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Investigating the Validity of Neurolinguistic Approaches through Previously and Recently Made Studies

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Abstract

Purpose: To introduce the schools of neurolinguistics from the point of view of specialists from different fields which are related in one way or another to this field (neurolinguistics) and to review analytically a number of the studies wherein it has been decided to what extent each neurolinguistic approach is valid according to its proof or disproof in the mentioned studies (theses and dissertations).

Method: Only books, theses and dissertations have been used as the data of this research-paper; therefore, this research-paper is qualitative, theoretical, comparative and analytic, that is it has nothing to do with statistics or other practical (applied) research tools.

Results and Conclusions: Results indicated that different tools and techniques have been used in the reviewed researches to decide on the validity of neurolinguistic approaches which merely include: computer-tomography scan (CTS) with x-ray use, magnetic- resonance imaging (MRI), functional-magnetic resonance imagining (fMRI), electroencephalography (EEG), positron-emission tomography (PET) and magnetic encephalography (MEG). Other techniques include computer-simulation, priming, dichotomy, Wada test, and psycholinguistic modeling. Additionally, analysis of reviewed studies have come to support to a great extent either (localizationists' view) or (connectionists' view). In other words, other approaches namely (holists' view) and (unitarism's view) have appeared to be [invalid]. Other approaches like (Equi-potentiality theory) appears to some extent in some cases (patients) whom their right hemispheres showed some marks of linguistic abilities, but the

idea that the two hemispheres work equally and can do the same job concerning language is [invalid]. Regarding (dynamic-localizationists) and (based-evolutionists), as far as I am concerned and with the reference to the results of the above mentioned studies, they are more like (connectionists' and Localizationists') views, but with a little bit differences which means they are [valid] but not as clearly discussed and used as (connectionism) and (localizationism).

Keywords: neurolinguistics, neurolinguistic approaches, localizationism, connectionism, dynamic-localizationism, evolution-based approach, holism, unitarism's school, equi-potentiality theory, Quantum theory, imaging techniques

1. Introduction

It is a well-known fact that both language and brain faculties are miracles. Generally, Hundreds if not thousands of books in nearly all [the world] languages have been written/composed investigating/describing these two issues. Thus, all that have been written/ said from here in there has reached the point that what we know about language and its representation and procession in the brain is just a scratch on the surface. Simply put, it says nothing indefinite, yet it contains a number of inferences, predictions, guesses, but not facts or definite decisions.

Arguably, scientists from different fields including neurolinguists have been arguing and conducted endless arguments (studies) attempting to decide on whether language can be localized on the brain or not. Interrogatively, they would ask: how language is represented in the brain: is it located on one area or scrambled areas on the whole brain? Again, they would ask: language has components such as phonological, semantic, syntactic and morphological: is there an area for each component in the brain which can be located? Similarly, language has skills and vocabulary (lexicon): is there an area for each which can be located in the brain? More interestingly, they would ask: for those who speak more than a language, bilinguals say: do these two languages occupy the same area [if language basically has areas], or there is an area for each and areas for components of each?

In response to the above raised questions, a number of different points of view say schools or approaches of neurolinguistics have been established. It is important to note here that, the majority of opponents and proponents of these schools have been being neurologists, pathologists, etc. rather than neurolinguists. Anyway, with agreements and disagreements, some would say language IS to be located in the brain and it is approved by this and that. On the other hand, some others would say that language CANNOT be located in the brain because it (brain) works as a whole. Different from these two approaches are those who say [Yes BUT] or who would say [NO BUT].

It is certain that nearly all creatures in this world do have brains and *language*. Yet, it is a truth that both human's brains and language are unique compared to all other creatures. Basically, the practical study of the brain was something impossible though its theories are as old as human beings. Language, on the other hand, is as old as human beings are. In other words, language is born with man or conversely man is born with language. Thus, both brain and language are interrelated terms and features. That is, what parts of the brain are responsible for language and what functions do they perform? Can language be located in the brain? These questions and many others are to be discussed in terms of language and its relation to the brain. Thus, these approaches will be viewed and introduced in this part of this research-paper.

