INTERNATIONAL JOURNAL OF ENGLISH LANGUAGE, LITERATURE AND TRANSLATION STUDIES (IJELR)
A QUARTERLY, INDEXED, REFEREED AND PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
http://www.ijelr.in (Impact Factor: 5.9745) (ICI)

RESEARCH ARTICLE

Vol. 7. Issue.4. 2020 (Oct-Dec)

INTERNATIONAL STANDARD SERIAL NUMBER INDIA
2395-2628(Print):2349-9451(online)

A STUDY OF NEURAL BUILDUP IN SECOND LANGUAGE LEARNING PROCESS

BHAGYA PRABHASHINI.C
Jazan University
Email:shiniprabha5@gmail.com

Article information
Received:08/10/2020
Accepted: 11/11/2020
Published online: 2/12/2020
doi: 10.33329/ijelr.7.4.120

ABSTRACT

This paper aimed in search of an outline framework for Language Learning Process (LLP) in an extensive view of Second Language Learning. In this connection, the study led to embracing the bottom line of the topic to notice the connection between language learning areas of the brain and how these are going to escalate the learning process during learning a second language. Apparently, it was well resourced that these areas became crucial elements in strengthening learning process of a second language. Further, as a matter of fact, alongside the pathway of the language learning process it has also been observed that there is no difference between the learning processes of first language and second language though there are various theories. Moreover, the main areas that centers the actions of language processing and the other areas that are engaged in the involvement of the language learning process are discerned.

Keywords: learning process, neuro-linguistics, perception, second language, brain areas.

1. Introduction

Being a linguist, it is an interesting area to see the linguistic path behind the language learning process among various areas of the brain. Characteristically, 'learning' and 'acquisition' are different for linguists, yet, hither, I would like to use the word 'learning' for the present purpose as the study is emphasized in learning process, in the viewpoint of L_2, as a whole entity, disregarding the other factors like age, sub consciousness, implicit or explicit etc. Hence, it is endeavored to illustrate the setup and style of learning in Second Language Learning Process (SLLP) i.e. by and large in a non-native setting. Significantly, Pulvemuller, (2002) recommended the idea to see a language in view of the processes that are taking place in 'teaching of the teachers' and 'learning of students'. In addition, 'teaching' and 'learning' paths should be reciprocal, while achieving the targeted learning outcomes. The language learners and the English language are part and parcel of Second Language Learning Process (SLLP), in L_2 environment. The linguists, in a broader view, studied the output and input of the language learning and described the output as 'oral speech', 'written discourse' and vice versa reading and listening. A few distinguished Dutch researchers¸ de Bot, Lowie, and Verspoor (2005: 3), did a study on how languages are learnt in connection with the dynamic aspects of Second Language Acquisition Research. Though the acquisition of L_1 and L_2 won't come under one umbrella, L_1 acquisition has been the study of the subject under Psychology field and L_2 acquisition has been the study of the subject under Applied Linguists field. In a lucid way, the basic difference between L_1 and L_2 has been given by N. Ellis, (2005) a: 305 i.e., 'learning language while using is L_2'. Hulstijn, 2007 b: 78 5 quoted language acquisition as a moment

through successive grammars among languages. In this connection, it is a tiny attempt to study and find out the path/s of language in the brain using the authentic psycholinguistic and neuro-linguistic material.

1.2 Research questions

Technology is carrying forward by promoting the brain studies, in view of language comprehension and learning paths. For instance, a Japanese company manufactured an interface machine of brain for physically challenged students. With that machine, the students can operate electronic devices without any physical moment as the blood flow in the brain is recognized by the machine and transitioned into electronic signals. In Germany, Max Planck Institute scientists manufactured a device that reads the intentions of the persons before they speak, but it was comprised of ethical issues. On the other hand, the studies are furthered in the prospect where the human brain is with diseases or lack of something in the brain etc. Therefore, in order to stock the language areas that contribute in the process of learning is necessitated in this study through the following questions.

- What areas of the brain aids in second language learning?
- What is the difference in learning L_1 & L_2?
- How is a language learning path?

2. Review of Literature

The objective of this Literature Review is to study theoretical, practical research and approaches that are related and successively completed so far on learning, provided with reference to Second language learning process.

2.1 'Learning'

Learning is a process where the learner will come to have a better comprehension from unknown, piecemeal, where the doubts and misconceptions are cleared with it. It is nothing but the process of moving from conscious competence, where the learner keeps all his / her efforts to get hold on the topics, to unconscious competence, to use it at times in the future. Learning can be occurred in any path; hence it is multifaceted. It can be in a natural way, or learning by doing (kinesthetic) or one of many kinds. Disregarding the learning type, the knowledge that is acquired through learning must be retained. Individuals should concentrate on basic competence before going to the conscious and unconscious competences. Psychologists divided the process of learning into various kinds depending on the source they get such as auditory learning, visual learning, and kinesthetic learning etc.

Carey, 2014, p. 180 explained 'perceptual discernment' as the process of how mind crams for the audio, visual and quality perceptions such as texture, to detect minute differences among them. Perceptual discernment in gaining knowledge involves an augmented capability to excerpt pertinent statistics from an impetus as the outcome of practice, added Gibson (1969). To further into, the Perceptual discernment in gaining knowledge is an augmented capability to identify the data postulating the purposes, proceedings, and characteristic topographies. The Perceptual differentiation theory has been proposed by Gibson (1969). According to him, this perceptual gaining of knowledge extracts the facts and figures out of the data absorbed from the surroundings. The surroundings are regarded as resources of quantitative data. An individual should be aware of the procedure to rejoin the characteristic topographies in making wisdom out of sensual contribution. Gibson's (1992) opinion of perceptual learning is the first and foremost process of a selection (p. 217). This Perceptual evidence converts gradually from particular to the personal, personal to global, and the associations stuck in between. According to Gibson's Perceptual learning, there are two mechanisms, the former say that the individual should acquire the characteristic topographies. In the latter mechanism declares that the individual should gain knowledge to make use of characteristic topographies to differentiate the various suitable entities.

