

Molecular Studies to Understand Brain Networking in Linguistic, Cognition and Emotions: Current and Future Challenges.

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Abstract

Bilingual language process is a key factor in left side of the brain. The cognition of the learning modalities is very crucial for assimilation, organization, and interpretation of knowledge. The neurochemical events like estrogen, testosterone, dopamine 5HT, Oxytocin, nerve growth factor (NGF) play as neuro-endocrine brain axis for learning to cognition. The human cognition recognises the language in five stages that is input, status of language, getting access over the literature of that language, interaction with family, and finally social network communication. The factors influence the bilingual aspects include language exposure, genes, perception and receiving, neurochemical pathways, social communication, and environmental conditions. Apart from these elements the other external influencing factors like health humanities and technological advances and make a lot of impact on cognition processes and mental health.

Key words: Human Brain, Language, Alertness, Orientation, Cognition, Clinical Factors, Neurochemicals, Networking

Introduction

Brain is a unique organ in the body controlling all body functions and providing holistic functional efficiency coordinating human

brain to body. The brain weighs 1.5 Kgs. and contains trillions of neurons with high interconnectivity leading to the efficient biological function. Healthy ageing of brain is a crucial biological phenomenon and understanding of healthy ageing still an open challenge. Any alterations in neurological integrity leads to brain disorders like cognitive deterioration, memory loss, movement disorders, loss of emotions and body coordination (1). Currently, 55million people are affected by brain disorders and by 2050 this number touches 155 million. The lack of early bio markers, cognitive and movement disorders disturbances are the critical challenges in the neurology clinics. The present paper highlights molecular understanding of brain and cognition and language interlinking leading to mental health.

The complexity of brain language

Language is a cognitive process in which brain involves and evolves while using. Language is a process involves brain include frontal, temporal and parietal lobes, and some posterior regions (1). Brain involvement and influence in using language as the brain centres express and increase extensively during the process of communication. This mechanism of language differs with second language as brain centres function differently while using a native language and executing a target language.

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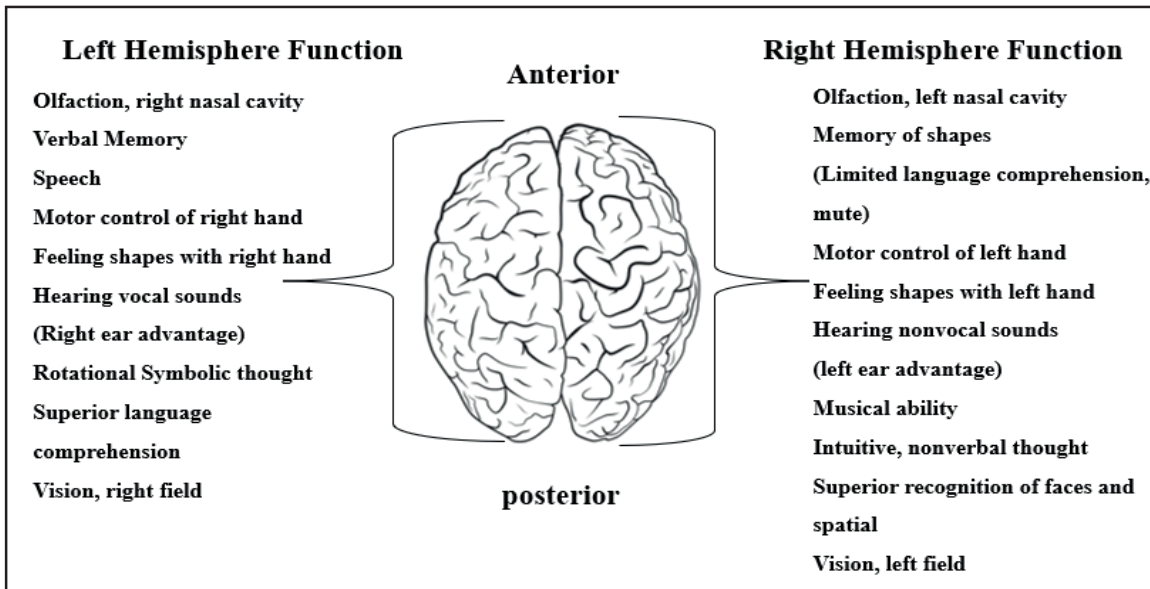


Figure 1: Function of Left and Right Hemisphere Brain

The above picture (Fig 1) replicates the brain and how the cognitive analysis take part. On the right side of the brain, the study, logic, and aptitude make brain receive the signals through study or observation thinks logically based on the aptitude calculations which memorizes on the left part of the brain it is shown in the picture which together forms the cognitive analytical process of brain function.

