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**Shweta Patidar**  
School of Language, Devi Ahilya  
University, Takshshila Campus,  
Khandwa Road, Indore Madhya  
Pradesh, India

## Second language acquisition and functioning of the brain: A review

**Shweta Patidar**

### Abstract

Language learning is a natural process. If a person never learns his mother language consciously, what makes him so fluent and correct in his mother language? By understanding this natural process of language acquisition, second language teaching can be made effective: providing students a natural setting to excel in foreign language rather than mugging up the vocabulary and grammar rule of that particular language. Through this review paper an attempt has been made to have a look at the scientific aspects of a language acquisition and the way the brain functions while learning a language.

**Keywords:** Language acquisition, neurolinguistics, psycholinguistics, age, and the brain

### Introduction

Most of us think that the organs of speech are tongue, lips, ear, teeth etc; if it had been so, just wonder how deaf and dumb people possess language. Sign language is also a form of language itself. Very few of us know that the very basic organ of our speech production is brain.

There is a branch of linguistics that studies the structure of brain and its function to produce and comprehend language. This branch is known as neurolinguistics. The theory of neurolinguistics is drawn from many interdisciplinary fields such as; neuroscience, linguistics, cognitive science, neurology, communication disorder, neuropsychology and computer science.

Psycholinguistics and neurolinguistics are two closely related disciplines that work on collaboration. Psycholinguistics uses models and algorithms to explain how language information is processed in the mind whereas neurolinguistics study brain activity to analyze how biological structure carries out those psycholinguistic processing algorithms. In other words neurolinguistics studies the physiological mechanism by which the brain processes the linguistics information.

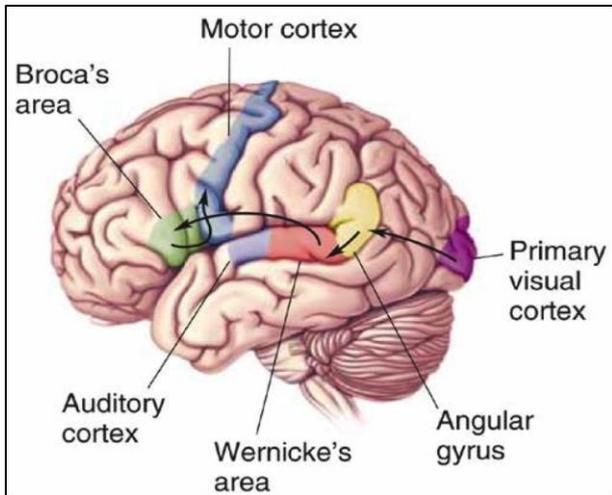
### Anatomy of the brain

The human cerebral cortex is a thick layer of neural tissues that covers most of the brain. The largest of human brain is cerebrum which is divided into two hemispheres; the left hemisphere and the right hemisphere. The left hemisphere is dominant for words, logic, numbers, analysis, lists, linearity and sequence. It controls the right side of your body. Whereas the right hemisphere is dominant for rhythm, spatial awareness, color, imagination, daydreaming, holistic awareness and dimension. It controls the left side of your body. These are generalizations and in normal people the two hemisphere work together are connected to each other.

The cortex is divided into four lobes- the frontal lobe, the parietal lobe, the temporal lobe and the occipital lobe. Within each lobe there are a number of cortical areas, each associated with a particular function, including vision motor control and language.

Let us focus the language areas of the brain. In 97% of people left hemisphere of brain is dominant for language. The left hemisphere of brain has three lobes- Parietal lobe, Temporal lobe and the Occipital lobe. All these three lobes together make up language control center. In these lobes two language dominant areas are there- (a) the Wernicke's area and (b) the Broca's area that enables you to understand, recognize, a read and speak.

**Correspondence**  
**Shweta Patidar**  
School of Language, Devi Ahilya  
University, Takshshila Campus,  
Khandwa Road, Indore Madhya  
Pradesh, India



### Broca's Area

Broca's area is located in the left hemisphere of the brain. It is associated with production of speech and articulation. The ability to articulate our thoughts and to use words accurately whether in spoken or written language, depends particularly on this area of brain.

### Wernicke's Area

Wernicke's area is situated in posterior superior temporal lobe. Neural network connects it to Broca's area. Wernicke's area is associated with comprehension. This area is involved with language processing, whether it is written or spoken.