2. Schools of Neurolinguistics

It is worthy to start by stating briefly issues which neurolinguistics account for. Neurolinguistics is a fairly modern discipline that combines both language and neurology. So, it searches on the linguistic aspects of neurology and deals with matters such as how

language is represented in the brain. Yet, it discusses practically both processes and procedures that take place in the brain. That is, how does it start? Where does it begin? How is it produced? Where do sounds come from? Does it proceed or follow thought? In what form ideas are stored? Where is language located in our brains? More specifically, it raises questions such as: can people of disordered brains and who are suffering from language loss be cured? Can they speak again or not? If they can speak again and recall their language faculty is it as it was or has it been negatively affected by the injury process?

Nowadays, neurolinguistics is becoming more and more interesting. That is, like any science, it has many theories and everyone is trying to say something in this newborn field. Thus, these questions and others are challenging both scientists in general and neurolinguists in particular.

Moreover, one of the main reasons why this field is still full of difficulties and left fraught with them is that both linguists and neurologists are issuing pure abstract matters. In a few words, humans' brains have been proved as unique, distinguished from those brains which animals do have. Needless to say, none can use a healthy or even *unhealthy* man to conduct his or her experiments on his or her brain! Has it been, and then humans are no more distinguished from other species! Thus, neurolinguistics is a completely new field of study which lacks any sharply accurate facts about the representation of language in the brain. It actually requires a brilliantly designed programmes, theories or may be a mixture of both to state scientifically what goes on in our brains and how do our brains manage doing so?

Actually, both brain and language are miracles and God-given gifts. Put it another way, brain is the secret of our knowledge. It works miraculously in a system of networks where in everything works with everything else. Surprisingly, the brain does not feel pains but it sends pains to other parts of the body, (Cordelia Fine, 2008).

Language, on the other hand, is another miraculous feature of humans. It is human-specific because whatever has been said and described as language of animals and other creatures; human language remains unique compared to other means of communication of other animals, (Dingwall & Whitaker, 1974; Lamb, 2005). However, when it comes to locate parts of the brain and their functions concerning language, it needs for another miracle to happen. I say what I said because both science and technology have not been able till now to state but not to suggest or propose the parts of the brains concerning language.

As a matter of fact, the process of identifying parts of the brain which are involved in language has begun in the 18th century when specialists from different fields tried to locate the places of language in the brain. From among those scientists are Darwin, Bateman, Gall, Flouren, Jackson, and Vogt … etc, (Stemmer and Whitaker, 1998). In spite of this, none of the above mentioned scientists was able to bring even a final decision whether language can be located or not?

Needless to say, identifying parts of the brain and their functions concerning language is left with many very unclear conclusions. In other words, it is actually being argued whether Broca's and Wernicke's areas themselves are true or not for the language issue in the brain is

an abstract issue that cannot be decided [holists' view]. Another group would say, there are Broca's and Wernicke's areas but also some other parts of the brain which have not been discovered and identified yet, do also take part in language functions [connectionists], (Obler & Gjerlow, 1999).

Above all, when discussing an issue such as schools of neurolinguistics questions such as: is language everywhere in the brain (quantum theory)? Is it in the whole brain (holism)? Is it scrambled in different connected areas in the brain (connectionism) or (interactionists)? Is it somewhere in the brain (localizationists) (localists)? Is it somewhere but with certain regular and irregular system(s) (dynamic localizationists)? Does it exist as a human feature/behviour (unitarism)? Is it a [generative] and potential system available in the brain's two hemispheres if one is damaged the other starts the same job automatically and equally (equipotential theory)? Or is it a matter of a developed hierarchical system (evolution-based theory)?

The study of language and brain (neurolinguistics) namely how it should be accounted for [approached] is as old as neurophysiology, but has started theoretically [predictions and theories] and has not been [proved] scientifically since technology and other means were absent [missed] in those days. For instance, consider Edwin Smith papyrus (Egypt, 3500 BC- language loss), Hippocrates (Greece, 400 BC- language disorders), Plato (Greece 400-300 BC- parts of soul in different parts of brain), Aristotle (Greece, brain, cognition, memory, sensation and perception) and Galen (Rome, 300-200 BC- pneuma in different ventricles). Afterwards, other ideas have appeared also in the Middle Ages and after, for example, Guainerio (15th century, naming errors), Varolius (16th century- psychological function in soft substance of the brain) and unitarism (17th century, soul indivisible). In spite of this, neurolinguistics as a new branch of linguistics and more specifically (Applied Linguistics) has been originated in the 19th century. Among the proponents of this branch are Gall, his theory of (localization of cognitive ablates in cortex map and cranioscopy), Paul Broca (Broca's area), Carl Wernicke (Wernicke's area), Lichtheim (extension of Wernicke's theory), J. H. Jackson (three levels of language), Freud, etc., (Ahlsen, 2006) and (Dingwall and Whitaker, 1974).