However, cognitive process of usage of language is synchronized with nonverbal patterns which strengthens and give emphasis to the communication. The language includes non-verbal which strengthens the communication (2). The process of neuro imaging enhances and supports the nonverbal patterns during the process of speaking and communicating. The context-based communication in expressions, the process of neuro imaging plays pivotal role to decode the message effectively. Hence, the cognitive outcomes of the bilingual concept are based on brain and its functions, exclusively the three active parts alertness, orientation, and detection of that language. This paper throws light on how these three patterns function in brain while using second language in expressing the thoughts to others effectively (3).

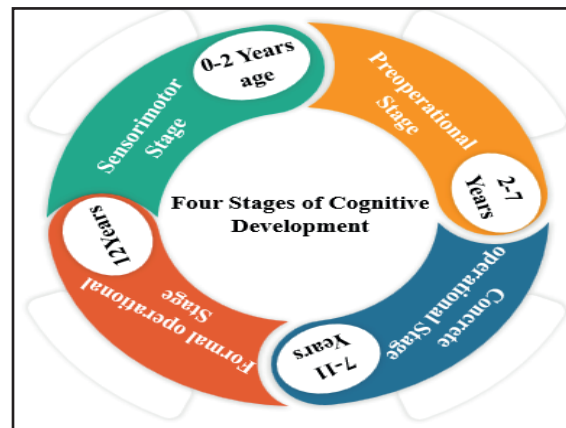


Figure 2: Developmental Stages of Cognitive Development

The above picture (Fig 2) connects with the cognitive process development once after its evolvement which is divided into four parts which finally leads to sensory motor where the destination of cognitive development of language understanding takes place based on the environment created amidst to them.

The early studies indicate that the anxiety and apprehension levels are high while using second language exclusively when compared it

with the native language (4). The process of using second language includes three main stages. The first stage is the influence of language, and the second stage is the execution of that and the third is contextual understanding and reproducing it in the second language accordingly. These three patterns influence, execution of language and contextual replica in expressions are the major mechanisms to emphasize on to avoid apprehensions using second language (5).

The major controlling power of fear while expressing thoughts during communication process is nothing but brain. As the process of cognitive analysis during the reciprocation takes place in brain, the understanding of brain patterns, controlling of brain and counselling of modules in brain are needed to avoid such challenges in using second language. While executing the bilingual language, the phobia, fear, and inhibitions in communication during the process of cognitive analysis there are mainly controlling processes involve in implications (6). As per the research studies till date, there are no authentic or concrete reasons found for the cause of fear, phobia and inhibitions in using of second language in public (7-10). The inhibitory controlling models to avoid anxiety while speaking in second language through the interferences phase in brain patterns. The second language usage in communication lead to many distractions in the adaptation of language. The configuration process in brain patterns while using when second language is used by the speaker as the two languages to be composed and executed at a time. The amalgamation process during the conversion of the context from understanding in native language to second language includes a major cognitive analytical process in brain patterns. The major challenge takes place in this due process. There is still a lot of research going on where the researchers are finding out the concrete and abstract reasons behind it.

As per the research done in the process of second language speaking, execution and challenges, the research says that the cognitive

challenges are not similar in all age groups, as it differs based on gender, age, intelligence, socio-economic status as well. The notion that bilingualism could have generalized consequences for nonverbal cognitive ability originated in research in human beings. There is a belief that bilingualism was detrimental for intelligence reported better performance by bilingual children than monolinguals on both verbal and nonverbal tasks.

As per the research done by the Hakuta *et al*, (11) the major challenges in using of second language without phobia, inhibitions and fear has become the need of the hour. Though the cognitive neuroscience has augmented the neurological challenges and problems of the usage of second language, still many more to be known which are prevailing in usage of second language by the native language speakers. The reason behind this is the process of mono lingual pattern in brain is different from bilingual usage as there are three factors influence the brain, they are alertness, orientation, and detection. These three are to be more activated through Inhibitory Control Model control in brain to face the challenges while using the second language eloquently without fear and inhibitions.

