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MODELING OF BRAIN, MIND USING COMPUTER SIMULATION

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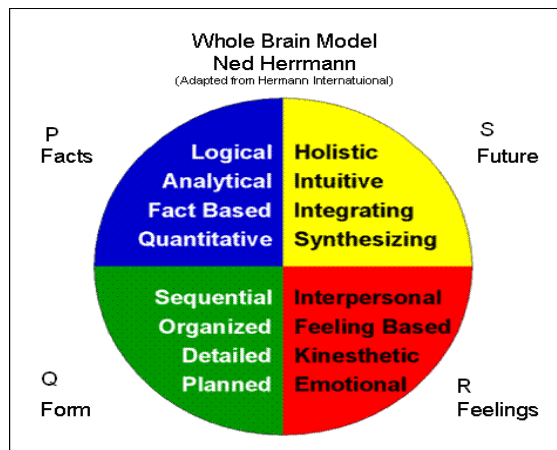
Abstract: Metaphysics of human brain is so complex that it baffles all scientific and mathematical models. We cannot define consciousness. Each thought corresponds to information. Each information is brought to the brain when our sensory system is activated. Brain collects information applying sensory system, intellect must process them and memory must store them. Brain behaves like an operator $B : X \rightarrow Y$ where Y , the output information may or may not be same as X , it is time dependent. In this paper phenomena of brain have been studied through modeling and Computer simulations.. Simulations is used to describe and analyze the behavior of a brain.

I. INTRODUCTION

“The brain is the engine, while the car is the physical body of the human being where the mind is the driver of this car of life.” The mind runs the show of living, behaving and acting out life within the parameters of the script provided by the brain.

Each information is brought to the brain when our sensory system is activated. Brain collects information applying sensory system, intellect must process them and memory must store them. Mathematically consciousnesses seem to be an operator which can generate all forms of energy, convert them into mass, exert a force and apply power perpetually [1, 2, 3]. Mind seems to be a tool used by consciousness to do thinking. If B denotes brain then as shown in whole brain model.

Whole Brain Model:



$$B = P \cup Q \cup R \cup S \quad \text{where}$$

P is facts

Q is form

R is feelings

S is future

The four thinking styles in the whole brain model are

i) Logician-

Analytical, mathematical, technical and problem solving.

ii) Organizer-

Controlled, conservative, planned, organized and administrative in nature.

iii) Communicator-

Interpersonal, emotional, musical, spiritual and the talker modes.

iv) Visionary-

Imaginative, synthesizing, artistic, holistic and conceptual modes.

Similarly mind is an operator $M: X \rightarrow Y$ where Y , the output information may or may not be same as X , it is time dependent.

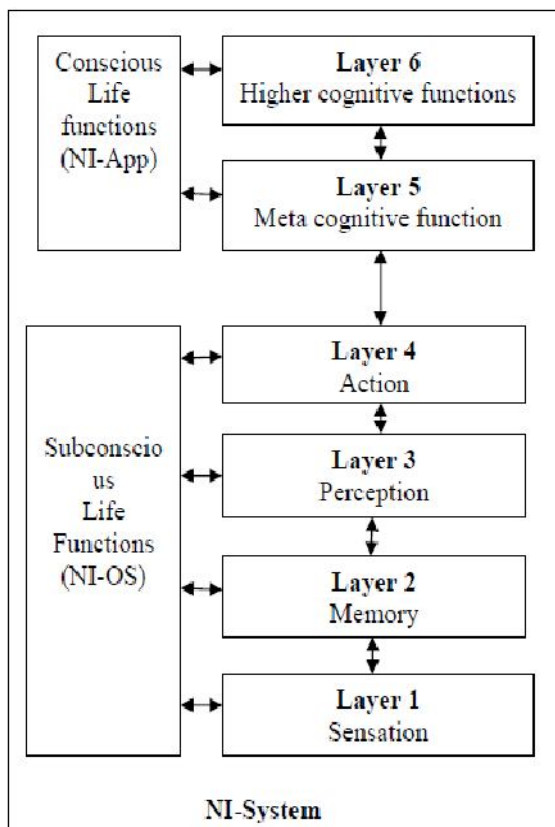
Difference between brain and mind:

A computer required hardware to perform its function. And the hardware needs software to make it run. Without software, hardware would be useless and without hardware, software cannot be used. Brain is like the hardware and mind is like the software. The mind made humans capable to solve complex logical problem which differentiates us than other living beings.

