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Processing Language via Brain

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***Abstract*—*This paper examines language processing in the human brain and, more specifically, what happens to spoken language when certain areas of the brain are damaged. Language processing is what takes place whenever we understand or produce speech; a normal task, but one of extraordinary complexity, whose mysteries have baffled some of the greatest minds across the centuries.*

Keywords—neuro-linguistics, brain, aphasia and language.

I. INTRODUCTION

Neuro-linguistics studies the relationship of language and communication to different aspects of brain function, i.e. it tries to explore how the brain understands and produces language and communication. It studies how the brain enables us to produce language. Neurologist studies nervous systems and brain, he contribute to the field of neuro-linguistics study human neurology and how behavior breaks down after damage to the brain and nervous system.

Neuro-linguistics is an interdisciplinary field that more disciplines contribute to it than those its name proclaims. psycholinguistics is participated in neuro-linguistics study, psycholinguist studies how language is processed in normal individual while Neuropsychologist studies the breakdown of cognitive abilities result from brain damage.

The term Neuro-linguistics is a new field, it can be trace back the 19th century, in that time a physician named Paul Broca who noticed the correlation between language disturbance and resulting from brain damage, he recognized also that a certain area on the left surface of the brain is responsible for language. He was involved in forming the Anthropological Society in Paris. Despite its root in the 19th century, Neuro-linguistics must be seen as relatively new science. It is new compared to sciences like physics and chemistry whose practitioners have worked out a substantial fact base and accepted theories to explain and study the facts.

1-1Function of language:

Our concern is primarily with language comprehension and its disorders. However, the neural mechanisms that the brain has evolved for language processing are based, at least in part, upon novel synergies that have evolved between the motor control and the auditory perceptual systems. These synergies are needed for imitation learning of rapid gestural sequences for speech production and perception.

Language is used not only to convey our thoughts and feelings to others, but also to represent them to ourselves. But thinking is not equivalent to talking to oneself, and the linguistic expressions with which we clothe our thoughts are merely signposts to meaning, not explicit representations of those meanings. Linguistic expressions are under-determined with respect to the message the speaker intends to convey.

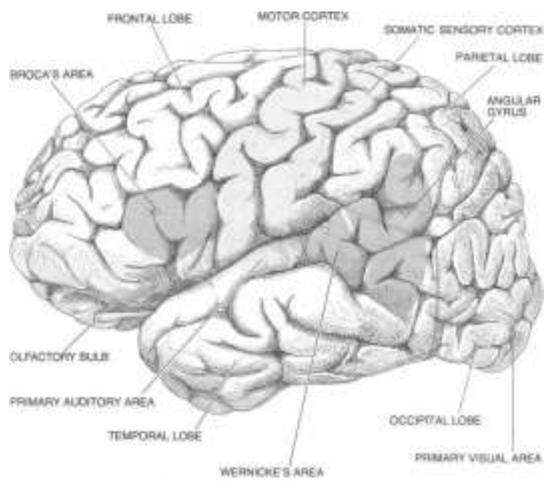
1-2 Language in the brain:

Language is predominantly lateralized to the left hemisphere in the vast majority of people, even the majority of left-handers. While the functional

asymmetries of the left and right hemispheres are well known and have been

much debated in the popular and technical literature anatomically, the structures of the brain appear to be quite symmetrical.

But the one known region where a structural asymmetry has been found occurs in the *planum temporale*, which is part of *Wernicke's* area, the second language area, known after its discoverer Karl Wernicke in 1874. The planum temporale of the left temporal lobe was found to be larger than its right hemisphere counterpart in 84 per cent of cases. The reason why this rather unique asymmetry was not observed by previous generations of anatomists, though it is quite visible to the naked eye, is that the planum temporal is located within the fold of the sylvian fissure, out of sight from surface inspection of the temporal lobe.



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1-3 Evolution of language and the brain:

It is uncontroversial, in scientific circles at least, that the human brain has undergone very rapid growth in recent evolution. The brain has doubled in size in less than one million years. The cause of this 'runaway' growth (Wills, 1993) is a matter of conjecture and endless debate. A strong case can be made that the expansion of the brain was a consequence of the development of spoken language and the survival advantage that possessing a language confers. The areas of the brain that underwent greatest development appear to be specifically associated with language: the frontal lobes and the junction of the parietal, occipital and temporal lobes (the POT junction – more of this later).

