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Research Article

Communication Impairment in Aphasia Patients: A Neuropragmatic Study

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Abstract

This paper is an attempt to introduce the theoretical concepts relating to the relationship between the brain and communication. It aims to explore communication difficulties experienced by individuals with aphasia. Using a neuropragamtic analysis, it investigates the challenges the aphasia patients face in their attempts to convey meaning within various communicative contexts. By showing how linguistic impairments intersect with pragmatic skills, this study enhances the understating of pragmatic processing in those with neurological impairments. In defining communication impairment, a neurological foundation of language in the brain is clarified. All the areas responsible for producing and comprehending language are presented along with explaining how lesions to the areas result in different language disorders. The last part of the study is devoted to the study of pragmatics from a neurological perspective where there is a description of the pragmatic skills of people who suffer from a brain injury. The emphasis, however, is on conversation as a major type of interpersonal communication to show how the cooperative principle and the maxims as the basic concepts of pragmatics are affected by aphasia which results in communication impairment.

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1. Introduction

Neurolinguistics, as an interdisciplinary field that developed in the 19th century, is drawn from both neurology and linguistics and yet takes methods and theories from other disciplines such as cognitive sciences, neurosciences, communication disorder, and neuropsychology. According to Field (2004**),** this discipline is mainly concerned with language localization in the brain, dealing with the cells of the brain that are active during different linguistic processes and the way having brain damage leaves severe consequences on language production and comprehension**.** Ingram (2007) argues that until recently, there was no direct way of examining the functioning of a normal, healthy brain, and the only way of extracting information was to study the speech of those unfortunate individuals who had suffered brain damage and then, after their death, to perform a post-mortem to see which parts of the brain had been damaged. Through these unfortunate individuals, neurolinguistics has highlighted the special role of that part of the human brain known as Broca's area in crucial aspects of human language, namely syntax: the component of language that involves recursion. However, recent studies focus on using brain imaging, computer modeling, and electrophysiology to deal with and evaluate the physiological mechanisms involved in language processing in the brain.

Yule (1996) states that pragmatics is the study of the speaker's meaning and the listener's interpretation of what is being communicated. Crystal (1997) further clarifies that pragmatics can be identified as the study of language from the perspective of its users, focusing on the decisions they make and the constraints they face when using language in social interaction and the effects their use of language has on other participants in the act of communication. That is, pragmatics focuses on what language users mean by their utterances, and what linguistic units and strategies they use to send their messages to have a successful communication. According to Levinson, 1983; Prutting & Kirchner, 1983; Stemmer, 1999 as cited in McNamara & Durso (2003), having a pragmatic communication ability and being a competent communicator means performing a conversation in which an appropriate amount of information is communicated in an appropriate social context at the appropriate time, such as; performing a speech act of requesting, commanding, apologizing in a way which is socially appropriate and acceptable. It can also refer to one's ability to narrate cohesive accounts of relevant events in their life. These social pragmatic communication skills can be impaired or even severely lost, when a language user suffers from a specific brain damage (Gallagher & Prutting, 1983). The loss of these essential skills can have serious consequences on an individual's social life as they hardly convey their needs, desires, and information to another, so they experience communication impairment.

Pragmatic communication skills have been studied in individuals suffering from brain damage due to a traumatic brain injury, a stroke, or a tumor. It is the current paper's interest to show how pragmatics is processed in the brain and how people with aphasia as a result of a stroke experience difficulties with social communication.

2. 2. The Intersection of Pragmatics and Neurolinguistics

The fields of neurolinguistics and pragmatics originate from different traditions, regarding theories as well as methods. When neurolinguistics was established in the 1970s, it did not focus on pragmatics at all as linguistics was more about structuralist and generativist theories where grammar and phonology were the focus of study. There were also attempts to relate semantics to neurolinguistics based on word recognition and word comprehension. However, the developments in the world of research methods of current and future studies provided an opportunity and a possibility to conduct interdisciplinary studies in the intersection of the two areas of pragmatics and neurolinguistics. Ahlsén (2017) explains that since the 1990s, there have been some studies attempting to relate pragmatics and neurolinguistics initiated by

researchers who were more into clinically-oriented research regarding language disorders. The studies were conducted on aphasics who had left-hemisphere damage, individuals with communication disorders having right-hemisphere damage, as well as people with traumatic brain injury, schizophrenia, and Alzheimer's. These attempts were mostly clinical and didn't fulfill the conditions of being typical examples of pragmatic studies as they rather took single phenomena that were often considered pragmatic in nature and were studied under experimental conditions.

The real studies of pragmatics in relation to neurolinguistics were put forward by authors, such as Stemmer (1994, 1999), Stemmer and colleagues (1994), Cummings (2007), Simmons-Mackie and Kagan (2007) and Joanette and colleagues (2008a, b). What they have focused on was mostly about communication disorders relating to the right hemisphere damage, which is the central location for pragmatic processing. Among these authors, Stemmer (1999) conducted a study to test the comprehension, production, and evaluation of indirect requests by individuals who suffer from right hemisphere damage. Further, Joanette and colleagues (2008a, b) attempted to widen the scope of aphasia, as it was previously studied in relation to the left hemisphere disorders, but these authors argued to study aphasia in individuals with right hemisphere disorders, that is, disorders of discourse and pragmatics, affecting prosody, semantic processing of words, discourse and pragmatic ability. Cummings (2007) and Davis (2007) both wrote overviews of pragmatics-related disorders in different patient groups, for example, in tasks involving inference, metaphor, and sarcasm (Ahlsén, 2017).

A.Clinical Linguistics and Clinical Pragmatics

The field of clinical linguistics was established in Europe which stemmed from the seminal work of David Crystal (1981) and the formation of the International Clinical Linguistics and Phonetics (ICPLA) organization. This organization aimed to extend the International Phonetic Alphabet Symbols to precisely describe any sound distortion or voice quality that an individual suffers from. The researchers who work in clinical linguistics usually go through general linguistics programs and then apply the skills to the area of communication disorder, but they are less knowledgeable in assessing and practicing speech-language therapy. They rather have medical knowledge and know the terminology relating to the disorder they investigate in their research (Davis and Guendouzi, 2013).

