Consciousness as a system

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Abstract

In this paper we will try to find resemblances of the operation of human consciousness with systems with the intention to simulate it mathematically. Also we will try to do the same for the non-conscious operations and try to synthesize the human mind in form of system with subsystems.

Scope Statement

Since the age of Aristotle, scholars and cognitive scientists are in a quest to describe the concept of consciousness. In fact, through out millennia we still do not have a widely accepted definition. In this paper instead of trying to define consciousness, we are going to find similarities of consciousness with *systems*. We will try to find fundamental similarities of consciousness with different types of systems and categorize it on a (one or more) system type(s) that can be modeled mathematically.

Many scholars worked on the systematization of the cognitive functionalities. Scholars have tried in the past to model cognition with dynamical systems, an idea away from traditional concepts of symbolicism, artificial neural networks and other statistical approaches. Instead of trying to describe all cognitive functionalities, in this paper we will focus more on the consciousness and its resemblance to a dynamical system and we will try to find the type of system that fits better.

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Definitions

But fist let's try to give some definitions of system. Bellow we present some widely accepted definitions system.

Definition 1 (Britannica): A group of related parts that move or work together

Definition 2 (Merriam): A system is a group of interacting or interrelated elements that act according to a set of rules to form a unified whole - a set of things working together as parts of a mechanism or an interconnected network; a complex whole

Definition 3 (Cambridge): A particular set of actions for doing something.

All these definitions are widely accepted and they have some things in common. First they have the element of *motion/action* and second they require entities that interact *temporarily* together. In other words a system is described as a generic "machine", though this type of machine could be either deterministic or stochastic and it could be either physical or intangible.

Sperm with no consciousness

What is the first cause of consciousness? Is has a materialistic nature or not? This question concerns scholars for 25 centuries now. In order to continue with our analysis we have to choose sides and we choose the former. Therefore we describe the materialistic nature of consciousness with the postulate below:

Emerging Consciousness Postulate: *Human consciousness does not exist on the first moments of someones life.*

This is a hypothesis that we have to consider it is true, in order to develop the theory. In other words "sperm has no consciousness" or a fetus in the mother's wound doesn't have (at least in the early stages) consciousness. Thus the human consciousness must be emerging along with the reaction with a non empty environment.

Thought Experiments

During this analysis we will go through some thought experiments and we will try to find similarities of the human consciousness with some types of systems.

Experiment 1

Human without input for it's entire life. Lets make the assumption that a human being, receive no signal from the environment since the time is born[1]. This person sees nothing, hears nothing, feels nothing and in general no signals can be transmitted to his brain - signals that refer to environmental stimuli and/or internal sense of his body kinematics. Lets also assume that this lack of stimuli happens for his whole life. Actions, states, objects or even qualia - that referred to environment - can not be formed in to this person's brain in the form of categorized tract entities. This person is completely cut out from the environment and thus will never acquire the sensory information to interpret, represent and understand it. So this person will lack of perception. Furthermore, since this lack of perception happens for all his life then his memory will be blank. With no perception and no memory the person will never acquire the ability of thinking, reasoning, imagining etc. and in general no mental processes will ever evolve to his brain. Therefore consciousness will not be developed in this person since the fundamental elements/entities and thought processes will never develop.

Conclusion 1 *A human can not develop consciousness without any input.*

Experiment 2

Human with the same input for its whole life. Similarly to the experiment 1, lets make the assumption that a person is born but now this person has a sensory channel (or many sensory channels) to accept stimuli but instead, through this channel(s) he receives continuously and consistently the same stimulus. As an example we can assume a person with vision as the only sensory channel but since birth he is receiving a red image as stimulus. An

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[1]In this experiment we assume that the postulate above is true and a person is born without consciousness.

all red image, with the same red tint edge to edge, with the same brightness continuously for his whole life. We can extend this with a person who has two sensory channels eg. visual and acoustic and receives the same red signal and a consistent acoustic tone for his whole life. The question is if this person will ever understands the redness of the of this red visual signal or the tonality of the tone.

In the previous experiment we described the system as an empty memory system. The subject on experiment 1 has not developed any mental states. Describing the mind with a mathematical set consist of mental states, the subject on experiment 1 has a mind with an empty set. In this experiment the subject receives input but only one, thus will develop only one mental state - a singleton set. Thus this person will never develop consciousness since it will never be aware of his input stimulus.

The system in this experiment develops a singleton set and thus lacks the ability of transitioning from one state to another.

Conclusion 2 *Consciousness is developed on humans only with a plurality of stimuli per sensory channel.*

Conclusion 3 *Consciousness is subject to state transitioning, in other words it is a dynamical system.*

From this experiment we can conclude that consciousness can be simulated by a dynamical system. But now a new question rises, are all functionalities of consciousness dynamical or there are some static ones? There are no clear evidences that static procedures are forbidden in the formation of consciousness. But awareness of an entity, rises from the transition of the non existence state of this entity. In other words consciousness is in a continuous transition of states which move the awareness from one entity to the next one. Although consciousness is in continuous motion there has to be some functionalities that they are static - those are we call *unconsciousness* and we will discuss about it in the next sections. Thus we derive to the next statement.

