

**Contents:**

Introduction	3
Language: A Biological Capacity or A cultural Invention	5
Biological Foundations of the Language	9
Reptilian Brain	10
Mammalian Brain	11
Human Brain	11
Evolutionary Aspect of Brain and Language	14
Brain study and Genetic account of the Language	15
Biological Basis of the Language: Selectivist vs. Constructivist	17
Biolinguistics vs. Connectionist approach	18
Conclusion	19
References	21

## **Introduction**

Many people have argued that the evolution of the human language faculty cannot be explained by Darwinian natural selection. Chomsky and Gould have suggested that language may have evolved as the by-product of selection for other abilities or as a consequence of as-yet unknown laws of growth and form. Others have argued that a biological specialization for grammar is incompatible with every tenet of Darwinian theory, that it shows no genetic variation, could not exist in any intermediate forms, confers no selective advantage, and would require more evolutionary time and genomic space than is available. We examine these arguments and show that they depend on inaccurate assumptions about biology or language or both. Evolutionary theory offers clear criteria for when a trait should be attributed to natural selection: complex design for some function, and the absence of alternative processes capable of explaining such complexity. Human language meets this criterion: grammar is a complex mechanism tailored to the transmission of propositional structures through a serial interface. Autonomous and arbitrary grammatical phenomena have been offered as counterexamples to the position that language is an adaptation, but this reasoning is unsound: communication protocols depend on arbitrary conventions that are adaptive as long as they are shared. Consequently, language acquisition in the child should systematically differ from language evolution in the species and attempts to analogize them are misleading. Reviewing other arguments and data, we conclude that there is every reason to believe that a specialization for grammar evolved by a conventional neo-Darwinian process.

All human societies have language. As far as we know they always did; language was not invented by some groups and spread to others like agriculture or the alphabet. All languages are complex computational systems employing the same basic kinds of rules and representations, with no notable correlation with technological progress: the grammars of industrial societies are no more complex than the grammars of hunter-gatherers; Modern English is not an advance over Old English. Within societies, individual humans are proficient language users regardless of intelligence, social status, or level of education. Children are fluent speakers of complex grammatical sentences by the age of three, without benefit of formal instruction. They are capable of inventing languages that are more systematic than those they hear, showing resemblances to languages that they have never heard, and they obey subtle grammatical principles for which there is no evidence in their environments. Disease or injury can make people linguistic savants while severely retarded, or linguistically impaired with normal intelligence. Some language disorders are genetically transmitted. Aspects of language skill can be linked to characteristic regions of the human brain. The human vocal tract is tailored to the demands of speech, compromising other functions such as breathing and swallowing. Human auditory perception shows complementary specializations toward the demands of decoding speech sounds into linguistic segments.

In the present work we have tried to explore the basic problems regarding its biological foundations. We have tried to answer the basic questions like why language evolved in humans only. And, where language is biologically situated in human beings. We have briefly explained some important theories regarding the origin of language, starting from divine to philosophical and then finally to biological theories. We have also

tried to find out if language is an innate tendency of human beings. Further we have explained the suggestive biology- language homologies, and location of language in brain centers, and at narrower level in genes.

### **Language: A Biological Capacity or A Cultural Invention**

Language can be seen as *a universal biological capacity* common to every individual, but can also be considered as *a cultural element* that would have evolved in relation to different external, environmental factors. It is interesting to examine the aspect of language that links it to a *biological predisposition* of man to use and understand it.

There are some clear genetic factors essential to the understanding of the origins of language. Although a little simplistic, a first element to consider would be a human *morphological predisposition* to language. Indeed, the sounds of language seem closely related to the morphology of the vocal tract: certain characteristics of a human face seem to have a decisive influence upon speech sounds. Simple elements such as the shape of the mouth and lips can be related to the development of language in man, or at least seem to be prerequisite for speech articulation, and oral motivity in man. A comparative study between chimpanzee and the human shows the following anatomical differences:

1. Chimpanzee have their tongue completely at rest, horizontally, within the oral cavity, whereas in man the posterior (back) part of the tongue is in a vertical position forming the anterior (front) wall of the supra-pharyngeal cavity.
2. In chimpanzee the soft palate and epiglottis can be approximated (moved together), whereas they are widely separated in adult man and can not be

approximated. In other words, the epiglottis can't close the oral cavity off from the airway leading to the lungs.