According to Cummings (2017), Clinical linguistics applies the main concepts, theories, and methods of general linguistics to study language disorders. These disorders can occur as the result of impairment in one or more of language components, i.e. a breakdown in phonetics, phonology, morphology, syntax, semantics, and pragmatics. According to Muller (2000), as explained in Davis and Guendouzi (2013), Clinical linguistics and Phonetics as a 'distinct field of study' performs two major tasks; the first task is applying linguistic theories to clinical data aiming at refining the phonetic description of speech disorder then they extended their task to deal with communication disorder. That is, there was an extension from clinical phonetics to clinical pragmatics where the aim was not only dealing with phonological and grammatical deficits but also focusing on problems in the social use of language which results in communication impairment (pragmatic impairment). This latter topic is the focus of the current work, which will be covered in detail in the upcoming sections of the paper. An extensive effort has been made to give an overview of one of the major pragmatic theories (the cooperative principle and the maxims) as well as a description of the populations affected by pragmatic disorders (aphasics, for instance).

The phenomenon of pragmatic impairment is usually studied within the field of clinical pragmatics and this field is defined by Cummings (2017) as "the branch of pragmatic research

which is concerned with the characterization, assessment and treatment of pragmatic disorders in children and adults." This discipline is developed by the concepts and theories of pragmatics in general, it applies concepts such as speech acts and theoretical frameworks like the Relevance Theory to manage those disorders which create a barrier to effective communication. Furthermore, according to Perkins (2011), 'clinical pragmatics is a subdiscipline of clinical linguistics, which in turn is a branch of applied linguistics concerned with how communication may be impaired.' That is, this discipline refers to the study of the pragmatic ability of any individual who suffers from a communication disorder. It describes, classifies, assesses, and attempts to treat pragmatic disorders in terms of pragmatic, linguistic, psychological, and neurological theories. Cummings (2012) claims that for almost forty years, clinicians and specialists have tried to describe the scope of various impairments in the pragmatics of language. The way they have attempted to administrate these impairments by characterizing 'verbal and non-verbal behaviors such as a failure to comprehend non-literal utterances, to contribute relevant utterances to a conversational exchange and to use gesture appropriately' has brought about quick development of the discipline of clinical pragmatics.

In many other cases, clinical pragmatics paves the way for studying conversational implicature in general linguistics. Regarding the maxims, what has been studied so far is the way the conversational maxims are flouted in conversation. However, in the cases of pathological conditions (right hemisphere damage, autism, traumatic brain injury, aphasia) in which an individual faces a communication disorder, one can study the ways conversational maxims and principles are either observed or violated as a result of the disorder.

B. Neuropragmatics

Pragmatics as an area of linguistic research has a long tradition in the philosophy of language and linguistics which occurred as a theoretical approach based on intuitions and observing linguistic behavior. Recently in the last twenty years, however; it has been incorporated into other disciplines, the neuroscience of language is an example in which theoretical pragmatics has developed into experimental pragmatics to provide 'theories on the use of language that are not only theoretically valid but psychologically plausible' (Bambini & Domaneschi, 2017). That is, these theories are promoted by empirical data which are all collected and gained through experimental methods. Examples of the approaches supported by empirical data are *neuropragmatics* and *experimental pragmatics*. According to Paradis, 1998; and Stemmer, 1999, observing some individuals who had damage to the right hemisphere (where pragmatics is localized) with no problems in producing and comprehending words and sentences but exhibiting communication problems resulted in incorporating pragmatic theories into neurolinguistic research where data are collected empirically based on experimental methods. Both neuropragmatics and experimental pragmatics are quite connected. The distinction is made by describing neuropragmatics to be the way of investigating the brain aspects involved in deficits in pragmatic processes, however; experimental pragmatics uses experimental methods, such as judgment tasks, selection tasks, matching tasks, eye-tracking techniques to explain the mechanisms of the different pragmatic processes. Thus, it corresponds to the classic issues of theoretical pragmatics.

The current paper has been concerned with providing a detailed description of neuropragmatics as an approach in neurolinguistics to deal with communicative difficulties that specific people face in conversation. The Neuropragmatics approach is defined by Bambini 2010; Hagoort & Levinson 2014 as cited in Bambini & Domaneschi (2017) as 'the study of the brain activity involved in the pragmatic level of communication.' It deals with the localization and neurochronometry of the pragmatic processes through neuroimaging techniques such as PET, fMRI or EEG/ERP. The main goal of this approach is to find out the

potential relations between pathological conditions, such as schizophrenia and traumatic brain injury, and failures in pragmatic behavior. Bambini (2012) mentions that if the neuroscience of language is all about dealing with neural mechanisms in the brain which are responsible for comprehending and producing language (Small, 2008), then neuropragmatics is an expansion of this but with more focus on the context of use, i.e how the neural systems in the brain represent beliefs, knowledge, and components of context to comprehend the speaker's inference and allow the production of appropriate pragmatic behavior (Stemmer, 2008).

Bambini & Bara (2012) provides a historical account of neuropragmatics and relates it to two historical facts. Firstly, in the late 1800s, patients who had deficits in the structural aspects of language were studied extensively but disruptions in pragmatic processes are reported to be studied a few decades ago. Secondly, aphasiology could rely on abstract and distinct cases such as Paul Broca's patient 'Tan', but as for pragmatic deficits, there were only initial descriptions in a general way. The reason for this is that pragmatics as a fully developed field of linguistics is quite recent in comparison to other disciplines of language and pragmatic deficits are not so obvious for clinicians because there are cases that have these deficits, but they still have the linguistic ability; thus, their inability of communicating is regarded as a secondary effect. Despite the compressed time-lapse, studying the relation between pragmatics and the brain expanded rapidly, and noticing the neural bases of pragmatics became apparent in the late 1970s. Winner & Gardner 1977; Brownell et al. 1983 as cited in Bambini & Bara (2012) explain that clinicians reported that there are cases with no damage to the left hemisphere but had lesions to the right hemisphere, these cases had linguistic and communicative impairments that couldn't be classified as cases of aphasia. Thus, different studies were conducted from the 1970s to the 1990s, and the hypothesis regarding the involvement of the right hemisphere enforced itself throughout the 1990s. That is, during this period, the term *neuropragmatics* was found in the literature (Joanette et al. 1990; Tompkins 1995; Beeman & Chiarello 1998) as cited in Bambini & Bara, 2012. However, in more recent times, with the innovations in neuroimaging techniques, the right hemisphere hypothesis was revised again through different studies where they investigated regions (mostly frontal and temporal regions) in the left hemisphere along with multiple brain networks responsible for pragmatic processing (Bookheimer 2002; Mason & Just 2006) as cited in Bambini & Bara (2012). The core of the studies confirms that both hemispheres seem to cooperate in pragmatic processing.

