

NEUROLINGUISTICS
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الخلاصة

يعتبر علم اللغة العصبي هو احد فروع علم اللغة الذي يدرس الاساس في ظام الجهاز العصبي للانسان لتطوير واستخدام اللغة ويحاول هذا العلم انشاء نموذج لسيطرة العقل على مختلف فعاليات الحياة. ويمكن ان يمثل هذا الجانب العلمي في فعاليات مختلفة في الكلام، الاصغاء، القراءة او الاشارة، ويحاول ايضا التحقق من استعمال اللغة وكما يعتبر علم اللغة العصبي فرع من فروع علم النفس لذلك فهو يركز على ما يحدث في عقل الانسان عندما يتكلم او يصغي، هنالك فعاليتان تعتبر الجوهره لعلم اللغة النفسي: انتاج الكلام والاستيعاب. ولكن في بعض الاحيان هنالك غموض في انتاج الكلام او اخراجه (وهذا يرجع الى العواقب في اعضاء النطق) والاستيعاب (الخلل في العقل) وهذا يكون بسبب تحطم اجزاء دقيقة في العقل، يحاول هذا البحث ان يكشف الخلل في عقل الانسان الذي يسبب عدم المقدرة اللغوية للانسان.

Abstract

Neurolinguistics is a branch of linguistics which studies the basis in human nervous system for the language development and use . it aims to construct a model of brain's control through the various processes of life. This field can be performed in different activities whether in speaking, listening , reading or signing , it also attempts to investigate the language use . As neurolinguistics is a branch of psycholinguistics , So, it focuses on what happen in the human mind when people speak or listen. There are two activities which can be considered the core of psycholinguistics: speech production and comprehension. But sometimes there is an ambiguity may arise in speech production (this may due to obstacles in the speech organs) and comprehension (default in the mind) this may be caused the damaging in specific Parts of the brain. This research tries to reveal the deficits in the human's brain which causes the language disabilities for people.

CHAPTER ONE

INTRODUCTION

1-1

In recent years , one of the fastest expanding fields of study has been , neurolinguistics – is a branch of psycholinguistics which investigates the language use . Psycholinguistics is the study of mental mechanisms which make it possible for people to use language .

This clarifies that the various branches of linguistics lead to the most important subsidiary linguistics branches : Psycholinguistics . Central to psycholinguistic research is what happens in the human mind when people speak or listen, so, The main term is language processing . In order to clarify the role of language, there are two activities of language processing constitute the core of psycholinguistics : speech production and comprehension . In addition to the acquisition which is considered as one of the major goals of psycholinguistics (it tries to reveal the strategies of language acquisition and the phenomena that occur in the acquisition process) . Moreover , there is a third subbranch of psycholinguistics which tries to perform two tasks:

First : Neurolinguistics is concerned with how is linguistic knowledge represented in mind .Second how are linguistic processes instantiated in the brain.

Moreover , there are two main issues constitute the core of neurolinguistics : the study of human brain and the study of language disorders . Because any damage in human's brain will affect on the comprehension , production and abstract knowledge of the brain .

This study aims to study the mental mechanism that makes it possible for people to use language . So , language is considered a worthy of attention as a regular body of facts and the theory is built up around it .

Chapter one presents the relationship between language and the brain and offers the definitions of neurolinguistics .

In chapter two , the researcher presents the human brain and the important issues : lateralization ; brain studies , brain centers , and language disorders .

The parts of brain , Broca's area , Wernicke's area , the motor cortex and

The arcuate fasciculus , and localization view are discussed in chapter three chapter four ends with a conclusion of the study and references .

1 – 2 Language and the brain

From the earliest stages there is a close connection between language and the brain which are highly interrelated with each other , because the brain stores the thoughts and ideas which are expressed by

the speech. As neurolinguistics investigates how the human brain creates and process speech and language , so , there is a need to clarify some popular misunderstanding about the human brain and how it functions . For example , the disproportionate attention is devoted to the well – known anatomical fact that human brains have two separate and virtually identical cerebral hemispheres . Biologically , this is an unremarkable piece of information , for this bifurcation which is found in all vertebrates and is itself a characteristic of the bilateral symmetry that pervades our living words . (Scovel , 1998 : 71)

However , there is unusual enhancement with the brain in our current culture , so that this anatomical condition has prompted a great deal of discussion about (left brain and right brain) differences in human behavior .