THE LAYERED REFERENCE MODEL OF THE BRAIN (LRMB)[4]

This section develops the cognitive model of natural intelligence by studying relationships between the inherited and acquired life functions and between the memory components of the brain, such as the long-term, short-term, sensory buffer, and action buffer memories. The hierarchical life functions of the brain as a natural intelligent system (NI-Sys) can be divided into two categories: The subconscious and conscious life functions. The former known as the NI operating system (NI-OS) encompasses the layers of

sensation, memory, perception, and action (Layers 1 to 4). The latter known as the NI applications (NI-App) includes the layers of Meta and higher cognitive functions (Layers 5 and 6). According to this classification, a Layered Reference Model of the Brain (LRMB) can be described as shown in Fig. In the LRMB model, cross layer communications are allowed, which are denoted by the horizontal arrows.



The layered reference model of brain

In LRMB, the subconscious layers of the brain (NI-OS) are inherited, fixed, and relatively mature when a person is born. Therefore, the subconscious function layers are usually neither directly controllable nor intentionally accessible by the conscious life function layers. This is why it is called no conscious life functions in psychology [5, 6]. Contrary to the subconscious NI-OS, the conscious layers of the brain (NI-App) are acquired, highly plastic, programmable, and can be controlled intentionally based on willing nesses, goals, and motivations. Note that there are gray areas in the classification of a given cognitive process as conscious or subconscious life functions. For instance, as shown in Table I, the conscious part of the memory process is classified as at Layer 5, while the subconscious part of it is at Layer 2. More generally, a daily life function of the brain is conducted as a concurrent and parallel combination

of multiple routine cognitive processes at almost all layers.

Definitions of each layer in LRMB are given below.

Layer 1: The Sensation Layer of LRMB

Definition 1. The sensation layer of LRMB is a subconscious layer of life functions of the brain for detecting and acquiring cognitive information from the external world via physical and/or chemical means.

A sensory system consists of sensory receptors, neural pathways and parts of the brain involved in sensory perception. Commonly recognized sensory systems are those for vision, hearing, somatic sensation (touch), taste and olfaction (smell). In short, senses are transducers from the physical world to the realm of the mind. The sensation layer surrounds all input-oriented senses such as vision, audition, smell, tactility, and taste. Corresponding to the sensation layer of life functions, the sensory buffer memory (SBM) is a set of input-oriented temporary memory, which is located at the memory layer of the reference model. The logical model of SBM is a set of parallel queues corresponding to each of the sensors of the brain [10].

Layer 2: The Memory Layer of LRMB

Definition 2. The memory layer of LRMB is the fundamental layer of life functions of the brain: (a) to retain and store information about both the external and internal worlds; (b) to maintain a stable state of an animate system; (c) to provide a working space of abstract inference; and (d) to buffer programmed actions and motions to be executed by the body.

It is recognized that the natural intelligence is memory-based [7, 8]. The memory layer is a part of the subconscious life functions. The memory layer encompasses the following types of memories [8, 9]:

- The sensory buffer memory (SBM)
- The short-term memory (STM)
- The long-term memory (LTM)

Where the ABM is originally identified and modeled by Wang in [7, 8].

The major organ that accommodates memories in the brain is the cerebrum or the cerebral cortex [8, 10]. The relations between memories and their corresponding parts in the cerebral cortex and lobes are established. The LTM, as the key memory of the brain, is mainly located at the association cortex in the frontal lobe of cerebrum.

Layer 3: The Perception Layer of LRMB

Definition 3. The perception layer of LRMB is a subconscious layer of life functions of the brain for maintaining conscious life functions and for browsing

internal abstract memories in the cognitive models of the brain. The cognitive functions of the perception layer can be considered as the thinking engine of the brain and the kernel of the natural intelligence. Perception may also be considered as the sixth sense, supplementary to the five external sensations at Layer 1, known as vision, audition, smell, tactility, and taste, which implements self consciousness inside the abstract memories of the brain. The perception layer is a core part of the subconscious life functions. The perception layer is the internal sensory layer that encompasses the cognitive processes of self-consciousness, motivation, willingness, goal setting, emotions, sense of spatiality, and sense of motion.

Layer 4: The Action Layer of LRMB

Definition 4. The action layer of LRMB is a subconscious layer of life functions of the brain for output-oriented actions and motions that implement human behaviors such as a sequence of movement and a pre-prepared verbal sentence. The action layer is a part of the subconscious life functions. The action layer encompasses all motor control and execution functions such as looking, reading, and writing.

Supplementary to the input-oriented SBM, the action buffer memory (ABM) is an output-oriented temporary memory [9,10]. The functional model of ABM is a set of parallel queues; each of them represents a sequence of actions, or a process. Both the action and the sensation layers form a closed-loop for implementing various life functions, particularly the cognitive life functions at the conscious layers.

