THEME SEVEN: Language Comprehension

Description and Rationale

This theme presents fundamental assumptions about language comprehension. Its main aim is to examine language comprehension as a psycholinguistic process. In more explicit terms, it attempts to elucidate how language (both spoken and written) is perceived and what cognitive mechanisms interplay to make it understood.

Learning Objectives

After completing this theme, students should be able to:

- Understand the process of language comprehension.

- Decipher the cognitive mechanisms underlying language comprehension.

- Explain how information is integrated into the already existing one.

- Identify what factors affect the comprehension ability.

- Display the cognitive architecture supporting language comprehension.

Guiding Questions

1. What is meant by language comprehension?

2. Regarding language comprehension, are all words, or word meanings, equally likely to be retrieved?

3. Which type of information (phonological, grammatical, semantic) is used first?

4. What are the cognitive processes people use to correct themselves?

5. How is the brain managing mental tasks related to language comprehension?

Theme Seven Contents

1. Language Comprehension: A Brief Introduction

Language comprehension is one of the most important tasks humans perform. Yet, it is also one of the most complex, requiring the simultaneous integration of many different types of information, such as knowledge about letters and their sounds, spelling, grammar, and general knowledge. It is argued that language comprehension uses general cognitive abilities, such as attention monitoring, inferencing and memory retrieval. The latter are usually used to organise information into a single meaningful representation (Understanding the mechanisms of language comprehension, 2016).

For the most part, we take the ability to accomplish this task for granted. People do not even consider and are not aware of the complexity of this process. If this process is to be realised, it is thanks to a certain organ in our bodies, the BRAIN. In addition to many important functions, the brain is at the heart of language realisation in general and language comprehension in particular. Without the role of the brain, humans cannot be able to use language and therefore communicate.

In this respect, it is dire to shed some light on this organ and attempt to explain how it processes language; and more importantly, it is very crucial to understand how the brain enables us to comprehend language, both spoken and written.

2. Language Comprehension: A Short Historical Account on the Study of the Brain

Lise Menn (2017), in her seminal book, entitled "Psycholinguistics: Introduction and Application", provides a thorough historical account and description of how humans throughout history have realised the great importance and role of the brain for thinking. In this book, the author advocates that western medicine took many centuries to figure out that the brain is used for thinking and several more centuries to have anything to do with ideas, dreams, and feelings.

According to this author, the first people and civilisation who gave humanity a written document that told us that the brain had something to do with language were the ancient Egyptians. This document was called the Edwin Smith Papyrus. It describes a head-injured man who became speechless when pressure was applied to the area of injury. Despite this evidence, the Egyptians still thought that it was the heart and not the brain that controlled our ability to think and move our bodies. About two centuries later, Hippocrates and his colleagues got it right. In another book called "Corpus Hippocraticum", there are accounts of speech loss after brain injury, even associating these injuries with a paralysis of the right side of the body, something we still see in people with language disorders after a brain injury.

After about two millennials later, Franz Joseph Gall in the late 1800s started a theory he called Organology. He recalled that as a child, he was impressed by a friend's ability to articulate and memorise verbal material. For Gall, his observation of many phenomena led him to conclude that in the brain, there are areas responsible for many functions. In other words, he gave us the idea that different areas of the brain might specialise in different functions. This idea, called for localisation of function, is still valid for some of our abilities (Lise, 2017, pp. 72-74).

3. A Brief Review of the Brain's Anatomy

In this section, we shall present and describe the brain's anatomy. It is worth mentioning that most of the information included in this section is common knowledge. This means that these pieces of information are available in the same way in different sources. Because our aim, as stated before, is to inform our students about the brain's anatomy, almost all of the information was retrieved from a webpage titled "Brain Anatomy and How the Brain Works" (https://www.hopkinsmedicine.org/health/conditions-and-diseases/anatomy-of-the-brain).

The brain is a complex organ that controls thought, memory, emotion, touch, motor skills, vision, breathing, temperature, hunger, and every process that regulates our body.

Together and with the spinal cord that extends from it, they make up the central nervous system, or as it is often referred to as CNS.

Weighing about 1400 grams in the average adult, the brain is about 60% fat. The remaining 40% is a combination of water, protein, carbohydrates, and salts. The brain itself is not a muscle. In the brain, grey matter refers to the darker, out portion of the brain, while white matter describes the lighter, inner section underneath. The distinction between the grey and white matters is shown in Figure 1 below.