There are millions of associations which connect the left and right hemispheres together , in normal brains any information in either hemisphere is shared with the other . The function of the corpus callosum (the largest sheath of association pathways connecting the two hemispheres) is known as ignored , or misunderstood so that nowadays is represented as a " fact " that there is " left – brained " and ' right – brained ' people in the same way that individuates can be left – or right – handed. (Ibid)

The speech production disordered largely whenever disease or injury affects the left side of the individuals' brain , some aspects of the ability to erceive , process , or produce language may be distributed . Such brain's disease or injury are said to be a phasic . Akmajian et al (1995 : 501)

A phasia is a " broad term encompassing numerous syndromes of communicative impairment . Some phasics labor to speak a single word,

w hereas others effortlessly produce long but meaningless utterances ” . (Ibid)

With reference to brain damage , Akmajian et al (1995 : 501) and Parker and Riley (2005 : 273) state that the brain damage effects on speech , in other words , it can be resulted in a language whether in comprehension or organization of speech and language .

Moreover , Gleason and Ranter (2009 : 15 – 16) view a phasia as a damage to language areas of the brain results in a phasia , a generalize , communicative disorder with varying characteristics depending on the site of the lesion .

1 – 3 Neurolinguistics

Neurolinguistics is a branch of linguistics which studies the basis in the human nervous system for language development and use , also called neurological linguistics . It aims to construct a model of the brain's control over the processes of speaking , listening , reading , writing , and signing . (Crystal , 1992 : 265)

As neurolinguistics is a sub_branch of psycholinguistics , Scovel (1998 : 127 – 31) defines it as a branch of psycholinguistics which investigates the use of language in experimental or clinical conditions as a window to the way in which the brain produces

and processes linguistics information .

Moreover , neurolinguistics is an offspring of psycholinguistics investigates how the human brain creates and process speech .

The study of abnormalities of speech provides psycholinguistics insights into psychology of language .

For example , the slip of tongue data , another injury is the second language acquisition (SLA) which can be considered as a branch of applied psycholinguistics .

The errors that non – native speakers make while they are learning a new language have turned out to reveal some of the learning processes they employ . So , it is not surprise that psycholinguists have found that dissolution of language , whether due to accident or age , as a rich source of information about how human controls our attempts to communicate . (Ibid : 70)

There is an intersection between brain and speech as Akmajian et al (1995 : 501) state that there is a kind of correlation between brain damage and speech and language deficits . The language and brain specialists believe that the study of language form and use will reveal the principles of brain's function may support or refute specific linguistic theories .

In sum , neurolinguistics can be considered as a basis for language because the crucial relationship between language and brain .

Chapter Two

2 – 1 The Human Brain

The human brain is the central element of nervous system which of a set of nerves through which the nervous system is connected with various issues of the body .

The human brain is lateralized , it has specialized function in each of the two hemispheres .

Those functions control the motor movements which involved in things like speaking and object manipulation which are largely confined to the left hemisphere of the human's brain . So , there is an evolutionary connection between language – using and tool – using abilities of humans and both of them are involved in the development of the speaking brain . Thus , most of approaches reveal that humans produce single noises to indicate objects in their environments . (Yule , 2006 : 4)

The theory of neurolinguistics is based on the anatomy of the central nervous system , the left and right hemispheres and the frontal , temporal , occipital , and parietal lobes . In addition , this theory uses concepts such as localization of function , hemispherical dominance , and hemispherical specialization . (Parker and Riley , 2005 : 2 92)

Moreover , each hemisphere controls the movements and receives sensory input from the opposite side of the body . (Crystal , 2007 : 173)

The neurolinguists focus on the following issues :

1. Lateralization
2. Brain studies
3. Brain centers
4. Language disorders (Handke , 2003 : 138)

2.1.1 Lateralization

Lateralization is the apparent specialization of the left hemisphere for language which is described in terms of lateral dominance .

(Yule , 2006 : 145) .

Lateralization is divided into a left side and a right side , with control of functions on one side or the other (used in describing the human brain) .

