured, the linguistic attitudes are also affected. The present paper, which is an outcome of field study, has shown the evidences in favor of this claim. The patients, as shown in this paper suffered from the deficits related to one of the basic aspects of human life. Of course, language is one of the basic elements of human beings. So, when this basic element becomes dysfunctional, people fall into jeopardy, consequently, they lose their confidence of living. Most of the patients, especially those of Broca's aphasia, studied for this paper, exhibited low sense of self worth. They had severe difficulty in communicating with others. The situation in Bangladesh, as the study revealed, is far more critical since the lack of awareness, sufficient knowledge, and other facilities has been a severe drawback.

2

Figure 1: Figure 2 g

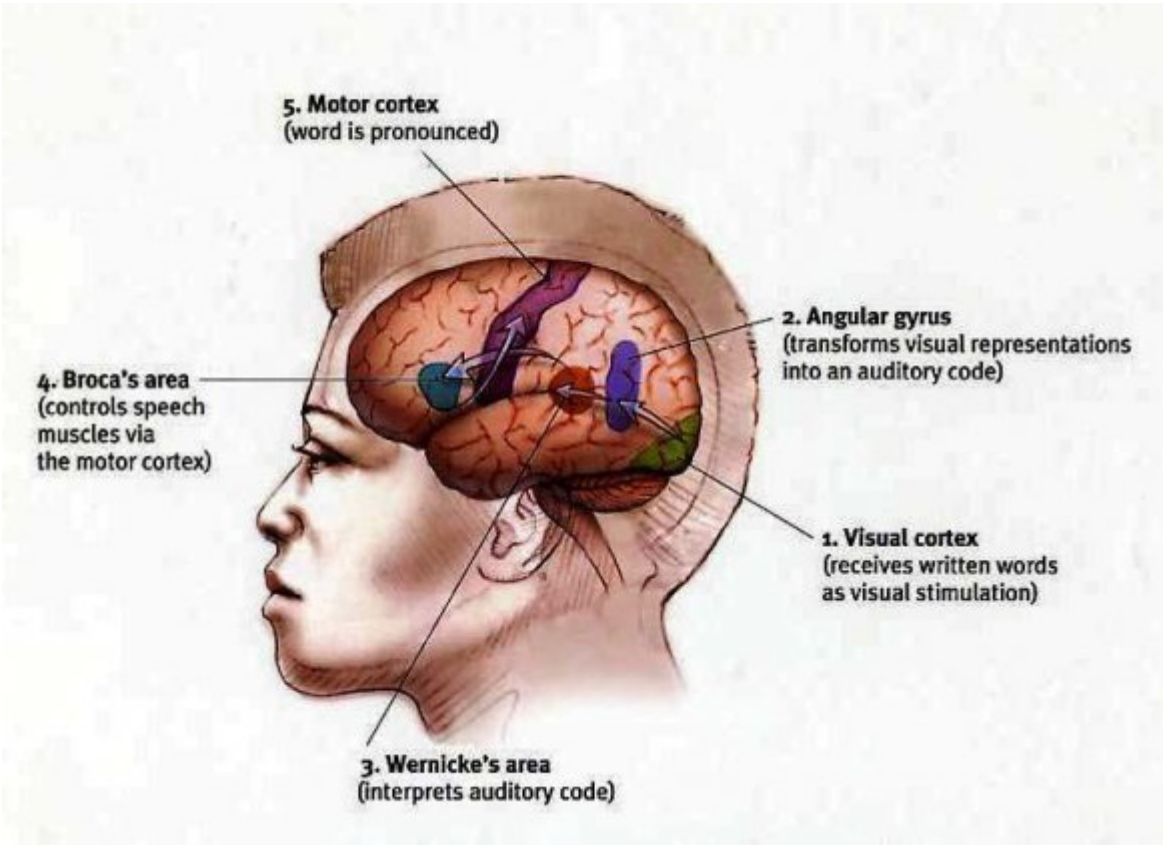

Figure 2:

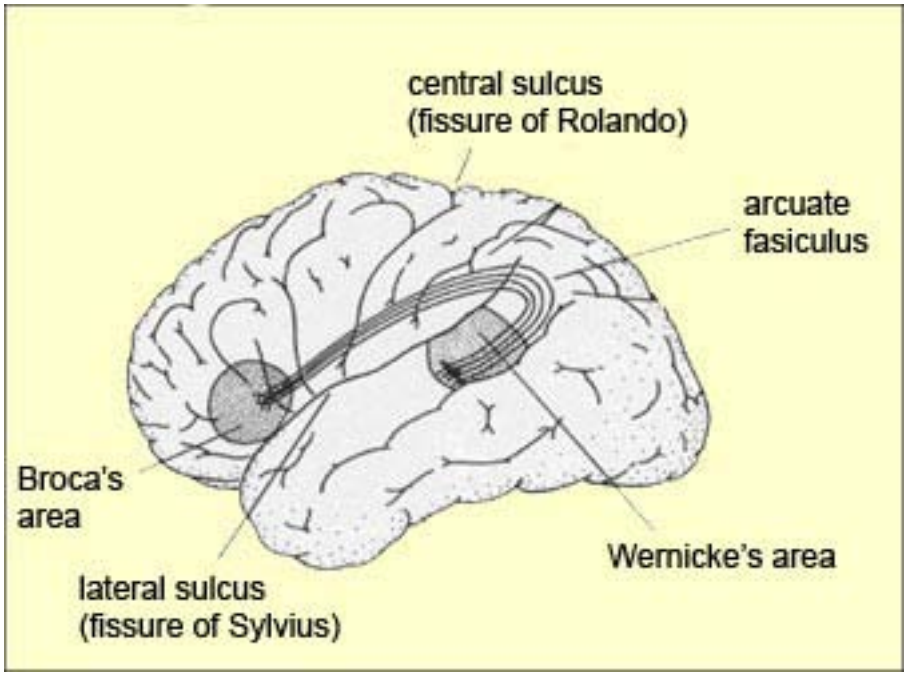

Figure 3:

[Foss and Hakes ()] , Donald J Foss , David J Hakes . *Psycholinguistics* 1978. Prentice Hall Regents, 3. Inc.

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