In the last twenty years, neuropragmatics has been used in studies on both language comprehension and production. Regarding the former, studies have been conducted on inferences, conversational implicatures, different kinds of speech acts, metaphors, metonymy, idioms processing, and disambiguation of ambiguous pronouns while for the latter, studies have been done at the discourse level. For example, studying the way people with language deficits organize turn-taking or maintain the topic of an ongoing conversation (Bambini & Domaneschi, 2017). Generally, neuroprgamatics play a crucial role in identifying the role of the brain in producing and comprehending pragmatic behavior by individuals with and without brain pathologies, as well as explaining the neural of the cerebral involvement. Although neuropragmatics research studies both healthy and unhealthy individuals, it is mostly concerned with the different patterns of neural dysfunction that cause communication impairment.

3.Language Localization and Lateralization in the Brain

For almost a century and a half, researchers have discussed the topic of speech and language localization within the brain. Areas such as the sensory and the motor ones have been located almost precisely, but whatever was related to the structures of the language areas responsible for language processes was not exactly and precisely known. In the 1860s, researchers known

as localizationists hypothesized that the working of explicit districts in the cerebrum was responsible for language. However, antilocalizationists disagreed and argued that speech and language processes are the result of the brain function as a whole (Akmajian et al. 2001).

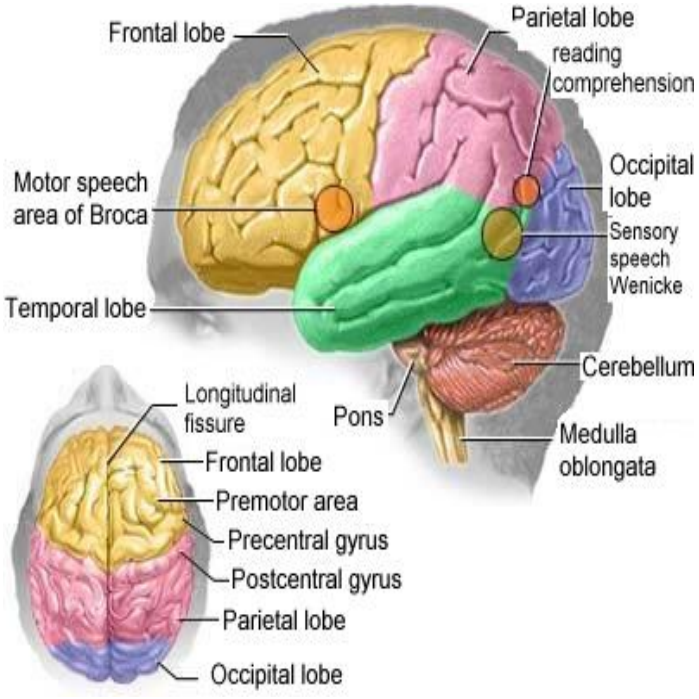
To understand the details of localization theory, it is necessary to become familiar with the brain anatomy, the organization of the language areas in the brain, and some basic concepts about the theory of dominance. These three topics are discussed in the following two sub-sections:

A. The Brain Anatomy

Human brain consists of many regions and cells that are organized like a peach in way that the structure of the higher regions seem to be more complex than the structure of the lower ones, i.e the organization is mostly hierarchical (Aitchison, 1999). The spinal cord locates at the lowest level which behaves as a cable to transmit several neuronal messages between the brain and the whole-body parts. The brain stem is located at the above level of the spinal cord; the function of the stem is to manage activities such as sleep, breathing, posture and body temperature. Both the spinal cord and the stem which are described to be the lower nervous system structures are reflexive and under the control of the higher structures. The brain is divided into two cerebral hemispheres which locate at the highest level of the nervous system and these hemispheres are responsible for voluntary movements and activities both in the brain and the body (Akmajian et al., 2001).

Furthermore, Munro (2003) states that the brain hemispheres being covered with a sheath of grey matter (cortex) are responsible for forming the front part of the brain called the cerebrum. The cerebral cortex takes part in regulating intellectual activities and voluntary movements and decodes the information coming in from all the different senses. Swash (1997) explains that the two hemispheres are connected to the spinal cord by the brain stem, which consists of the mid-brain, pons, and the medulla. At the back of the pons is the cerebellum, which is located at the back of the head and is responsible for the maintenance of body posture and the coordination of all movements. According to Aitchison (1999), 'the hemispheres look roughly similar, but this is an illusion,' because the left hemisphere has a more dominant role, the reason is not that it is responsible for controlling the right side of the body, but because it contains the language areas and controls language. Thus, mentioning language in the brain, Crystal (1988) states that what is significant to the process of speech and language function is 'the massive transverse fiber tract called the corpus callosum. Through the corpus callosum, the two hemispheres can communicate with each other in the form of electrical impulses.'

Each hemisphere consists of four lobes (frontal, temporal, occipital, parietal) which are separated from each other by certain gyri and sulci. The frontal lobe is separated from the temporal one by means of the lateral sulcus (fissure of Sylvius); then the central sulcus (fissure of Rolando) separates the frontal lobe from the parietal. However, there is no fissure to separate the parietal and occipital lobes; they can be distinguished only by microscopic examination of cell structures (Swash, 1997). The frontal lobe is regarded as the largest part of the brain which locates in the front of the head and is responsible for personality characteristics and movement. The middle section of the brain is the parietal lobe and this lobe is responsible for identifying objects and making sense of spatial relationships. Then the back part of the brain is the occipital lobe which is involved with vision. Finally, the temporal lobe, the sides of the brain, these lobes are involved in memory, speech, and sense of smell (Aitchison, 2008). The following figure shows the different lobes and regions of the brain.