In the spinal cord, this order is reversed: the white matter is on the outside, and the grey matter sits within. Grey matter is primarily composed of neuro somas (the round central cell bodies), and the white matter is mostly made of axons (the long stems that connect nerves together) wrapped in myelin (a protective coating). The distinction of the location of the grey matter and white matter between the brain and the spinal cord is shown in Figure 1 below.

Figure 1.

A diagram of the human brain and the spinal cord, by Mandira (2017)
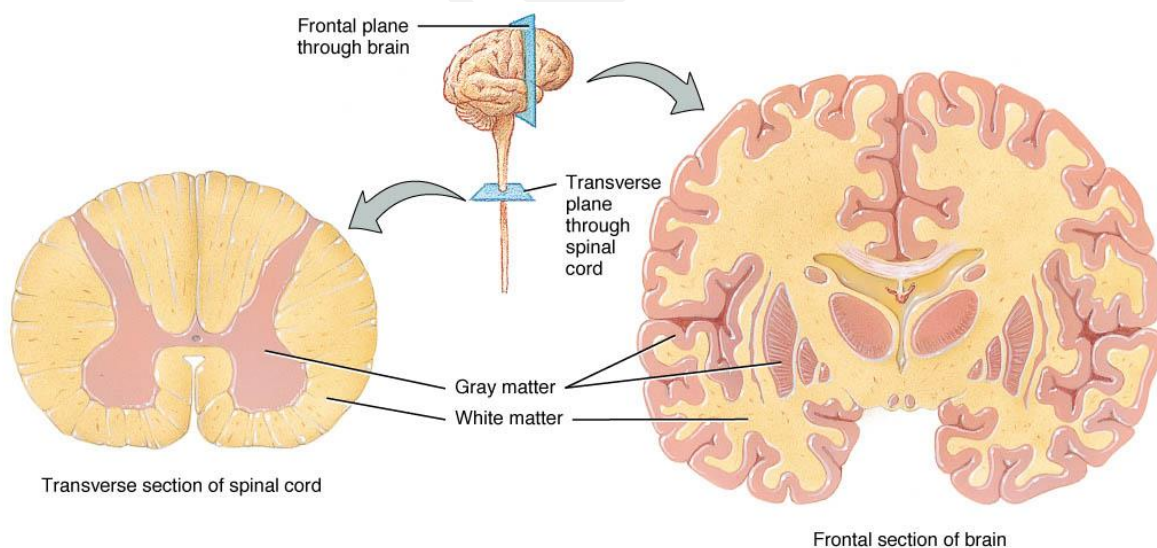
According to the anatomy of the brain, the brain can be divided into three parts. These are the cerebrum, brainstem, and cerebellum (see Figure 2). In what follows, we shall describe these parts with some details so that we could realise how complex and important is the human brain.

A. The Cerebrum (Front of the Brain)

It comprises grey matter (the cerebral cortex) and white matter at its centre. The largest part of the brain, the cerebrum initiates and coordinates movement and regulates temperature.

- **The Cerebral Cortex:** The cerebral cortex describes the outer grey matter covering the cerebrum. The central cortex is divided into two halves, or hemispheres. The two halves join at a large, deep sulcus (the inter-hemispheric fissure, also known as the medial longitudinal fissure) that runs from the front of the head to the back.

The right hemisphere controls the left side of the body. The two halves communicate with one another through a large C-shaped structure of white matter and nerve pathways called the corpus callosum. The corpus callosum is in the centre of the cerebrum.

B. The Brainstem (Middle of the Brain)

The brainstem includes the midbrain, the pons, and the medulla.

- **Midbrain:** It is a very complex structure with a range of different neurons.

- **Pons:** The pons is the connection between the midbrain and the medulla.

- **Medulla:** It is located at the bottom of the brainstem. It is where the brain meets the spinal cord.

C. The Cerebellum (Little Brain)

It is a fist-sized portion of the brain located at the back of the head, below the temporal and occipital lobes and above the brainstem.

Figure 2.

