Interdisciplinary Nature of Neurolinguistics and Prospects of Research

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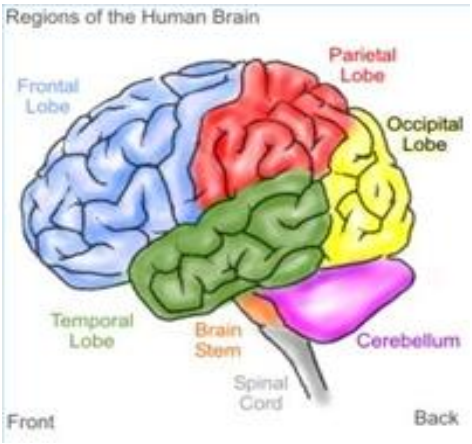
Abstract

The area of Neurolinguistics is interdisciplinary in nature as it has connections with language and psychology, and neurology, which is the sub-discipline of the study of medicine. Whereas Psycholinguistics studies the processes of language development going on in mind, Neurolinguistics studies the relationship of language with brain and explores the functions of parts of brain in its development. It also studies through descriptive analyses of the related documents what areas can be further probed into by the researchers of Neurolinguistics.

1. Introduction

As discussed by Caplan, D (1987), the study of relationship of language with brain started in the late nineteenth century as the impact of problems related with brain on language started being explored after the landmark studies of Paul Broca in which he determined which areas in the brain are responsible for development of language in human mind. One of the main areas of linguistic studies is the exploration of connection of language with mind (psycholinguistics), the processes that go on in human mind during the various evolutionary stages of language development, and the impact of various psychological issues on the language. As well as we study the relation of language with mind, which is an abstract entity, the need is also imminent that the relationship of language is established and explored with brain, which, of course, is a physical entity and the focal point responsible for the functions of human mind, where, to repeat it once again, the evolutionary processes of language development take place.



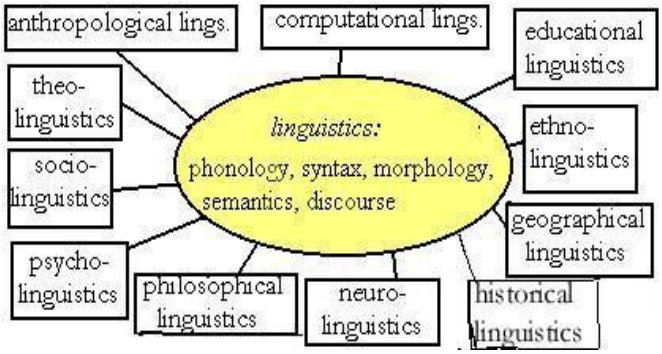
This documentary research is aimed at exploring various studies which try to establish a connection between the three areas, which, when studied in relation to each other, give rise to the emergence of a separate field of study called Neurolinguistics, and find out distinction between the study of relation of language with mind and the ones based on relationship between language and brain. The fact that language is related with brain can be established with various observations of the studies exploring the effects of injury to the brain on various language functions among the speakers who use language normally to meet their day to needs of communication before becoming victims of such an injury.

Neurology, as was thought earlier, is no more merely a medical field but also is related with linguistics. The recent studies have found out that the neurological determinants of language disorder can be studied and the remedies reached only when the two disciplines work side by side, one complimenting the other to solve problem of each of them. Brain is not responsible only for controlling the physical functions such as body movements of different kinds, but is also responsible for development of language. It is only the smooth functioning of neurological system that ensures proper functioning of language, and any problem or disruption in this system leads to various kinds of linguistic disorders as the studies under scrutiny have shown.

Treatment of such disorders is not the task of neurologist alone since he may not be able to detect the very nature of linguistic problems resulting from the brain injury which he is sufficiently competent to handle. Similarly, a linguist is not able to study the neurological determinants of the problems related to language, though he may have a fair idea of the nature of linguistic problem faced by the patients of neurological disruption of any kind. Hence, it is pertinent that the two disciplines worked hand in hand with the other to try and sort out the difficulties faced by the patients that can be studied under their respective areas of interests.

