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28th of December, 2006  
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## **On How The Brain Functions**

### **Abstract**

This article presents my view and theory on the basic principles behind a thought process and how the brain functions.

The phenomena of thinking stems from an iterative process of colliding electromagnetic waves. The characteristics of electromagnetic wave behaviour lie as a foundation for thought processes.

A new sense, tuning sense, is the antenna and receiver of our thoughts and the location of conscience. A neuron is as an organically developed radio transceiver of the simplest form.

### **Memory**

The memory of an organic brain is dissimilar to currently used computer memory, where each bit resides in a fixed slot accessible via a memory address. The organic brain is based on continuously travelling electromagnetic waves. Thus, our memories are not hardcoded physically to neurons and connections between them. I propose that the storage concept is the same as in the first digital computers in the 1950s: a delay line memory.

To contrast brain's memory with the internet, memories are not stored in a server hardware somewhere - they are on a constant run on copper wires and fibre-optic cables instead, i.e. distributed and flowing all around the neural network of the brain. Memories are streaming all the time: words and sounds we have heard, muscle movements we have made, etc. In this kind of memory, there is no need to orchestrate vast amount of neurons to operate sequentially; to fire in a sequence. To provide a rough example for illustrating this point; when we are throwing a ball, we are "listening" to a previously recorded action and channeling it to our muscles.

The memory capacity of an organic brain is directly related to the length of its neural wiring; the longer the wiring, the more capacity is available. Like is the case with fractal-like coastline of Norway, zigzags generate the length. On examining a jelly fish we can see that their easily visible wiring is so short, that their actions are a direct and instant result of the impulses they are getting from their surrounding environment. Those fish do not have any wiring to provide space for circulating waves, thus they do not have any memory.

I would use a water basin as a metaphor. Let's define a wave going through the water as

an information carrier. The bigger the basin, the more information it can process and act as a medium for. Throw a coin to the basin filled with water, the water ripples for forty seconds. An ocean, however, can remember an earthquake which occurred much earlier; it can broadcast the message of a tsunami for several hours.

Delay line memory provides an important functionality for information processing; by merging an inverted version of a previous signal to the newest signal, the memory can pinpoint and concentrate to the change in information. This method was used in radio wave-based radar systems - the systems were able to eliminate static scenery, and display only the moving objects. I see that an organic brain benefits enormously from this straightforward and simple capability. Incidentally, the line between two concepts - memory and information processing - is getting blurred.

Hypothetically, if we were teleported to an other place, atom by atom, we would physically resemble the same person. In my view, however, our memory would be blank and our thoughts would be on the level of a new born.

## Neuron

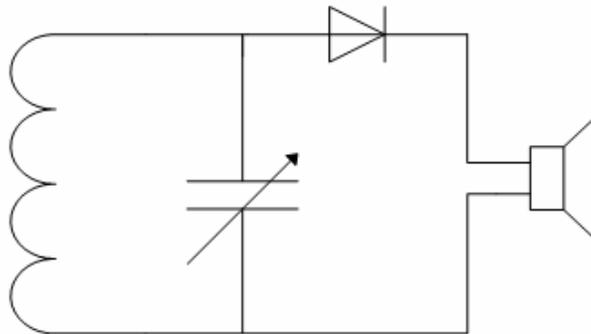


Figure 1. Crystal set radio.

A simple form of an electrical radio, so-called crystal set, consists of a diode, a capacitor and a coil as an antenna. The organically developed counterparts for those components are the basic building blocks of organic brains, also. I suggest that a neuron is a microscopic radio.

Generally, an antenna acts simultaneously as a receiver and a sender, likewise, a neuron is also a transceiver. Thus brain functions as billions of microscopic radio transceivers. They broadcast and re-broadcast the programme they are receiving from the senses and other neurons. On a functional level, radio transceiver is an equivalent circuit for a neuron. Dendrites take the role of a fractal antenna and are thus capable of receiving and radiating a large range of frequencies.

## New Sense

Our eyes convert the photons to changing electrical current. Our ears translate the changes in air pressure to changing electrical current. Changing electrical current creates

electromagnetic fields. Each sense transmits using a different frequency range which guarantees that the signals do not mix with each other – normally.

The new sense - tuning sense - is the trimmer of our brainwaves. It selects what frequency we're tuned to: what are our thoughts, what part of the multiple stimuli from our senses and neuronal activity we perceive.

