



Brain to Mind - A Journey

Mukundan CR^{1*}, Sharma S² and Mukundan C³

¹Chairman, Axxonet Research Laboratory, India

²CTO, Axxonet Research Laboratory, India

³Director, Axxonet Research Laboratory, India

***Corresponding author:** Mukundan CR, Axxonet Research Laboratory, Axxonet System Technologies, Bengaluru, India, Email: crmukundan@gmail.com

Received Date: August 16, 2024; **Published Date:** September 03, 2024

Abstract

This study explores the intricate relationship between the brain and mind, proposing a conceptualisation of mental processes as functional states of brain cells. Through a comprehensive review of neurobiological, cognitive, and psychological research, we investigate the mechanisms underlying self-awareness, neural encoding, and information management within the brain. The paper examines the interplay between cognitive processes and emotional responses, emphasizing the role of emotional arousal in shaping behaviour and memory formation. We analyse the formation of self-image, the development of language skills, and the perception of time and space as crucial components of human cognition. The paper also delves into the influence of faith and belief systems on individual and societal behaviour and explores the neuroanatomical correlates of various mental processes. We investigate the phenomenon of "neural hijacking" and its implications for impulsive behaviours. The research highlights the importance of social conditioning in developing cortical controls and shaping societal norms. We examine the human brain's potential for developing mental strength and creative capabilities, while also addressing the misuse of spiritual beliefs in justifying aggressive actions. Finally, the study touches upon cognitive changes associated with aging and their philosophical implications on mortality. This multifaceted exploration of the brain-mind relationship tries to contribute to our understanding of human cognition, emotion, and behaviour, with potential applications in neuroscience, psychology, and social policy. .

Keywords: Brain-Mind Relationship; Cognitive Processes; Neural Encoding Self-Awareness; Social Conditioning; Mental Strength; Neural Hijacking; Language Acquisition; Cognitive Aging; Emotional Intelligence; Neuroplasticity

Abbreviations

ACC: Anterior Cingulate Cortex; ARAS: Ascending Reticular Activating System.

Introduction

There is an intricate relationship between the brain and mind, especially the genesis of mental processes and their

neurobiological underpinnings. This paper builds upon previous works, exploring the mind-body relationship and the functional aspects of cognitive processes. A core premise is the conceptualization of the mind as a functional state of brain cells, challenging traditional notions of the mind as an independent entity. This perspective offers a more integrated understanding of mental processes and their neurological basis. The exploration of how the mind becomes aware of its own processes, and how this self-awareness enables control

over bodily actions and responses to external stimuli. The mechanisms by which brain cells encode, process, and store information, and how this stored information is utilized in initiating and executing responses is of great interest. The role of awareness in interpreting both retrieved signals and current sensory input, and how this contributes to the perception of reality. Furthermore, we explore the interplay between emotional effects and cognitive processes, on how emotional arousal influences actions and memory recall.

This paper uses a multidisciplinary approach, integrating findings from neurobiology, cognitive science, and psychological research. By providing a comprehensive understanding of the mind as a product of brain function, this paper aims to contribute to both theoretical frameworks and practical applications in fields such as neurology, psychology, and artificial intelligence. The research includes areas of brain-mind relationships, cognitive and emotional functions, self-image formation, perception of time and space, and the role of faith and belief in shaping human behaviour and societal structures.

Brain-Mind Relationship

There is an intricate relationship between the brain and mind, proposing a novel conceptualization of mental processes. We propose that the mind is fundamentally a functional state of brain cells, challenging the traditional view of mind as an independent entity. This perspective offers a more integrated understanding of mental processes and their neurological underpinnings. A key feature of this brain-mind relationship is the mind's capacity for self-awareness. The mind can become aware of its own processes, a capability that emerges from the complex interactions of neural networks. This self-awareness is not merely a passive phenomenon but serves as a control mechanism, enabling the mind to regulate bodily actions and responses to external stimuli. Furthermore, this awareness allows for anticipatory functions, where the mind can react to events that one may experience or anticipate occurring. An important part of this relationship is the process of neural encoding and information management within the brain. Brain cells encode all received input signals, utilizing familiar neural pathways and linguistic structures. This encoding process involves the assignment of meanings to inputs, followed by the storage of processed information within selected brain cells. The stored and online information serves multiple purposes, including response initiation, action execution, and memory formation. All these processes are stored for later retrieval, contributing to the continuity of mental experiences.