Adapted from Munro (2003) 'Anatomical Structures of the Brain'

B. Language Areas in the Brain

The matter of speech and language localization in the brain with hard evidence first came into existence with the attempts of both scientists, Broca and Wernicke. In 1861, Broca who was a French surgeon and anatomist announced a case in which a patient who had a cyst on the brain found it difficult to produce speech, however; the patient had no problem comprehending what was said to him and could communicate to a limited extend (Ingram, 2007). At autopsy, they reported that the patient had lesions in 'the posterior inferior part of the frontal lobe in the left cerebral hemisphere, now known as Broca's area (the motor speech area).' Thus, Paul Broca became the first scientist who found a single area in the brain responsible for speech and language. Then he claimed that any lesion to a particular area affects speech and language and results in speech impairment. Swash (1997) states that Broca's area lies directly in front of the area responsible for the motor representation of the organs of speech (e.g. lips, tongue, palate, vocal cords, and face). This discovery led to the assumption that Broca's area is the cerebral structure responsible for the mapping of language programs into articulatory forms. Akmajian et al. (2001) explain that the claim regarding speech localization in the brain was later extended by Broca in 1875 when he announced that lesions to sites in the left cerebral hemisphere produced aphasia, however; any damage to corresponding areas in the right hemisphere didn't affect linguistic capacities.

Regarding speech and language areas in the brain, further evidence was obtained from a German physician, Carl Wernicke, in 1874. He examined patients who had lesions outside Broca's area and reported that these patients had problems with comprehending what is said to them. The lesions of these patients were located in the posterior temporal lobe. Thus, Wernicke discovered the second language area which was named Wernicke's area (ibid, 529). The exact location of this area is end-to-end with the cortical representation of hearing, and it

is assumed that this area is involved in recognizing spoken language. Wernicke's discovery reinforced the claim that Broca had regarding the structures in the left hemisphere being responsible for fulfilling various linguistic functions (Collinge, 1990).

Broca's and Wernicke's areas are not separate from each other, they are rather connected by a nerve tract which allows 'the auditory form of a word to be transferred from Wernicke's area where a proposition, word, or idea is converted into a syntactic design to Broca's area where this design is programmed onto the muscles of articulation and projected to the organs of speech' (Aitchison, 2008). Damage to both areas or even the neural tract would affect the process of speech production and comprehension in a way that leads to some forms of speech and language disorder (ibid, 2008). Trask (1999) argues that the discovery of these structures in the left hemisphere led the scientists to conclude that the site of language localization is exactly in the left hemisphere, i.e., a human function such as speech and language production is accomplished within a particular location of the brain. This became the theory of localizationists who contested the anti-localizationsts who argued that there were other areas in the brain responsible for language processing.

C. Dominance

The issue of the availability or lack of a relationship between both brain hemispheres has been argued and researched in neuropsychology and clinical neurology. The researchers first believed that the left hemisphere was intensively involved in most activities, so they regarded this one to be superior. However, this thought was soon refuted and announced that each hemisphere has its significant role in behaving in a way that is more involved in performing some activities and less in some others, i.e. each hemisphere is responsible for a particular mental function. According to Lyons (1981), the development of these functions within one or the other hemisphere is known as 'lateralization'.

Akmajain et al. (2001) explain that having two hemispheres in the brain and identifying language areas in the left one doesn't mean that the hemispheres work separately, they rather have to communicate with each other to permit speech processes to function normally. If the left hemisphere controls movements in the right part of the body and the right one is responsible for body movements in the left, then sensations from the halves of the body go to the opposite hemisphere, i.e. sensations from the right half of the body go to the left hemisphere and vice versa. Thus, if there is an object in the left hand and one wants to name it, sensations go from the left side of the body to the right hemisphere where the object is recognized, however, verbalizing the object's name is performed in the left hemisphere. For this reason, the right hemisphere is somehow responsible for the language processing function. According to Traxler & Gernsbacher (2006), the right hemisphere is said to be 'dominant for the perception of global patterns, part-whole relationships, spatial orientation, creative sensibility, musical patterns, and emotional expression or recognition.' So, when an individual suffers from a lesion in the right hemisphere, they cannot construct recognizable patterns out of visual data, which means they cannot recognize things just by looking at them. If they are given an object to recognize and name it, they can use the healthy left hemisphere to describe all the different parts of the object, but they find it difficult to name it as they lose their recognition ability. The discovery of the relationship between both hemispheres led scientists to perform further investigations into the role of the right hemisphere concerning language processing throughout the 1970s to 1990s. It was in the 1990s when they reported that the right hemisphere is involved in pragmatic ability.

Perkins (2011) explains that neurological evidence has investigated that much of what is considered as pragmatic ability is controlled by the right cerebral hemisphere. On the other hand; language processing in general is mostly controlled by the left hemisphere. Therefore, what is regarded as pragmatic impairment is mostly studied in individuals who have right hemisphere damage or autism, as well as other speech and language pathologies (aphasia and developmental language disorder). These pathologies are regarded to have pragmatic dimensions too because they result in restricting the ability to produce and/ or comprehend utterances that are necessary for a communicative situation.

4. Neuroanatomy of Language and Aphasia

When communication occurs, almost every area in the brain is activated. During communication, it is not only the use of language that prevails, other cognitive functions such as attention, memory, emotion, and executive processes are also involved (Nasios *et al*., 2019). What has been discovered so far regarding the neural networks that are responsible for communication is still a matter of challenge for neuroscientists. They have worked on different models to explain how the brain comprehends, speaks, and writes, and how aphasic disorders are rehabilitated. In the following sections, the classical clinical findings are reviewed starting with the very early model indicating the history of aphasiology to explain the major symptoms of language disorder moving to a first-approximation model regarding the way language is represented in the brain.

A. The Classical Account: the Broca- Wernicke- Lichtheim Model

The BWL (Broca-Wernicke-Lichtheim) model provides a pre-psycholinguistic understanding of how language is represented in the brain. The BWL model worked on notions of functional neurology that were new at the time, but are now regarded as foundational: notions involving '(a) functional relations between primary, sensory and motor regions of the cerebral cortex, (b) secondary association regions, and (c) the structural and functional connections of both to other 'higher' cortical areas and to the subcortical structures of the brain' (Ingram, 2007).