3. There is practically no supra-laryngeal portion of the pharynx present in the direct airway leading out of the larynx in chimpanzee. This difference from the direct airway of the adult man is a consequence of the opening of the larynx into the pharynx, which is immediately behind the oral cavity in chimpanzee. In adult man this opening occurs farther down in the pharynx.
4. In the chimpanzee the level of the vocal chords at rest is at the upper border of the fourth cervical column, whereas in adult man it is between the fifth and sixth in a relative longer neck.

These types of physiological differences impose a relative amount of constraint in case of sound production. For example the lack of a supra-laryngeal pharynx at right angles to the oral cavity prevents chimpanzee and human new born also from producing the vowel triad [i], [a], and [u]. However, anatomical descriptions do not seem to provide an accurate explanation for the *nature*, or the *origin* of language itself, and does not lead to insight into man's capacity for language, i.e. the underlying complexities of the matter. Some much more interesting aspects of study exist and must be considered.

One of the most influential *nativist* theorists is the linguist *Noam Chomsky*, who insists on the fact that man has mental structural capacities including an *innate* concept of human language. This concept appears to be *genetically determined*, and present in every human individual. He explains that a "normal" human child is thus predisposed to learn any language easily, by combining a set of innate rules with "language data", that she or he hears.

Language would therefore appear in man as an abstract system of rules that cannot be acquired by traditional learning principles.

An interesting example illustrating this predisposition to language is the creation of the *Creole* language among children of a mixed community of Japanese, Chinese, Korean, Portuguese, and Puerto Rican parents at the turn of the century. Immigrants of these various communities were "forced" to live together and thus communicate by some sort of *hybrid* language, viz. *pidgin*. A generation later, their children had invented (or come up with) a new language (*Creole*), being a highly developed linguistic system whose structure appeared to be similar among all the children of the community. This amazing fact seems to prove that, according to *Bickerton* (1983), *first-language acquisition is mediated by an innate device (...) the device provides the child with a single and fairly specific grammatical model*. A biological basis of language would indeed seem to be more than just a possibility.

Another important aspect of the *nativist* view emphasizes on the fact that environmental (external) stimuli alone, such as learning, cannot account for language possession. This idea is summarized in the theory of the *Poverty of the stimulus* that explains the ways in which language is born into an individual. *Lightfoot* (1982) explains that *there are no data available to the child that will suffice to establish some rule or principle*. This implies the idea of an *innately-primed learning*, that is, of an innate set of rules and information, of internal mechanisms suitable for the acquisition of language. The *poverty of the stimulus* phrase refers to the insufficient information obtained from the outside, the individual thus implying the idea of some sort of compensating *internal biological mechanism*.

This is where it becomes interesting to examine *S. Pinker's* view on the origins of language being determined by *natural selection*. *Darwin's theory* of *natural selection* explains the existence of human organs in terms of *adaptive complexity*; this means that every organ of the system has a specific function, and is adapted, arranged to perform a certain function, some sort of task. For example the eye (i.e. the visual organ) is adapted specifically for visual imagery (Function/task). For *Darwin*, therefore, it is through a process of natural selection that these organs have developed this specific function. It is this theory that *Pinker* relates to language. Indeed, he attempts to explain the origins of language as a natural process.

For *Pinker*, natural selection is a plausible explanation for the *complex cognitive mechanisms* underlying language.