A crucial aspect of the brain-mind relationship is the role of awareness in perception and cognition. Two key areas of awareness are: the awareness of retrieved signals and the

awareness of signals being detected by the sensory system. These aspects of awareness contribute significantly to the acceptance of signals as representations of real objects in the world, and whether the signals are being directly perceived or being retrieved from memory. This conceptualization of the brain-mind relationship provides a foundation for understanding how the brain creates and manages mental processes. It sets the stage for more detailed explorations of cognitive functions, emotional responses, and the complex interplay between neural activity and subjective experience. An integrated view of brain and mind could have significant implications for our understanding of consciousness, cognition, and behavior.

Cognitive and Emotional Functions

There is an intricate interplay between cognitive processes and emotional responses in the human brain, directly controlled and affected by the mechanisms by which the brain encodes, processes, and utilizes information, as well as the role of emotional arousal in shaping behaviour and memory. It is known that the brain encodes all input signals received through sensory channels, utilizing familiar neural pathways and linguistic structures. These encoded signals are then assigned meanings and stored within selected brain cells in different parts of the brain. This stored information, along with real-time sensory input, forms the basis for initiating and executing responses. The research emphasizes that awareness of both retrieved signals and current sensory input contributes to the perception of real objects in the world. The frequent induction of emotional effects by input signals, can lead to the execution of actions or trigger certain behaviours. Emotional experiences have been observed to trigger the recall of original incidents, including their temporal and spatial sequences. This phenomenon highlights the interconnectedness of emotional and cognitive processes in the brain.

Unique mental states arise from the integration of cognitive and emotional responses. These states are characterized by distinct functions that modulate the drive in specific brain areas. Individuals make self-estimates of these inputs, which are experienced as emotional arousal. A minimum level of emotional arousal is necessary for the initiation and continuation of any related action or response. Emotional arousal, combined with personal experiences and stored information, contributes significantly to the creation of an individual's self-image. The role of language acquisition in cognitive and emotional development is critical as individuals learn languages to express themselves, communicate their experiences, and articulate desired outcomes and planned predictions. People develop skills for documenting ideas to facilitate communication with others. There is a complex relationship between cognitive processes and emotional responses, and the interaction between the two shape

perception, behaviour, memory, and self-image, providing a comprehensive view of the brain's role in creating and managing mental processes.

Self-Image and Communication

The formation of self-image and the development of communication skills are integral aspects of cognitive and emotional functioning. There are intricate processes involved in self-image construction and the role of language in expressing and sharing individual experiences. Self-image emerges as a complex construct, shaped by the interplay of emotional arousal and personal experiences. Emotional responses elicited by various stimuli, combined with the information acquired and stored within the brain, contribute significantly to the creation of an individual's self-concept. This self-image becomes the foundation upon which the individual identifies as "self" or "I" in all interactions with others, forming a crucial component of social cognition. Language acquisition plays a pivotal role in the expression of self and the communication of experiences. Individuals learn languages primarily to articulate their personal experiences and convey their understanding of the world to others. This linguistic capability extends beyond mere description, allowing for the expression of desired outcomes and planned predictions. Such predictive articulation demonstrates the sophisticated cognitive processes underlying human communication. The development of documentation skills is an essential aspect of communication. Individuals cultivate the ability to record their ideas, a process that facilitates more effective communication with others. This skill of documenting thoughts and experiences contributes to the preservation and transmission of knowledge, both on an individual and societal level.

An important cognitive function closely associated with Language and communication, and our ability to document things, is the ability to detect and resolve relationships between events across time and space. The mind demonstrates remarkable capabilities in determining temporal differences between events and comprehending spatial relationships between different points. This cognitive skill is fundamental to the organization of experiences and the formation of a coherent narrative of one's life and environment. There are complex processes involved in self-image formation and are strongly influenced by language and communication skills, and in expressing and sharing individual experiences and ideas. The intricate relationship between cognitive processes, emotional experiences, and social interactions shapes an individual's sense of self and their ability to communicate effectively with others.

