

# The Cognitive Model of Consciousness in Toto

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**Abstract:** In cognitive science, "Consciousness" remains an interesting topic. Many scientists attempt to solve this mystery and try to understand the human mind mechanism. The fact is 'consciousness is not a process; it is a result of process'. Integrated sensory-motor loop (ISML) is responsible for consciousness. All other processes also driven by ISML such as self organizing, self learning and self govern executions. Why did I call integrated? Because there must be involvement of two or more different type of sensors such as microphone & camera or eye & ear with human brain. So that output is result of integration between two or more types of sensory inputs. Here it comes real artificial intelligence because of actual integration of sensory information and create new form of results. This theory is not only about logic behind consciousness but also giving artificial neural network model for other processes such as associate plastic memory, adaptive bridging, labeling, learning, data structure and self govern executions. Algorithms mentions in this research paper are practically tested and at the same time I built applications on this theory. This research paper is not just a theory I believe it's a beginning of self aware, self learning and self govern machines.

**Keywords:** consciousness, cognitive model of consciousness, embodied cognition, artificial consciousness, self aware machines

## 1. Introduction

Consciousness remains an interesting topic in cognitive science whether it is philosophy, psychology or artificial intelligence. It is one of the prominent mysteries which was yet to be solved. Many attempts are made to define consciousness. Locke defined consciousness as "the perception of what passes in a man's own mind"[1]. Actually Consciousness is not process or activity. Consciousness is result of activity. Consciousness has great importance in artificial intelligence. It has been possible to build consciousness in machine. Many scientists made attempts to simulate human mind. Artificial neural network is one of the good examples of it. Warren McCulloch and Walter Pitts [2] (1943) created a computational model for neural networks based on mathematics and algorithms called threshold logic. Though ANN is biologically inspired system has imperfections. Basically human brain has various types of neurons where in ANN they use single multipolar model of neuron. It is very hard to create real time consciousness into machine using classical ANN. In this research paper I am presenting cognitive model of consciousness in toto and its application in artificial intelligence. All efforts of this research paper to build awareness into machines. So that machine will become self organizing, self learning and self govern system.

## 2. Definition of Consciousness

I defined, "Consciousness is result experienced by body when one of the body sensor controls body motor activity." Where body is one unified system composed by variant of energy level sensor and motor units with definite boundaries between inner and outer world.

## 3. Integrated Sensory-Motor Loop (ISML)

Integrated sensory-motor loop is constant rotation of signals from sensory part to motor part and again motor part to sensory part via different type of sensor of the same body. It is uninterrupted process where signals are constantly

circulated from sensory to motor and motor to sensory which results into consciousness.

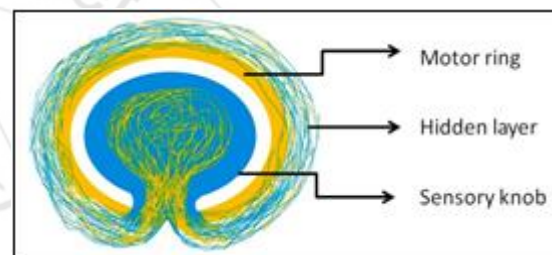


Figure 1: Basic model of ISML.

In figure 1, motor ring is purely motor part of body. Motor ring separates inner virtual world (IVW) from outer real world (ORW). Motor ring convert IVW actions into ORW actions, whereas sensory knob is purely sensory system of body. Sensory knob converts ORW into IVW. Both motor ring and sensory knob defines boundaries of body. Energy transition occurs in these layers of body. Hidden layers are extensions of sensory motor interaction in IVW.

Consciousness exists between motor ring and sensory knob. When body dealing with outer world then reflection of existence will be at outside of the body and when body dealing with inner world then existence lives inside the body. "Sensory knob and motor ring is a part of one body, which can easily percept that its own motor part is acting on its own sensory part i.e. sensory knob. With this phenomenon sensory knob can move motor part onto the sensory surface."

Associate plastic memory, pattern recognition, learning, control, thinking and emotions these all processes are driven by the integrated sensory-motor loop and part of hidden layer.