Finally, the most important argument in favor of a biological foundation of language is probably the universality of its structures, i.e. it definitely seems to be common to every individual. The linguist Chomsky for example insisted on the fact that there are similar linguistic traits all over the world. In order to understand this, it is interesting to consider the idea of a *Language Acquisition Device*, which explains the transformation of a *corpus of speech*, i.e. a set of utterances (some grammatical, some not) into a complex grammatical system. This is generally studied in relation to the acquisition of language in a child. For example, the corpus of speech will be utterances overheard by a child in a given environment. Upon receipt of this corpus, the *Language Acquisition Device* creates a grammatical system. The device therefore represents some kind of internal structure that must be able to acquire any natural language. It is therefore universally applicable to the fundamental human capacity for language. The idea of an

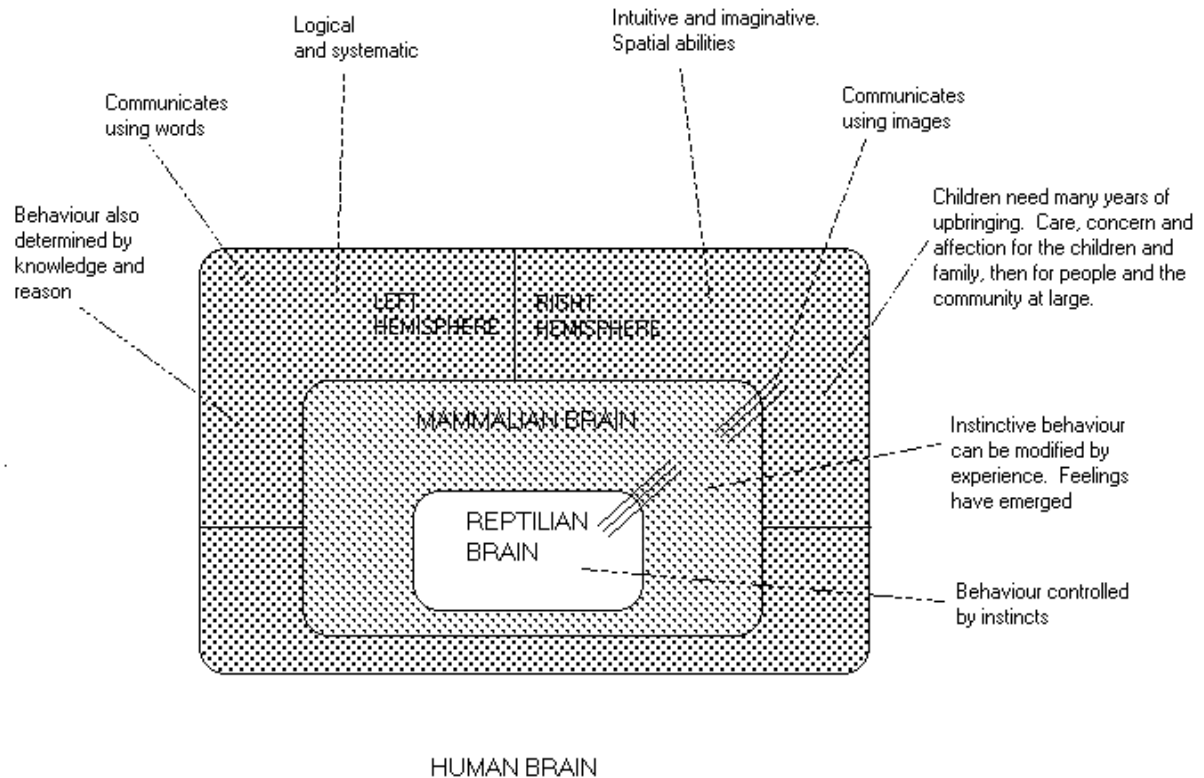


internal and universal capacity for language is closely associated to that of *Universal Grammar* (UG), whose study is clearly an attempt to specify the forms and features common to all human language. *UG* suggests a universal set of grammatical rules, and therefore also suggests that a child is predisposed to entertain certain hypotheses concerning the structure of language. The idea of *UG* clearly implies the idea of a biological foundation of language, and suggests that no individual will thus "start from scratch" his/her acquisition of language.

### **Biological Foundations of the Language**

The subject topic of this project paper is to understand the biological foundation of the language. Human being is the only living being on the earth to have a highly developed language system, which no other creatures possess. To understand this extraordinary capacity of linguistic behavior, we have to find out the way human differs from the rest of the animal kingdom, in terms of the evolutionary aspect.