Time and Space Perception

Cognitive processes are involved in perceiving and understanding temporal and spatial relationships. This

aspect of mental function plays a crucial role in how individuals interpret and interact with their environment. The mind's capacity and cognitive ability to detect and resolve relationships between events and objects across time and space, allows individuals to mentally plan and determine time differences between events and spatial points, thus allowing us to function as a society and interact and collaborate with each other. There are standardised global measurements for time and space. These scales, mentally planned and agreed upon by individuals, provide a systematic framework for measuring and materially displaying temporal and spatial relationships. These standardised scales are not arbitrary constructs but are systematically or scientifically determined and materially displayed. This enables consistent measurement, shared understanding and communication of temporal and spatial concepts across different contexts and cultures. The difference between two events or spatial points may be determined through either experiential or objective means. When temporal or spatial relationships are established through personal experience, research emphasizes the importance of trust in one's own perceptions. Each experience is personally encountered and acquired, leading to the development of faith in these experiences. This faith allows individuals to accept their perceptions as representations of real occurrences, which in turn cause subjective effects.

This faith or belief in personal experiences becomes a strong method of accepting and interpreting events. Once an individual develops faith in a particular experience, they generally do not question its authenticity. This acceptance extends to the associated emotional effects, which may partially recur whenever the person recalls the experience. There is a complex cognitive interplay between objective measurement and subjective experience in the perception of time and space. It suggests that our understanding of temporal and spatial relationships is not solely based on physical reality but is significantly influenced by cognitive processes and personal experiences. This has direct implications on various fields, including psychology, neuroscience, and philosophy. It affects how individuals construct their understanding of reality and how this understanding influences behaviour and decision-making. There are neural mechanisms underlying these perceptual processes and provides pathways to applications in areas such as education and cognitive therapy.

Faith and Belief

Human cognition has historically been affected by faith, and belief systems. Faith emerges as a complex mental construct, developed through reasoning and the amalgamation of positive concepts and perceived divine attributes. This mental state, while not empirically verifiable through

physical or scientific methods, serves as a potent emotional force within individuals. The cognitive processes influenced by faith function as a significant source of personal strength, supporting individual actions and responses in various life situations. Notably, people often invest substantial personal resources in this mental force, dedicating their capabilities to its cultivation and maintenance. This investment in faith creates a self-reinforcing cycle, where the belief in an infinite strength becomes a wellspring of immense personal power. An aspect of faith is its tendency to manifest as a physical or spiritual entity in the human mind. This phenomenon is observed across cultures, where individuals create a tangible presence for the abstract source of their faith. This manifestation of faith as a spiritual entity represents a significant part of human cognition, demonstrating the mind's capacity to bridge the abstract and the concrete.

Often faith influences life structuring and goal setting. Individuals often organize their activities around these spiritual forces, deriving spiritual goals that provide direction and purpose to their lives. This spiritual framework serves as a coping mechanism, enabling individuals to confront life's complexities with enhanced resilience and positivity. The cognitive processes involved in worship and spiritual requires significant mental engagement. This engagement potentially yields personal gratification and psychological support, contributing to an individual's overall well-being. The intergenerational transmission of faith and belief systems is another crucial aspect explored in the study. It suggests that people shape their living patterns based on their beliefs, potentially transferring strong life habits to subsequent generations. This process influences patterns of social interaction and contributes to the perpetuation of belief systems across time. There is an important role of faith and belief systems in shaping individual psychology and societal structures. It underscores the profound impact of these mental constructs on personal strength, life structuring, and intergenerational continuity, offering a nuanced understanding of the human cognitive landscape.

Neuroanatomical Correlates

Decades of extensive research into the cognitive and emotional capabilities of the brain, identifying specific brain structures that contribute to various functional states. Neuroanatomical correlates of mental processes provide insights into the complex interplay between different brain regions in generating cognitive and emotional responses. Mukundan CR, et al. [1,2] highlighted the role of the medial parts of the cerebral cortex in generating arousal and drive. Specifically, they identified the Anterior Cingulate Cortex (ACC), located above the corpus callosum, as a key structure in this process. The interconnection of the two cerebral hemispheres through the ACC has been recognized as a

significant contributor to such experiences. The Ascending Reticular Activating System (ARAS), situated in the brainstem area, plays a crucial role in arousal and awareness functions of the brain. As demonstrated by Moruzzi G, et al. [3], the ARAS maintains connections with both cortical and subcortical areas, facilitating its influence on overall brain activation.