2. Relationship of Language with other disciplines

Linguists agree among themselves that their job is to study language, but there is no agreement found among them on what 'language' actually is. One may observe various views formed about the origin of language in terms of its relationship with other disciplines and branches of study such as society, culture, ethnicity, neurology, neuroscience, history, theology, philosophy, biology and psychology, while going through any book aimed at giving an introduction to linguistics. The same kind of view of language has been presented by Bunge, M (1975:4) in his article titled *Philosophical problems in Linguistics*. Here we will take the discussion of each relation of language with each of the other disciplines one by one and try to analyse how language is said to serve different purposes and how it is said to be associated with different disciplines by different schools. As Bunge states:



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For pure linguistics language is a system of symbols with certain syntactic, semantic, and phonological features codified in grammar. Here we can clearly see how Bunge has tried to establish the connection of language with each of the disciplines with which it is thought to be associated in different ways. To start with, he throws light on pure linguistics, which takes language as a system of symbols which are used by the humans to convey meanings. Meanings are associated to these symbols by the speakers through their arbitrary choice, and these symbols are arranged grammatically in a proper syntactic order and they follow a proper phonological and semantic coding.

The next discipline with which language is associated is psychology in that language is a means of expression of thoughts and feelings, and that thought and feelings have their impact on language on their own way and affect its formation and make it distinct in each case where thoughts and feelings differ. In this case, Bunge (04) says "For psycholinguistics, language is a psychological phenomenon: it expresses feelings and thought, in an adjunct to action, and also a tool that facilitates the elaboration of thought." To socilinguistis, language is an 'ingredient of cement of society', as Bunge puts it, as it facilitates the social interaction and helps the members of society communicate with other members of the society, and hence promote the social interaction. In the words of Bunge, "For sociolinguistics language is a means of communication; as such, it is an aspect of social behavior and therefore an ingredient of the cement of human society." So here we see that language is taken as a bond between the members of a society as it helps them communicate with each other.

What it actually communicates is taken up by psycholinguistics, as we have discussed earlier, as they say that language communicates our thoughts and feelings, an area which could only be taken up by psychology rather than by any sociological discussion. Further, about applied linguistics, Bunge says that "For applied linguistics language is an ability that can be taught." It looks into how language can be applied to practical fields such as education to make it do the day to day tasks. How language is used in the practical life is deeply studied under ESP, as it tells us the ways in which different professions can use language in their own ways, and how alteration in linguistic design may achieve the communicative as well as performative goals.

The critical differentiation between neurolinguistics and linguistic aphasiology must be viewed very carefully here. Binge opines that

> For neurolinguistics language is the set of speech processes, which are in turn physiological (in particular neurophysiological) processes. And for medical linguistics (or aphasiology), language is a brain function that can be impaired by injury or disease of certain brain "areas" or "structures" (i.e. neural systems).

For neurolinguists, language is a set of speech processes which are less social or cultural or psychological or anything else, and more physilological, as neurology looks into how the neurons could be taken as determinants of speech signals processed in brain, and what physiological processes are responsible for corresponding speech processes. On the other hand, linguistic aphasiology is not the study of normal physiological process only, but of the disruption of these processes which result from injury to any part of the brain. As the neurologists note in their clinical observations, certain injuries to specific areas of brain result in deviation or disruption of language processing in brain, and consequently language impairment can be seen in the patients going through such brain injury. The total or partial loss of speech in children or adults under the influence of brain injury resulting from accident, trauma, infection or other reasons is what is called aphasia. There could be as many types of aphasia as there are types of injury to brain tissues, and the extent and nature of loss of language is different in each case of aphasia. To make the distinction between the two clear, we shall further look at how the two are closely linked yet separate entities in the study of linguistics.