For some people (specialists) language is somewhere in the brain, that is there are some parts (places) which are concerned with language functions. This view has started clearly in the 1960s and later, marked by the experiments and finding(s) of a French neurosurgeon, Paul Broca who had a patient who lost his ability to speak and his brain was experimented after his death. Broca concluded his study with that a particular area of that person's brain was damaged and that area is no doubt [the center of language in the brain]. Specifically and according to Broca, this part is responsible for language production. Hence, from that time, this area has been known as Broca's area, named after the neurosurgeon that first identified it.

Another area which is also responsible for language is Wernicke's area. Similar to Broca's area is Wernicke's area which has been also named after its discoverer, Wernicke, a German neurologist. Principally, Wernicke's area is located in the left hemisphere of the brain at the temporal lobe, unlike Broca's area which is located in the left hemisphere at the frontal lobe, (Akhutina, 2003) and (Lamendella, 1979).

Therefore, from that time till now, Broca's area and Wernicke's area have been known and considered as major areas concerning language. In spite of this Broca's view of language is different from that of Wernicke's, the former is a localizationist and the latter is a connectionist.

As a matter of fact, localizationism is a school of neurolinguistics, its proponents and followers including Broca and Gall believe that language can be located in the brain and there are parts responsible for language functions in the brain.

Unsatisfied with this view and with such an idea that certain parts of the brain can be considered as fully responsible for language functions, a new school of neurolinguistics has emerged, from among the proponents of this school (connectionism) (anti-localizationists) are Wernicke, Lichtheim and Geschwind. Actually, unlike localizationists, connectionists believe that language may have parts which are concerned with language, but these parts are necessarily connected with each other to perform language functions perfectly. In other words, brain is working in a form of networks wherein everything is working with everything else, (Ahlsen, 2006) and (stemmer and Whitaker, 1998).

In comparison, while localizationists view aphasia (loss of language) as a result of some kind of damage to one part for the parts concerning language, connectionists consider it as a result of disconnection between the networking system(s) of the brain. For that matter and according to connectionists, we have many types of aphasia rather than two main types (Broca's and Wernicke's aphasias). Simply put, other types of aphasia including conduction aphasia (as a result of disconnection (disruption) between Broca's and Wernicke's areas), transcortical sensory aphasia as a result of disconnection (disruption) between Wernicke's area and the concept centre, and transcortical motor aphasia as a result of disconnection (disruption) between Broca's area and the concept centre. Again, other linguistic problems will appear as a result of disconnection (disruption) between both the right and left hemispheres in a case the corpus callosum is removed which is the connector between the two hemispheres. Consequently, one can infer and according to the connectionists (interactionists) that the claim of certain parts are fully concerned with language is invalid because the availability of all these types of symptoms (aphasias) which have been proved as a result of disconnection (disruption) between/ among certain areas and not only one certain area, (Akhutina, 2003) and (Lamb, 2005) and (Ingram, 2007).

A group of specialists from different fields have been partially interested in the localizationists' view; they feel it needs for modification. As a result, a new semi-localizationism approach has emerged lead by Vygotsky, Luria and some others. However, like localizationists, they (dynamic localizationists) believe in the availability of certain parts of the brain concerning language but these parts share some functions with each other to fully perform language functions. In other words, they claim that there are sub-functions in certain parts of the brain concerning language which are connected to perform other complex functions and in this way only their view is different from the localizationists' view, otherwise, they are alike, (Ahlsen, 2006) and (Obler & Gjerlow, 1999).

One more school of neurolinguistics is (evolution-based) school who argue that language is

represented in the brain in terms of layers, that is lower and higher functions which are developed to perform language functions. From among the proponents of this school are Jackson and Brown. More importantly, for this school namely for Jackson, researchers in this field [must] not mix apples and oranges, that is to believe that identifying (locating) symptoms means identifying (locating) functions! It seems that Jackson is suggesting the idea that the loss of a particular linguistic component, say phonological or semantic vice versa the identification of the damaged area in the patient's brain DOES NOT in any way mean that this damaged area is completely responsible for that lost component (performed function), (Ahlsen, 2006) and (Dingwall & Whitaker, 1974) and (Akhutina, 2003).