Cortical areas primarily support neurocognitive processes, as evidenced by the works of Luria AR [4,5] and Teuber HL [6,7]. Further research by Petrides M, et al. [8] and Petrides M, et al. [9] has expanded our understanding of these cortical functions. Concurrently, the limbic system, with its intricate connectivity, underpins emotional arousal and responses, as elucidated by Cummings JL [10] and Hayden BY, et al. [11]. Motor programming and movements are associated with the basal ganglia and its connections, was demonstrated by Alexander GE, et al. [12,13]. These researchers also revealed that neurocognitive control functions are carried out by thalamocortical systems, which connect the thalamus with various prefrontal areas through the basal ganglia, forming distinct functional systems. The neurocognitive functions encompass multiple levels of processing. At the reception level, they include sensory reception, attentional processing, and working memory, as explored by Pribram KH, et al. [14] and Salmon E, et al. [15]. At the interpretation level, these functions are associated with anticipation, perceptual processing related to mental imagery creation, and perceptual integration. Motor-level functions include motor programming and executions with autobiographic and episodic memories. Ultimately, this processing leads to encoding and transcoding necessary for awareness and language-based communication, as discussed by Mukundan CR, et al. [16]. Numerous research studies conducted in recent years have further illuminated the significant neurocognitive, emotional, and motor execution processes within the brain's networks. Of particular interest has been the execution of aggressive behaviour, which involves complex interactions between various brain regions. This understanding of neuroanatomical correlates provides a solid foundation for exploring the intricate relationship between brain structure and function, offering valuable insights into the neural basis of cognition, emotion, and behaviour [17-19].

Neural Hijacking

The concept of "neural hijacking" provides crucial insights into the complex interplay between subcortical and cortical processes in response to sensory inputs. This phenomenon, first identified by researchers such as Goleman D [20] and LeDoux J [21-24], occurs when sensory inputs bypass cortical evaluation, leading to immediate responses without proper judgment. In the normal course of information processing, sensory inputs pass through the thalamus in the subcortical

area before reaching the orbitofrontal, anterior cingulate, and temporal cortices. These cortical regions typically work on the sensations to decide appropriate responses after considering the context and meaning of the input signals. However, in cases of neural hijacking, this cortical evaluation is bypassed. The “fight and flight” response observed in intense emotional reactions exemplifies this process. Goleman D [20] termed this phenomenon “amygdala hijacking,” while LeDoux J [21-244] referred to it as “neural hijack.” In such instances, input signals are not evaluated for appropriateness or justification of response at the cortical levels. Instead, when input signals are reacted to at the thalamic or amygdala levels, decisions occur without considering the justification of such reactions. It is important to note that the co-activation of both subcortical and cortical systems is typically required for day-to-day activities. These systems develop their controls in individuals through social conditioning during early years of development and growth. The socially accepted cortical controls of behaviour or responses must develop during early social conditioning as the child grows.

The functional capability for peaceful and positive control of behaviour develops through cortical controls. However, when the thalamus-amygdala directly activates motor responses, bypassing cortical evaluation, it results in neural hijacking. This process can lead to impulsive or inappropriate behaviours that may not align with social norms or individual long-term goals. The study of neural hijacking has significant implications for understanding human behaviour, particularly in situations of high emotional arousal. It underscores the importance of developing strong cortical control mechanisms through appropriate social conditioning. Further research in this area could potentially inform strategies for improving emotional regulation and decision-making processes in various contexts, from individual therapy to societal interventions.