In 1872, F. J. Schmidt proposed 'wave theory' that featured the initiation of 'language spread' that begins from a central location. The spread starts from this location and continues to concentric circles which weaken with the increasing number. It is similar to the waves created by a stone when tossed into a still water. This theory has been applied to convergence of other languages as it changes the feature of the new

language which he called it as an innovation. These innovations of each language are shown connected through interfaces between the concentric circles. It is mostly being upheld by the modern linguists, though; it hadn't been superseded by the tree model theory. Later, the theory of language learning had been proposed by Eric Lenneberg, (1967). He estimated that sexually grown-up persons can learn a foreign language or L_2 including accent at the age of 40, but it encountered oppositions, one such opposition is his explanation about a matrix that was already set in the cerebral cortex for language learning. Then, Gazzaniga, (1974) indicated more specifically that the place of learning in the brain is left conical area. After that, in 1980, Lakoff and Johnson proposed Metaphor theory, stating metaphors supply thoughts with a bond between human experience domain and abstract concept. As our conceptual system is metaphorical in nature, so the intention of the used metaphor makes us to understand what the cognition is.

Importantly, the Global Workspace Theory explains that the brain needs hundred billion number of neurons to get the global access, so that the brain can display two important features i.e. consciousness and speed. This theory has been proposed by (Baars in 1997a, b) using similes. He matched neural system to theatre by saying, 'a bright spot on the stage'. The other pairs matched by him are 'attention-spotlight' and 'brain-publicity organ'. Though he used similes he exclaimed these senses as metaphors because of the small number of events that take place on the theatre stage like neural set up i.e. Speaking to one or a couple. Yet, he emphasized on the 'no limit' of visual memory with consciousness that gives entry to millions of units of knowledge or data information that we gain through unconscious learning. Vividly to say, the tremendous memory of visual unit is to store millions of images and do Quick-ultra scan search from an unconscious gallery of images to discern previously seen images. He depicted that the human brain possessed global access as it had 100 billion neurons and named it as 'a global access device' saying that it works with speed and with the narrowed necessary limitation that brings out the information from the unconscious memory. Whereas, information processing theory states that the human brain is like a computer which processes the received information. It is a well-known wonderful ability that the brain processes the learning of any language. The most recent researches of neuroscientists revealed a tremendous capacity of the human brain, i.e. Each individual can produce a neural signature, which is unique for every individual like own finger print.

2.2. Linguistic theory of natural language acquisition

In childhood, everyone starts learning from parents, siblings and the environment surrounded by the individual. There is no uncertainty that the children with good exposure to the language get good linguistic basics. Let's take a symbol which is a unit that stands for its individual context. Practically, language itself is symbolic. For example, *Phonemes, syllables, nouns* are symbolic. The symbolic knowledge like phonemes, nouns, and syllables as explained by Hulstjin (2002a), is Connectivism. For instance, the example for the alphabet '*O*' is "*Orange*", represents the shape of the letter, MacWhinney (2001a:79-80). That is the reason, Hulstjin (2002a, 2007a), encapsulated that symbolic and sub-symbolic knowledge comprises cognition. He also adds that the second language learning process is explained with specified successive grammar and with regard to White (2007:46) it is with Universal Grammar, the linguistic competence. The ideas of intrinsic language ability, speed, and proficiency of acquiring their languages are less than best situations; this is what a native speaker possesses. 'Nativism' was proposed by Noam Chomsky as the children have an innate ability to learn a language. Noam Chomsky's Universal Grammar Theory (UGT) explains the motive behind the changes in the grammar in the production of language by means of 'Language Acquisition Device' (LAD). As per his idea brain is a language acquisition device (LAD). Per Alec, P. 'LAD' shows similar properties and functions to all the common languages and the children can learn any language when exposed to it in the early days of childhood. As specified by Chomsky's Universal grammar, domestication of linguistic data of language rules allow children to generate new structures.

2.3 Stages of Second Language Acquisition Process among Linguistic Learners

General observation of learners shows that understanding a couple of words slowly starts acquisition and in a long run it turns to small phrases and sentences. Actually, there are five knowable stages of second language acquisition per Krashen & Terrell, (1983), Preproduction, Early Production, Speech Emergence, Intermediate Fluency, and Advanced Fluency. Primary education standards, family education level, economic

status, and the time expended for L_2 practice and other related factors decide how quick the learners can progress through all these stages. As revealed by Vygotsky (1978), the gap between what they can do and what they can't do under the supervision of a teacher makes them work in the zone of proximal development. In addition, the time spent by the learner in each stage of L_2 acquisition is concerned, as it varies from student to student. Consequently, L_1 acquisition is natural acquisition and also sometimes controlled acquisition yet, it is implicit and unconscious during childhood whereas L_2 learning is both conscious and unconscious in childhood or puberty. At this point, it is wise to talk about the SLA stages explained by Robertson, K. and Ford, K. (2007).

2.3.1 Pre- introduction

Prior exposure of new materials give support to good comprehension because the better the background the students have, the more the cognized will be. Better comprehension aids in creating the conceptual maps. The first step of learning is when the students start working on a new topic posted by the teacher on a bulletin board, a day or couple prior to teaching. The teacher should observe students' interests and knowledge base to develop positive thoughts while posting. Some colorful peripherals, a positive note adds essence to learning environment that builds up interest and self-encouragement in students. Apparently, they get connected unconsciously to the bulletin topic and set their goals to initiate inquiries about it.

