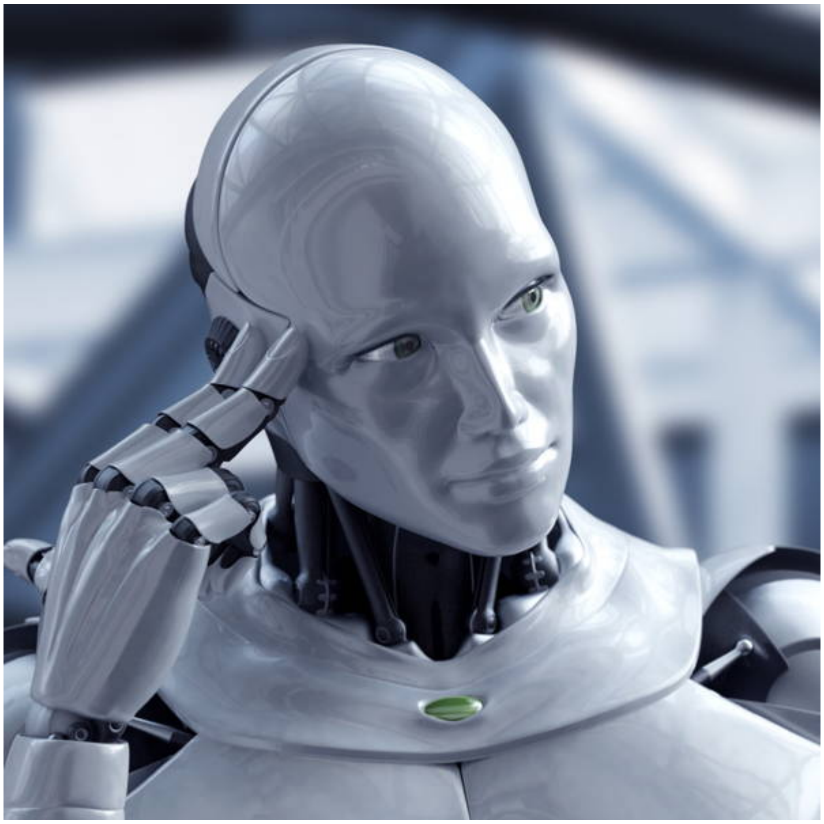

Where Thoughts Come From

(part 3)

The better you understand the landscape, the more you see in it.

"The only thing that makes life possible is permanent, intolerable uncertainty."
— Ursula K. Le Guin

In **part two of the series** I talked about how we assemble our image of ourselves from what we've learned and what we've seen. I proposed our thoughts are limited to pieces of ideas that I called "oughts." Oughts are elements of meaning, pieces of thoughts, that do not appear in our minds until we have a context for them. Oughts, by themselves, are are not enough to verbalize.

Before I describe how thoughts might be formed, you should understand a few things. I was going to focus on a mathematical model, but more background will make it more recognizable.

We know little about the mind beyond organic chemistry and physiology. We don't know much about the brain either. We know virtually nothing about the connection between mind and brain. Your ignorance does not handicap you in this regard; everybody's ignorant.

On the other hand, to make a connection with what we do know, you've got to reach beyond the obvious. You've to grasp loose ends that are far from making a good connection with anything we're trying to understand. The yawning distance between what we do and don't know puts us firmly in the land of conjecture.

Neuroscience

Neuroscience fractures along lines of specialization. The most active lines are those where new observations are being made, and this emphasizes new machines that are creating new images. People are making lots of pictures that don't conclude anything and generate a lot of interest. This is more about making bets and building machines than it is about understanding the brain.

Psychological neuroscience approaches the brain along research and therapeutic lines. Here you'll find studies of injuries, exceptional symptoms and behaviors. This is the realm of Oliver Sacks (*The Man Who Mistook His Wife for a Hat*) and Norman Doidge (*The Brain the Changes Itself*). People love to talk about this stuff but it doesn't have a direct effect on the field.

Pop psychology presents a lot of fun stuff and a lot of poor science offering anecdotal evidence as proof. The field of clinical psychology has been obsessed with "evidence based" practice for the last 40 years. Practice follows popular demand. This is an improvement on what previously had no evidence at all but as most of the evidence is still poor, much of the result is poor therapy.

Clinical neurology concerns itself with explaining and addressing disabilities. This pragmatic field is less concerned with what's causing things to happen and more concerned with what works. It's a field influenced by money and politics that pertains to public policy, government support, and managed care.