According to Ingram (2007), during the 19th century, research regarding the brain networks was mostly observational starting with what the young anatomist Broca assumed which demonstrated that 'the seat of articulate language' locates in the inferior frontal gyrus of the left frontal lobe. Broca's subject, Lebourge, nicknamed '*Tan'* as that was the only word he could utter, had a cyst on the brain. During his residency at the hospital, he could understand what was said to him but could communicate to a limited extent with people around him. Broca noticed that the patient's muscles of production such as the face, lips, tongue, and jaw were unimpaired, but had a motor deficit due to the cyst on the brain which resulted in a language disorder later termed *aphasia*. The speech production deficit of Broca's patient was so intense that it was difficult to assess the extent of the linguistic impairment. However, nowadays, one of the overt signs of people with damage to Broca's area is agrammatism (impairment of grammatical words and inflectional morphemes). Thus, Broca gave fundamental knowledge about linguistic structures and the relation between the brain and language.

In 1873, Wernicke had his contribution added to Broca's findings, stating that language disorder is not only the result of damage to Broca's area, a disorder may also occur as the result of a lesion to the left posterior superior temporal gyrus, now dubbed Wernicke's area which is responsible for language comprehension. Thus, any lesion to this area leads to a type of aphasia named *Wernicke's aphasia*. Later on, the model expanded with Ludwig

Lichtheim's contribution (1845-1928), who developed the way language is processed and represented in the brain and came up with another type of aphasia which was *conduction aphasia* (Nasios *et al*., 2019). The location of Wernicke's area is close to the primary auditory cortex, similar to how Broca's area is near the primary motor cortex, which directly controls the muscles of speech production and vocalizing. Both auditory analyses for speech perception and the articulatory engrams for speech production are stored in these two anatomically separate regions. Both regions are connected through a subcortical fiber tract dubbed the *arcuate fasciculus.* Any lesion to this area will disconnect the sensory and motor speech areas, which eventually impair 'simple repetition more than it should conversational language use.' This description is exactly the main symptom of *conduction aphasia* (Ingram, 2007*).* People with this type of aphasia have no problem with comprehension, but they fail to encode phonological information for production, and whenever they are asked to repeat a word, they face difficulty with it. They are aware of their errors, but they cannot correct them.

During the 20th century, an American Neurologist named Norman Geschwind (1926-1984) contributed more to the model of the neuroanatomy of language. To him, when communication occurs, the primary auditory cortex in the brain receives the sounds of the words via the auditory pathways, and then they are transferred to Wernicke's area to extract the meaning of the words. To let the production process occur, the arcuate fasciculus plays an important role in transferring the meaning of the words from Wernicke's area to Broca's area where the morphemes are formed and then transferred to the motor cortex. However, any information from a written word is transferred through the visual cortex to the angular gyrus and then passed on to Wernicke's area. Thus, the standard and the classical model of the neuroanatomy of language can be called the Broca-Wernicke-Lichtheim-Geschwind model (Nasios *et al*., 2019). According to Hickok & Poeppel (2004), though the model is classical and outdated for lacking an adequate description of the neural networks relevant to language and presenting a modular perspective by focusing more on the cortical structures, it is still considered to be an important approach to categorize aphasia types, in which 'frontal lesions cause motor aphasias, temporal and temporal-parietal lesions cause sensory aphasias, lesions affecting the arcuate fasciculus cause conduction aphasia and deeper cortical lesions cause disconnection syndromes.'

Trembley and Dick (2016) reviewed this classical model and commented on the gaps this model had regarding the neuroanatomy of language, they stated that this model had 'a lack of circuit information regarding the neural connections of the brain areas involved.' Furthermore, the model excluded the subcortical regions and focused only on the cortical structures based on classical brain anatomy. However, during the last three decades, studies based on neuroimaging, recording, and manipulation techniques for brain research proved that both temporal lobes have their roles in speech comprehension, and a wide range of frontal and parietal regions in the left hemisphere along with many subcortical regions are activated during speech production. Thus, a new model of the functional neuroanatomy of language as Nasios *et al*., (2019) state was developed, *the dual-stream model*, consisting of 'two interacting networks ("streams"), one ventral, bilaterally organized, for language comprehension, and one dorsal, left hemisphere dominant, for production.'

B. Hickok and Poeppel's Dual Stream Model and the Language Processing Networks

The older model with its serious gaps needed a real shift to a modern network-based one. This new model was achieved through observations on both human and nonhuman primates (Chang et al, 2015). This new model which was proposed by Hickok and Poeppel was named a 'dual stream' model composing parallel and interconnected streams to involve both cortical

and subcortical areas. Based on this model, speech processing occurs in *dorsal* and *ventral* streams/ pathways (Hickok and Poeppel, 2004). The ventral stream's organization is bilateral, starting from the temporal lobe to the occipitotemporal cortex where speech is processed for comprehension. However, the dorsal one occurring in the left hemisphere is organized from the posterior superior temporal to the inferior frontal cortices (Hickok and Poeppel, 2015). The function of this latter stream is limited to the "sensory-motor mapping of sound to articulation" (Saur et al, 2008).

It is worthy to state that this model works on language processing and describes the anatomical foundations of normal people with no language disorder; however, studies conducted on people with stroke aphasia seemed to offer evidence supporting this model. For example, Kümmerer *et al.* conducted a study on 100 aphasic stroke patients and tried to assess how the impairments of repetition and comprehension were related to the lesions occurring in the dorsal or ventral stream. They concluded that the ventral extreme capsule pathway mediates the interaction between temporal and prefrontal brain regions necessary for task performance on auditory comprehension measures (Kummerer et al., 2013). Furthermore, Fridriksson *et al.* (2018) worked on stroke patients in the context of this model and stated that impairment of motor speech is associated with lesions to the dorsal pathway, and speech comprehension impairment is strongly caused by lesions to the ventral one. Thus, language functions such as naming, speech repetition, and grammatical processing depend on networks and interactions between the two streams. This explains why patients who have lesions in different locations often face similar impairments in specific speech and language tasks; the same broad cortical network that supports these tasks is affected by their different but related cortical damage. Since their results showed a linkage between motor speech impairment and comprehension impairment with the two streams, their results support the *dual-stream model*.