2.3.2 Grounding

The teachers should realize the exact background of the students instead what they think is right. Therefore, it helps the faculty to customize their plan in building stimulation and excitement that match the learning styles of the students to organize a real-world preparation. The plan should include 'warm-up' activities, students' opted activities, and the realia that allure and inspire them. Moreover, including some real entities such as simulations, demonstrations or botanical travelling, historical visits, host speeches, etc. involve them into the subject because these are learner-friendly classrooms that contribute in providing answers to the learner.

2.3.3 Beginning & attainment

Managing a good rapport with the students develops an enthusiasm to open up their thoughts about the topic. Typically, initial informal acquisition takes place due to encouragement. Provision of virtual scenes using computer programs to advance the ability of students to express their views regardless of their relevance. This is an advisable stage to follow by expectations and opinions. Making the students to be available for a number of alternative options would give a chance for them to discover the whereabouts of the topic in visual, auditory or kinesthetic modalities.

2.3.4 Amplification

Learning starts prior to teaching as it elaborates students' ideology to think about using the intellect. The activities such as debriefing of a simulation, story continuation process provide chances of elaboration. Letting the students to devise their rubrics for the assessment of learning and further letting them to search online about the topic through blogs, videos or slides; and allowing the learners to draw mind maps and organize peer discussions with consciousness but without competence, infer students to come up with a group report.

2.3.5 Maturation and encoding of reminiscence

This stage is for a review session. During this session, the learners recapitulate from a down session where there is no external guidance from any faculty. They consciously do pair work, discuss and further extend their discussion with family members and other friends. Teachers need to encode what they learned into memory, using true experiences, mnemonics instructions, simulations etc.

2.3.6 Confirmation and assurance form

This stage of verification and confidence check is applicable both for teachers and students. So, teachers have to make sure that the Teaching-Learning Material (TLM) is appropriate to the content and organized in a

way to exhibit in a timely manner during the teaching process. Likely, students have to ensure their learning process with good comprehension during learning new concepts, so that they are able to share their learning material with others. Let the students to interview each other in a positive approach and allow them to respond to some of the activities such as paragraph writing on a given topic or from a stage show, mono-action, project work etc. increases their confidence levels.

2.3.7 Celebration and Amalgamation

The stage, Celebration and Amalgamation takes place over time after many review sessions. This is an emotional stage related to an interest in learning. Allow class to have cafeteria stuff alongside their project work show, experiment demonstration in front of college guests or community guests. To save time, the teacher has to incorporate new learning strategies to avoid difficulties encountered while using old learning strategies.

2.3.8 Cognition

Hurley, 2001, analyzed and said that, among all the cognitive theories Sandwich model is vivid as it shows cognition as a process between 'perception' and 'action'. The other mechanism involved in this process is interception. These mechanisms are nothing but modalities. Cognitive visual system works out there to make it into action while using a color simulation. If the simulation is a sound or music, the cognitive auditory system works over there to lead that into memory. There is a cognitive sensory system for simulations with the physical environment as the brain has different configurations to route the conditions.

2.3.9 Long- and Short-time memory

Double check of the information gained is necessary for organization in order to associate with the pre-knowledge what the student already possessed. This process leads to create a mental picture. The frequent review of this mental picture of practicing the knowledge makes the learners to store this knowledge as long-term memory, so that the learner can use it well for future purposes. Importantly, language processing is a unique ability of human beings to produce speech with grammatical understanding and native like language acquisition ability to achieve before puberty. Our working memory can keep only 7 individual things and do only two urgent actions at a time, accordingly, Baars (1997b: 293) referred the brain as a slow organ, performs work one thing at a time or else it becomes an error prone organ. With regard to present discussion, study of human brain is a focal point of present study.

3. Language Acquisition Device, the brain

A study shows the relationship between language and the brain using neuro-linguistics, where neither the observation of linguistic activity in the brain nor the linguistic structures with information in the cells is possible. Even though there is a possibility to find answers to the research questions require the study of brain and its areas associated with Second Language Learning Process (SLLP). According to Baars, 2007b, brain is the most intricate structure in the world with billions of neurons and trillions of synapses. The human genome codes evolve as the brain, are responsible for the speech ability that acquires language and speech skills after birth. In fact, it's an intrinsic truth that the important human organ involved in language learning process is 'brain'. Therefore, it is important to see the salient features of inner parts of the brain, to make Psycho-neuro-linguistic way as smooth as polished as to accentuate the process of second language learning, to see how second language processing is going on in the brain. The most important skill to improve among the students during second language learning is 'parole' i.e. the speaking skill, of course, the more the exposure, the more the proficiency will be.

3.1 Structure of Human Brain

Based on feature functionality, the brain is divided into three parts. They are Neocortex, Limbic brain and Brain stem. Neocortex is meant for Higher order thinking, Limbic for emotions and brain stem is for survival function. Another classification of brain depending on its activity features divides it into three sections i.e. The primary one is Hindbrain, where the involuntary system of human body is being managed by this. The

cerebellum is active during memory functioning, alphabetical order, skill decoding words, stimulus response effects, and multiplication tables etc. The secondary part is Midbrain which is a small, simple area which manages eye moment and pupil's constraint. The last part is Forebrain which constitutes important entities of language learning.