Hormones cognitive networking

Brain is a hall mark centre for neuron endocrine centre controlling many biological functions. The brain endocrine access links holistic cognitive networking. The following figure 3 highlights the role of thyroxin which takes care of mental health all the life. While Dopamine enhances memory circuits, emotions and decision making while love hormone oxytocin controls social cognition. The estragon influences the brain integrity while progesterone, enhances memory and testosterone enhances the function of cognitive through NGF. There is still lot of debate on role of endocrines in cognitive networking as the detailed mechanism is not still clear (12)

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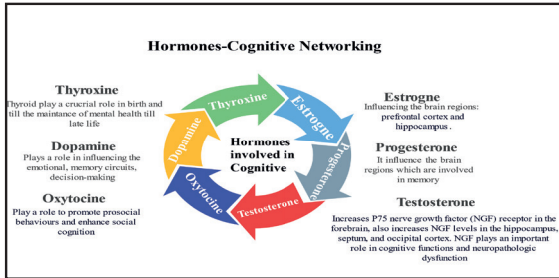


Figure 3: Hormone-cognitive networking in the brain

The brain cognitive process patterns

The constant effort and control over the cognitive process while using the bilingual languages can be made by overcoming through Inhibitory Control Model control in brain. It is observed by the researchers that while using the second language by native speakers, the situations, responses, reactions are similar in both languages while presenting, explaining, and writing as well while speaking. However, the nonverbal signs are additional points to the expressions (13). However, the inhibitions are similar in using the second language in all speakers however, the inhibitory control systems can be overcome with the assistance of pictures, contextual points, and appropriate representation. Inhibitory Control Model (Mechanism for Bilingual Effects) in which it was argued that bilingual language processing was based on an attention system, the Supervisory Attention System that inhibited the unwanted language so that processing could proceed in the target language (14).

The controlling process for Inhibitory Controls in brain play key role in second language (15). To avoid the interference of the other languages while using the second language, there should be a strong cognitive control system is a pre-requisite, which leads to attention, mental configuration while proceeding to bilingual communication. It is also observed that these control systems vary and differ based on socio linguistic, socio economic intelligent quotient levels and so on. The major effect of using multi languages is flexibility, switching over and monitoring (16).

The process of magneto encephalography

The measurement of the magnetic field produced by neuronal electrical activity is known as magneto encephalography, or MEG. The main application of MEG is as a non-invasive tool that uses suitable source localization techniques to identify the epileptic focus by detecting interictal epileptic discharges such as spikes (17). While scalp EEG is sensitive to electrical fields produced by extracellular currents, MEG predominantly detects the magnetic fields induced by intracellular currents. Currently, MEG is approved for usage in two situations: pre-operative brain mapping and epilepsy surgery.

By applying signal processing and source reconstruction algorithms to MEG sensor data, brain imaging with MEG sensor data is made possible (18). This results in highly dynamic maps of brain activation across a wide range of neural oscillatory frequencies with a high degree of spatiotemporal precision that is not possible with other imaging techniques. Across widely dispersed brain areas, this imaging method is perfectly adapted to monitor dynamic neuronal activity and simultaneously characterize their interconnections (19-20).

MEG systems to measure brain signals is the process of isolating miniscule brain-related signals from the massively greater signals from outside the brain. Thus, MEG has required the development of very exquisitely sensitive sensors, filtering, and a method to shield the sensors from recording outside noise (20).

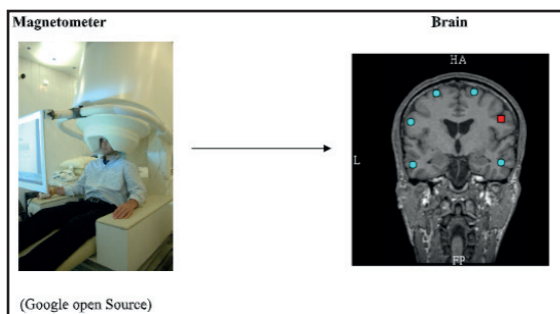


Figure 4: Magneto encephalography and its analysis.