The major parts of the brain, by Pearson (n.a.)
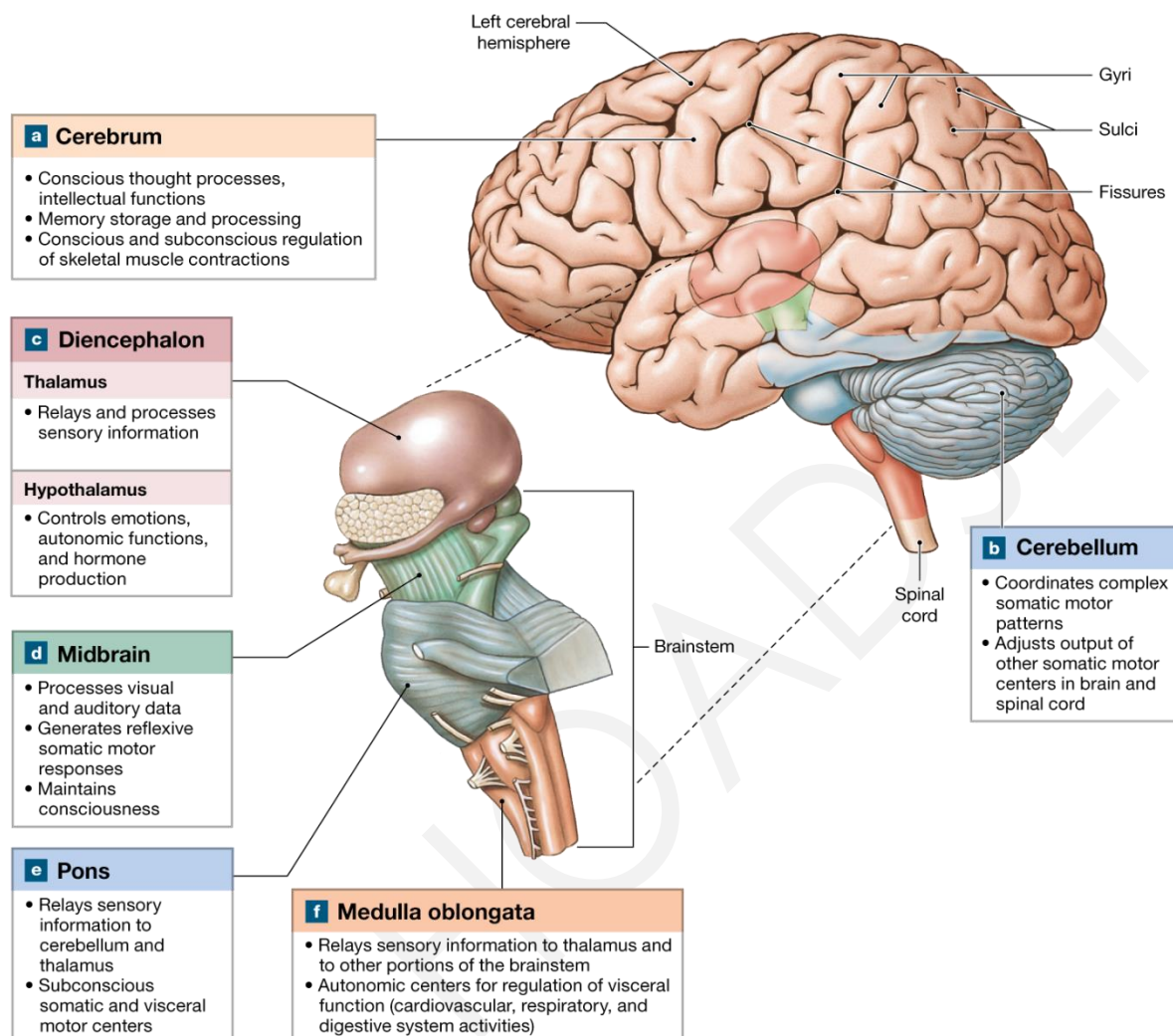
▪ **Lobes:** Each brain hemisphere has four sections, called lobes: frontal, parietal, temporal and occipital lobes. Each lobe controls specific functions:

- **Frontal lobe:** It is the largest lobe of the brain.

- **Occipital lobe:** The occipital lobe is the back part of the brain.

- **Temporal lobe:** The sides of the brain, temporal lobes are involved in short-term memory, speech, and some degree of smell recognition (Brain Anatomy and How the Brain Works https://www.hopkinsmedicine.org/health/conditions-and-diseases/anatomy-of-the-brain). Check Figure 3 below for a clear depiction of these three lobes.