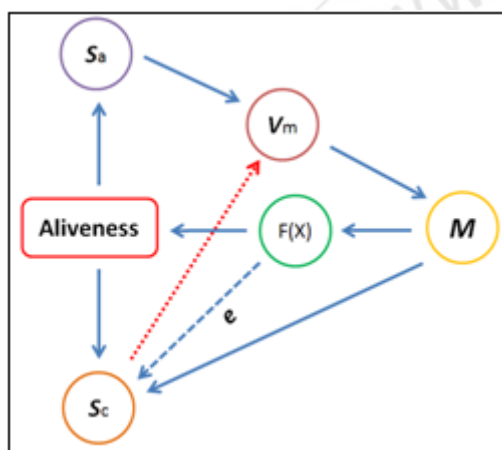
## 4. Cognitive Model of Consciousness

Body is composed of variant energy level sensor and motor blocks with definite boundaries which separate inner virtual world of the body from outer real world. Variant energy

level refers to its data transmission rate from one sensor to another. It may vary according to the type of sensors and motor blocks. Eyes transmit light energy to the body and ears transmit sound energy to the body, both have different energy levels. Hence I mentioned sensors and motors have variant energy levels.

Neural block refers to a neuron with specific properties and structure. Neural activity is always driven by function or work or goal. Whatever we are doing is for performing some kind of functions. Even in machines, we are programming machines for particular functions. In a human system, food and reproduction are major functions. These have also important goals to keep aliveness continuous. Our each activity is directly or indirectly results into one of these functions. So, Function is the main controller of neural network activity. Function can be an output, work or goal.

Let's consider  $f(x)$  is function.  $S_a$  is actuator sensors.  $S_c$  is control sensors.  $V_m$  is virtual matrix. Motor neurons  $M$  associate with end motor activity where energy transition  $e$  occurs.



**Figure 2:** Cognitive model of consciousness.

In figure 2,  $S_a$  and  $S_c$  are input sensory blocks which deal with the outer real world and convert it into the inner virtual world. On activation of  $S_a$ , it performs some motor action  $M$ . That motor action is getting used for doing some function  $f(x)$ , while performing that function, control sensor  $S_c$  watches that activity. Control sensors are again divided into  $S_{cd}$  doer sensors and  $S_{cw}$  watcher sensors.  $S_{cw}$  and  $S_{cd}$  have an internal connection i.e. living liquid ( $LL$ ). So,  $S_{cw}$  can control  $S_{cd}$  because of its internal access. Consciousness is experienced by  $S_{cw}$  during controlling  $S_{cd}$  for doing motor activity  $M$ . We will understand this process in detail in the next topic virtual matrix.

## 5. Virtual Matrix

Input matrix composed of  $S_a$  and  $S_c$  neural blocks. Input matrix, where real world objects or actions convert into electric energy. Output layer or output matrix composed of motor neurons ( $M$ ) where electrical energy converts into different energies. Input matrix converts outer real world into inner virtual world and output matrix converts inner virtual world into outer real world actions. Now, Virtual matrix is a hidden layer between input matrix and output matrix. All

data processing, learning, language, thinking and emotions are occurring in this layer. Virtual matrix is forward extension of input matrix and backward extension of output matrix. Virtual matrix is divided into Horizontal virtual matrix and Vertical virtual matrix. H-virtual matrix connects input matrix to output matrix. V-virtual matrix is concerned with memory and data processing.

Rigid Sensory Blocks ( $S_r$ ) are the neurons which are associated with 'before motor activities' and Rigid Motor Block ( $M_r$ ) are the neurons which are associated with 'after motor activities'. Both have synaptic associative memory. Adaptive bridge between  $S_r$  and  $M_r$  are Linker Blocks ( $LB$ ). Connection between  $S_{cw}$  and  $S_{cd}$  is Living Liquid ( $LL$ ). A connection between  $S_{cd}$  and  $S_r/M_r$  is access. Focus ( $F_c$ ) has a very important role in virtual matrix. Each type of neural block has specific structure and properties.

### Types and Properties of Neural Blocks

**Input sensory block ( $S_a$ ):** They are the outermost layer or visible layer.  $S_a$  converts the outer world into electric energy. It has a direct effect on one of the outer motor blocks.

**Rigid sensory block ( $S_r$ ):**  $S_r$  has associative memory; it can store input data and can be activated by the same input data.

**Rigid motor block ( $M_r$ ):**  $M_r$  has associative memory, it can store an output data and on activating it fires the same stored output data.

**Output motor block ( $M$ ):** It converts electrical energy into kinetic action or any other real world actions.

**Doer control sensor ( $S_{cd}$ ):** Doer sensor is part of control sensor which is indirectly connected to motor blocks. Their area of coverage is smaller than watcher sensors.

**Watcher control sensor ( $S_{cw}$ ):**  $S_{cw}$  is part of control sensor. Watcher sensors have a large coverage area than doer sensors. So that watcher sensor can sense the activity of doer sensor as well as real world actions too.