3. Neurolinguistics and Linguistic aphasiology

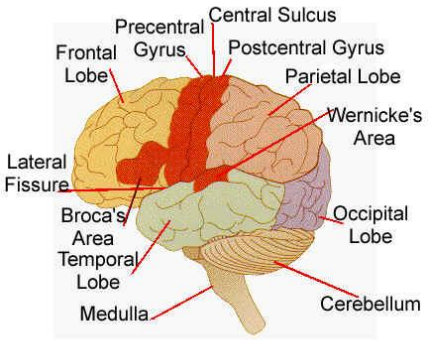
In her review of Caplin, D's book Neurolinguistics and linguistic aphasiology ( ), Obler, L. K remarks that according to Caplin, D,

> 'the goal of Neurolinguistics…….is to understand the organization of the brain for representing and processing language, normal and deviant; the goal of linguistic aphasiology is to understand normal language processing in terms of psychological and especially linguistic constructs through study of data from aphasic patients -------- patients whose brain damage results in systematic breakdown in language performance (with cognitive abilities largely spared).

In the book, as Olber has commented, Caplin has tried to establish that the two fields are separate yet closely and intimately intertwined. Although neurolinguistics dwells on the data that linguistic aphasiology receives through the studies of patients with linguistic impairment, it is not all that it studies, and goes rather beyond this in studying the interrelationing of language and brain not only in the cases pertaining to language impairment, but also in case of normal language processing among the humans. Hence, what we come to understand through this discussion is the fact that neurolinguistics is an overall study of organization of the brain in how it represents and processes the language, and a branch of it is called linguistic aphasiology that studies the way in which the representation and processing of language gets impaired due to some injury to a part of brain or the other.

3.1 Aphasiology & Aphasia

Aphasiology is the particular field of study of aphasias in neurolinguistics that is based on the clinical evidences collected by the neurologists through different case studies of patients with linguistic disorder resulting from brain injury. It bases its discussion on the evidence collected from such case studies as injury of brain as a result of accidents or diseases such as infection or trauma. Garman, M (1990: 416) asserts that since 'language is a complex of functions, its manifestations of impairment are not all the same'.



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But before we talk about the different kinds of aphasia and the various representations of it, it would be pertinent to discuss a definition or two of aphasia. Garman, M defines aphasia as 'a long term, systematic impairment of linguistic abilities as a result of damage to brain tissues' (416). In another comprehensive definition he says that it is 'the (a) impairment of (b) central language abilities in (c) the speech modality following (d) brain damage'. It is a linguistic disorder that results from brain injuiry od some kind. Various kinds of impairment of linguistic functions could be ***aphasia,*** (total loss) ***dysphasia,*** (partial loss) ***alexia,***(loss of reading) ***agraphia,***(loss of writing) ***dysgraphia,***(some degree of loss of writing) ***dyslexia,***(some degree of loss of reading) ***agnosia,***(loss of knowledge) ***anarthria, apraxia,*** (articulatory disorder) ***dysarthria*** and ***dyspraxia*** (some degree of articulatory disorder). All these kinds of aphasia are different in nature and can be distinguished in that each of them represents some kind of ailment or the other which is quite unique from rest of the syndrome. The symptoms seen in each of the disorder are different from the symptoms seen in the other kind of disorder, and this is what makes these disorders stand distinct from each other. The series of stmptoms is called a syndrome, that is, aphasia.