Social Conditioning

Social conditioning emerges as a critical stage in individual development, playing a pivotal role in shaping behaviour and societal norms. This process, which occurs during the formative years of both children and adults, is essential for the development of cortical control functions that enable socially acceptable responses to various stimuli. Social conditioning is intrinsically linked to the development of belief systems and faith in society. These mental states allow individuals to act in accordance with societal norms, contributing to the collective happiness and satisfaction of community members. The process of social conditioning is complex, involving the development of ideologies that promote prosocial behaviours while discouraging violence. A key aspect of social conditioning is its influence on the

development of cortical controls. These controls are crucial for the regulation of emotional responses and the execution of socially appropriate behaviour. The absence of proper social conditioning can lead to a lack of these cortical controls, potentially resulting in antisocial behaviour, including extreme manifestations such as terrorist activities.

Research and studies emphasize that social conditioning is not a passive process but rather an active engagement with complex ideologies developed for the benefit of society. These ideologies typically encourage the display of affection and care for others while promoting non-violent interactions. The internalization of these values during early developmental stages is crucial for the formation of a functional capability for peaceful and positive behavioural control. Social conditioning plays an important role in shaping individual value systems. These systems, developed during the early years of growth, influence how individuals respond to external stimuli, evaluate themselves, and interpret their experiences. These early-formed value systems often guide individuals in handling external challenges throughout their lives. There is great potential for social conditioning to foster love and empathy towards others. This aspect of social conditioning is noted to provide individuals with significant personal strength, often manifesting in self-suggestions related to personal fulfilment that become highly acceptable to the individual.

Social conditioning emerges as a fundamental process in human development, crucial for the formation of socially adaptive behaviour and the cultivation of prosocial values. Its impact extends beyond individual development, playing a significant role in shaping societal norms and promoting harmonious social interactions. Further research could provide valuable insights into improving social conditioning methods to foster more cohesive and empathetic communities.

Mental Strength and Creative Capabilities

The human brain demonstrates remarkable potential for developing mental strength and creative capabilities, and each individual cultivates these abilities in their own way, and it has a profound impact on both personal and societal development. Research indicates that the human brain possesses an immense capacity to mould emotional effects and create superior mental states that transcend physical limitations. This ability enables individuals to channel mental faculties towards an inner force, which serves as a source of personal strength and resilience. A key aspect of mental strength development is the accumulation of self-induced suggestions. The human mind can gather and reinforce these suggestions over time, ultimately leading to the creation of vivid mental images using neural systems.

This process results in a powerful mental state where individuals internalize strength from various sources, both real and conceptual.

Complex mental and structural methods can be used for strengthening mental forces. These methods become significant sources of emotional and intellectual interest, contributing to the overall cognitive development of individuals. The mental strength achieved through personal beliefs and practices aids in the acquisition of extensive mental capabilities, which in turn help individuals structure and shape their lives. Spiritual or divine beliefs also play an important role in fostering mental strength. Individuals who engage in such practices often experience extensive and intense mental development, enriching their personal experiences and enhancing their ability to face life's complexities. The concept of divine strength, when internalized, becomes a powerful tool for navigating challenging situations. The human mind's potential to create mental images and accept mental strength from various sources is particularly noteworthy. This capability allows individuals to transcend physical limitations and achieve states of consciousness that contribute to personal growth and creativity. Often eminent individuals with extensive mental or physical abilities serve as sources of encouragement for younger generations. This intergenerational transfer of knowledge and capabilities plays a crucial role in societal growth and the perpetuation of positive mental states.

The research also touches upon the societal implications of these mental capabilities. Most humans utilize socially supported methods for interactions within social groups, often based on beliefs in spiritual power and the use of love and affection as emotional resources. These interactions form the basis of complex social structures and contribute to the overall fabric of human society. The development of mental strength and creative capabilities emerges as a multifaceted process involving complex cognitive mechanisms, belief systems, and social interactions. Understanding these processes provides valuable insights into human potential and offers avenues for fostering personal and societal growth.