Neuropharmacology provides psychiatry with pharmaceutical interventions. Pharmaceuticals are a multi-billion dollar industry that has captured much of government, institutional healthcare, and national policy. Pharmaceuticals are part of the military's new biological weapons programs. These private corporations take a leading role in pharmaceutical research. They install their subcontractors in academic positions and on editorial boards. They are allied with neither the objectives of science nor the Hippocratic Oath.

Neurophysiology is a laboratory neuroscience that studies the nervous system in vitro: examining nerves, vivisecting animals, fiddling with genetic sequences, and testing chemicals. This is the most complex area because there is no limit to the theories or tools that can be employed. Laboratory neuroscience can pose any question and employ any means to address it.

Computational neuroscience concerns itself with abstract modeling having little connection with practical applications or observations. Because computational neuroscience builds off the axon-nerve-synapse model, it appears mechanical and computer-like, but it is not necessarily so constrained. To the extent that unusual models of the brain can be found—models that don't rely on nerve impulses or digital analogies—all sorts of computational models can be advanced.

Finally, more or less, there are electromagnetic models of brain function. These models range from the microscopic, looking at the electrical behavior of individual nerves, to the macroscopic, looking at the electromagnetic fields produced by large areas of the brain. We can easily, painlessly, and cheaply gather data by observing outside fields generated by processes inside the brain. Even electric fields inside the brain can be explored without putting probes inside the skull. Invasive observations can also be done, but, in that case, the objectives are medical.

Spirit

Neuroimagery, psychology, physiology, pharmacology, computational, clinical, and electromagnetic neuroscience provide scientific approaches that encircle the Western question of the mind. The Western notion might not be right and the "circle" that these approaches form might not really contain the answers we're looking for.

In a somewhat macabre analogy of Christians and lions, science throws questions of the mind into this arena where they're torn to pieces. As far as I can tell, nothing comes out alive. The Western model consistently collapses into reductionism because it has no connection to a higher goal. In the province of the mind, reductive thinking is a vine with nothing to climb on.

Eastern and other spiritual traditions reject the reductive, purely intellectual notion of mind. These traditions start from the assumption of a higher power and work downward with the object of avoiding the spiritless universe of objects. They also object to the hubris that often characterizes modern science of which little is said. Pervasive intellectual arrogance is a larger problem than most people realize because it fuels a predatory mindset.

The model that I'm suggesting is self-organizing. That means it isn't entirely reductive. It reduces larger structures to smaller structures, but every stage retains an aspect of the ineffable because the components of the model are the building blocks of meaning.

These structures say more about how we create ourselves than they say about the atoms we are composed of. I'm not reducing spirit to mechanics, I'm reducing bigger meanings to smaller meanings. If my model sheds some light on how humans think, then it will shed light on how any species thinks.

Measure

I propose a model that is supported by physical structures at some level, but we're still too far from these structures to observe them separately. We don't know what a thought is at any level, and my proposal is that thoughts are best imagined as shapes of an electromagnetic field. We have to rely on imagination because no one knows what that would mean in reality. The problem with systems that involve electric fields, which simultaneously connect the operation of many parts, is that you destroy their integrity when you separate their parts.

Whenever you measure something you take something out of it. If it's sufficient to take only a little bit, then you can leave the object and the operation you're examining intact. But if you violate the object's integrity by interfering with its essential action, then you destroy it. At the current time, we cannot observe a thought without destroying it. That's because we don't know the structure of what we're looking at. We are the proverbial workmen with hammers; we either smash things together or we smash them apart.

The model I'm working with involves us with the psychological, electrical, and computational lines of neuroscience. It's interesting to incorporate other approaches, or to reach for implications in other disciplines, but simpler is better at the start. A quick summary of these areas will be followed by more detail in the next installment of this series.

The result is a tool useful for reflection, therapy, and self-exploration. I think there is physical truth to the model, and that it is not just a reflection of how we phrase the problem. I believe aspects of thoughts will be measurable someday. Once that is possible, this model will be experimentally verifiable.

Modeling

Psychology

The best exploration into the nature of thinking follows from the study of emotion. Most studies of emotion focus on neuroanatomy asking whether or not particular areas of the brain are responsible for particular emotions. The consensus is that emotions are not localized in the brain. This is complicated by the somewhat vague distinction between different emotions.

Some "emotions" are more localized than others. Fear, for example, seems to be mediated by the amygdala, a small, central organ that's part of the limbic system. A complex emotion like happiness is harder to define and localize. Complex emotions like love are not considered emotions at all because they lack a clear definition.

For my purposes, emotions are higher-order constructions. They are thought-complexes that I will not be concerned with at first. I'm more interested in how emotions are built as that sheds some light on how thoughts are built.