In evolutionary biology, one concept is very popular and has a wide range of implications in different branches of the human cognition, and that one is as follows – *ontogeny repeats phylogeny*. The most vital proof of this fact can be traced out from the structure of the human brain. It can be divided into three constituents, among which the most fundamental one is popularly known as the *reptilian brain*. Out of this reptilian brain evolves the *mammalian brain*. After that the deposition of the gray matter, popularly known as the *neocortex*, ultimately transformed it into the human brain. This *neocortex* is divided into different hemispheres, popularly known as the left and the right hemispheres. An abstract presentation of the brain structure is given bellow along with its functions –



From the above picture it is quite clear that the ultimate projection of the human brain is the result of the co-ordination among these three compartments. But before an intensive discussion, let's have a look into these three different compartments.

### **Reptilian Brain:**

It is the innermost part of the human brain and not effected even by the evolution. It controls the basic function of the human body, such as the breathing and body temperature. The behavior relating to the survival of the species and reproduction is also control by this brain. And it is *autonomous*. It has an intuitive power to understand the hidden principles of the natural selection. Or in other way we can say that it is tuned with the nature and except nature, nobody has any command on it.

### **Mammalian Brain:**

In the history of the evolution, next to the reptiles, mammal emerges out. Since *ontogeny repeats phylogeny*, this type of historical development also leaves a permanent trace on the existing structure of the human brain. An enormous change took place as mammals evolved from reptiles, the mammalian brain containing organs:

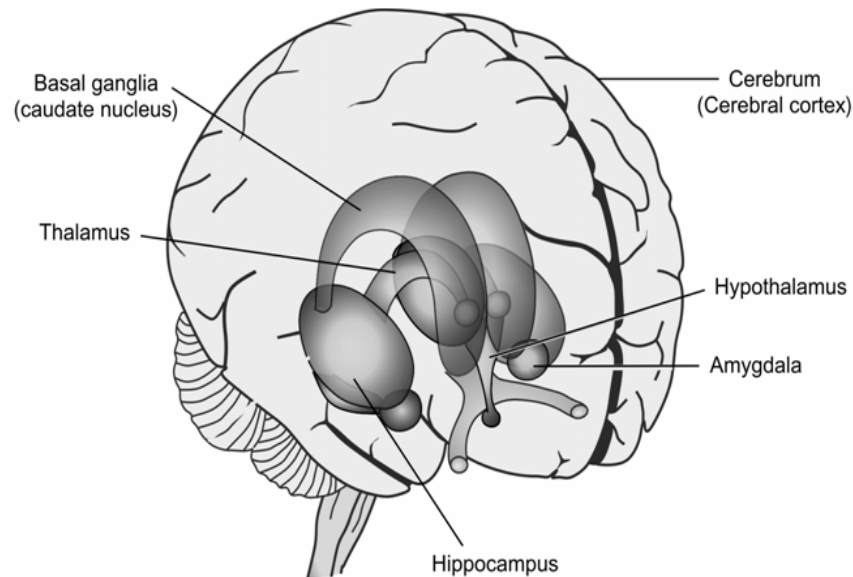
- For the automatic control of body functions such as digestion, the fluid balance, body temperature and blood pressure (autonomic nervous system, hypothalamus).
- For filing new experiences as they happen and so creating a store of experience-based memories (hippocampus).
- For experience-based recognition of danger and for responding to this according to past experience. And for some conscious feelings about events (*amygdala*).

To this extent the mammal is more consciously aware of itself in relation to the environment. Millions of neural pathways connect the *hippocampal* and *amygdala* structures to the reptilian brain and behavior is less rigidly controlled by instincts. It seems that feelings such as attachment, anger and fear have emerged with associated behavioral response patterns of care, fight or flight.

### **Human Brain:**

The mammalian brain became the human brain by adding the massive grey matter (*neocortex*) which envelopes most of the earlier brain and amounts to about 85 per cent of the human brain mass.

The brain is actually divided into its 'hemispheres' by a prominent groove. At the base of this groove lies the thick bundle of nerve fibers which enable these two halves of the brain to communicate with each other.



Inner structure of the human brain, including the limbic system.