Violence and Aggression

There exists an intertwined relationship between spiritual beliefs and violent behaviour, highlighting a concerning trend where some individuals utilize their faith as justification for aggressive actions. This phenomenon has been observed across various geographical locations and historical periods, presenting a significant challenge to social harmony and peaceful coexistence. Certain groups resort to violent methods when interacting with those who do not share their lifestyle or spiritual practices. This stands in stark contrast to individuals who use their faith to promote peace and

happiness. This dichotomy in the application of spiritual beliefs may stem from differences in social conditioning and cognitive development. A particularly troubling aspect is the use of spiritual beliefs to justify terrorist activities. Some groups sponsor such actions under the guise of protecting their social and spiritual beliefs, a practice that has persisted for several centuries. This misuse of faith often involves terrorizing individuals from different cultural or spiritual backgrounds, ostensibly to strengthen and protect the perpetrators' own spiritual conceptualisations and worship methods. The psychological mechanisms underlying these behaviours suggest there is an intense merging of neurocognitive processing methods and emotional effects in individuals who engage in such violent acts. This integration results in a belief that their actions are supported or even watched by their spiritual entities, leading to a perceived divine approval of their aggressive behaviour. This use/misuse of mental strength and spiritual beliefs is not an inherent outcome of faith itself. Rather, it represents a misapplication of the human capacity for mental and spiritual development. The same abilities that can lead to positive personal growth and societal contributions can, when misdirected, result in destructive behaviours. The actions of violent groups pose a significant threat to social harmony, particularly in diverse societies. The fundamental misunderstanding or misapplication of spiritual concepts highlights the need for improved education and social conditioning. Further critical analysis and research is needed to understand how faith and belief systems, when misinterpreted or misused, can lead to violence and aggression. The interplay between spiritual beliefs, psychological processes, and social behaviour, underscores the importance of fostering a balanced and peaceful application of faith in society.

Intellectual Decline and Death

The phenomenon of intellectual decline in old age and its implications for human cognition and existence is a topic close to everyone's heart. The natural progression of cognitive changes and potential coping mechanisms, as well as the philosophical considerations surrounding mortality. Intellectual decline is recognized as a normal occurrence in the aging process. However, the studies suggests that individuals may be able to mitigate the effects of such decline through various supportive aids. Music and emotional responses are highlighted as potential natural aids for cognitive maintenance, potentially serving as essential revitalizing components in an individual's life. While these aids may help in managing cognitive decline, there is no remedy or alternative to death itself. This reality underscores the finite nature of human existence and cognition. The concept of "I" ceases to exist upon death, a universal truth that all living individuals must ultimately accept.

Despite the finality of death, individuals leave lasting impacts beyond their physical existence. It suggests that one can become a creative force during their lifetime, with certain qualities and contributions potentially becoming permanent influences for future generations. This concept of legacy extends beyond the individual, as the study notes that human qualities and characteristics can be genetically transmitted to subsequent generations. The nature of mind and consciousness in relation to death reiterates that the mind is a functional product of the brain, creating functions and needs for the individual to carry out. Importantly, the products of the mind are understood only by the mind itself and do not constitute a logical material reality of the universe. Cognitive changes are an important part of aging, and it has philosophical implications on the concepts of mortality. The potential for individuals to leave lasting impacts despite the biological limitations of life, creates links between individual cognition, societal legacy, and the fundamental nature of consciousness.

Conclusion

We have explored the complex relationship between the brain and mind, and various aspects of cognitive processes, emotional responses, and social conditioning. There are intricate processes involved in neural encoding, information processing, and the generation of awareness. It emphasizes the role of emotional arousal in shaping behaviour and memory formation, demonstrating the inseparable link between cognitive and emotional functions. We also discussed the formation of self-image and the development of language skills as crucial components of human cognition and social interaction. The concept of faith and belief systems, has significant impact on an individuals and societal behaviour. The findings suggest that these mental constructs serve as powerful sources of personal strength and play a crucial role in shaping social interactions and cultural norms.

The phenomenon of “neural hijacking” and the mechanisms underlying impulsive behaviours, are an important area of work. It strengthens the need for developing cortical control through appropriate social conditioning, and to understand and potentially mitigate antisocial behaviours. The development of mental strength and creative capabilities, highlights the human brain’s potential for moulding emotional effects and creating superior mental states. This exploration of mental potential offers valuable insights into personal growth and societal development. While acknowledging the inevitability of cognitive changes and mortality, there are potential strategies for maintaining cognitive function and leaving lasting impacts beyond one’s physical existence. In conclusion, this paper scratches the surface of the brain-mind relationship and provides an understanding of human cognition, emotion, and behaviour. Brain-Mind relationships

influence fields such as neuroscience, psychology, neurophysiology, psychiatry, neurology, and has applications in areas such as education, mental health, and social policy, contributing to our broader understanding of human nature and societal dynamics.