Overall, such findings and the modern model guided modern research to move from a modular perspective to a network one. In the classical studies, the neuroanatomy of language regarding language representation in the brain was considered to be modular. Thus, whenever they wanted to provide a patient with speech treatment and therapy, they focused on specific linguistic tasks that were performed separately (i.e., naming or syntax). However, based on the *dual stream model*, language functions are considered to be interconnected with many other brain functions and stream widely throughout the brain. Fridriksson *et al.* (2018) confirm this new knowledge, coupled with technological progress, with new sophisticated and widely available and affordable tools for neuroimaging and neuromodulation, as well as telerehabilitation, will propel clinical neuroscience into a period of enhanced therapeutic approaches for individuals coping with language and communication impairments.

5. Neuroanatomy of Pragmatics and Communication Impairment

The cognitive processes thought to be involved in pragmatics have been linked to specific brain structures and functional networks. Hence, the inferior frontal gyrus, middle frontal gyrus, and superior temporal gyrus are known to be the core of the brain's left perisylvian language network (the region which includes both Broca's and Wernicke's area) for phonological, syntactic, and semantic knowledge (Hagoort, 2017). However, pragmatic language processing extends beyond this left neural network, including a bilateral frontotemporal and medial prefrontal network engaged by pragmatic form and stimulus configuration, building the pragmatic language network (PLN) (Reyes-Aguilar et al., 2018 as cited in Toledo et.al, 2021).

Any injury in the brain can significantly affect a person's life. In some situations, brain injury is a result of physical damage. In others, though, some brain injuries occur after birth

due to other factors. Concerning brain injuries, there are two categories used to describe how the damage is sustained: traumatic and acquired (non-traumatic). Traumatic brain injury is any damage that alters a person's brain functions and results from external trauma or force. Acquired brain injuries result from injuries to a person's brain after birth due to health conditions such as lack of oxygen in the brain, heart attack, meningitis and other infections, tumors, and stroke (Sheldon, 2019). Regardless of the type, any brain injury can seriously impact a person's life. One of the most obvious impacts is on the way the individual communicates with the people around them as the brain is the center where language is localized. Any injury to any cell of the language center in the brain results in either a speech, language, or communication disorder.

Blake (2021) states that several scholars such as Brownell, Carroll, Rehak & Wingfield, 1992; Brownell & Stringfellow, 1999; Joanette & Brownell, 1990; Shammi & Stuss, 1999; Stemmer, 1994; Stemmer, Giroux & Joanette, 1994; Tompkins, 1990 have studied individuals with right hemisphere damage to examine their pragmatic abilities and disabilities. Their studies concluded that damage to the right hemisphere leads to communication impairment. Despite intact language skills, RHD patients are often described as conversationally odd or inappropriate in social situations. Their conversational style has been described as embellishing, rambling, tangential, uninformative, irrelevant, repetitive, and literal. They jump from topic to topic and leave the listener with information gaps; they miss the overall point of a conversation and have difficulty maintaining the topic of a conversation. They also face difficulties in appropriately producing, understanding, or interpreting non-literal or figurative language, indirect requests, metaphors, proverbs, sarcasm and irony, idioms, or some types of humor.

Although pragmatic abilities and disabilities have been most commonly studied in RHD patients, pragmatic impairments have also been observed in other clinical populations. It is worth mentioning that observing similar pragmatic impairments in different populations does not necessarily mean that the causes of impairments and the identical lesions always result in the same pragmatic impairments (Ball et al. cited in Stemmer 2008). One of the clinical populations that seems to suffer from pragmatic impairments is the aphasics, whose disorder is most commonly caused by a left hemisphere lesion. Investigating pragmatic abilities in these patients can be difficult because it is often difficult to draw a firm conclusion as to whether the impairment is linguistically based or pragmatic in nature. Good control of pragmatic skills and functions was described in a patient with severe Broca's aphasia. The patient's language impairment has been associated with frequent initiation of conversations, switching between subjects, and reduced production when prompted (Dronkers, Ludy, & Redfern, 1998). Similarly, language impairment appears to have affected the performance of patients with fluent aphasia, whose discourse was less informative than that of non-brain-damaged adults (Chapman, Highley, & Thompson, 1998). However, the ability of these patients to draw inferences between textual content and real-world knowledge was intact.

Other problems described include inappropriate pause times during conversational exchange, reduced variety in the use of types of speech acts, and reduced specificity and accuracy of the message. In general, some pragmatic abilities appear intact in aphasics, and those abilities found to be impaired may be related to linguistic impairments. However, there is a possibility that cognitive impairments, for example in working memory, play a role (Caplan & Waters, 2002). This possibility has rarely been explored in these patients. Research further suggests that this type of aphasia affects pragmatic skills. There is currently no clear evidence that the described pragmatic weaknesses in aphasics are independent of their language problems.

6. Pragmatic Communication Abilities in Patients with Aphasia

Using language appropriately in social situations requires several different systems to work together and includes the understanding and expression of both non-verbal and verbal communication skills in social interactions. It requires people to self-monitor their performance and change communication styles based on the social context. Injuries to the regions of the brain responsible for these fundamental functions can lead to deficits in social communication abilities. Individuals who suffer from a traumatic brain injury struggle with pragmatic skills, they have difficulty understanding and producing nonverbal communication, initiating conversation, turn-taking, maintaining the topic of conversation, and reacting to social cues (Struchen, Pappadis, Sander, Burrows, & Myszka, 2011).

The last two sections of the paper clarify the pragmatics of people who suffer from aphasia. To explain this topic, interpersonal communication, and conversation are put in plain words for the sake of showing how the cooperative principle and the maxims as a major concept of pragmatics are affected by aphasia which results in communication impairment.

A. Communication

Communication is essential as it facilitates understanding, exchange of ideas, and collaboration among individuals. Effective communication enhances relationships, resolves conflicts, and drives productivity in personal and professional contexts. It enables sharing information, expressing emotions, and conveying thoughts, ultimately leading to better decision-making and overall success in various aspects of life (Holmes, 2001). There is a key link between communication and relationships in that the major aim of communication is to establish and maintain relationships. Having impaired communication ability could increase the risk of social withdrawal (Davidson et al, 2008).