It is easy, perhaps all too easy, to reconstruct plausible scenarios illustrating the survival advantages that possession of a hands-free auditory/vocal means of communication with the symbolic power to represent almost any imaginable situation would confer on a social group. Perhaps it was the superior linguistic abilities of homosapiens, with brains and vocal tracts better adapted for speech and language, that led to the rapid displacement and extinction of the Neanderthals in Europe, some 40,000 years ago. Language is of such importance in our daily lives and culture that it is almost impossible to imagine how our species could survive without it.

But perhaps the most surprising thing about the evolution of language and the

brain structures required to support it is – as indicated earlier – how rapidly they were acquired by our species. It is well known that quite dramatic phenotypical changes can take place under adaptation pressures in relatively short periods of evolutionary time. However, there appears to be no parallel in other species to the rapid increase in cranial capacity accompanied by the signs of an evolving material culture that one finds in the human archaeological record. What drove this massive yet selective increase in brain tissue, confined mainly to the cerebral cortex and to some regions more than others? According to the co-evolution hypothesis, it was the voracious computational requirements of a symbolic representational system, i.e. of a language. It is not difficult to appreciate this point. Just look up from the book and cast an eye around the myriad of recognizably distinct objects in your immediate field of view. A large proportion of them have names. All the others can effectively be provided with names by verbal constructions such as: 'low radiation energy sticker' for the object fixed to the screen monitor casing of PC. Language, as every language user knows, involves a kind of doubling of our perceptual universe. For every object of experience, there is at least a name or a naming construction to represent that object. Once the germ of a representational system has implanted itself in the mind/brain, there is no quarantining its spread to the whole realm of imaginable experience. This is evident from the period of

explosive vocabulary growth that occurs in normal human infants around two to three years of age, for which there is no parallel in even the most loquacious of the signing chimps that have been studied. The voracious growth of a representational system is also movingly illustrated in the diary of Helen Keller, the remarkable woman, rendered blind and deaf in infancy, who suddenly discovered the representational function of tactile signs at an age when she was old enough to consciously appreciate their communicative significance. Everything suddenly required a name.

While the origins of language remain obscure, the co-evolution hypothesis claims that once the seeds of a symbolic representational system were sown, the brain responded with a vigorous and unprecedented increase in its processing and storage capacity. According to the co-evolution hypothesis, the brain as a system which supports representational computation cannot remain 'a little bit pregnant' with language. 'Representational computation' is perhaps an awkward way of saying 'thinking with language'. Representational computation conveys the idea that thinking supported by linguistic expressions involves a second order level of manipulation, not just of objects, events or states of affairs, as perceived or imagined in 'the mind's eye', but also the manipulation of symbolic representations of those objects, events or states of affairs. Thus, perception and episodic memory provide a first-order 'internal' representation of the 'external' world. But language users have access to a second-order and publicly shareable level of symbolic representation, whereby objects of perception are coded as linguistic expressions.

In addition to linking the evolution of language to symbolic reasoning – an idea which has a respectable philosophical pedigree in European philosophy though not widespread acceptance in contemporary cognitive science – the co-evolution hypothesis asserts that a quantal increase in the brain's processing capacity was required to accommodate this second-order representational system. Also, that although the evolutionary adaptation of the brain took place in incremental steps, the pace of change was such as to produce a qualitative new step in speciation. Furthermore, the co-evolution hypothesis asserts, controversially, that thinking with- language is a unique facility of human brains. Deacon's (1997a) book-length exposition of the co-evolution hypothesis is a bold and controversial idea. It has met with a very mixed reception from linguists, depending on their theoretical orientation. As a scientific hypothesis, it is rather too difficult to prove or to refute. We offer it here primarily to set you thinking along the paths we wish to explore in this book. Norman Geschwind in the 1960s was the first to offer a clear account of how recently evolved cortical structures that distinguish humans from primates enabled the formation of extensive networks of cross-modal associations, which in his view provided the neural computational basis for vocabulary formation, and hence the evolution of a natural system of symbolic representation.