These two halves of the brain are not exactly a like , each hemisphere has functional specialization . Some functions whose neural mechanisms are localized in one half of the brain . The functional specialization within the left hemisphere concerns with speech and language abilities . (Ibid : 244)

Speech lateralization can be tested in various ways as : -

1- Dichotic listening tasks : which can be identified as different sorts of input show different ear preferences . Subjects with left – hemisphere are more accurate in reporting items arriving at the right ear than items arriving at the left ear when the input is verbal stimulus .

While the majority of people have a left – ear advantage for tasks involving the recognition of music or environment . (Handke , 2003 : 138 – 139)

2- Split - brain patients

The Sperry experiment illustrated that split - brain patients , whose corpus callosum had been cut .

3- Clinical reports people that have brain injuries . Based on these data , and on indirect measures , between 70% to 95% of humans are estimated to have a left – hemisphere language specialization . While the rest may have anomalous patterns of specialization .

These might include :-

1. Having a right – hemisphere language specialization or
2. Having little lateralized specialization .

In addition , the more one knows about neurological mechanisms underlying language abilities , the more complicated these issues become . For instance , some language functions (like the emotive content of speech are specialized in the right hemisphere of people with left hemisphere language specialization .

As a result , there is still a great deal about brain lateralization that people simply do not yet understand . (Ibid : 139)

2.1.2 Studying the brain

Methodologies that are used in recent neurolinguistic studies involve form of functional neuroimaging , where the activity of the brain is tracked during the performance of a linguistic task as follows : -

1. ERP measurements (event – related potential)

Measurements are EEGs used to detect different patterns of electrical activity in the brain . They are minute fluctuations in voltage recorded from the surface of the scalp in response to sensory stimulation .

So , ERPs reflect the processing of sensory characteristics of the electing stimuli and different types of cognitive activity elicited by the stimuli (Handke , 2003 : 139) .

2. PET Scanning (positron emission tomography) :

Is a diagnostic examination that involves the acquisition of physiologic images based on the detection of positrons (are ting particles emitted

From a radio active substance administered to the patient . The PET

Scanning method measures increased blood flow to areas of the brain that are engaged in a linguistic task . (Ibid : 140)

3. FMRI methods (Functional Magnetic Resonance Imaging) :

Use the radio waves and a strong magnetic than x – rays in order to provide clear and detailed pictures of internal organs and tissues . While ‘ functional ’ magnetic resonance ‘ imaging ’ (FMRI) is the procedure that use MR imaging to measure the quick , they metabolic changes that take place in an active part of the brain . (Ibid)

2.1.3 Brain centers

In 1800 , Paul Broca who is a French neurosurgeon identified a particular area of the left hemisphere that plays a primary role in speech production . Where as Carl Wernicke identified another part of

the left hemisphere concerned with language comprehension . Both of these two brain centers turned out to be of utmost importance for language processing that have been made after their discover : Broca’s

area and Wernicke’s area . Broca and Wernicke's area can be elaborated as follows :-

- A. : Broca's area : is named after the French physiologist Paul Broca (1824 – 1880) is commonly known as the motor center for speech . According to recent insights , Broca's area is not a ' unit ' . At least there are four subsections areas can be identified : areas for word associations , if .. then conditions , sequential order , and speech output .
- B. : Wernicke's area : named after the German physiologist Carl Wernicke , is commonly referred to as the sensory center for speech , i.e area which is mainly responsible for the reception of speech . This posterior part of the brain appears to be crucial for language comprehension . People who suffer from neurophysiologic damage to this area (called Wernicke's aphasia or fluent aphasia) are unable to understand the content words while listening , and unable to produce meaningful sentences .Their speech has grammatical structure but no meaning . (Handke , 2003 : 144)

2.1.4 Language Disorders

A central issues in neurolinguistics which concerns with all those brain - based language disorders that have been acquired :

A : A phasia is an acquired impairment due to brain injury in the left cerebral hemisphere . The most common cause of a phasia is a stroke,

Brain tumors , head injury , or other neurologic illness . Aphasia attacks an intricate part of a person’s daily life (the act of communication and sharing) there are two common forms of aphasia :

A : Broca ’s Aphasia is characterized by the loss of production of complete sentence structures in speech and writing . The aphasia may have lost all forms of pronouns , articles and conjunctions . Broca's aphasics struggles to speak more than one word at a time but shows signs of enormous effort ; thus , patients with Broca's aphasia is characterized as ' non – fluent aphasia ' . The main properties of Broca's aphasia are reduction of speech output 4 words / utterance , laborious and clumsy sound production , little comprehension impairment , and limitations in writing . Alternative names for Broca's aphasia : expressive and motor aphasia , for example :

" Yes ... ah ... Monday ... er Dad and Peter H ... (his own name) , and Dad ... er hospital ... and ah ... Wednesday ... Wednesday nine o'clock ... and and oh ... Thursday ... ten o'clock , ah doctors ... two ... an' doctor ... and er ... teeth ... Yath " .