Different from the above mentioned schools is (holism). Holists lead by Marie, Head and Goldstein believe that language is available in the whole brain. It is not true that certain parts of the brain are concerned with language, they claim. Dissimilar to mainly localizationists and yet the above mentioned schools, holists view aphasia as a result of 'general cognitive loss', it is not 'specific language loss' as in the localizationists view, (Ahlsen, 2006: p. 11).

In addition to what I have mentioned above are the (unitarism's school) and (Equi-potentiality theory) school. Well, for (unitarists), they have a [traditional] belief that brain and soul are one and so are language, brain and soul. Differently put, it is illogical to attempt identifying certain or particular parts as responsible for language functions, because it is not only the brain [which] is responsible for language, the [soul] and other human factors and faculties accomplish each other to make humans produce this language.

From another view, a neurolinguistic school called (Equi-potentiality theory) lead by Karl Lashley (physiologist), Lenneberg and others who believe in the idea that both the (right and left hemispheres) work equally. It is assumed that if the left hemisphere is damaged, the right hemisphere will automatically take the job or function instead. In fact, this view has been greatly attacked and it has been proved by many studies that the two hemispheres are not equal at least in terms of alternating the language functions equally. In spite of this, such an approach has been encouraged and may be succeeded when applied to cases from children who show to some extent that such a theory can be true, (Obler & Gjerlow, 1999) and (Ahlsen, 2006).

One more theory or more accurately (theory-like) is approaching language localization's issue from the point of view of theories of other fields, say here (Quantum theory) or (computer analogy).Generally, the abstractness of the brain can be explained with the help of the (Quantum theory) derived from Physics. Principally, an atom consists of two main parts neutrons and protons, the former is neutral and the latter is plus. Additionally, the number of the protons is equal to the electrons outside. As a result, the atom is electrically balanced and that is why touching anything would not cause any electric shock for us. That is, the number o f the protons is equal the number of the neutrons to keep the atom balanced. Consequently, this means there are atoms and electric atoms which we cannot actually see but prove their validity by the use of electricity. Actually, the electric atoms have the speed of light but we know for sure that they are there because of electricity. In effect, electrons are there all the time (Quantum Theory). Thus, language is also there, it exists in our brains all the time as

long as we are alive and healthy (without brain damages) in all the brain, (Kebbe, 2009).

Finally and with reference to computer system (analogy), learning a language by a child is like going on a new software. That is, certain areas are activated and others are discarded from among the open options. Actually, a child chooses a particular language in certain areas with certain features to be enabled and others are disabled. What happens then is that the child is exposed to that language (option (data)) which has been chosen (enabled). Brain, however, starts clicking on some certain areas to activate some features of the chosen system (language) such as adjective after or before nouns. Consequently, the brain saves these features and forgets (ignores) the other features of the other languages (systems) (enabling and disabling process). At the age of may be three or four, a child starts the process of language use (restating the computer to allow the downloaded system to work). More interestingly, when using a computer, one can shape so many shapes and from them in the way he or she wants; this exactly similar to what happens in the case of language production, namely new sentences production by children, (Kebbe, 2009).

3. Valid and Invalid Neurolinguistic Approaches

It has been shown in the first part of this research-paper that different approaches (schools) of neurolinguistics wherein each one is in disagreement with the other. Of course, the only sources for those specialists in order to prove their arguments were usually persons who have passed through brain damages be it mild or severe. In other words, aphasic people were usually if not always the tool of argument between and among the proponents of the above mentioned approaches.

Needless to say, the difficulty of deciding which approach (school) from these approaches is the most correct one lies in the fact that human's brain has been approved different from other animals' (creatures') brains. In addition, it is only humans who have this faculty (language faculty) and for that matter it becomes more difficult to account for such an issue. To make it clear, in nearly all other kinds of diseases and also symptoms, animals are used as tools for the scientists' experiments so that they can find the suitable medicine, right diagnoses and right prognoses as it is approved that other organs are shared between and among [some] species including humans. Nevertheless, in the case of brain, it is different (human's brain has been proved as the *largest*) for this reason and other unknown reasons only humans can use the tool of language in its real sense.