Given the uncertainty in language studies, brain was treated as a 'black box' that aids in output and input. It is a well-known fact that the human brain normally has two parts called small brain and big brain. The big brain is covered by a cortex layer and is grayish in color so it is called as 'Gray matter'. The inner cerebellum is divided into two parts called right hemisphere and left hemisphere. The left part of the hemisphere is responsible for right-half of human body and the right part of hemisphere is responsible for left-half of human body; exemplified as lateralization. A bridge called the corpus callosum, which connects these two hemispheres intact. They contain a huge number of nerve cells called neurons. These neurons connected to each other by means of nerve fibers so that the communication occurs at axon, the place where a sheath of myelin coat present. One neuron is possessed with one or few axons; these axons are slender, thin projections of neurons, characteristically long in nature. The communiqué between neurons is by means of axons and dendrites. The dendrites are protoplasmic extensions of neurons. This junction is nothing but synapses where information flows with dopamine by neurotransmitters.

To precise, the main location that is connected to the fabrication of language is Broca's area, which is an inch size and is situated near left hemisphere towards the temple. Another area, which is responsible for language understanding, is Wernicke's area, situated at the back of left ear. Some fibers connect these two areas and control feedback and repetition processes of a language. It is evident from the language pathological studies that Left hemisphere involves in ordinary language functions because its loss leads to language impairment. The studies also witnessed that the right hemisphere is involved more in the initial stages of language learning. However, the more exposure over time processes the multiple facets of information associated about a word (Stiles & Thal, as cited in Elman et al., 1997, pp. 309-310). Between these two hemispheres, left hemisphere of the brain is "logical" in function, and involves in language analysis, whereas right hemisphere is "creative" in function and involves in daydreaming and imagination. The scientific studies regarding the left and right lobes of the brain and its operations on body reveal that around 97% of peoples' language ability is located in the left hemisphere. In 19% of left-handed people, this ability locates in right hemisphere. Also, in 68% of right hemisphere people, some language abilities are located in both left and right hemispheres. The left hemisphere is responsible for math, logic, language and balances right body moments, whereas the right hemisphere controls visual imagery, spatial abilities, music, and the ability to recognize faces. Each hemisphere has an almond-shaped part related to feelings, memory and learning. The functions of the main parts of the brain are tabulated for better comprehension.

Table-1 Functions of brain parts

Brain parts	Functions	Referrals
Brain	Speech ability/skills	
Broca's area	Fabrication of language, articulation of the related words, loud reading, word production center, syntax	Use nouns on Broca's Aphasia (can't create Grammatically complex sentences)
Wernicke's area	Language comprehension and development of spoken language, pronunciation of words and syllables, silent reading, Word input center	A sort of Aphasia, no recognizable speech
Broca's area and basal ganglia	Retrieval of knowledge	-
Basal ganglia	Motor control to memory	-
Left hemisphere	Language analysis, logic, phonology, semantics, and text/sentence processing, language production	-
Right hemisphere	Day dreaming, imagination, visual imagery, spatial abilities, music, and the ability to recognize faces, speech perception, pragmatic aspects of language	Language production in the absence of left hemisphere

3.2 Language areas

Cortical Stimulation Mapping is a procedure helped to analyze speech related regions in the brain. There are 52 areas that are identified per Brodmann. The most important areas that participate in language learning among the 52 Broadmann areas are Area-1, Area-17, Area-18, Area-19, Area-22, Area-39, Area-40, and Area-41. Area-17 is useful to take the visual input. Area-18 is beneficial to interpret meaning of images that are being seen. Area-19 grasps the inputs directly from the retina part of the eye and Area-22 is the area that aids in language processing. Area-39 assists in transferring the visual information to Wernicke's area, whereas Area-40 is the area that monitors in Reading. Likewise, it guides in comprehending meaning of reading and to understand the phonology of it. Area-41 is very valuable as it is able to espy the physical properties of a sound from where it has come.

3.3 Neural networks in the brain

Edelmann derived an information about neurons that there are 100 billion neurons can make connections with 20000 other neurons. The average number of neurons is same for everyone, as babies born with the same number of neurons. Glial cells are the cells along with the neurons that aid in nourishing and cleanliness of neurons. Kuniz, 1999 explained that these Glial cells contained hair like structures which are called as fibers help in the motion of neurons in the brain.

Gopnik and Kuhl, 1999 revealed that the pre-school children's brains are more active than adults. The cerebral cortex of the human brain contains Area-17, Area-22 and Wernicke's area with Area-39 & Area-40. Wernicke's area is responsible for pronunciation of words and syllables. One of the areas of the brain is Area-17 is the part of cerebral cortex, called the visual cortex, is responsible to process the visual information. Likewise, another area of the cerebral cortex, called the auditory cortex, Area-22, is responsible for processing aural data and by being a part of the sensual scheme for listening and hearing distance, including rudimentary and advanced earshot. Language consists of two basic functions, comprehension and speaking. Comprehension is sensory / perceptual in function, and speaking is motor in function. A dual auditory pathway is the model that connects the frontal lobes to the auditory cortex, where each pathway is accountable for different linguistic roles. The two pathways are (AVS) Auditory Ventral stream and (ADS) Auditory dorsal stream. The language related functions of the brain areas and AVS, ADS streams are tabulated here.

Table-2 Functions of brain areas

Brain areas	Functions
Area -17	Visual information
Area -18	Interpretation of meaning of the images
Area -19	Receives visual input from retina
Area-17, 18&19	To read the information from the written text
Area -22	Language processing & processing aural data
Area -39	Transfers visual information from Wernicke's area
Area -40	Monitors Reading in view of comprehension & phonology
Area -41	Espy the production of sound
AVS	Recognition of sound
ADS	Localization of sound

The former is known as auditory pathway 'what', as it is responsible for the recognition of sounds and the latter is called auditory pathway 'where', as it is responsible for the localization of sounds. This dual pathway is in charge of production of speech, repetition of speech, lip-reading and phonologically working memory and long-term memory.