The left hemisphere usually controls movement and sensation in the right side of the body, while the right hemisphere similarly controls the left side of the body. We saw that with the mammalian brain emerged feelings such as attachment, fear and anger and associated behavioral response patterns. And human emotional responses depend on neuronal pathways which link the right hemisphere to the mammalian brain which in turn is linked to the even older reptilian brain. The way is fascinating in which work is divided between the two halves of the brain, their different functions and the way in which they supplement and co-operate with each other.

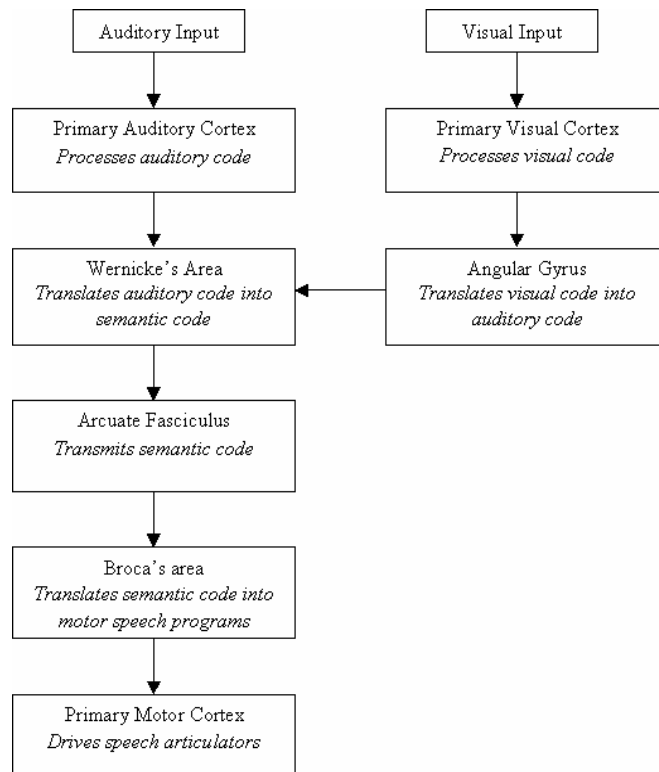
A general overview of the functional division of activities between the two hemispheres would be:

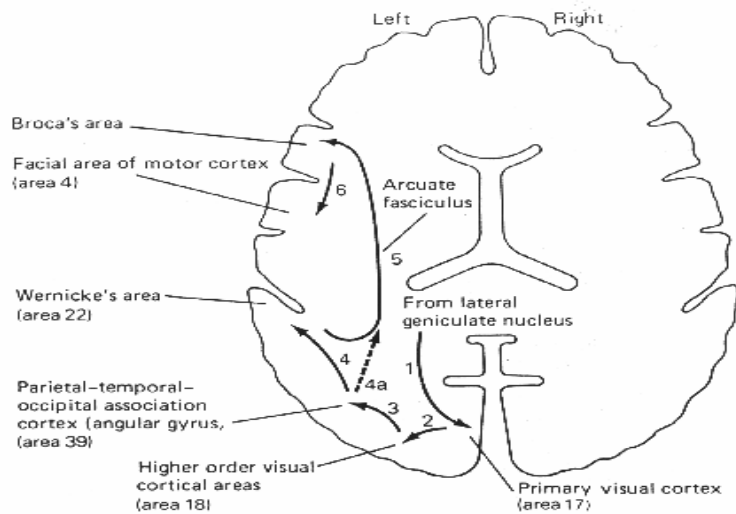
### *Left Hemisphere*

Communicates by using words, has highly developed verbal abilities, is logical and systematic, concerned with matters as they are.

### *Right Hemisphere*

Communicates using images (pictures), has highly developed spatial abilities, is intuitive and imaginative, concerned with emotions and feelings.





### Evolutionary Aspect of Brain and Language:

Brain and language both are subject to the evolution. Evolution is, as Darwin recognized, a complex process that inherently involves all aspects of the life cycle and environment of the species and its relationships to other species. Everything depends on everything else, and the interaction through natural selection is the crucial factor if any thing is. A Darwinian approach to the study of language of course involves more than the application of the theory of the natural selection. We will, for example, make use of the principle of *pre-adaptation*, that is, natural selection channeling development in a new direction because of previous modifications for some other role. This principle is extremely important, for it demonstrates how natural selection operating in small steps can effect radical changes in behavior.