Anyway, recently, various imaging techniques have been developed and they can identify which area(s) of the brain are stimulated directly. Of course, these recent techniques are more reliable compared to those used in the past. These techniques allow us to decide to some extent whether language can be located or not, at least it tells us real (concrete) results though they are not one hundred percent accurate and remain arguable and questionable for they are not exactly similar and show significant differences and results. These differences make it impossible to bring definite decisions or ascertain a particular approach. Instead, these results in one way or another do support a particular approach and result to the fall of another approach.

In this part a number of the studies (theses and dissertations) which have been conducted with the use of different techniques attempting generally to measure linguistic ability of some 'normal and damaged brains', (Ahlsen, 2006: p. 6), will be reviewed and mentioned. The techniques used in these studies almost include: computer tomography scan (CTS) with x-ray use, magnetic resonance image (MRI), functional magnetic resonance imagining (fMRI), electroencephalography (EEG), positron emission tomography (PET) and magnetic encephalography (MEG). Other techniques include computer simulation, priming, dichotomy, Wada test, psycholinguistic modeling, etc.

Pandey (1997), in her research argued that discourse analysis use for analyzing aphasics' impaired speech is very much useful. Regardless of its degree of reliability, it indicated to neurolinguists, neurologists, speech therapists, psycholinguists and other specialists too valuable pieces of information to deal with aphasic persons. Again the results indicated in one way or another that language is located and it does not work as a whole system in the brain at least from the point of view of the analyzed data which indicated different symptoms for different types of brain damages.

Additionally, brain issue can be studied through other techniques say traditional, in order to investigate how do we perceive information (language). Nate (November, 1999) has investigated in her study the fact that one can predict what goes on in the brain through eyes' movements which are not, according to her research, random. Actually, she has conducted her research on 50 children and concluded the study with that the eye movements when processing and constructing visual information are totally different from those used when processing and constructing auditory information. Simply put, in the former case, they 'look up or straight out in front and in the latter case, they 'look side to side' instead, (p. abstract). More amazingly, they look 'down and either to the right or to the left when processing auditory digital or kinesthetic information', (ibid). Thus, the researcher did not indicate that such movements can also mean different areas and processes may happen similarly in the brain.

Using the Cognitive Linguistic Adaptive Resonant Network (CLAR-NET) model and other imaging techniques and models used in cognitive sciences, Eleni (April 28, 2004) conducted his/her research. The study demonstrated the importance of analyzing the 'conceptual relationships , such as polysemy, homonymy, ambiguity, metaphor, neologism, conference as resonant patterns represented in terms of neuronal activation', (Eleni, 2004: p. iii). It is concluded that such a model has proved an effective use and reliability to be used for natural language processing NLP namely determining neurons responsible for language items with the use of (CLAR- NET) model and other introduced models.

Fiorentino (2006) argued in his/her research with the use of (MEG) about the representation of lexical items mainly morphologically- complex words. It is proposed that it is the morpheme but not the word which is the basic unit processed in the brain.

Claiming that the [insula] plays a major role in the case of phonological processing of language, Novak (May, 2006) has conducted her study attempting to prove the reliability of (Magnetoencephalography) (MEG) in neurolinguistic studies namely identifying (locating)

brain's areas involved in language production and comprehension. It is concluded that the ignored area (insula) has a major role in the phonological processing of language. The researcher has also claimed that other areas may be also included but have not been imaged/ considered by the (MEG). Thus, it was proposed that semantic words are located in different areas from those wherein (pseudo-words and non-words) are located.

Graves (July, 2006) conducted four experiments to prove his claim that 'retrieval of lexical phonology is processed by posterior superior temporal gyrus (pSTG) and lexical semantics by occipital temporal cortex (OT), with the two processes sharing and possibly being bound together during production by inferior frontal gyrus (IFG)', (p. vii). His study, however, manifests and ensures the dominance of the left hemisphere concerning language matters.

From a different point of view which seems [psycholinguistic] rather than neurolinguistic, Dolnick (August, 2006) studied the positive effects (advantages) of using NLP (neuro-linguistic programming) for teaching purposes. It is proposed that it does greatly, but positively affect the attitudes, aims and communication processes among teachers and their students if applied/ used properly. It is may be not related to our issue here, but it indicates in one way or another the view that our brain works in terms of simulations and responses, as if there is an area for each kind of behviours and action we perform and receive including language issue.