Figure 3.

A diagram of the brain lobes, by Borba (2011)
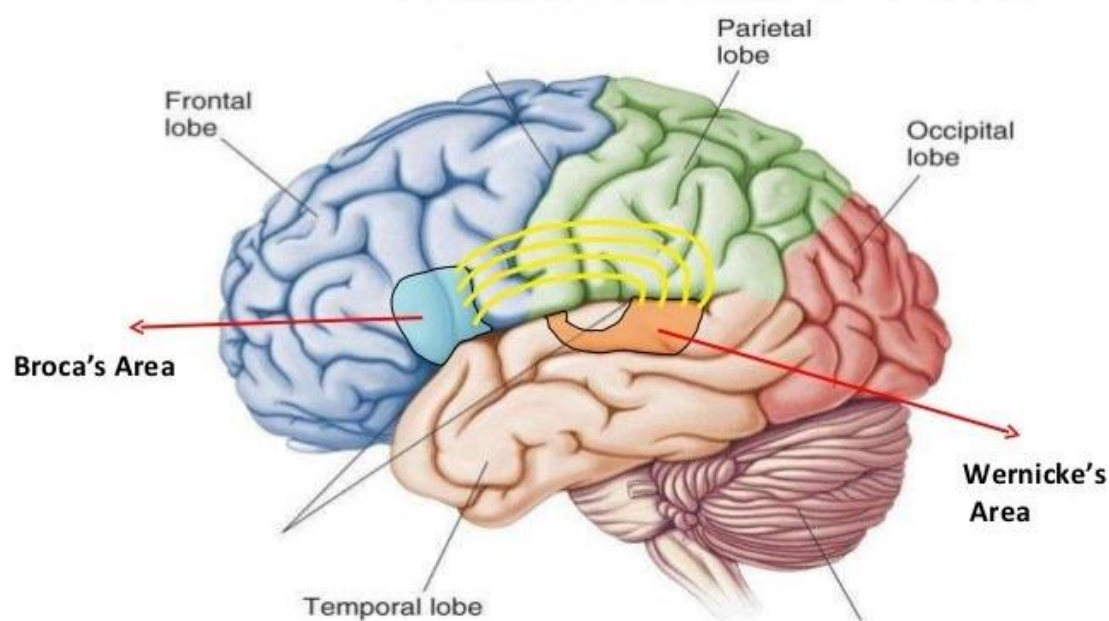
4. Language and the Brain

Without the brain, there would be no language. There is strong evidence that there is a correlation between a person's brain and language. The main language centres are located in the hemispheres. These are the Broca's area, in the front part of the brain, Wernicke's area, towards the back, and the angular gyrus, which is even further back. Broca's area and Wernicke's area are connected by tissue, referred to as the arcuate fasciculus. These are not found in the right hemisphere. It is claimed that it is only the left hemisphere that is used for speaking and writing.

In what is coming, a brief description of language areas and their functions are going to be presented:

- The front part of the parietal lobe, along the fissure of Rolando, is primarily involved in the processing of sensation.

- The area in front of the fissure of Rolando is mainly involved in monitor functioning and is thus relevant to the study of speaking and writing.

- An area in the upper part of the temporal lobe, extending upwards into the parietal lobe,

plays a major part in the comprehension of speech. This is "Wernicke's area".

- In the upper part of the temporal lobe is the main area involved in auditory reception, known as "Heschl's gyrus", after the Austrian pathologist R. H. Heschl (1824-1881).

- The lower back part of the frontal lobe is primarily involved in the encoding of speech. This is "Broca's area".

- Another area towards the back of the frontal lobe may be involved in the motor control of writing. It is known as "Exner's centre", after the German neurologist Sigmund Exner (1846-1926).

- Part of the left parietal region, close to Wernicke's area, is involved with the control of manual signing.

- The area at the back of the occipital lobe is used mainly for the processing of visual input.

Research has shown that the Broca's area is connected with Wernicke's area by the arcuate fasciculus. Moreover, some of the neural pathways that are considered to be involved in the processing of spoken language are:

- **Speech production:** The brain structure of the utterances is thought to be generated in Wernicke's area and is sent to the Broca's area for encoding.