**Linker Bridge ( $LB$ ):** Linker Bridge has a very important role. They are adaptive components in neural networks. They connect simultaneously activated neurons. They also have synaptic plasticity but it only determines the intensity of signals not data weight. It is like a tap which can control the flow of liquid. Liquid might be water, oil or anything. More and more activations will increase the diameter of the hole. It's similar to training.  $LB$  is responsible for self-organizing property.

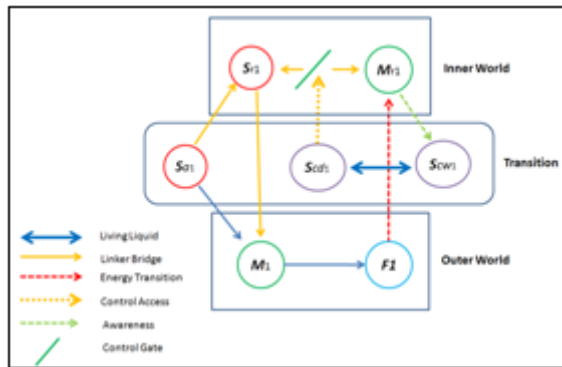
**Access:** It is a type of Linker Bridge where only gets access to activate other neural blocks.

**Control Gate:** Control gate is a type of access according to the state of affecting neural blocks. If the focus is outside then access will get control to outer world activity. If focus is inside then access will get control to inner world activity.

**Living Liquid ( $LL$ ):**  $LL$  is an internal connection between watcher sensor and doer sensor. Living liquid is internal

motor activity between these two sensors. It has equilibrium point which can be disturbed by internal or external stimulus.

**Focus (Fc):** Fc is activation of bunch of neurons by body itself. Focus is very important in learning and allocation of memory.



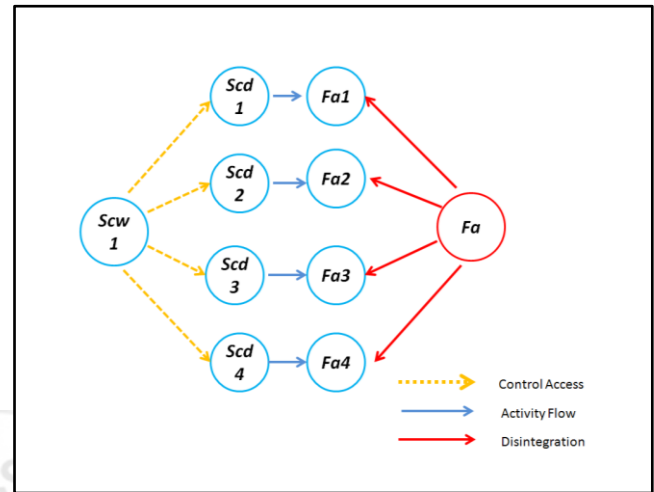
**Figure 3:** Detail expansion of ISML

Above figure 3 is functional unit of ISML. Each outer stimulus has its own 'unique voltage potential' and 'own bit of information' and 'associated with own rigid sensory block'. That's why human brain can store, differentiate and process vast amount of data. Sa1 get activated with environmental stimulus which activates M1 which perform motor action with respect to function F1. Sr block come into action only if activated with focus. Sr1 store that stimulus in the form of membrane voltage potential. After activation of Sr1 it activates M1 block. After performing function it gets converted into electrical potential by watcher sensor Scw1, which activate Scd1. So that in the absence of outer stimulus Scd1 can activate Sr1 to activate Mr1. On activating Mr1, It can give same feeling that real function gave in real world action. So, Sr and Mr Blocks are responsible for formation of virtual world. This is whole activation flow of ISML.

## 6. Series of Functions and Disintegration of Large Function

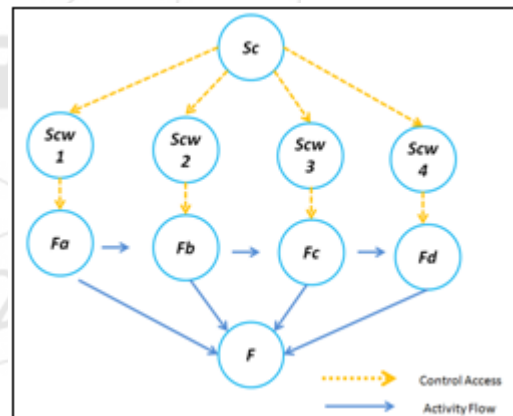
Learning process occurs in step by step manner. Learning can be divided into two parts, first one is natural learning and executions and second one is self learning and self govern executions. Natural learning is controlled by outer stimulus where self learning is controlled by body itself. Initially natural learning occurs, only copying and execution. It is like reflex action or can mimic the actions taught by other system. These small actions integrate into large functions. Natural learning became primary function and related function is going to attach with primary functions and form series of functions. Later body learns to control motor activity. In self govern execution; first disintegrate the hypothetical large function into small functions and then one by one execution happen with learned data. Watcher sensors play very important role in making virtual hypothesis of function and perform controlled action on the basis of learnt data by body. One large function is disintegrates into small functions by watcher Sensors which cover larger area and they controls doer sensors by dividing function into small steps. Each function is related to other functions and form series of functions. For example the bigger aspect of human function is collecting food and bigger aspect of watcher