These two pathways first occur in the brainstem auditory nerve where an anterior branch enters anterior part of cochlear nucleus which gives auditory ventral stream. The entrance of posterior branch, into

dorsal and posterior-ventral cochlear nucleus, forms auditory dorsal system. The important part is Wernicke's area which is located in the left junction between temporal and parietal parts. This Wernicke's area welcomes words. This area projects in Broca's area, which is located in the left inferior frontal Gyrus is the word production center. Hence, language input is through Wernicke's area and output of language is through Broca's area. The anatomical and lesion studies revealed that the two auditory fields, the anterior and posterior are separated with the projection of the anterior associative auditory field areas into anterior primary auditory field areas. Also, the posterior primary auditory field area separated into posterior associative auditory field areas. Though the study of Elman et al., 1997, (p. 340) details the brain acts as a 'whole entity' in almost all the higher vertebrates like human beings, however, the brain has specific regions for specific functions. Some of the functions of the cortical lobes that are associated directly or indirectly with the SLLP are tabulated.

Table-3 Functions of cortical lobes

Cortical lobes	Functions
Lobes	Coordination of cognitive skills, plans implementations, actions, evaluations, empathy, altruism, empathy, altruism
Temporal lobe	Hearing the language, auditory memory
Frontal lobes	Reasoning and planning
Posterior lobes	Vision
Inferior Parietal Lobule	Speech interference which results in speech errors.
Cortex	Cognition
Parietal lobes (sensory cortex)	Touch sensation, pain, temperature, speech, special orientation, speech, visual perception
Occipital lobes-visual cortex	Visual stimuli
Cortical system	Language & actions
Pre-frontal Cortex	Forming goals, forming objectives, devising plans of action
Lateral Occipital Cortex	Object recognition
Lateral Prefrontal Cortex	Image processing, cognitive control
Frontal cortex	Problem solving

During learning, neurochemical communication is formed in the brain, in between the neurons of adjacent and distant neurons in simple and complex ways. When a learner listens to a sound brain can't differentiate the sounds, but continuous exposure makes the brain to differentiate the sounds and the sounds correspond to the words. As it is auditory, simple and complex neural connections are formed and get activated in temporal cortex of the left hemisphere and expansion takes place to further related knowledge. The early activation of neural circuits is simple and weak, whereas parallel expansion progressions are detailed. Repetition of exposure takes less input so that learners can pay attention to another input. This is the reason 'learning' needs time to form a neural network. Further, learning phonics along with the meaning is more effective than individual learning and it is the way to use simple skills in complex dealings, using higher order centers of the brain. The electro cortical stimulation studies revealed that there are some common sites for naming areas, and some specific sites where the naming was interrupted, only for one language in bilinguals.

3.4 Neuroplasticity

Gerald Edelman, 2006, described 'plasticity' as one of the essential properties of the synapse. As the learning continues brain undergoes some changes like expansion of neural networks under pressure or with efforts (Gopnik 2016: 31) which we call it as neuro-plasticity or plasticity in general, whereas Santiago Ramon Y. Cajal called it as 'synaptic connection'; these neural networks are formed by the electrical impulses created with the entrance of new information and these networks become stronger by induced learning. This synoptic formation takes place in cerebral cortex, hippocampus, cerebellum and basal ganglia. Merriam and Bierema (2014): 171-2 quoted that brain even learns during challenging situations. The difference between a child's brain and an adult's brain (Alison Gopnik, 2016) has been explained as "plasticity" in the brain, it is more in child's brain than in adult's brain. Young brain is ready to make more new and flexible connections, and these weak connections change easily and quickly during learning new information. The more the number of connections the more efficient the brain will be. In the same way, the more we use the connections for information the more retention will be. Predominantly, the language regions are Broca's area and Wernicke's area which are interlinked by means of a bundle of axons. Arcuate fasiculus and many other Cortico-cortical connections run the language and action related messages through them. Each detailed and distributed connection strengthens and speeds up by means of activated neurons and denotes a particular cortical area for every language and action process. This spread of interactive connections was called as cell or neuron or neurocognitive assemblies, by many psycholinguists. Neurotransmitters are chemical substances produced in neurons when enzyme acts on some specific substances.

The improved synaptic growth upshots the cortical expansion, that enriches the achievement of the motor skill, irrespective of any age group, Karni et al., (1995); Greenenough, Black, and Wallace, (1993). The transplantation of cortical tissue of young animals in the brain from one location to another location came out consequently the tissue acquired the functions of that area rather than its native function, Sur, Pallas, & Roe (1990) & O'Leary & Stanfield (1985). Some other language related functions of brain organs are tabulated.

Table-4 Functions of brain organs

Organs	Functions
Thalamus	Consciousness & controller of in and out messages
Amygdala	Emotional memory and stimulus appraisal
ADS	Localization of sounds, production and repetition of sounds, lip reading, long term memory and phonological working memory
Hippocampus	Motor control to memory, production of new neurons
TP-MTG	Sentence conception
Cerebral region	In charge of grammatical functions
Right cerebellum	Lexical knowledge
Olfactory bulb	Sense of smell
Neuroplasticity	Influencing learning & memory, adapt to environmental changes
Angular gyrus	Language & cognition related processes like, comprehension of metaphors,

FMRI studies among learners 'who are studying Chinese as their second language' group at Pennsylvania University attributed some facts related to learning 'words' where neural responses are observed from learning group students. Responses are observed in superior temporal gyrus and in left cerebellum, along with additional reduced neural responses in few surrounding regions. At the same time, these weren't seen in non-learners group students. Their results also disclosed more neural activations in successful learners than less successful learners. The connectivity maps drawn during FMRI studies resulted in more lines in bold activity among successful learners than less successful learners and non-learners.