State transitioning postulate: *All the fundamental characteristics of consciousness are subject to state transitioning.*

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Experiment 3

System with no input from a point after. In this experiment we make the assumption that a system already has developed consciousness and from a point after it losses all its sensory channels similar to experiment 1. Lets assume that a person with developed consciousness suddenly loses all his senses (but not being in a comma or brain dead or in a vegetative state). This person has definitely lost some very important abilities like perception but still he will maintain some others, important enough to maintain consciousness like imagination, self awareness, thinking, reasoning etc. At least in the first seconds after the lost of senses this person will maintain those abilities in a good condition driving his brain to change states similar to before. Therefore, sensory input information can lead and drive the development of consciousness but is not essential to maintain it.

Conclusion 4 *Input is necessary for a human to develop consciousness but not necessary to maintain it.*

Taking into account the conclusions from all the above experiments we resume that:

1. Consciousness is developed only within an environment.

2. Consciousness is a temporal system.

3. Consciousness has memory.

In other words consciousness is a dynamical system, that it is developed through a training process with the interaction with the environment. It is noteworthy that all people have almost the same consciousness regardless the environment. Translating this behavior in dynamical systems theory means that consciousness as a dynamical system has attractor(s) which is common among humans and keep the operation of consciousness within some limits of bounded behavior.

Of course there are questions that they are rising now. What type of dynamical system is consciousness? How many and what type of attractors does it have? How many dimensions? Is it continuous or discrete? All those questions are subject for future research.

Para-consciousness

There is another type of processes in the human mind that they are very similar to consciousness but awareness is vague. In order to describe those processes we will borrow the term paraconscious. It is a type of consciousness that operate in the side of consciousness - thus the prefix *para-*. Unfortunately, in literature this term is quite ambiguous. It has been used to describe different phenomena and multiple definitions of paraconsciousness are contradictory.

Here we refer to paraconscious functionality as all those processes that they are almost or not at all aware in contrast to conscious processes. Those processes could be our dreams and nightmares or our habits, like driving. All of those processes they have in common a smaller memory engagement but still they are dynamical systems like consciousness. With the exception of dreams all other paraconscious processes they can be conscious and in most cases they start as conscious (when we learn them) but over time repeatability transforms them into habits that then can be processed paraconsciously without being fully aware of them.

Non-conscious operations

Besides the conscious and paraconscious mind characteristics there is a group of many other cognitive operations more simple but very important. When someone sees a flower there are many operations that take place until this person is aware of the flower. For example, the raw visual information has to be interpreted in a form where consciousness can digest it. Operations like these, are essential for consciousness to operate in a more abstract space.

These processes from a third type of cognitive processes and they appear to be very simple, almost static or at least they look static in short term. Those processes are mostly connected with sensors or muscles and they interpret the interaction with environment. Nowadays many of these processes have been emulated with simple systems and they exhibit results that in some cases surpass average human. Latest advancements in Machine Learning have shown that tasks in Computer Vision, Computer Audition, Systems Control and other fields can be executed with a precision very similar to humans. In most cases those systems are static and they exhibit great abstraction skills similar to human mind. Those operations are never

been aware from human and thus we call them unconscious or non-conscious operations.
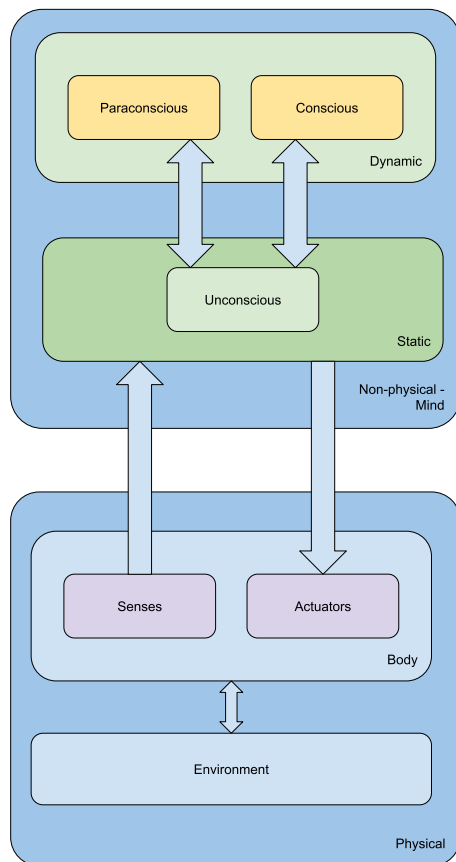

Figure 1: Body - Mind - Environment representation

Final thoughts

Combining these two types of systems we can synthesize human mind. The first layers is the static layer which has the role of interpreting senses and interactions from/to the environment. This layer is responsible of abstracting or concretizing in a manner similar to a Machine Learning Encoder or Decoder.

The deeper second layer has no direct interaction with the environment, though it is connected indirectly via the first layer. This second layer consist of dynamical systems that form the (para)conscious module of human mind.

In the diagram above the body and environment are split from the mind in a Physical - Non-physical manner which tends to be closer to a Dualistic perspective rather than a Physicalistic one. This distinction is used to emphasize the materialistic nature of the body as a Machine and the mind as an intangible Algorithm.