4. Neurolinguisics & Psycholinguistics

> Neurolinguistics, as we have discussed earlier studies the processing of language in human brain.
> To quote from the review of Ingram, J.C. L's (n.d) book Neurolinguistics, the discipline takes into account "What biological factors make human communication possible? How do we process and understand language? How does brain damage affect these mechanisms, and what can this tell us about how language is organized in brain?" (www.cambridg.org)

The study of aphasiology can not be carried out satisfactorily as long as it is not done in conjunction with the psycholinguistics, as is the main premise of this research. To prove this premise as true, we must support it with some kind of evidence from the scholarly discussion and at least one or two authentic proofs. As Garman, M (417) discusses the issue of basis of impairment of language, the point becomes evident that it is not the disturbance in physiological patterning of the brain as a result of injury that is responsible for language disorder among adults, there could be more reasons also. Else than the neurological determinants of language impairment, there is a strong possibility that the root of such a disorder could be traced to abnormal psychotic states too. Also, one of the factors of loss of language could be aging, which results in abnormality of language functions. These two factors are concrete basis of the argument that the reason of language disorder is not necessarily neurological, it may also be psychological, and hence, psycholinguistics must go hand in hand with neurolinguistics to study the various linguistics states present among the patients.

4.1. Assessment of Language Disorder & the Framework of Psycholinguistic Functions

In aphasiology, the language disorder is determined against various functions of language that are seen as psycholinguistic aspects of language. These psycholinguistic functions provide a framework against which we can study the variation among each of the patients having aphasia as they would have different characteristics and would differ in their performance in case of each of these functions. The psycholinguistic abilities that are commonly tested by the neurolinguists in the study of aphasia are i. Spontaneous speech, ii. Auditory comprehension, iii. Auditory repetition, iv. Spontaneous writing, v. Reading comprehension, vi. Copying, vii. Writing to dictation, viii. Reading aloud, ix. Confrontation naming, and x. written word to object matching .

The way the differences are observed in each case of aphasia against the yardstick of these functions, and the details of results of such studies is a different story and may take a lot of pages to elaborate the differences, but what is important and worth highlighting is the fact that it would simply not have been possible to determine the areas of differences if help was not taken from psycholinguistics in provision of this framework against which we try to measure the impact of brain injury on linguistic performance of the patients. Talking about the interaction of neurolinguistics with other disciplines, Lamendella, J. T. (1979) states that

the range of neurolinguistic interests is quite broad and far-reaching in its implications for that constellation of multidisciplinary concerns which encompass human communication, culture ,and cognition(see also 96-99, 102).

Here we can see a new dimension of discussion that can be opened up with the statement given by Lamendella. Here he observes that language combines in it the multi disciplinary concerns which are related to communication, culture and cognition. The intertwining of the study of language by neurolinguistics with the other disciplines is the proof of the fact that language is not an entity which could be of interest to linguists only; it could be an area of research for the experts from various disciplines. And there could be as many branches of linguistics as there are the dimensions in which its relationship can be traced.

This point is further discussed by Obler, K. L in her review of Neurolinguistics and linguistic aphasiology by Caplin, David. He asserts that when studying neurolinguistics, it is not the language-brain relation alone that the neurolinguists discuss, but says that it is essential for them to be aware of linguistics theory as well as the terminology, then with the relationship between language and psychology, that is, how language is developed in human mind and the cognitive functioning, and then how the language processes go on in brain, as physiological processes. Hence, a neurologists can not be called a neurolinguists unless he has the knowledge of all these inter related disciplines and he will be able to properly detect the areas of linguistic deficiency or the linguistic disorder only if he is aware of the theories of linguistic development in human mind as well as theories of language as a social and cultural construct. Obler, K. L. remarks that

Arguments in neurolinguistics may start from linguistic and psycholinguistic concepts such as 'sound image' or 'auditory receptive field' and conclude with neural structures such as 'Wernicke's area' or 'Broca's area', or they may begin with the neuroanatomy and conclude with the linguistics.