3.5 Recognition of Sound

The part involved in the recognition of sound is AVS (Auditory Ventral Stream). The research study on monkey was brought into the limelight that there are more neurons in the anterior Heschl's Gyrus area than posterior Heshcl's Gyrus area which recognizes the sound. The sounds are categorized as background noise, voice, melody songs, surrounding sounds, communicative sounds without speech, and with speech. The organ, Superior Temporal Gyrus (STG) is meant for working memory in human beings. Temporal Pole (TP) and Middle Temporal Gyrus (MTG) stores semantic lexical relationships. The STG is the storage of audio-visual stuff for a long-term memory.

3.6 Recognition of Vision

Humans are able to store millions of images in visual memory and recognize a particular image from visual memory in a scan of seconds i.e. in a second, human brain allows us to scan 51,180 images, thereupon Baar's Global Workspace Theory claims for 'consciousness' that needs millions of nerve cells to run with sufficient speed.

3.7 ADS-Auditory Dorsal Stream

The ADS controls the localization of sounds, production and repetition of sounds, lip reading, long term memory and phonological working memory in human beings.

3.8 VES-Ventral Auditory Stream

The Auditory pathway is formed by a connection of the auditory cortex of auditory ventral stream with middle temporal Gyrus and temporal pole. Hence, it also connects with inferior frontal Gyrus and recognizes the sound. This pathway includes sound recognition, sentence comprehension, bilateral functioning, auditory dorsal stream, production of speech, vocal mimicry, speech monitoring, and integration of phonemes with lip moments, Phonological long-term memory, phonological working memory and evolution of language.

3.9 *Production of Speec*

Inferior Parietal Lobule (IPL) connects with speech interference which results in speech errors. This IPL electrical stimulation is a reason for the lip movements in patients.

3.10 Sentence Comprehension

The Temporal Pole (TP) and Middle Temporal Gyrus (MTG) region's trade is to find out meaning from sounds that are heard to make sentence conception. Damage of TP-MTG demonstrated, impairment in sentence comprehension. Different types of speech and language problems provide us knowledge about the spaces of language location. E.g. The people suffering from left hemisphere strokes may use nouns only. This helps in understanding that nouns and verbs located in different loci. Hence, language pathology is a realistic angle of remedial linguistics.

4. Second Language Learning Process

Broca area and Wernicke's area and the surrounding areas of brain add up meaning to the language learning processing. Though L_1 and L are different, learning pathways are same, yet they are varied quantitatively and qualitatively at some psychological processes (Mac Whinney 2004). He quoted language learning process as a unified model and is well balanced with self-organization maps. The general learning process components are 6 in number, i.e., *attention, memory, language, processing & organizing, graphomotor* (writing) and *higher order thinking. They* show up learning and offer a prospect to shoot up meta-cognition. Learning is an active process during relaxed situations and it gets interrupted during anxiety and tension.

According to Pulvemuller's (2005) study semantically related to comprehending action of some words like lick, pick and kick activate the action structure in a somatotopic way depending on the organ-action relation. For example, each body organ possesses its individual linguistic function, therefore, the systems of the cortex have their own cortical base for the language regions such as the motor cortex, pre-motor cortex

etc. The learning method of verb forms by infants show a synchronized learning of motor activity related to neural representations and repetition of this activity strengthens links of cell assemblies. Because, the action words represent body parts such as, the motor cortex with a mouth and articulators, the hemisphere with dorsolateral sites, and feet with vertex and sulcus terminalis. To further into, if the action words have a semantic association with neuro-cordial ensembles include semantically associated moments of face, hands and legs. It has been experimentally proved by Pulvemuller, using somatotopic activation of motor circuits in specific cortical areas showed response to particular information about words of body parts which are semantic though. Somatotopic outcomes reveal that the action words trigger cortico-semantic system to process action in conjunction with equivalent activation of motor cortex and other language regions, to provide necessitated meaning or perception of words.

4.1 The Oral path

Initially, oral words would pass through aural paths in area-41, i.e. primary auditory cortex, or Heschl's Gyrus and then sent to Wernicke's area. In this Wernicke's area, meanings of words are dug out. Hence the subsequent pace is to express the meanings of words that are sent through Broca's area to arcade fasciculus. Arcade fasciculus is a place where morphemes are assembled. Broca's area is accountable for the articulation of related words, thus directions from at this point passes to facial motorized neurons of brainstem through a makeover area of motor cortex, which communicates undertaking guidelines to the muscles of the face.

- Oral words-Area-41→ (auditory cortex, or Heschl's Gyrus) Wernicke's area (meaning) → Broca's area → (arcade fasciculus- morphemes assemble) → articulation → facial neurons to express

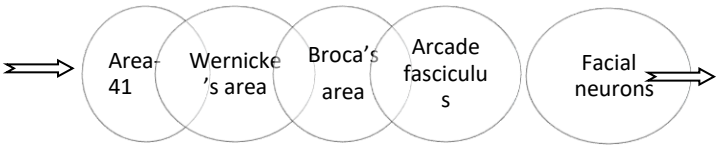

Figure-1 Oral path

Speaking perception leads to muscular articulations like signals, hand waving, gestures etc. Through cell assemblies. The amount of transmission of meaningful word context, such as critical phonemes equates a connection between intense bonds within the cortex cells, which in turn results in production of auditory responses. The articulate motor program gets activated when a sound is heard and if the sound of that word is a verb, instantly, 'thought of action' will be initiated. Tool words are the words that belong to the same subject or specific situation that show similar motor program words in a conversation of two people. Though the words are not action oriented words like verbs, they are related semantically. This semantic association and automatic sensory and motor connections aid in the learning process for better understanding.