sensors is eye and ear because eyes and ears covers larger area of surroundings. So it becomes controller for activity. That large function of collecting food divided into smaller functions which may include running, hunting ....etc these are smaller functions.



**Figure 4:** Disintegration of large function

In figure 4, the first step in learning process is assignment of inputs for specific outputs via Sr blocks. Function Fa disintegrates into fa -> fa1-> fa2->fa(n) which are controlled by Scw1. The weight of Scw is label for that whole function (fa). Like Fa, series of other function related to previous function are growing like a tree. Then that all fa->fb->fc... f(x) are consequently assigned by Scw1->Scw2->Scw3... Scw(n). In this fashion pyramid of functions is developed.



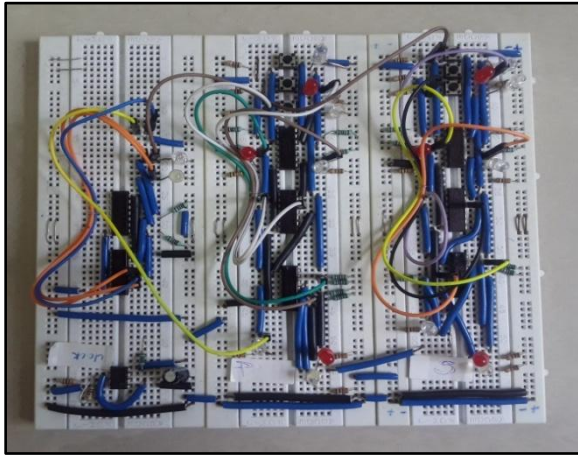
**Figure 5:** Pyramid of functions

In figure 5, Pyramid of functions is growing by integration of small functions into a large function and in self-govern execution large function disintegrates into small functions.

## 7. Simulation and Use of ISML

I think time has come to make machine conscious or self aware. I built a processor called Awareness Processing Unit (APU) which is built upon the integrated sensory-motor loop, virtual matrix and machine learning algorithms. It is self-aware, self-organizing, self-learning and self-govern system like human mind. Self-awareness is first step to make machine fully autonomous, self organizing, self learner and truly intelligent.





**Figure 6:** Awareness Processing Unit (APU)

Unit) – World's first self aware, self learning and self govern machine.

All algorithms which are mention in this paper are tested on it. This project is under construction. In support with this experiment I built another self-aware, self-learning and self-organizing system which was hybrid approach using both hardware and software.

I believe rather than uploading mind into machines and become immortal, more important is to create consciousness into machine. What is birth and death? Actually birth of new person is born with consciousness and knowledge (data). Just we label that person (whole function) with name. Death isn't a final end. Final end is 'end of consciousness from universe.' So, we should preserve such highly complex process.

## 8. Conclusion

Consciousness is not a process, it is a result of process and that process is integrated sensory motor loop. "Consciousness is defined as result experienced by body when one of the body sensor controls body motor activity." The algorithms given in this theory are practically tested and definitely we can create consciousness into machines. Finally I want to say here, this is not just a theory I believe it is a beginning of self aware, self learning and self govern machines.

## References

- [1] Locke, John. "An Essay Concerning Human Understanding (Chapter XXVII)". Australia: University of Adelaide. Retrieved August 20, 2010.
- [2] McCulloch, Warren; Walter Pitts (1943). "A Logical Calculus of Ideas Immanent in Nervous Activity". *Bulletin of Mathematical Biophysics*. 5 (4): 115–133. doi:10.1007/BF02478259.

## Author Profile



**Dr. Mukesh Bangar** is author of book "I am me – Universal Rational Belief System" and founder of InorganicMind Automation company. He has done his graduation from MUHS, Nashik and he has keen interest in subject area Cosmology, Physics, Neural Networks, Philosophy and Artificial Intelligence. He has done break through work in mind philosophy and invented APU (Awareness Processing