Emotions are not built consciously or intentionally, and they're not subject to logic or reason. Unlike thoughts, emotions are not intentional. When we try to control our emotions, we often do it by first trying to control our thoughts. There are therapy models that manipulate emotions which work with the connection between thoughts and emotions.

Emotions are being constructed for artificially intelligent systems. The field of artificial emotions is essential for the development of human-like artificial intelligence. And while we don't have an organic theory of mind, we do have computer models that generate artificial minds, and in this context people are trying to build artificial emotions.

> "Putting into practice a workable computational system can also demonstrate which parts of psychological theories are coherent and reassure the appropriateness of the undertaken directions of further studies."
> — Kowalczuk and Czubenko, 2016

Electricity

Two electrical properties pertinent to this model are the brain's harmonic waves and the discharges of individual nerves. These harmonic properties are seen as brainwaves, rhythmic excitations exhibiting changing patterns in different areas of the brain. We can measure these to varying degrees. We can correlate changes in brain waves with changes in behavior. Training changes in brain waves results in the training of changes in behavior.

We have not been able to identify the source of these waves which originate in the collective discharge of synapses. The subtle aspects of their creation, synchronization, propagation, and absorption are largely unknown.

Electrical waves are shaped not only by what creates them, but also by the medium they pass through. The brain is a non-uniform conductor whose properties can change faster than the currents that travel through axons and across synapses. A good part of the brain's operation is likely modulated by shaping electric fields through the action of chemical gradients, membrane potentials, and phase boundaries. Science is only at the earliest stages of making sense of this.

The brain's rhythmic properties are critical to this model. Different parts of the brain are subject to waves generated by local and remote parts of the brain. We know these fields correlate with cognition and we believe these frequencies play the role of pacemakers for enduring, plastic changes in brain structure. In my model these rhythms simply "clock" the step-wise evolution of our thoughts.

> "There is increasing evidence that low-frequency (2–25 Hz) neural oscillations are not simply epiphenomena, but reflect an essential mechanism for coordinating brain function."
> — Miller et al., 2012

Computation

My model is ostensibly computational, but it's unlike any computational model I know of. It's simpler because it correlates with the psychology we understand rather than physiology we don't.

There are two types of computational models: bottom-up and top-down. Bottom-up models attempt to derive behaviors from neural structure, while top-down models try to derive possible structure from observed behavior.

This is a top-down model except that I'm not even trying to connect to neural behavior. I want to understand how the brain creates more complex information from less complex information. That makes this a conceptual rather than a physical model.

Digression On Foundations

This is an important point: most people think the building blocks of a model must be physical and that's a serious mistake. The tendency of people to believe more in what they visualize rather than what they can intellectually discern, makes them vulnerable to sleight of hand and to various forms of manipulation.

All "building blocks" are conceptual things. All models are fundamentally conceptual. The fact that some of these "concepts" can be measured does not really make them real, but we tend to think so. We "believe" what we can see, but sight is an illusion and it is not essential. What is important is repeatability because that is the foundation of prediction, not what's visible.

Most models I have seen are deterministic. They aim to create a method that either maps to neural structure or to simple behavior. I am not satisfied with deterministic models because an essential aspect of mind, one that distinguishes it from machine intelligence, is its non deterministic behavior. This is essential both for creative thought and adaptive behavior. I am proposing a model that is both basically simple and infinitely complex.

Simplicity

My first concern is with simplicity. I want you to be able to see the basic structure and quickly identify it with your own cognitive processes. My next concern is that the model is able to grow without bounds but, at the same time, retain some of its original structure. I want the model to grow in a manner so that it's simple structure is enlarged but not destroyed. One way to make that happen is for it's basic structures to be reflected in its larger structures.

These requirements are met by systems that scale through iteration. These are fractal systems that display unlimited complexity based on simple, underlying patterns. This model is of that type and because it is intrinsically unstable we direct ourselves to observe its general properties rather than the result of any particular prediction.

This is consonant with using our own introspection because introspection leads us to see patterns in our thoughts rather than the mechanisms of them. We are more aware of our thoughts billowing like clouds than we are of chemical gradients and neural structures.

In the next installment, I'll speak specifically about combining psychological observations and electrical functions that generate the simplest model of oughts combining to create thoughts. Because this model builds on the well-known logistic equation for population growth—here the populations are thoughts rather than animals, but the behavior is similar—we can make a number of conclusions about how thoughts behave and compare these with what we observe in ourselves.

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Mind Strength Balance

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