4.2 The Reading Paths

To read an information from a written text, the visual Areas-17, 18 and Area-19 send a message to angular Gyrus, Area-39, and reaches Wernicke's area. This results in silent reading and if this direction is via Broca's area instead Wernicke's area, it results in loud reading. In addition, a study revealed that there is no problem in comprehension and speaking of English as SLA in patients with a damage in Left Angular Gyrus of Right-handed patients.

- Area-17, Area-18 and Area-19⟶(angular Gyrus, the Area-39)⟶Wernicke's area (silent reading)

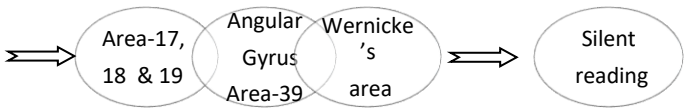

Figure-2 Silent Reading path

- Area-17, Area-18 and Area-19 - (angular Gyrus, the Area-39) - Broca's area-loud reading)

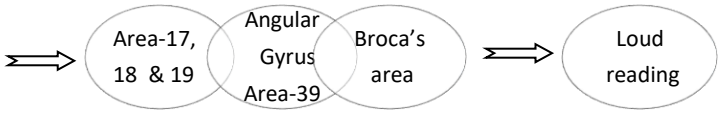

Figure-3 Loud Reading path

The axons act as output channels to transmit messages to other neuron's dendrites; hence dendrites are input channels to receive messages. The terminal portion of the axon of a neuron comes into contact with the dendrites of another neuron, which is a synapse with a small gap in between and can be scientifically termed as minuscule. Deletion of weak connections and addition of new connections is possible in synaptic pruning between 10-16 years of age. The chemical neurotransmitter, dopamine released during synapse formation onus of the minute electric nerve impulse. Broca's and Wernicke's areas are once considered as centers for language. New discoveries added some more areas such as Basal ganglia, Cerebellum etc. as they involve in actual language functions.

4.3 The auditory path

Auditory pathway constitutes many functions like sound recognition, sentence comprehension, bilateral functioning, auditory dorsal stream, production of speech, vocal mimicry, speech monitoring, and integration of phonemes with lip moments, phonological long-term working memory and evolution of language. One of the connectionist models of learning process is with neural network as it transmits information in activation from one unit to another unit in a parallel way. Whereas neural network contains numerous nodes to receive, provide and transmit information. Having the possibility, the division of nodes can be as output nodes, input nodes, and hidden nodes. Besides nodes, the neural network model comprised a network of controlling system and information in the form of activation that transmits knowledge or information. During listening, left inferior frontal cortex is active in the superior temporal areas' presence near the auditory cortex. Likewise, while speaking, superior temporal cortex is active in the presence of the inferior frontal cortex with motor, pre-motor and pre-frontal areas indicating these involve in the fabrication of sound and comprehension.

4.4 The chemistry of learning path

Sarah Jayne Blakemore stated that during learning there is a minute modification in brain structure because of changes in chemical characteristics. Synapse is the place of connection between the dendrites of two different neurons. Four ions, sodium, potassium, calcium and chloride ions are at hand, near the synapse, where positive sodium, potassium and calcium are outside the membrane of the neuron whereas the negative chloride ion is inside the membrane of neuron. This electric moment during formation of synapses releases some chemical agents from synaptic vesicles. As already discussed, these are neurotransmitters spread across the synaptic cleft and combine with receptors of message receiving dendrites of another nerve cell. A small tube-like structure is generated from receptor cells and these cells protrude into the receiver neuron membrane. These connect to a bridge that becomes a channel for 'in' and 'out' flow of ion particles. The swap over of ions between the neurons is the exact center point of learning.

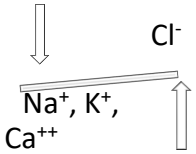

Figure-4 Centre point of learning

This tube-like bridge is like a key, and the receptors are like locks which fit intact (Susan Greenfield, 1996). As specified by Candace Pert, neurotransmitters are chemically divided into amino acids, peptides, and monoamines. One such neurotransmitter is Dopamine, which plays a role in pleasurable feelings, motivation, and moving voluntarily in a same way the Serotonin neurotransmitter aids in emotions and memory. The neurotransmitters either aid in nerve impulse formation or put off the impulse formation depending on the receptor it is going to make bond.

4.5 Hematological evidence of learning

During learning there is a change in the blood supply in neurons as neural activity becomes more. Hence, neurons need more energy to raise the rate of learning or responding. This is equally proportional to the demand of metabolic activity of cerebral area and spatial activity of the brain.

4.6 Visual perception

The location of visual perception is in the occipital lobes. Due to some important mental functioning with neuro-activity in these lobes, show the sign of availability of language functions. From the visual field, few nerve cells are able to catch red light in a single location. Brain constitutes an algorithm that represents linguistic competence as neural activities; these promotes semantics, phonology, morphology and syntax, Paradis (2004). According to N.Ellis (2005) a:314, this is similar to language major and language non-major subjects.

4.7 Automatic learning process

Language learning processing is an automatic and unconscious process, Schneider & Shiffrin, (1977). In milliseconds, the brain can receive external stimuli taken in by all the senses. Johannes Muller demonstrated that the five senses percept stimuli into the brain, hence responses are being created in brain. The brain retrieves words and sends messages to phonological encoding for phonemes. Some of the important attributes of language processing are Specializing, Fastness, Routinizing, Mandatory language process and Implicit language process strengthens automatic process. Automaticity means a subject without a goal with features of unintended, uncontrollable, speed and unconsciousness whereas non-automatic process is a replica of automatic process, but with features like intended, controllable, slow and consciousness. Irrespective of its featured properties, the automatic processing goal is competent and resourceful and non-automatic is incompetent. Statistical learning explains about a chunk of words of learning in a language. Typically, in English, most of the language trainers say learning becomes easy by learning chunks of words instead single words; it is because these chunks make the learning process easy.