### Angular Gyrus

The angular gyrus enables us to process multiple types of language-related information. It is located in close proximity to other critical brain regions such as the parietal lobe which processes tactile sensation, the occipital lobe which is involved in visual analyses and the temporal lobe which processes sounds. The angular gyrus allows us to associate a perceived word with different images, sensations and ideas.

### Brain Plasticity

Brain plasticity refers to changes in neural pathway due to changes in behavior, environment, neural processes, thinking and emotions. The brain is structured in a way that it changes to better cope with the environment. If neurons do not have a purpose or function to perform, they become damaged or even die.

After ten years of age, the brain starts losing its plasticity. Maximum plasticity of brain in a person's life is during the first two years of his life. The young children learn a foreign language with ease. Older children and adult can also acquire a language but more efforts are required.

### Researches

Dr marzenich on his web site 'Brain Connections' writes an article "How brain learns a second language" and says that auditory feedback proves to be a crucial step in learning language. He refers a study from University of California, San Francisco that suggests even animals learn sounds and tunes from their elders. This learning is not merely depend on hearing those sounds but also attempts to vocalize or articulate those sounds. Through various studies he has logically concluded that despite the structure of brain that supports language learning, the stimulation from a

linguistics environment is also necessary. If the brain single is enough to acquire a language, any learner of second language would have master in it without much trouble.

Fred Genesee in "Brain Research Implications for Second Language Learner" writes when cortical tissues are transplanted from its original location to the new locations in the brain, it starts the functions of new locations than that of old locations. For ex: if the tissues from the visual cortex of the brain are transplanted to cerebral cortex, transplanted tissues lose their ability to process visual inputs and starts processing sensory inputs. (O'Leary & Stainfield 1985).

There are a number of evidences of neuro-chemical communication between neurons is facilitated when learning takes place and make connections between neurons from simple to complex and vice versa. When the stimuli and exposure is frequent, these simple and complex neuron circuits are activated more easily and the process of learning becomes easy. Hence learning is a slow process because new connections between neurons take time.

Stephen Krashen discusses two ways by which we can have command over two languages- one we can acquire it or the second we can learn it. He further observes that language acquisition is a subconscious process. We are often not aware while acquiring language whereas language learning is a conscious process. We may acquire language unknowingly while listening to radio, watching movies or even listening to others conversation. Many researchers have shown and supported that not only children but adults also can acquire language subconsciously.

Discussing natural order hypothesis the author further writes that there is not a particular order to acquire the rules of any given language. It happens naturally and arbitrarily. Simple rules might be acquired later and complex ones earlier depending on individual's experience and interest. And this natural order cannot be altered even after providing explanation, drills, exercises etc. According to the Monitor Hypothesis by author; the consciously learned language acts as monitor or editor. When we speak fluently it is our subconsciously learned language that helps us forming sentences. It is really very difficult for the speaker to use monitor or learned language subconsciously. Therefore it becomes almost impossible for a speaker of second language to remember and use all the rules he had learnt about grammar while he is having conversation in second language. When we speak a sentence we realize our mistake just after speaking but rarely while speaking it.

In the comprehension hypothesis the author suggests that we acquire a language only when we understand the piece of writing that we have read. We learn rule only when we use them in sentences or read them used in a piece of writing. Unless we use those rules they can only be mugged up but cannot be learned.

The affective hypothesis by author says; if the acquirer is new to a language speaking group, he might be anxious or low esteemed. He may understand the input but may not reach "language acquisition device." Consequently he might not be able to make speech in second language. It explains how learning in two students differs even after providing same input. The one may be open to input and ready to learn while the other may not be. For beginners level Krashen has suggested that the students must be given commands talking slowly ad using less complex language and structure. All it need is comprehensible and interesting activities. For higher level students the author has suggested sheltered subject

matter teaching. In these classes, the subject matter is emphasized and not the language. The focus is paid on the meaning and not on the form. He has also suggested self-selected reading, narrow reading and integrating self-selected learning for improvisation.

Palmer writes every child is a natural learner of at least one language called native language. The child may belong to any caste, color or creed. He will naturally adopt his first language without special instruction. Here language does not referred for reading or writing but for understanding whatever has been said and to express one's ideas or wishes. Kirk Hagen in "The Bilingual Brain" observes human evolution and second language acquisition. And make a comparison between a child's first languages with an adult's second language acquisition from the evolutionary point of view. The author argues that second language acquisition is a physical phenomenon rather than a sociological, psychopedagogical or others and that language acquisition is an age sensitive cognitive process. He refers critical period hypothesis that claims that human brain is prepared for language acquisition since early childhood till adolescence. No special instructions are required during this period of time to make the speaker fluent in a particular language. The child just needs to be exposed in a linguistically rich environment. When the age increases language acquisition becomes problematic.