Locher (2010) claims that people's identity (self-image) is not a product of sex, age, and class only; it is rather mostly created through relationships. Self-image is a product of modifying the image of oneself which is achieved in relation to the environment through language (Mead, 1962). Furthermore, Hogg & Vaughan (2008) state that identity markers (e.g., looks, roles, and competence) affect the process of identity creation in which competence and incompetence are constructed within the social environment of everyday life and competence is assessed through communication. If identity is a result of relationships, aphasia may harm it which eventually affects both self-confidence and self-esteem (Schiffrin, 1988). As a result, aphasia may have a negative effect on relationships in at least two ways. First, due to the person's poor communication skills, relationships may end and it may be harder to build new ones. Second, having low self-esteem may lead the person to withdraw from making current relationships and establishing new ones (Lock et al., 2001).

Communication is the process of transmitting information, ideas, thoughts, or feelings between two or more participants. It involves both the sender, who encodes the message, and the receiver, who decodes and interprets the message. Communication can occur through verbal, nonverbal, written, or visual means, and it plays a crucial role in conveying meaning, building relationships, and facilitating understanding among the participants. Because language ability is needed to choose the right signs and code and decode these signs, it follows that a language disorder (such as aphasia) is also a communication disorder (Harris, 1996). Communication could be classified into different types. First, based on the communication channels used, it can be classified into Verbal Communication and Nonverbal

Communication. Second, it can be classified according to the participants in the process into Intrapersonal Communication, Interpersonal Communication, and Intercultural Communication. According to Wilkinson (2011), all kinds of communication could be disturbed by aphasia. However, the focus of this paper is on interpersonal communication, whereof the most common type is conversation.

Conversation is described as "a basic form of communication.....a vehicle through which selves, relationships, and situations are socially constructed" (Schiffrin, 1988). In addition, Wilkinson (2011) defines conversation as an interactive dialogue between two or more individuals where the content, duration of speaking turns, and order of speakers are predetermined. It is the most used form of spoken language in everyday life and is of great importance. For Sacks et al. (1974), conversation is separated from other interpersonal communication, i.e. "institutional interaction", such as lectures, debates, testing, interviews, and work-based talk, since everyday conversations are ordinary, usually informal, spoken rather than written, and private rather than public (Weber, 2010). The ability to communicate through conversation is central to social life, and social interaction provides a powerful means for defining self, achieving self-esteem, and maintaining relationships with others (Schegloff, 1982). Any breakdown in conversational abilities in the event of aphasia will have, therefore, a significant effect on both the person with aphasia and his/her family.

B. Conversational Principle and the Maxims

Communication is co-constructed by the participants based on conversational *principles and maxims*. For communication to happen, people have to cooperate; besides, they should take turns in their conversation as speaker and listener to contribute to the same topic. The participants should cooperate in their daily dialogue, to have a successful conversation (Cruse, 2006). Communication has different functions and is conducted in a context with, for instance, the physical environment and the participants as important components. The participants in their turn require communicative competence, bring personal characteristics and attitudes into the conversation, take different roles, and exert different communicative behaviors during the communication event (Johansson *et al*, 2012). This principle is connected to four conversational maxims: to communicate efficiently, rationally, and cooperatively, Grice proposed four maxims; the maxims are called conversational maxims (CM). Interlocuters have to speak sincerely, relevantly, and clearly, and provide required and sufficient information. The participants should adapt their contribution in terms of *quantity* (as much information that is asked for/required, but no more) and *quality* (not to say anything that is false or where adequate evidence is lacking). The contribution should also be relevant (*relation maxim*) and clear (*manner maxim*) to its content.

Cruse (2000) believes that the maxims of conversation are rules for communication but differ from grammatical rules; they are much more flexible, more like guidelines. An ill-formed utterance is created from violating the grammatical rules, but the maxims of conversation can be breakable on purpose. Cruse also states that conversational exchanges are developed when interlocutors are guided by the rules of the cooperative principle. Communicators try to follow them; besides, they expect their conversational partners to do the same as well. Saeed (2003) also mentions that the maxims are not behavioral attitudes or moral principles which people have to follow while interacting. Thus, people can say more than is required and lie, and they may not order the events in their utterances. Speakers are not obliged to follow these maxims and they may break them, but the listeners always assume that the interlocutors abide by the maxims, although speakers can break them for various purposes.

Ahlsen (1993) explains how aphasia directly impacts the quantity and manner maxims by causing individuals with anterior aphasia (Broca's aphasia) to likely produce insufficient information, potentially resulting in ambiguity and obscurity. Conversely, those with posterior aphasia (Wernicke's aphasia) may use too many words, leading to similar issues of ambiguity and obscurity. The quality and relation maxims are affected more indirectly according to Ahlsén. Because of, for example, verbal paraphasias (such as saying "yes" instead of an intended "no"), the person with aphasia may utter something false. However, this maxim violation may also be seen as a violated manner maxim – the intention is not to lie. The relation maxim could be violated by paraphasias and circumlocutions, but also by a disturbed language comprehension that may result in inadequate responses. The following transcripts taken from Ahlsen (1993) show how the maxims are affected by aphasia. The first transcript is a narration from a patient with Broca's aphasia, whereas the second is a narration from a patient with Wernicke's aphasia. According to Ingram (2007), Broca's aphasics output is characterized by slow and halted conversations with ungrammatical statements. On the other hand, Wernicke's aphasics are fluent in language production but they face problems in language comprehension and their speech output is full of Jargon words. The patients' narration is based on a picture description task in which both patients are required to describe the objects and the scenes of the same picture.

Transcript I

a basket and one sweeps a leaf / takes // basket / takes up /
takes up the leaf / leaf leaves fly / he gets angry (// = pause of 3 seconds or more)

Transcript 2

it is a man who eh // he / yes when s when is is
a little colder outside then then comes k a on the snow or on the /
next to / eh he picks in in what's that called /what's it called /
he he lies iiin bag not a bag 1yes almost a bag

and then blows it too much then it it fla fla flates a away
then lies it on the ground and then must he / and he
must then do again once more you see

When these two transcripts are compared, the output of Broca's aphasic who produced the first narration is characterized by slow and sparse grammar. He produces only 20 words and does not give enough adequate information. He talks about the basket, the leaves and sweeping, but misses other relevant information such as the man, the children, the wind, and the tress. Further, he cannot describe the scenes such as the way the wind blew the leaves, or the children's observation of the way the man sweeps the leaves and puts them in the basket. This is described as non-observance of both quantity (very little details and information) and manner maxims (sparse grammar which causes ambiguity and obscurity). Examining the language production in Transcript 2, one can note that Wernicke's aphasic produced almost 90 words. Yet, he fails to mention some details. For example, the two children and the dog are not mentioned. The extra verbosity of his narration comes from his problem with word retrieval, jargon words and circumlocutions. Thus, both quantity and manner maxims are not observed and are directly affected by aphasia. The non-observance of the quantity maxim lies in the way he gives more information than what is required. On the other hand, circumlocutions and jargon words cause ambiguous and obscure narration.