5. Conclusion

Language learning is a natural happening and the brain is malleable with some important areas for specific learning. Therefore, the brain learns naturally and comes up with new findings in brain-based research over time. For instance, old brains exploit the opportunity and moves ahead quickly, whereas young brains are significant for exploration and provide solutions to experiment, Cohen *et. al.* (2007). John Dewey advised to stick to both young and old brains as they are vital for learning. The old brains are experienced to use intelligence and the youngest brains are prone to plasticity, ready for acquisition because the molecular and genetic investigations reveal the reason for individual differences. It is because of different genes that made neurons affect the brain function, as given by Ramsoy, Balsley and Paulson, (2007). In fact, though 99% of the genes are similar among individuals, 1% makes a big difference in cognition. Until recently, it was unknown that specific areas of the brain are wrought up by learning experiences. Understanding of the learning process of the brain will give a conceptual idea to the participants of educational system in order to organize the concerned resources for better comprehension. Frank Mc Neil, (2009) provided information about sorting out of things according to grouping. It is a two-step complex phenomenon of recognizing and dealing with necessary information among neurons and some other areas of the brain. Moreover, pedagogues can conceptualize the reasons behind individual differences by their learning styles. To put it in a nutshell, though the learning processes are same and natural in L_1 and L_2, it involves complex procedures to make a point of understanding to respond to an impulse with an average speed and automaticity. Emphatically, brain can manage a speed and slowness depending on implicit and explicit learning methods chosen by learners.

References

Primary resource:

Zoltan, D. 2009. The Psychology of Second Language Acquisition. Oxford University Press.

Secondary references:

Allen, B., & Kenji, H. 1966. In Other Words: Science and Psychology of Second Language Acquisition. Basic books, A Division of Harper Collins Publishers.

Elman, J., Johnson, M., Karmiloff-Smith, A., Parisi, D., & Plunkett, K., 1997. Rethinking innateness, Cambridge, MA: MIT Press.

Frank, Mc N. 2009. Learning with the Brain in Mind. Sage Publications.

Fred, C. 2005. Language in the Brain-Critical Assessments. British Library Cataloguing-in-Publication Data.

Friedemann, P. 2005, Brain Mechanisms Linking Language and Action. Nature reviews.

Gibson, E.J. 1969. *Principles of Perceptual Learning and Development.* Appleton-Century-Crofts.

Greenenough, W.T., Black, J.E., & Wallace, C.S. 1993. Experience and brain development. In M. Johnson (Ed.), Brain development and cognition: A reader (pp. 290-322). Oxford: Blackwell.

Hans, J., (2017). Entrenchment and the Psychology of Language Learning. United Book Press, Baltimore, MD.

Karni, A., Meyer, G., Jezzard, P., Adams, M., Turner, R., & Ungerleider, L. (1995). Functional MRI Evidence for Adult Motor Cortex Plasticity during Motor Skill Learning. Nature-377, 155-58).

Kees, D., Wander, L., & Marjolyn, V., (2004). Second Language Acquisition: Ad Advanced Resource Book.

Routledge, Taylor & Francis Group, London and New York.

Marilee, S. 1999. Learning and Memory: The Brain in Action. ASCD Publications, USA.

Mary, F., Bloom's Taxonomy- An Emerging Perspectives on Learning, Teaching and Technology. The University of Georgia.

Nadja, E., 2015. Towards a Theory of Epistemically Significant Perception: How We Relate to .... Library of Congress Cataloging-in publication data, Germany.

O'Leary, D.D., & Stanfield, B.B. 1985. Occipital cortical neurons with transient pyramidal tract axons extend and maintain collaterals to subcortical but not intracortical targets. Brain Research, 336, 326-333.

Thomas, A., Thorne, G., Small, R., DiSanti, P., & Lawson, C., 1998. *MINDWORKS! …and How mine works*. Covington, LA: Center for Development and Learning.Thomas, A., & Thorne, G., 2008.

Higher order thinking, Metairie, LA: Center for Development and Learning. Thorne, G., & Thomas, A., 2008.

Memory: How it works and how to improve it. Metairie, LA: Center for Development and Learning. Vail, P. 1994. *Emotion: The on/off switch for learning.* Rosemont, NJ: Modern Learning Press.

Robertson, K., Ford, K. 2007. Language Acquisition: An Overview. Retrieved from Color in Colorado on (16/4/2020) http://www.colorincolorado.org/article/26751

https://en.wikipedia.org/wiki/Human_brain as of 14/3/2020

https://www.indeed.com/career-advice/career-development/kinesthetic-learning as of 19/3/2020

https://doi.org/10.3389/fpsyg.2014.01219 as of 23/3/2020

https://www.simplypsychology.org/vygotsky.html#:~:text=Vygotsky's%20theories%20stress%20the%20fundamental,process%20of%20%22making%20meaning.%22&text=Vygotsky%20has%20developed%20a%20sociocultural%20approach%20to%20cognitive%20development. as of 9/4/2020

https://www.colorincolorado.org/article/language-acquisition-overview as of 7/4/2020

https://www.forbes.com/sites/bryanrobinson/2020/07/19/neuroscientists-discover-each-of-us-has-a-distinct-brain-signature-could-it-be-used-to-predict-your-job-potential/#70f45a9c72b4 as of 7/4/2020