Arguing that extensive studies have been done on neocortex as the place of human language and minimizing or marginalizing subcortical areas was the core idea of Chan's (2007) dissertation. She has used the (fMRI) on 24 healthy right-handed English speakers to see if such an area will show any marks regarding her claim. She has proposed that basal ganglia (BG) 'especially the head of the caudate nucleus were involved in the abstract sequencing of language and that the distinct brain asymmetry associated with different familial sinistrality background might be rooted in the BG', (ibid: p. 11).

Schenker (2007) studied the anatomical structure of Broca's area within and among species to see if there are any differences or similarities regarding the anatomy of this area but more importantly to see if there [are] any similarities and differences regarding language functions. It is argued that such an area mainly (Brodmann's areas 44 and 45) have been studied only and extensively on human, that is we need to include all other types of creatures (starting with hominoids) as this researcher has done to get more knowledge which will allow us to bring definite decisions regarding the distinguishablity of human's brain (this area) from other creatures. Both quantitative and qualitative results showed that size was the only interpretation found in this study to interpret human's faculty of language and its lack in other creatures (involved here apes, gorillas, chimpanzee, orangutan, gibbon specimen and bonobo).

Using more than tool and technique including (fMRI) and spatiotemporal mapping, Nedim (May, 2007) conducted four experiments attempting to demonstrate how words including their use grammatically (reading, inflecting and producing) (input and output), are inserted into our brains and what goes on when they are processed, formed and then produced in the form of inflected grammatical expressions, and so on and so forth. Both Broca's and

Wernicke's areas were accounted for as responsible for such matters, yet some specific areas within these major areas were the aim of the researcher to determine or locate.

Discussing and analyzing one type of aphasia (primary progressive aphasia) (PPA) through case studies, Sonty (June, 2007), attempted to show diagnoses, prognoses and mention nearly all details regarding this syndrome. It has been shown that such a syndrome can be a mixture of different types of aphasia including anomia and may be [partial] Broca's aphasia, partial Wernicke's aphasia and etc.. The researcher made use of (fMRI), Voxel-based morphometry (VBM), dynamic casual modeling (DVM) and other techniques when conducting the experiments on the aphasic persons (subjects of this study). Two areas were considered as to a great extent responsible for this kind of symptom if damaged which are (inferior parietal lobule [iPL] and superior temporal gyrus [sYG].

Santi (November, 2007) has done four experiments using (fMRI) (functional magnetic resonance imaging) to test both Broca's anterior and posterior regions concerning sentence comprehension. Thus, the study is concluded with that 'anterior aspects of Broca's area are specific to filler-to-gap distance… posterior aspects of Broca's area are more generally engaged in syntactic processing', (ibid: p. 6).

Three experiments were conducted by Rogalsky (2008) attempting to identify the area(s) of the brain concerning sentence processing. According to Rogalsky such an issue is 'elusive', (p. abstract) in terms of neuroscience. It is also mentioned that the issue of sentence processing has been widely discussed and Broca's area was identified as the place where a sentence is processed, but for this researcher it is claimed that anterior temporal lobe does also play a major role regarding sentence processing especially 'in syntactic computations and combinatorial semantic processing', (p. xi). One of the experiments has included also the effect of music melodies (piano) and scrambled sentences on this area compared with normal sentences. The researcher has come up with that the anterior temporal lobe has 'specific roles in sentence processing, but it is possible… they are involved in processing hierarchical structure more generally', (ibid: p. xii). Again, in the case of the third experiment, results have shown that these regions and sub-regions of the anterior temporal lobe are more active regarding sentences and less or no effects regarding music melodies and scrambled sentences which indicates that such areas (places) are linguistic-specific. It is important to note that the researcher made use of (fMRI) (functional magnetic resonance imaging) as a main tool for his/her research.

Attempting to find some working memory differences between interpreters and non-interpreters in terms of cognitive abilities, Signorelli (2008) conducted a research on about (47) participants whom their ages vary from [31- 63] divided into two groups old and young interpreters. It has been shown that old interpreters have shown both primacy and recency effects in terms of phonological recall; whereas young interpreters have shown only primacy effects. On the other hand and semantically, old interpreters showed word-length effects, but young interpreters did not.