- **Reading aloud:** The written form is first received by the visual cortex, then transmitted via angular gyrus to Wernicke's area, where it is thought to be associated with the auditory representation. The utterance structure is then sent on to Broca's area.

- **Speech comprehension:** The signals arrive in the auditory cortex from the ear, and are transferred to the adjacent Wernicke's area, where they are interpreted.

Overall, although most language processes occur in Broca's area, Wernicke's area and the angular gyrus, some language functioning does occur in the right, "non-language", hemisphere (Psycholinguistics: Language and the Brain, 2010).

5. Language Comprehension: Understanding the Mechanisms

Language comprehension is a complex process. It involves a number of abilities, skills, processes, knowledge and dispositions from which meaning can be derived. It concerned more with recognising and producing words and understanding and creating sentences. Although language comprehension is accomplished easily and effortlessly, it is a complex process, requiring the interplay of a variety of cognitive mechanisms. As such, language comprehension is interwoven with core cognitive abilities, which show multidirectional patterns of change as a function of both primary aging processes and experience (Steen & Stine-Morrow, 2016).

Given that, the main focus in language comprehension concerns how people represent and make use of the meaning of words and sentences, and how they decode the communicative purpose of linguistic elements, and how memory is involved in this decoding (Hatzidaki, 2007). For Hatzidaki, prior to presenting the main issues that are relevant to the comprehension of meaning, it is worth distinguishing between two concepts: a word's denotation and a word's connotation. The former refers to the actual meaning of a word (what is usually provided as a first meaning in a dictionary), and the latter refers to associations people make in reference to the cultural and contextual background where this word operates.

In the literature, for other scholars, language comprehension concerns how we understand the meaning of words, phrases, clauses, sentences, or discourse we listen to or read. For a great deal of these scholars, language comprehension cannot be separated from its specific components. On this point, Indah and Abdurrahman (2008) summarise these components in the following:

- **Speech processing:** It is about the segmentation and classification of the incoming sensory input. Speech processing covers the construction of these sensory inputs. The latter are represented in the form of speech signals and are perceived as being made up of distinct units in the mind of the speaker.

- **Lexical processing:** It concerns the recognition of individual words and the access of individual words and the access to the different types of information associated with them.

- **Sentential processing:** It deals with the extraction and combination of syntactic information of individual words and their order to construct a syntactic representation and knowledge to arrive at a sentence interpretation. In the sentential processing, three components of sentence comprehension will be parsed. These are: (1) extracting the syntactic structure and semantic representation of a sentence; (2) interpreting the representation of the preceding linguistic context: and (3) retaining the relevant information in the long-term memory.

- **Discourse processing:** It is about the integration of the interpretation and successive sentences to create a discourse representation. In discourse processing, the listener attempts to understand discourse and draw inferences to get the meaning of what the speaker intends to convey (Indah & Abdurrahman, 2008).

In the same vein, Hatzidraki (2007) provides another description and classification of the process of language comprehension. This author focuses more on how people represent and make use of the literal and figurative meaning of words and sentences, how these are decoded, and finally how they are memorised. In precise terms, Hatzidaki (2007) suggests this classification:

1. **Representation of the meaning of words:** It mainly deals with how words are represented in our minds. Hatzidaki (2007) refers to Putman (1975) who provided the Reference Theory of Meaning. According to Putman, the essence of this theory is that a word's meaning is usually equated to the meaning of this word in the world.

2. **Comprehension of word combinations:** It is about how comprehension is achieved when two words are put together and how people could understand word combinations.

To answer these questions, Hatzidaki (2007), based on the available literature, advocates that people's interpretations of word combinations may rely on a number of linguistic and extra-linguistic factors. Examples of these include (1) thematic relation, (2) property link, (3) hybridisation, and (4) past experience.

3. **Sentence comprehension:** It concerns the psycholinguistic perspective on how people represent meaning at a larger unit of language representation. For Hatzidaki (2007), in order to be able to understand the structure of a sentence, people have to combine different sources of information in relation to language constituents. In his words, these people have to be able to retrieve:

   ▪ the semantic representation of each lexical item in a sentence;

   ▪ the grammatical items they can combine with;

   ▪ the syntactic information about items they can combine with; and

   ▪ the kind of dependencies they can form. The author concludes that the precise meaning that is assigned to a sentence is highly correlated with the discourse environment with which a sentence is presented.