In the research related with aphasiology, the hypothesis normally is that the impairment of muscular function of brain results in linguistic disorder. This linguistic disorder is not random but systematic in that each type of disorder shares certain characteristic features which may be different from the ones present among patients of other disorders. These features are called symptoms. The disorder, as the studies of neuroloigy endorse, stem from a focal injury in brain or some kind of lesion which is present in one part of the brain or the other, with each spot of injury of site of lesion being responsible for different kind of aphasia. At times even the difference of one centimeter of site of injury may result in different states of linguistic disorders, this fact emphasizing the need of carefully ascertaining the site of injury or volume of lesion as the faulty analysis of the injury may lead to different treatment from the one which is actually required to treat the syndrome.

The abnormality of brain structure causes abnormality in language structures. As Olber puts it,

Most frequently argumentation proceeds from characterizing abnormal language patterns, associating these with abnormal brain structures and then drawing conclusions about normal language processing. Argument in linguistic aphasiology infers brain-language correspondences from correlating associations of symptoms (such as loss of bound grammatical morphemes) in groups of aphasics with similar lesions and similar language behavior, or from dissociations of symptoms in studies of a single case.

In assessing the abnormality of language structures, the neurologists correlate the findings of clinical studies with the linguistic studies of abnormal patterns, and seeing the abnormal linguistic pattern in the light of abnormal brain structures enables them to draw conclusions as to what kind of abnormality in brain structure has led to what kind of abnormal linguistic pattern among the sufferes. How then, the conclusions are drawn by the neurologiusts about the reason underlying the linguistic disorders. In this regard, Olber sums up the case in the following lines. From correlations or associations of symptoms we may infer that two language abilities either are conceptually linked or are organized contiguously in the brain. From dissociations of symptoms we may infer that two language behaviors are organized independently.

5. Future Prospects in the Field of Neurolinguistic Research

In the conclusion of discussion of aphasia and its different types and reasons of development of aphasic syndromes in the patients suffering from brain injury, in one of the chapters of his book Psycholinguistics, Garman, M (1994: 467) opines that the trend of the two main areas of linguistics, namely psycholinguistics and neurolinguistics going apart from each other has taken a turn and recent studies show that both these areas are moving together closely. In the light of this trend, he suggests that some of the areas discussed in the aphasiological studies require further probing by the researchers. The first issue, as he says, is "whether or not language functions can legitimately be associated with the focal localization in the brain". The second area he points to is opposition between the unitary and componental views of aphasia. The third one arises from the possible relationship between aphasia and the impairment of intelligence. We will take these points one by one to see how the studies can be carried out in the given areas in the right direction, so as to make them helpful for the overall understanding of neurological functioning or malfunctioning in human brain.

Broca's study of Leborgne was the first exercise in localization of language symptoms with cites of lesions. There have been questions on whether such an approach is correct or not. There have been discussions on whether attempts should be made to identify language functions with brain areas or not. There are certain issues such as the one, as Garman remarks, that "site of lesion cannot simply be equated with the site of (impaired) language function." And that "further refinements are required in the means used to determine the site and nature of lesions; and that refinements are also required on our understanding of what specific language functions involve" (468-9). In the second case, that of unitariness of aphasia or otherwise, the discussion could be carried out on whether or not aphasia is a single disease, as symptoms in different patients vary from case to case and from disease to disease. The third issue, that of relationship between the language disorder and loss of intelligence as a result, if any, as Garman says, have been hampered by the problems in defining the term intelligence itself.

6. Conclusion

In this research based on the documentary evidences, the researcher has tried to explore the issue of how language processing and language impairment is studied by the neurologists in the light of clinical findings of the patients who have some kind of brain injury and they suffer from loss of language of various kinds as a result. Language. An effort has also been made to link the neurologiucal studies with the studies of linguistics and that of psycholinguistics, as both are integrated closely with neurology, and the neurological findings could be utilized in a btter way if they are studied in conjunction with the studies of linguistics and the findings of psycholinguistics related to certain functions language performs for humans as the members of society. Also, the areas of future research have been hinted at so that the problems the research has been facoing uptill now could be overcome if these hitherto unsettled issues are explored and some conclusion is reached.

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