Tuning sense resembles the tuning knob of a radio, which is actually a variable capacitor. When we sleep, the tuning knob turns randomly from left to right, figuratively speaking. It picks up all kinds of signals mixing them freely and channeling visions to visual cortex.

Tuning sense also resembles the read/write head of a hard disk. In hard disk storage system a circular disk, platter, is used for recording data. Read/write head reads and records the data to a disk, which is rotating several thousand rounds per minute. In our minds, the data itself is "rotating", i.e. moving around on neural network. So, there isn't need for anything to physically move or revolve.

Some of the mental illnesses are caused by a misbehaving tuning sense. Pigeons' tuning sense has evolved to catch additionally the electromagnetic field of the earth, thus their orientation capabilities are much improved.

The concept that we are listening to our inner radio broadcasts raises a question: which part of us is turning the knob of the tuning sense? The way I see it, the knob is controlled by a feedback mechanism inherit in our brains. Tuning sense is controlled by the sum of the internal electromagnetic state of a portion of the brain. The role of thalamus is central in sensory and other operations; it can be presented that thalamus is the tuning sense, receiving input from the senses and feedback input from the cerebral cortex.

Brain is a parallel, layered processing unit. There is one tuning sense for thought process and also several other dedicated for other bodily functions. Figuratively speaking, we cannot "hear" the signal from all the tuning senses; they are not part of our consciousness directly.

Thought process is not a chemical one per se. It can be altered, improved and distracted by chemical substances which change the electromagnetic properties of the brain, the behaviour of the tuning sense and other senses, and the regeneration and growth of brain cells. Furthermore, some senses' operation is based on chemical reactions. In the end however, each sense converts stimulus into a general, unified, common type for processing - into electromagnetic waves.

The differences in an ability to think and act rises from physical differences; the type of brain cells, nerves and the connections to the senses are differently distributed and unique.

## Learning

Learning begins with a process in which we let more and more waves travel into our brains. According to my simplified view, each time we hear, taste, see or touch something, or get an internal stimulus from tuning sense, we get potential material (i.e. waves) for learning to occur. Forgetting occurs when new waves obscure the old ones, caused by the limited brain memory capacity or other electromagnetic wave behaviour phenomena. In addition to the process of forgetting, wave behaviour phenomena also leads to creativity; new waves (information) emerge caused by the phenomena.

Put simply and on a very basic level, learning manifests itself as an ability to respond with a reaction to a stimulus. We have learnt that red light on a road advises us to stop. Our whole life is a continuing series of similar infinitesimally small steps of stimulus-reaction. Impulses from our senses, tuning sense included, create a reaction in us. Our mind factors in all the impulses it is receiving, and calculates a result. In a way, it is like a mirroring water surface. The ripples interfering each other on the water represent our past stimuli and experiences. They change how the surface refracts and mirrors its surrounding scenery. The ripples (waves streaming on our brains = past stimuli) alter the current result (mirrored image = reaction).

## Intelligence

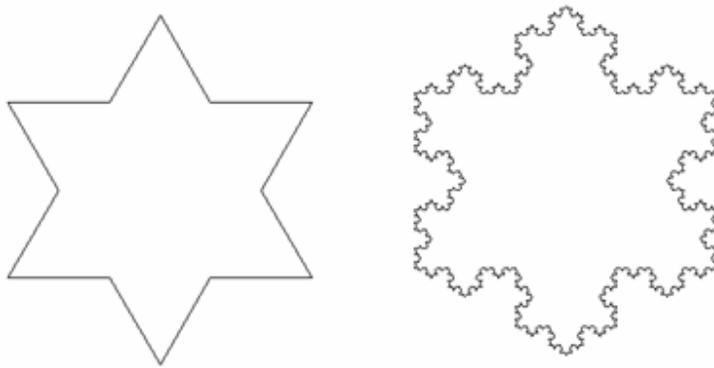


Figure 2. Two Koch Island curve L-system fractals with one (left) and four iterative steps. More iterative steps result in more richness.

Intelligence can be defined as a measure of context size; how large amount of various stimuli we take into an account and process prior an action emerges. In other words, it is about how many mental plates we manage to juggle in the air concurrently.

Like is the case with an L-system fractal and other iterative processes, simple rules generate complex behaviour. Feedback mechanism is important for achieving complexity and the richness of the form, for raising rich conceptual thinking (e.g. language). Electromagnetic waves feeding and changing each other creates thought. As a simplified example, the brain of an ant utilizes less iterative steps than the brain of a human being.

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