Furthermore, Perkins (2011) gives an example of a 74-year-old man who suffers from anomic aphasia and has problems with lexical retrieval. As a result, he is unable to encode sufficient information linguistically to express what he means. Thus, he fails to observe the maxim of quantity.

T: so what did you make? what did the factory make?

W: what did we make was not a lot because we only made things for the things that were [ded] so we all made things that were out our out of our um things.

Overall, a language disorder such as aphasia could disturb pragmatics and lead to pragmatic impairment. This could be confirmed when the output of aphasics is evaluated through the Gricean maxims as the aphasics find it difficult to observe the maxims to have a successful communication.

7. Conclusion

The human language system is crucial to everyday life and forms the fundamental aspect of human culture. It combines with other systems to lead to successful communication. However, this system can sometimes be highly affected by a disorder in everyday neurological practice as a result of having focal damage to the left hemisphere or even to the right which eventually causes distress to communication among the speakers and listeners. Language impairment can be the result of a traumatic brain injury, a stroke, or a degenerative neurological or motor disorder. Regardless of the way the impairment develops, the symptoms in adults can be the same. They are characterized by the way the person finds it difficult to comprehend things or being unable to share thoughts, ideas, and feelings. For example, aphasia is a language impairment that causes the person to have difficulty with reading, writing, comprehending, and producing language.

The current study worked on the way pragmatics is affected by a brain injury that results in communication impairment. This impairment is connected with individuals who face difficulties with language use as a result of cognitive and neurological dysfunction. For example, individuals with right brain damage, autistics, or people who have a language disorder such as aphasia, can be assigned with pragmatic dimensions because these pathologies result in a limitation of the ability to produce and/or understand utterances that are necessary for a communicative situation. Researchers, in what has come to be known as 'neuropragmatics', focused on the neural basis of particular conditions associated with odd pragmatic behavior such as right hemisphere damage and traumatic brain injury in which the frontal lobes are affected.

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تێکچوونی پەیوەندیگرتن لە نەخۆشانی ئافازیا: توێژینەوەیەکی نیورۆپراگماتیکیە

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پوختە

ئەم توێژینەوەیە هەوڵێکە بۆ ناساندنی چەمکە تیۆرییەکانی پەیوەست بە پەیوەندی نێوان مێشك و پەیوەندیگرتن. ئامانجیەتی لێکۆڵینەوە لەو کێشەو گرفتانە بکات کە کەسانی تووشبوو بە ئافازیا لە کاتی پەیوەندیگرتن تووش دەبن. بە بەکارهێنانی شیکارییەکی نیۆرۆپراگماتیکی, لێکۆڵینەوە لەو گرفتانە دەکات کە نەخۆشانی ئافازیا ڕووبەڕووی دەبنەوە لە هەوڵەکانیان بۆ گەیاندنی مانا لە کۆنتێکستە جۆراو جۆرەکانی پەیوەندیگرتندا.لەپێناسە کردنی تێکچوونی پەیوەندیگرتن، بنەمایەکی دەمارەیی زمان لە مێشکدا ڕوون دەبێتەوە. هەموو ئەو ناوچانەی مێشك کە بەرپرسیارن لە بەرهەم هێنان و تێگەیشتنی زمان خراونەتە ڕوو لەگەڵ ڕوون کردنەوەی ئەوەی کە چۆن زیانی ناوچەکانی زمان لە مێشکدا دەبێتە هۆی تێکچوونی زمان. کۆتا بەشی توێژینەوەکە تەرخانکراوە بۆ لێکۆڵینەوە لە پراگماتیك لە ڕوانگەی دەماریەوە کە تیایدا باس لە پراگماتیکی ئەو کەسانە دەکرێت کە تووشی بریندار بوونی مێشك دەبنەوە. بەڵام جەخت لەسەر گفتوگۆ کردنە وەك جۆرێکی سەرەکی لە پەیوەندیگرتن بۆ ئەوەی نیشان بدات کە چۆن بنەماکان و ماکسیمەکانی پەیوەندیگرتن وەك چەمکە بنەڕتییەکانی پراگماتیك کاریگەری ئافازیایان لەسەرە کە دەبێتە هۆی تێکچوونی پەیوەندیگرتن.

ووشە سەرەکییەکان: ئافازیا, تێکچوونی پەیوەندیگرتن, نیورۆپراگماتیك,پراگماتیك

اضطراب التواصل لدى مرضى الأفازيا: دراسة تداولية عصبية

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الملخص

يعد هذا البحث محاولة لتقديم المفاهيم النظرية المتعلقة بالعلاقة بين الدماغ والتواصل. ويهدف إلى استكشاف صعوبات التواصل التي يعاني منها الأفراد المصابون بالافازيا. باستخدام التحليل التداولي العصبي، يتناول هذا البحث التحديات التي يواجهها مرضى الأفازيا في محاولاتهم لنقل المعنى ضمن سياقات تواصلية مختلفة في تحديد اضطراب التواصل، يتم توضيح الأساس العصبي للغة في الدماغ. تُعرض جميع المناطق المسؤولة عن إنتاج وفهم اللغة، مع شرح كيفية تسبب الاصابات في هذه المناطق في اضطرابات لغوية مختلفة. يُكرس الجزء الأخير من الدراسة لدراسة التداولية من منظور عصبي، حيث يتم وصف التداولية لدى الأشخاص الذين يعانون من إصابة في الدماغ، لكن يتم التركيز بشكل خاص على المحادثة باعتبارها نوعًا رئيسيًا من التواصل، لإظهار كيفية تأثر المبدأ التعاوني والثوابت الأساسية للبراغماتية بخلل في القدرة على الكلام، مما يؤدي إلى اضطراب لتواصل.

الكلمات الأفتتاحية - الأفازيا، اضطراب التواصل، التداولية العصبية، التداولية