Chapter 1

Ignition of Algorithm Mind: The Role of Energy in Neuronal Assemblies

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ABSTRACT

The ignition of the algorithmic mind is a fascinating phenomenon that occurs in our brains. The algorithm mind is related to our reasoning. When we use it, we consume a lot of resources from our brains like energy. The ignition process is triggered by reflective mind and it works through neuronal assemblies. Specific neurons are ignited and then it begins a recruitment process for other neurons in order to assemble a complex structure. To understand these mechanisms, we have developed a simple multi-agent model, where we explored the role of energy and respective limits on neuronal assemblies. The available and consumed energy are the keystones to ignite the algorithm mind and to find out the limit that interrupts our reasoning’s. The connections between incumbent and new neurons are at the same level as the connections established only between the new neurons in the case of algorithmic mind. Unlike, the autonomous mind established more connections, only between new neurons. Finally, the algorithmic mind consumes more energy than autonomous mind, which has a clearly declining trend.

INTRODUCTION

The Algorithm Mind was a concept launched and defined by Keith Stanovich (2008). It was a work where he brought a new approach with an intuit of giving a step forward from the two systems of thinking (Kahneman, 2011). Basically, Daniel Kahneman defended the existence of two systems of thought inside our brains: system I and II. System I, is considered as being fast, automatic, frequent, emotional and subconscious. Instead System II is slower, requiring additional efforts, is less frequent, logical, calculating and conscious (Kahneman, 2011). System I and System II debate the use of reasoning or lack of it regarding the decision making process. Instead, Stanovich disagreed with this simplistic approach of dividing the way that we think. Proceeding with his logical reasoning he suggested a mind with tri

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process theory. According to this theory, Stanovich suggested the division of the mind in three distinct minds: reflective, algorithmic and autonomous. The three process approach was an advance on the discussion of great rationality debate in cognitive science and a step forward in trying to work out the impacts of dual process theory (Stanovich, 2008). The author has focused his work on debating add-ons and issues belonging to the dual-process theory. Then, he worked on the effects of these ideas with the intuit of building his perspective on human rationality.

Rationality, in terms of physiological perspective works under the prospect of neuronal assemblies (Greenfield, 2002). Neuronal assemblies are structures of transiently synchronized neurons belonging to a variety of neural systems and are thought to encode sensory information or store short-term memories (Galan, 2006). This phenomenon is reminiscent of the formation of clusters in models of coupled phase oscillators (Golomb et al 2002; Galan, 2006). In reality, all the dynamic involving neural networks is normally described by systems of coupled phase oscillators as long as networks have weak connections and the neurons’ firing frequencies are roughly constant.

Now, if rationality is sustained on the neuronal assemblies, we should question:

- Why do our brains are considered lazy giving more use to system I in deterrence of system II?
- Or according to the tri-process of Stanovich why people use more the autonomous mind for solving problems instead of using more the algorithmic mind?

We have investigated the mechanisms leading to the emergence of these neural assemblies with models of coupled oscillators (Galan, 2006). We took in consideration that the formation of synchronized assemblies is a rather general phenomenon. And we used as assumption the mathematical analysis done by Galan among others to support the necessary conditions for the occurrence of synchronized neuronal assemblies.

If we analyse the subjacent mathematical formulas, we can verify that energy represents a specific and important role in the way that neuronal assemblies are structured on the tri process of mind. The brain, besides other elements, works under a spectrum of energy (Kahneman, 2011). Typically, these elements are combined in a certain way, with the objective to produce energy that puts all necessary synapsis working. It is also interesting to see human brains emitting waves, like when a person focuses his attention and tries to perceive some risk or remembering something important or even trying to solve a complex problem. This activity fires thousands of neurons simultaneously at the same frequency generating a wave, at a rate closer 10 to 100 cycles per second (Kahneman, 2011). There are several types of brain waves and the algorithmic mind occurs when the brain waves become beta and gamma, depending on the implicit reasoning needs. Waves that are the fastest ones comparing to the waves used by automatic mind. Automatic mind usually works with out more by using alpha waves which are considerable slower. So the question arises: if the autonomous mind is associated to system I which is faster, instantaneous and the subconscious works with waves in a slower frequency mode, why does the algorithmic mind which takes more time, is infrequent and conscious works with waves in a higher frequency? Isn’t supposed to work in an opposite way? In other words, does it make sense to have a lower energy frequency for a mind working intensively and a higher energy frequency for a mind working less intensively? Why the systems work inversely and are asymmetric?

To tackle this problem, we decided to explore the role of energy in the ignition of the algorithmic mind and try to explain why exists this negative correlation between the characteristics of each type of mind and the frequency of energy. For that we built a simulator under multi agent based system methodology.