In her doctoral dissertation, Geyer (April, 2009) investigated the effect(s) of (repetition priming and concreteness in bilingualism). She conducted three experiments proposing and at

the same time attempting to form theory for how two languages are represented and stored in the brain. Yet, the researcher focused on abstract and concrete words, [an issue which is by itself an abstract to be accounted for]. It is claimed in this research that words (lexicon) in L2-L1 are represented in the form of conceptual connections mainly concrete ones which have more effect than abstract words. The subjects of this study were bilingual students (French (L1) and English (L2), (Russian (L1) - English (L2) and other languages in the other experiments). It is concluded that in terms of abstract words, there are different degrees of effect which have appeared different form one language to another. Again in the case of the proposed claim it was only approved in the case of doing it with intermediate or low level students, in the case of advanced students, L2 priming and concreteness effect does not show up clearly. More importantly, the representation of both abstract and concrete words shows nearly the same indication regarding their processing and representation.

4. Conclusion

This research-paper aimed at introducing critically the schools of neurolinguistics and more importantly the validity of these schools (approaches). The researcher introduced nine approaches to the study of language and brain (Neurolinguistics).

These approaches included views such as: certain parts are concerned for language functions (localizationists), certain parts of the brain are responsible for language but with a dynamic system, that is from sub-functions to complex functions and so on and so forth (semi-localizationists or dynamic-localizationists), language is represented in the brain in the form of networks wherein everything works with everything else (connectionists or interactionists), language is represented in the form layers, that is from lower to higher functions (based-evolutionists), language is not located in particular areas, it is scrambled in different areas in the whole brain (holists), language is represented in the brain and the soul, it is a human feature that cannot be identified in a separate area (organ) without the help of other organs more importantly the [soul] (unitarism's proponents), language is there in the two hemispheres if the left one is damaged the other will automatically take the job or function equally instead (Equi-potentialitists) (Equi-potentiality theory), language is there just like [electrons] are there all the time, it exists in our brains all the time as long as we are alive and healthy (without brain damages) in all the brain, (neurolinguistic Quantum theory), and finally language can be explained in the brain in terms of computer analogy, it is there represented systematically, but here it is not a (binary) system, it is a totally unknown different system.

The researcher also reviewed fifteen theses and dissertations where in different techniques were used by the researchers to explore the linguistic ability in normal and damaged brains. These tools and techniques included: computer tomography scan (CTS) with x-ray use, magnetic resonance image (MRI), functional magnetic resonance imagining (fMRI), electroencephalography (EEG), positron emission tomography (PET) and magnetic encephalography (MEG). Other techniques included computer simulation, priming, dichotomy, Wada test, psycholinguistic modeling, and other which are mentioned in this research-paper.

To all intents and purposes, the above researches support to a great extent either (localizationists' view) or (connectionists' view). In other words, other approaches namely (holists' view) and (unitarism's view) have appeared to be [invalid]. Other approaches like (Equi-potentiality theory) appears to some extent in some cases (patients) whom their right hemispheres showed some marks of linguistic abilities, but the idea that the two hemispheres work equally and can do the same job concerning language is [invalid]. Regarding (dynamic-Localizationists) and (based-evolutions), as far as I am concerned and with the reference to the results of the above mentioned studies, they are more like (connectionists' and localizationists') view but with a little bit differences which means they are [valid] but not as clearly discussed and used as (connectionism) and (localizationism).

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References

Ahlsen, E. (2006). *Introduction to Neurolinguistics.* Amsterdam, Philadelphia: John Benjamins Publishing Company [electronic version] .

Akhutina, T. (2003, May-June/ July-August). Roman Jakobson and the Development of Russian Neurolinguistics. *Journal of Russian and East European Psychology , 41*(3/4), 129-158. Retrieved from http://search.epnet.com

Chan, S. H. (2007). *Linguistic Sequencing in the Cortex and Basal Ganglia. A doctoral dissertation with major in Linguistics in the Graduate College of the University of Arizona.* (UMI Number: 3257920).

Cordelia Fine. (2008). *The Britannica Guide to the Brain: A guided Tour of the Brain- Mind, Memory, and Intelligence.* Encyclopædia Britannica, Inc. [electronic version] .