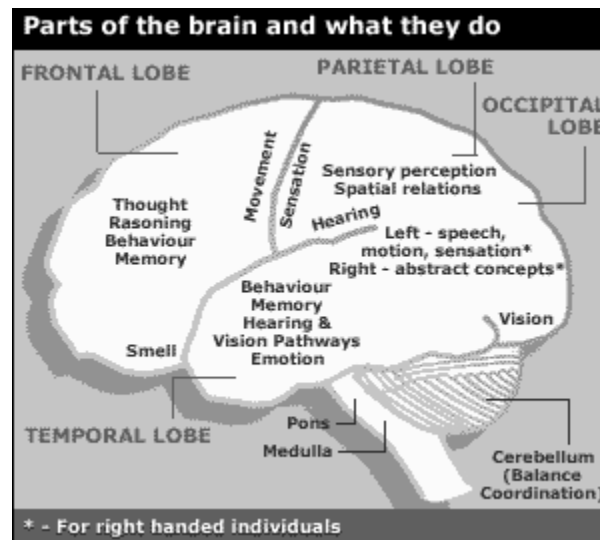
Therefore in case of language, same thing can be referred to. From some of the present day experiments it can be clearly deduced that the principle of *pre-adaptation*, works an important role even in the work of the linguists. They are referring to the fact

that there is a biologically determined language acquisition device, acquired in course of evolution, which plays a crucial role in case of the language acquisition. This theory of *innateness* is nothing but the resonance of the same principle of *pre-adaptation*. Moreover it is found that even a pre-linguistic child has the capacity to make a differentiation between voiced and voiceless bilabial sounds at the time of sucking. The rate of sucking gets higher when (s)he is exposed to the voiced bilabial sounds, in comparison to there non-voiced counterparts. This type of pre-linguistic ability is basically acquired by the human being by the course of evolution. And this ability, by and large, is universal through out the different cultures. Even in case of the deaf child, it is found that the pattern of babbling is quite same as that of the normal child, in the pre-linguistic period. The difference originates only in the level of the verbal child, which is specific to the culture. Therefore the notion of language essentially incorporates two levels of discussion- one, the pre-linguistics evidences shows that the existence of a universal pre-adaptive principle, which can be equated with the concept of the innateness hypothesis and two, in course of development, the child acquires the language specific particular grammar, which is channellized to a particular direction because of the pre-adaptive innate principle.

### **Brain study and Genetic account of the language**

The basic concern of this paper is the first level about which we have already talked, in our previous paragraph. Here we will try to make an account of the fact whether it is possible to make one to one correspondence between the language function and the human physiology. It is *Brocka* and *Weirnicke*, who first make an argument that

the impairments in the certain portion of the human brain ultimately result into the language loss. The way of study, because of the nature of their intension, is popularly known as localist approach. Following the path, shown by *Brocka* and *Weirnicke*, the following correspondences are found-



In spite of the aphasia study, conducted by *Brocka* and *Weirnicke*, there is some strong evidence that both the hemispheres are equally potent to pick up the language task. Damage of the left hemisphere in the early age triggers the right hemisphere to pick up the linguistic capability in case of the child. This kind of observation infers that at birth two hemispheres are equipotent and non-specialized. The equipotency of these two hemispheres basically depends on the neural connection which is known as *corpus callosum*, though a much more detail study is needed to understand the entire process of lateralization and its impact upon the language acquisition.

Moreover, one another effort is taken to find the underlying genetic disposition of the language, by introducing the biology-language homologies-



CELL	HUMAN LANGUAGE
Nucleotide bases	Alphabet
Amino Acids	Words
Axons	Phrases
Folding	Syntax
Proteins	Word Senses
Protein Circuit	Sentences
Biological function	Semantics
Regulation of Gene expression	Language generation

Whatever we have discussed above basically, is an effort towards the reductionism, e.g. the reduction of the linguistic ability into the organic one. But this type of study has some drawbacks, because language as a phenomenon is the projection of the interaction among the different parts of the brain and the genetic structure.