4. **Sentence comprehension during figurative meaning processing:** It concerns language processing when the meaning of an utterance goes beyond that of common use. To have a better understanding of sentence comprehension, Hatzidaki (2007) refers to Hawley (2005) who proposed three types of figurative speech. In Hawley's words, they are expressed in the following:

   ▪ Metaphors;

   ▪ Idioms; and

   ▪ Indirect requests. In Hawley's terms, a metaphorical expression comprises smiles (whereby one thing is linked to another of a different category); strict metaphor (namely, a single use of metaphor); and synecdoche (whereby a part is substituted for

a whole or a whole for a part).

For idioms, Hawley adds that they are combinations of words that, when considered as a whole, are different in meaning regarding the meaning suggested by the individual words. For the same author, it is assumed that these words are represented and stored in memory as a single word. Furthermore, as for requests, whereby the speaker does not know his/her intercalator whether s/he is physically able to perform a particular task and whether he is willing to do so, people appear to rely heavily on inferences. By drawing inferences, people attempt to construct a coherent meaning of discourse, either by being guided by the actual meaning of words, or by combining the words together.

5. **Text comprehension:** In text comprehension, we are concerned with the way sentences are combined to construct a representation in order to decode the text's communicative purpose. In this respect, like in sentence comprehension, text comprehension involves an inferential activity. This simply means that the information from both the text and the reader is used to build up meaningful representations.

Hatzidaki (2007) refers to the Processing Cycle Theory to yield an explanation about how people process when they are confronted with texts. According to this theory, a text representation is constructed by integrating each sentence representation into the context that has been formulated by the preceding sentences. In doing so, whenever a sentence occurs and ideas are recognized, new relationships have to be established to include new information (Hatzidaki, 2007, pp. 15-18).

6. **Let us Practice!**

6.1 Questions

Read the below questions and answer them.

▪ How would you describe the main parts of the brain?

- What parts of the brain are responsible for language?

- What are the primary structures of neurons and what are their functions?

- How meaning is represented and processed in the mind in reference to a word, a sentence, and a text?

6.2 Activity

Read this statement and answer the question.

"Language comprehension is a complex process. It involves a number of abilities, skills, knowledge, and dispositions from which meaning can be derived" -**Explain**

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Section of English	**Course:** Linguistics
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In-Take Home Test (7)

PART ONE: Just Remember it!

Activity 1: Choose the best answer

1. The first people who gave humanity a written document about the study of the brain were the ancient —————————.

    a. Chinese   **b.** Greeks   **c.** Egyptians

2. In the late 1800s, Gall started a ————————— he called Organology.

    a. book   **b.** theory   **c.** paper

3. Weighing about 1400 grams in the average adult, the brain is about ————————— fat.

    a. 70%   **b.** 60%   **c.** 50%

4. it is claimed that it is only the ————————— hemisphere that is used for speaking and writing.

    a. right   **b.** centre   **c.** left

Activity 2: Decide whether these statements are **True** or **False**

    a. Without the role of the brain, humans cannot be able to use language.

    b. Broca's area and Wernicke's area are connected by tissue.

    c. It is assumed that words are represented and stored in memory collectively.

    d. Language comprehension requires efforts and energy.

a	b	c	d

Activity 3: Match the concepts with their respective definitions

1. Speech processing	**a.** It concerns the recognition of individual words.
2. Lexical processing	**b.** It is about the integration of interpretation to create a discourse representation.
3. Sentential processing	**c.** It deals with the extraction and combination of syntactic information.
4. Discourse processing	**d.** It is about the segmentation and classification of the incoming sensory input.

PART TWO: In-Between

Activity 1: Fill in the gaps

Language —**1**— is a complex process. It —**2**— a number of abilities, processes, skills, and dispositions from which —**3**— can be —**4**—. It is concerned more with the recognition and production of words.

1	2	3	4

Activity 1: Briefly, answer the following questions

1. What is the focus of language comprehension?

_____

_____

2. How do people process when they are confronted with texts?

_____

_____

PART THREE: In-Depth

Activity: Read and discuss the following statement

- "For most part, we take the ability to accomplish language comprehension for granted. If this process is to be realized, it is thanks to the brain."

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