Dingwall, W. O., & Whitaker, H. A. (1974). Neurolinguistics. *Annual Review of Anthropology*, pp. 323-356. Retrieved from http://search.epnet.com

Dolnick, K. H. (August 2006). *Neuro-Linguistic Applications to Classroom Managment:Reach them to Teach them. A Dissertation Presented in Partial Fulfillment Of the Requirements for the Degree Doctor of Philosophy Capella University.* (UMI Number: 3230009).

Eleni Koutsomitopoulou, M. (April 28, 2004). *A Neural Netwrok Model for the the Representation of Natural Language. A doctoral dissertation in Linguistics submitted to the Faculty of the Graduate School of Arts and Sciences of Georgetown University* . Washington: (UMI No. 3137058).

Fiorentino, R. D. (2006). *Lexical Structure and the Nature of Linguistic Representations. Dissertation submitted to the Faculty of the Graduate School of the University of Maryland, College Park, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.*

(UMI Number: 3222619).

Geyer, A. (April, 2009). *Repetition Priming and Concreteness Effects in Bilingualism. A dissertation submitted for the degree of Doctor of Philosophy in Experimental Psychology – Cognitive Neuroscience TUFTS University.* (UMI Number: 3354694) Copyright 2009 by ProQuest LLC.

Graves, W. W. (July, 2006). *Distinguishing the Neural Bases of Lexical Access. A doctoral thesis in Neuroscience in the Graduate College of the University of Iowa.* (UMI No. 3229659).

Ingram, J. C. (2007). *Neurolinguistics: An Introduction to Spoken Language Processing and Its Disorders.* Cambridge: Cambridge University Press.

Kebbe, M. Z. (27/10/2009). Theories in Modern Linguistics, (A lecture on Brain Anatomy and places concerning language: (lecture: 2), Department of English and Literature, Faculty of Arts, King Saud University, MA Programme, 2nd year, 1st term.

Lamb, S. M. (2005). Language and brain: when experiments are unfeasible, you have to think harder. *Linguistics and the Human Sceinces , 1*(2), 151-176.

Lamendella, J. T. (1979). Neurolinguistics. *Annual Review of Anthropology*, pp. 373-391. Retrieved from http://search.epnet.com

Nate, S. R. (November, 1999). *Eye Accessing Cues: A study of Eye Movements while Retrieving Internal information. A doctoral dissertation in Psychology, Walden University* . (UMI No. 9958731).

Nedim (Ned) Turan Sahin, S. (May, 2007). *Neural Circuits for Reading, Inflecting and Producing Words: Spatiotemporal Mapping with HumanIntracranical Electrophysiology and FMRI. A doctroal dissertation in Psychology, Harvard University, Cambridge, Massachusetts.* (UMI No. 3264899).

Novak, B. J. (May, 2006). *Cortical Processing of Real Words, Pseudowords and Nonwords as Measured by Magnetoencephalography. A doctoral Thesis, Rice University.* (UMI No. 3216755).

Obler, L. K., & Gjerlow, K. (1999). *Language and the Brain.* Cambridge: Cambridge University Press [electronic version] .

Pandey, A. (1997). *A Linguistic Analysis of Adult Aphasic Discourse. A doctoral thesis in Linguistics in the Graduate College of the University of Illinois at Urbana-Champaign.* (UMI No. 9812729).

Rogalsky, C. (2008). *fMRI Investigations of SentenceProcessing Cortical Networks. A doctoral dissertation in Psychology, University of California, Irvine.* (UMI No. 3328071).

Santi, A. (November, 2007). *fMRI Studies in Broca's Area in Sentence Comprehension. A doctroal thesis, Neurology and Neurosurgery, McGill University, Montreal.*

Schenker, N. M. (2007). *Comparative Analysis of Broca's Area in Hominoids. A Dissertation submitted in partial satisfaction of the Requirements for the degree Doctor of Philosophy in Anthropology University of Califronia, San Diego.* (UMI Number: 3283454).

Signorelli, T. M. (2008). *Working Memory in Simultaneous Interpreters. A dissertation submitted to the Graduate Faculty in Speech Language and Hearing, the City University of New York.* (UMI No. 3310604).

Sonty, S. P. (June, 2007). *Primary Progressive Aphasia: perspectives from functional and structural neuroimaging. A doctoral dissertation, the Graduate School, Field of Neuroscience, Northwestern University.* (UMI No. 3260548).

Whitaker, H. A., & Stemmer, B. (1998). *Handbook of Neurolinguistics.* Academic Press [electronic version].

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