Another reason for believing that the joint study of brain–language relationships will be productive derives from the study of language itself and how it is acquired. Language, as we shall presently discover (if you have not done so already), is the most complex of human artefacts,2 re-invented by each successive generation of language learners, who are quite unaware of the enormity of their accomplishment. Linguists like Noam Chomsky have long argued that young children can only accomplish the remarkable feat of learning their native language by virtue of inheriting some specialized neural machinery specifically designed for that task. The reference here is to Chomsky's *principles and parameters* (P&P) model of grammar. The principles are structural properties to which all languages supposedly conform, constituting a *universal grammar* (UG). The parameters define the ways languages can vary from one another. The idea is that if a large part of the structural complexity of human language is pre-programmed into structural principles, then language learners have only to discover the parameter settings appropriate for their language community. Thus, the 'principles' set limits on how human languages may vary, confining natural languages to a restrictive set of possible types, thereby narrowing the 'search space' of the language learner. Furthermore, if a special 'parameter setting' mechanism for language learning can be invoked, then it is easier to see how first language acquisition could be under the control of 'instinctive' maturational mechanisms, by analogy to such behaviours as nest building in birds or 'learning to walk' in mammals. In this way, a language faculty can be conceived as a special-purpose module of the mind/brain, dedicated to the demands of spoken language communication and acquired through special learning mechanisms linked to the maturation of perceptual, motor and cognitive systems of the infant brain.

Clearly a great deal of investigative groundwork is needed to isolate the principles and parameters that underlie natural languages and to then show how such principles and parameters may be incorporated into a model of first language acquisition.3 But this is precisely what linguists and psycholinguists in the Chomskian paradigm seek to do. The P&P theory of language is in fundamental respects antithetical to the idea, advanced in the previous section, that language is an undifferentiated 'symbolic system'. Nevertheless, P&P theory also provides an alternative formulation of the co-evolution hypothesis that the emergence of natural language drove the most recent 'runaway' stage of evolution of the human brain, albeit a formulation with a very different conceptual foundation as a modular 'faculty of language'.

1-4 The resilience of language:

It is undeniable that some regions of the brain are more involved in linguistic, and specifically grammatical, processing than others. However, the strongest version of the anatomical specialization hypothesis – that grammar resides in the pattern of connections in Broca's area – is clearly false. As we have seen, there is considerable evidence that individuals who have suffered lesions to Broca's area do not lose their grammatical knowledge, but are simply unable to access it at will. Furthermore, the most entrenched grammatical patterns, such as basic word order or case inflections in morphologically rich languages, generally do remain accessible. This suggests that linguistic knowledge is represented in a redundant manner in various regions of the brain, with the language areas acting as a kind of central switchboard. There is also evidence of close links between grammatical and lexical deficits, which in turn suggests that these two aspects of a speaker's linguistic competence are closely intertwined. Another important lesson to be learned from the research on aphasia is that our capacity to use language is extremely resilient. In immature individuals, language can survive the loss of the 'language areas' or even of the entire left hemisphere. In adults, such large-scale reorganization is not possible, perhaps because the regions which take over language processing in brain-damaged children are already committed to other functions. However, there is evidence that even adults are able to recruit new areas or make new connections to some extent. Furthermore, adults are certainly able to compensate for the damage suffered by developing new language processing strategies. Both of these facts lend further support to the claim that the architecture supporting the human language faculty is very flexible.

1-5 Aphasia as evidence of the brain's representation of language:

The study of aphasia, or the loss of language functions caused by damage to the 'language areas' of the brain, has been our major historical source of evidence for the study of brain–language relationships. We can trace the clinical study of brain–language relationships to Paul Broca's (1861) famous discovery of the language area that bears his name, located in the posterior region of the left frontal lobe of the cerebral cortex. The precise role of Broca's area in normal language functioning remains controversial to this day.

Disease or injury to the recently evolved regions of the cerebral cortex may be revealing of how language is organized in the brain. We can have various types of injury. Focal damage to a limited region may occur as a consequence of a 'stroke', when a blood vessel bursts or an artery is blocked and there is oxygen deprivation to some local region of the brain.

II. CONCLUSION

We have seen in this research that brain is the dominate in processing language and without brain and its very important areas human being can't to have language. We have seen too that neuro-linguistics the new science is responsible for studying different cases of damaging of human brain. Language is predominantly lateralized to the left hemisphere in the vast majority of people, even the majority of left-handers. We have studied the evolution of human brain that the human brain has undergone very rapid growth in recent evolution. The brain has doubled in size in less than one million year. This paper has examined the resilience of language that some regions of the brain are more involved in linguistic, and specifically grammatical, processing than others. The paper has studied also the function of aphasia and its importance in loss of language when human brain is damaged.

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