The author refers to various studies and says that second language learned later in the life are situated or learned by distinct areas of the brain whereas those learned early in the life are situated in coextensive regions of language one. The examples of the girl Ginie and the boy Victor are noteworthy. Both of them were deprived of a linguistically rich environment since their early childhood consequently they could never become a fluent speaker in any language even after long psychological and speech therapies. Both of them were found in the age of 13 and 12 respectively. There is a similar case of the girl named Isabelle, she was also a language deprived girl since a very young age but unlike Ginie and Victor she was found at the age of six and surprisingly after the language training she became a fluent speaker within two years and lived a normal life. Giving various examples the author argues and concludes that language acquisition is a biological process.

As Krashen claims that language acquisition is a subconscious process while language learning is conscious, in contrast McLaughlin claims that learning is conscious process while in classroom setting and the learned knowledge in classroom setting becomes an automatic process in using L2 even outside of the classroom. McLaughlin refers Schumann and writes that learning depends on personal experience and exemplifies that if you have learned a language without notable instruction you will support Krashen's point of view where as if you have learned a language by learning grammar and grammatical instructions, you will support McLaughlin. Stonislas Dehaene writes all the brain patterns related to language are images of brain plasticity. If a sentence is delivered in a foreign language the left Perisylvian activity is absent. Language acquisition changes the brain through symmetry breaking. Therefore the brain gets tuned to one language and the other language often left unresponsive.

Yue Wang at el. experimented and concluded that an fMRI study asserts that mathematical operations are generally performed in L1. Even proficient speaker of L2 performs

mathematical functions in L1. The authors refer some research works and write that mathematical functions in brain are directly related to language that involve a integrated neural network. They researched on some Mandrin and English speaking people to find out whether L1 & L2 have a shared or independent neural system in cognitive capacities and found when the subjects were presented with English words and Chinese characters, their left hemisphere was activated for English and bilateral processing for Chinese with environment of right hemisphere. They further argued that this may be because of the logographical nature of Chinese characters.

### **Advantages of being bilingual**

According to the American Speech- Language- Hearing Association Bilinguals learn new words easily. Bilinguals can process information in new and innovative ways.

Many other researchers have also proven that the bilingual children have more developed cognitive skills than that of a monolingual. They develop strong thinking skills and also have an advantage to learning and solve mathematical problems. Bilinguals cultivate greater cultural awareness, and are more focusing and good at remembering. They use logics to deal with problems. And if they have these many advantages they naturally grow up to be better individuals than monolinguals in terms of salaries and career opportunities (Zelasko and Antunez, 2000 cited on VIF International Education). The demand of bilingual speaker is rapidly increasing in the global market. No doubt that a bilingual mind is cognitively active and flexible. They can easily cope up with the environmental needs and situations.

Luis A. Cordon refers some researches and affirms that bilingual children have much more cognitive abilities than that of monolingual children. They are able to compare between available choices logically. The results of bilingual students are higher than monolingual students. The other positive cognitive skills such as concept formulation, classification skills, and visual-spatial skills are also associated with bilingualism. The author further writes that the only disadvantage of bilingualism is that the person may show low processing speed in some language tasks may be because of the large vocabulary or the end number of rules available in grammar.

### **Conclusion**

The research has clearly shown that the brain changes accordingly with the environment to better deal with it. If the exposure is given in early years of life it will be fruitful and language acquisition will take less time and efforts. The more a brain gets familiar with a language the easier it becomes to learn it. Therefore for acquiring a language the exposure should be given as much as possible. Psychological theories suggest that when a person is learning a language, it is the conscious mind that receives it. Gradually when given a continuous practice, the information is sent to the subconscious mind. The information in subconscious mind is hard to forget and is used without the awareness of the person using it i.e. subconsciously.

As India has a wide and rich variety of language and dialects, almost in every Indian family at least two languages are spoken. The first inherent from the parents (Sometimes two; one from the father and from the mother) and the other language is of formal education. The child becomes fluent in both the languages though he/she learns

the grammar and theory of the formal language of education only. This also strongly proves that the language can easily be learnt if given environment.

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