The patient lies inside the scanner (Fig 4), which is equipped with a few insulated sensors. Ionic currents that are passing through the dendrites are the source of the signals (bottom). There is no detectable field produced by action potentials (21). The magnetometer displays the brain cross sectional image with detailed features of the brain (22-25).

Risk Factors Influence Cognitive Functionalities/Function

Cognition is a crucial parameter in brain function. There are number factors influences brain-cognition axis. Fig 5 indicates the role of clinical parameters like sugar, hypertension, high lipids etc play a key role in modulating cognition integrity in brain. Cognitive disorders are crucial in diabetes, hypertension etc in age and related disorders. The cognitive integrity and functionality are also influenced by neurochemical, Psychological and these factors cause changes in neural networking leading to changes in memory and cognition and finally influencing mental health as represented in Fig 6. The psychologies and psychiatrists are trained to use counselling using the factors influencing cognition as a source in their therapeutic modalities. As presented in Figure brain and cognition is influenced by multi factorial and the complex biological to environmental to sociological hence, the complex aetiology is still not clear for cognition.

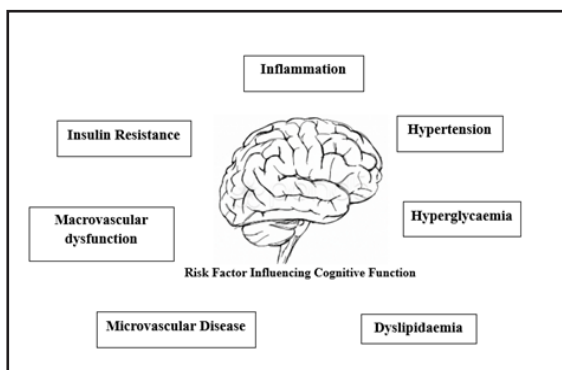


Figure 5: Clinical risk factors for cognitive dysfunctions

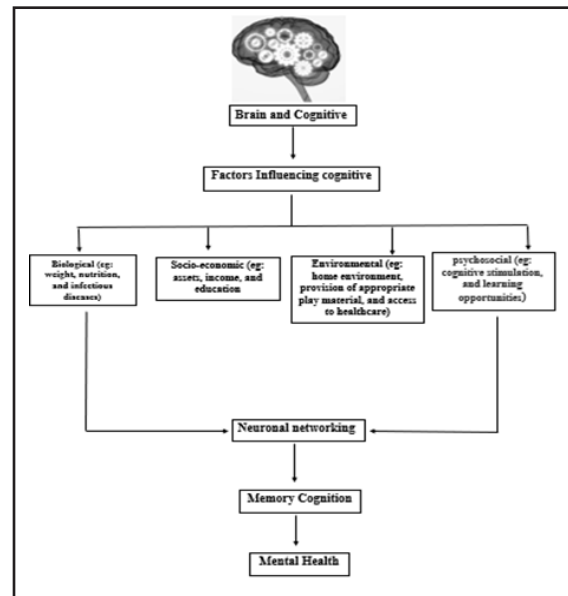


Figure 6: Factors Influence cognitive function.

Conclusion

Human brain is overwhelmed with abundant cognitive thoughts with innumerable wave patterns. Second language acquisition is purely a cognitive approach which needs a lot of attentiveness and alertness while using it. The deviations which happen in brain in using the second language can be controlled through the alertness, orientation and detection which is already proved by Russell and team in their research. Further research how the Inhibitory control model is developed and how the brain patterns recognised, reorganized, and restructured to overcome the inhibitions to be done in detail in further research.

Future Challenges

The studies highlighted very complex challenges in understanding brain and cognition and also focussing on mental health challenges in brain like autism, speech problem, language assimilation, and memory challenges etc., currently, scientists trying to understand from the basics to clinics to face the clinical challenges in cognitive disorders. People also looking at new concepts like artificial intelligence, deep

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brain stimulations, regenerative medicine computational aided learning etc., (29-31). It is also necessary to understand the total architectural and functional entity of the brain with reference to regions involved in cognitive networking and this may help for cognitive understanding and resolving issues in near future.

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