In the previous passage , there is a difficulty in interpreting a patient with Broca's aphasia . This a phasic may be trying to explain that he has a dental appointment at the hospital , or that his dad has an appointment . However , amazingly , the Broca's a phasic's comprehension level which tested through , the following irreversible sentence structure :-

1. The girl is reading the yellow book .
2. The dog chased the cat .

In the first sentence , there is no trouble in understanding the Broca's aphasic whereas in the second it demands an ability to recognize the sentence . Both of these sentences are Nps could be interpreted as the subject of the sentence . It is shown that Broca's aphasic retains a good portion of their comprehension level . (Hanadk , 2003 : 144)

B: Wernicke's aphasia ; patients with a lesion in Wernicke's region have a difficult understanding in the production of speech as well as a difficulty in selecting phonemes or entire words with which to express their own meaning , producing errors known as paraphrases . Wernicke's aphasia (addition , omission , or change of phonemes in position) .

Such phonemic paraphasias accumulate in a word , the harder it is to understand it , to the extent that the intended word may become unidentified . Wernicke's aphasics speak extremely fluently with no informative purpose . Wernicke's aphasia is known as ' fluent a phasia ' . However , speech is far from normal . So , the sentences do not hang together and irrelevant words intrude sometimes to the point of jargon . However , the main symptoms of Wernicke's aphasia are impairment of comprehension , little difficulty of producing connected speech and impairment of reading and writing . There are alternative names for Wernicke's aphasia : fluent and sensory aphasia . Example

Well this is ... mother is a way here working her work out o'here to get her better , but when she's looking , the two boys looking in other part . One there small tile into her time here . She's working another time because she's getting too .

Clinician : Tell me where you live

Patient : Well , it's a meander place and it has two ... two of them . For dreaming and placing after supper . And up and down .

Four of down and three of up ...

Clinician : What's the weather like today ?

Patient : Fully under the jimjam and on the altigrabber . (Ibid : 144 – 145)

It is clearly that Wernicke's aphasics have many problems in expressing their thoughts to their audience . Thus , the sentence structure does not follow the correct grammatical patterns , and there is no meaning . Moreover , their comprehension level is more reduced than in a patient with Broca's aphasia . Confronted with (ir) reversible sentences , Wernicke's aphasics react poorly on both sentences .

1. The girl is reading the yellow book .
2. The dog chased the cat .

Thus , Wernicke's aphasics have lost a major part of their comprehension's ability .

Broca's aphasia and Wernicke's aphasia occur in the left hemisphere of the brain which is responsible for controlling the right side of the body with speech and language abilities . Broca's aphasia affects the front lobe adjacent to the primary motor cortex , and Wernicke's aphasia affects the posterior portion of the first frontal lobe . A general distinction can be made between the two disorders as follows : Broca's aphasia limits speech while Wernicke's aphasia limits comprehension . (Ibid : 144)

C : Dyslexia : Dyslexia is a brain – based type of learning disability that impairs a person's ability to read . These individuals typically read at levels significantly lower than expected despite having normal intelligence . Although the disorder varies from person to person , common characteristics among people with dyslexia are difficulty with phonological processing (the manipulation of sounds) and difficult with rapid – visual responding .