### **Biological basis of language: Selectivist vs. Constructivist**

The issue, under this topic, is not whether language is innate, for, clearly, language must be learned. Nor is the issue whether the aptitude for learning a language is inborn: it takes a human being, with a functional brain to learn a tongue. The question to explore is whether there is biological foundation at the root of organization and internal structure of language.

The scholars considering spoken language acquisition have divided over internal and external causation dichotomy. Two prototypical models of language acquisition are

"selectivist" and "constructivist" models, respectively. The selectivist model, which depends on internal causation argument, can be associated with Noam Chomsky. The selectivist model assumes that "language template is pre-organized in the neuronal structure of the brain, so that the fact of being an integral part of a given environment selects the borders of each individual neuronal structure, without affecting its fine organization, which pre-exists". The constructivist model, which assumes external causation of language acquisition, follows lines drawn by behaviorists such as Piaget and Skinner. This model assumes that "language is built up constantly from a continuous interaction with a well-structured environment".

### **Biolinguistics vs. Connectionist approach:**

*Biolinguistics* approach involves the study of questions concerning (1) *language*, (2) *language development*, and (3) *language evolution*. It is explicitly considered to the study of the biology of language. The connectionist approach is radically different, as is explained in *Rethinking Innateness*. The main query is *how seriously one should take biological constraints*.

Connectionist approach is concerned with intelligent behavior in general. It includes organically based intelligence (human language, basket weaving, nest building, etc.) as well as silicon based intelligence (chess playing computers, computers that recognize speech etc.). Thus connectionists are interested in general-purpose learning algorithms that work across domains and across organisms, whether based on DNA or on silicon.

On the other hand Biolinguists are interested in the following questions: (1) what constitute the knowledge of the human language? (2) how does does human language develop (in the individual)? (3) how does human language evolve in the species?

### **Conclusion:**

To some extent the above discussion supports the claim that language is most of all a biological capacity. However, it is easy to note that it is not this biological basis alone that makes up for the study of language. Indeed, it seems to have a context as well, some sort of external, *cultural* aspect.

Indeed, language is often considered *a cultural invention*, precisely because it evolves differently among peoples and cultures as *a means of communication*. Language often seems to have been invented by man simply in order to communicate with his peers.

The capacity to use language is a capacity to use and comprehend the use of *sign*. It is the arbitrariness of the sign that implies that there is something cultural about language. The fact that for example the word "tree" is used to define the concept of a tree in the English language, but that in French one will use the word "arbre" to the same concept, proves the arbitrariness of the sign, i.e. the word. This *arbitrariness* shows that language is *culturally determined* to some extent, and relates to the idea of *particular grammar* in opposition to *UG*.

*Particular Grammar* studies the features of a particular language (though always in relation to universal features of Grammar). Another important aspect to consider with the cultural aspect of language is the external factors having an influence on the

acquisition of language. Language may well be culturally determined, in that some aspects of a culture or a given environment may well act as stimuli to the development of it.

The *nurture* view (as opposed to a *nativist* account of language) emphasizes on an account of traditional learning principles being key-elements in the development of language. The theorist *B.F. Skinner* (1957) proposes a *theory of reinforcement*, in which he explains that it is certain elements in a child's environment (e.g. parents) that are capable of *reinforcing*, that is, improving the child's early babbling sounds. The concept of imitation is here very important, since it is this activity that enables the child to *reinforce* its language abilities. It is therefore in this sense that language can be considered as culturally determined, because certain aspects of a culture tend to either provide a language with a particular grammar peculiar to that culture, or simply *reinforce* the process of acquisition.

It would seem that the origins of language are a little complicated to understand. Although it would appear obvious that *language represents a cultural invention* (because of its *communicative function* and the fact that it actually symbolizes *man's will to communicate*), language seems to be at the root biologically determined, proving man's predisposition to acquire and use a language.

However, one must take into account both sides of the answer. Indeed, language seems definitely to be genetically determined and universal, but finds its evolution and development in external factors as well. An internal structure would therefore be at the core of language acquisition, whereas external stimuli lie around this key-structure to

make it more solid and complex. One can thus say that language is both a biological capacity and a cultural invention.

-The End-

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