References

1. Mukundan CR, Kacker P (2018) Molding emotion while cognitively processing physical & virtual realities. *EC Neurology* 10(5): 354-366.
2. Mukundan CR, Kacker P (2018) Emotional Arousal - the Driving Force of Life. *Journal of Psychology & Clinical Psychiatry* 9(1): 1-12.
3. Moruzzi G, Magoun HW (1949) Brain stem reticular formation and activation of the EEG. *Electroencephalography & Clinical Neurophysiology* 1(4): 455-473.
4. Luria AR (1980) Higher cortical functions in man. Basic books, New York.
5. Luria AR (1966) Human Brain and Psychological Processes. Harper & Row.
6. Teuber HL (1963) Maze perception and its disturbance after brain injury in Man. *Neuropsychologia* 1: 47-57.
7. Teuber HL (1964) The riddle of the frontal lobe in man. In: Warren JP, et al. (Eds.), *The Frontal Granular Cortex and Behaviour*, New York, McGraw-Hill, 19(1): 25-46.
8. Petrides M, Alivisatos B, Meyer E, Evans AC (1993) Functional activation of the human frontal cortex during the performance of verbal working memory tasks. *Proceedings of the National Academy of Science USA* 90(3): 878-882.
9. Petrides M, Milner B (1982) Deficits on subject ordered tasks after frontal and temporal lobe lesions in man. *Neuropsychologia* 20(3): 249-262.
10. Cummings JL (1993) Frontal-Subcortical circuits and human behavior. *Archives of Neurology* 50(8): 873-880.
11. Hayden BY, Platt ML (2010) Neurons in Anterior Cingulate Cortex Multiplex Information about Reward and Action. *Journal of Neuroscience* 30(9): 3339-3346.
12. Alexander GE, Delong MR, Strick PL (1986) Parallel organization of functionally segregated circuits linking basal ganglia and cortex. *Annual Review of Neurosciences* 9: 351-381.
13. Alexander GE, Crutcher MD, DeLong MR (1990) Basal

- ganglia - thalamocortical circuits: parallel substrates for motor, oculomotor, 'prefrontal' and 'limbic' functions. *Progress in Brain Research* 85: 119-146.
14. Pribram KH, Miller GA, Eugene G (1960) Plans and structure of behavior. New York, pp: 65.
 15. Salmon E, Van der Linden M, Collette F, Delfiore G, Maquet P, et al. (1996) Regional brain activity during working memory tasks. *Brain* 119(5): 1617-1625.
 16. Mukundan CR, Kamarajan C (2021) Brain to Mind: Creation of the Virtual World. *Advances in Social Sciences Research Journal* 8(10): 513-544.
 17. Mukundan CR, Kamarajan C (2020) The real physical and the virtual mental worlds. *Journal of Psychology & Clinical Psychiatry* 11(6): 170-175.
 18. Mukundan CR, Kamarajan C, Ajayan P (2019) Mind in the Brain - Creation of the Greatest Virtual World. *Journal of Psychology & Clinical Psychiatry* 10(2): 83-90.
 19. Mukundan CR (2018) Understanding and Dealing with the Mental Creations: Living in Real and Virtual Worlds. *Journal of Psychology & Clinical Psychiatry* 9(4): 394-398.
 20. Goleman D (2005) *Emotional Intelligence*. Google Books.
 21. LeDoux J (1996) Emotional networks and motor control: a fearful view. *Progress in Brain Research* 107: 437-446.
 22. LeDoux J (1998) Fear and the brain: where have we been, and where are we going? *Biological Psychiatry* 44(12): 1229-1238.
 23. LeDoux J (2002) *The emotional brain revisited*. Penguin Group, New York, pp: 200-234.
 24. LeDoux J (2003) The emotional brain, fear, and the amygdala. *Cellular and Molecular Neurobiology* 23(4-5): 727-738.