D : Deep dyslexia : Deep dyslexia is an acquired reading disorder which is marked by the occurrence of semantic errors , such as tartans as ' kilt ' or anchor read as ' boat ' . Patients with deep dyslexia have extensive left – hemisphere damage sufficient to produce aphasia (Broca's aphasia) and normally also a left hemisphere . Deep dyslexia generally shows all of the following symptoms in reading – a loud tasks :

1. Semantic errors , such as tartan read as ' kilt ' or anchor read as ' boat ' .
2. Visual error : a visual error in reading , when the response shares many letters with the stimulus , such as quarrel read as ' squired ' or angel read as ' angle ' .
3. Morphological errors : a morphological error , when a prefixed or suffixed word is read with the root of the correct word but the prefix or suffix wrong , such as running read as ' runner ' or unreal read as ' real ' . (Handke , 2003 : 145 – 146)

4. Concreteness effect : concrete highly – imageable words) , such as : tulip or green are much more like to be successfully read than abstract (difficult – to – image) words such as idea or usual .
5. Function words , such as and , the or or are very poorly read .
6. Non words , such as vib or ap cannot be read a loud at all
7. Spelling / writing may be impossible for , the studies of speech fluency , for example , stuttering (the interruption of the forward flow of speech) are not researched within neurolinguistic . (Ibid)

Chapter Three

3.1 Parts of the brain

A numerous studies have been made about specific parts in brain in which have a crucial role to language functions . The most important parts are : -

3.1.1 Broca's area

Broca's area : is an anterior speech cortex or , more usually as Broca's area . (Yule , 2006 : 39)

Pall Broca who is a French Surgeon . He reported in 1860 s that damage to this specific left part of the brain was related to the production of speech while , the damage on the right hemisphere had no such effect .

It is argued that language must be located in the left hemisphere and it has been treated as an indication that Broca's area is crucially involved in the production of speech .

Gleason and Ranter (2009 : 16) state that Broca's area lies in the left frontal region which is very near to the part of the motor strip that controls the tongue and lips , and the damage to Broca's area results a phasic syndrome , can be known as Broca's a phasic . It means that the patient has a good comprehension but much difficulty with pronunciation and producing the little words of the language , for example , articles and prepositions .

3.1.2 Wernicke's area

Wernicke's area is the ' posterior speech cortex ' or Wernicke's area Carle Wernicke was a German doctor who reported , in 1870 s , that damage to this part was found among patients who had speech comprehension difficulties . This idea confirmed that the left hemisphere location of language ability and to the view that Wernicke's area is part of the brain crucially involved in the understanding of speech. (Yule , 2006 : 139)

The location of Wernicke's area lies in the posterior left temporal lobe near the auditory association area of the brain . So , the damage to Wernicke's area produces an aphasia which is characterized by fluent speech with many neologisms (nonsense words) and poor comprehension , for example , Wernicke's aphasia when asked to name ashtray , said

" that's a fremser " , when he was asked to point to the fremser , he had no idea what the examiner means . (Gleason and Ranter , 2009 : 16 – 17)

3.1.3 The motor Cortex and the arcuate fasciculus

The motor cortex can be illustrated as an area that controls the movement of the muscles (for moving hands , feet , and arms) . Broca's area is the part of the motor cortex that articulatory muscles of the face , Jaw , tongue and larynx .

Moreover , this area is involved in the physical articulation of speech which estimated in 1950 s two neurosurgeons , Penfield and Roberts (1959). They apply small amounts of electrical current to specific areas of the brain and it can be identified where the electrical stimulation would interfere with normal speech production . (Yule , 2006 : 139)

3.1.4 Lateralization view

It is a specific aspect of language ability that can be accorded specific locations in the brain . The localizational view used to suggest that the brain activity involved in hearing a word , understanding it , then saying it . So , the word that is heard or comprehended via Wernicke's area . This signal is transferred via the arcuate fasciculus to Broca's area where the prepositions are made to produce it . (Ibid : 139 – 140)

The localization can be considered as one way of our linguistic abilities have identified locations in the brain . However , it is argued that there is an evidence which does not support this view . Any damage of one area of the brain appears in another .

Chapter Four

4.1 Conclusions

The humans have an innate ability in their minds which is programmed automatically to comprehend and understand language .

Language is the key of communication between people and they understand each other through the shared knowledge between the speaker and the hearer .

Neurolinguistics investigates the use of language in experimental or clinical conditions , in order to pave the way to brain to produce language . It also , allows to use the mental image that resembles object or event which represented in mind .

People had language disabilities of the damaging in specific area of the brain , for example , brain injuries cause aphasia and brain disorders due to disease and illness .

Moreover , the term neurolinguistics has been mostly associated with the study of linguistic deficits , and spared abilities resulting from specific forms of brain damage .

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