Layer 5: The Meta Cognitive Processes Layer of LRMB.

Definition 5. The Meta cognitive process layer of LRMB is a conscious layer of life functions of the brain that carries out the fundamental and elementary cognitive processes commonly used in higher cognitive processes. The Meta cognitive process layer is a part of the conscious life functions that can be controlled directly by the conscious mind (or the thinking engine) as mental applications. The Meta cognitive process layer encompasses the basic processes of attention, concept establishment, abstraction, search, categorization, memorization, and knowledge representation.

Layer 6: The Higher Cognitive Functions Layer of LRMB.

Definition 6. The higher cognitive functions layer of LRMB is a conscious layer of life functions of the brain that carries out a set of specific cognitive processes under the support of the Meta cognitive processes. The higher cognitive process layer is a part of the conscious life functions. More complicated and diversified life functions can be implemented by the serial, parallel, interleaved, and/or concurrent combinations of these fundamental cognitive processes in LRMB. That is, complex and instant

intelligent behaviors of the brain and mind can be reduced to the combinations of the six-layer cognitive processes as modeled in LRMB.

Now consider queuing systems in which simulation is often used in the analysis of queuing models.

Key elements of queuing systems:

- i) **Customer:**Refers to anything that arrives at a facility and requires service.E.g. people,machines,body.
- ii) **Server:**Refers to any resurce that provides the requested service.

E.g.:

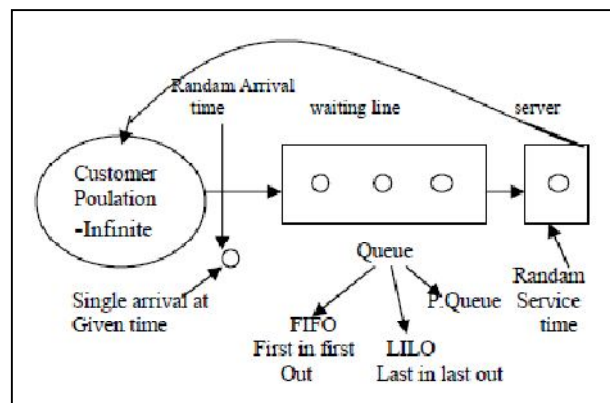
System	Customers	Server
Reception desk	People	Receptionist
Hospital	Patient	Nurses
Network	Packets	Router
Computer	Jobs	CPU,disk,CD
Brain	Myself	Mind

A queuing system is describedby

- i)calling population
- ii)Arrival rate
- iii)Service mechanism
- iv) Queuing discipline

Single Server Queue:

Calling population is infinite.Arrivals for service occur in a random fashion. System capacity has no limit i.e.any number of units can wait in the line.Arrival rate must be less than service rate for a stable system.Queue discipline refers to the rule that a server uses to choose the next customer from the queue when the server completes service of the current customer. Single Server Queue system is as shown in the figure.

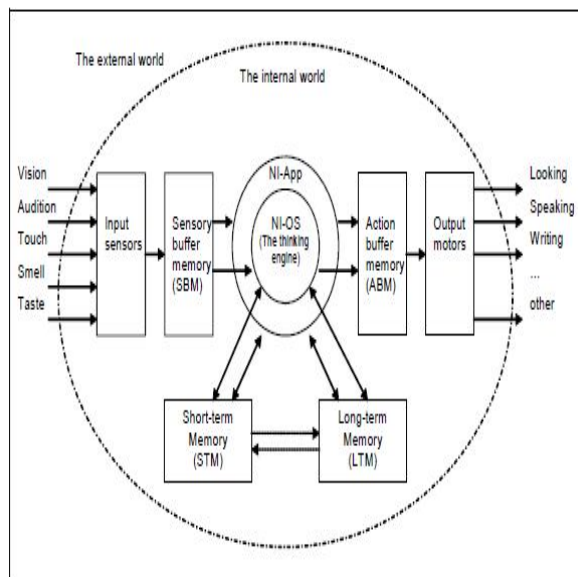


Single server Queue

Using above theory we can define the functional model of Brain as follows

The Functional Model of Brain

The basic characteristic of the brain is information processing. The brain may be stimulated by external and internal information, which can be classified as shown in the figure.



CONCLUSION:

This paper has described modulation of brain using computer simulation. The brain is involved in everything you do when your brain works right; you tend to be effective, thought for creative, and

energetic. With the right plan you can reverse damage and optimize your own brain and subsequently improve your life. The open framework of LRMB has made future extension and refinement possible for accommodating new cognitive processes of the brain and mind.

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