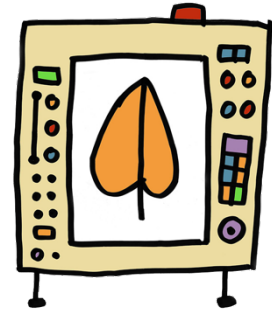


SEIZING AN ALTERNATIVE Toward an Ecological Civilization June 4-7, 2015

Section IV: Reenvisioning Nature; Reenvisioning Science



“Organisms, Memory, Quantum Physics, and Agency” By Philip Tryon

“The question ‘What is life?’ is not often asked in biology, precisely because the machine metaphor already answers it: ‘Life is a machine.’ Indeed, to suggest otherwise is regarded as unscientific and viewed with the greatest hostility as an attempt to take biology back to metaphysics.”

- Biologist Robert Rosen

Introduction

This presentation is a slightly extended version of a paper that I presented at the CPS conference in June as part of a scientific track entitled ‘Emergence and Evolution of Living Agents.’ It is based on a manuscript called, “Being Alive” which is, at this time, only available as an e-book. With the intention of appealing to a broader readership, I keep the language simple and straightforward. This can be problematic at times and I want to say in advance that when referring to ‘matter’ in the context of an organic model, I am not referring to inert material that is moved only by external forces (as in mechanism). And my word ‘organism’ does not refer to something ontological, but a phenomenon that is readily observable, even by those who are not scientists or philosophers. Changing constantly, with indistinct borders, and in a constant state of becoming, an organism is likely to be a secondary phenomenon, emerging from what must be an actual, more fundamental reality.

I. Organisms

A. Definition of organism and ‘organism type’

Okay, with that out of the way, I will begin with an insight from Thomas Kuhn in *The Structure of Scientific Revolutions: A paradigm has a great effect on scientific and metaphysical processes, largely dictating what is to be observed and scrutinized and*

what questions are to be asked. In line with Whitehead's philosophy of process, I would hereby like to recognize and scrutinize two phenomena that are commonly overlooked by scientists: **organism** and **habit**.

First, let me be clear about what I mean by an organism: It is a physical entity that *embodies internally cohesive processes and flows* as it *experiences and interacts* with the world outside of itself. Virtually all organisms exhibit the following:

- characteristic internal rhythms and pulsations
- characteristic (for the type) external relations with others
- a multitude of pre-existing organisms of its 'type' (similar to it)
- a structure and a set of behaviors, as well as inclinations and aptitudes, inherited from these predecessors

Types of organisms would include foxes, bacteria, plants, paramecia, termite colonies, sperm cells, orca pods, and perhaps even planets like Earth and Mars. An individual organism would then be any particular entity from the above categories.

B. Interrelations and boundaries

Mutual relations with other centers of experience (other informed entities) are common and generally characteristic of the organism type while also being dependent on the individual's history. In fact, it is impossible to characterize a particular organism very effectively without reference to its significant relationships. (What would anyone be apart from their relationships and significant others?) It is because of the significance of relationships that *the boundaries of organisms must be indistinct*. The edges of an organism are often unclear and it is sometimes impossible to ascertain where the entity begins and where it ends or what is part of it and what is not. (Like most organisms, one's own body is a conglomerate entity made up of many complementary living cells, most of which have foreign DNA.) Though the indistinctness of organisms presents a withering challenge for advocates of mechanism and mathematical models, this may just be the way the universe is: complex, with indistinct boundaries between organisms, and rife with entanglements that appear too immediate, too idiosyncratic, and too unpredictable to be the result of universal laws and chance alone.

C. Hierarchy

Whitehead and others have pointed out that the life-world is a hierarchy of organisms where individuals interact coherently at various levels of complexity in order to comprise higher level organisms in which they participate. According to this view, bodies of plants and animals are organisms which are made up of organs that are made up of cells, and so on, all of which are organisms in their own right. Likewise, individuals combine to form packs, hives, herds, flocks, and shoals which interact coherently to make up local ecosystems. The life-world, according to an organic perspective, is a hierarchy, up and down, where individual parts participate in relations with others at the same level in order to make up organisms at the next level.

D. Why mechanistic models cannot account for organism

A final observation about organism: The attributes of organisms, including internal cohesion, participatory interrelations with others, and distributed intelligence, cannot be accounted for by mechanistic models, no matter how much one rearranges the parts and modifies the relations between them. The stuff of mechanism – inert matter – will not behave as we see organisms behave; that is, unless one envisions a machine-like model where organisms are centrally controlled and running on some sort of a code, as machines obviously are. Noteworthy philosopher Thomas Nagel recognizes this deficiency of the current mechanistic model in his recent work: “*Mind and Cosmos: Why the Materialist Neo-Darwinist Conception of Nature Is Almost Certainly False.*” Whitehead would have emphatically agreed, and common sense tells us, that mechanism – the rearrangement of inert material particles according to the external forces recognized by physics and chemistry – cannot account, in any detail, or even in a believable way, for many of the characteristics of organisms.

II. Habits

A. Definition and examples

Now let's consider the second phenomenon of interest: Habits, which are not often scrutinized in modern science and philosophy. Clearly, habitual activities must represent a phenomenon that is difficult, if not impossible, to quantify or render into mathematical formulas. Nevertheless, habits can be seen as recurring processes of material movement and flow that follow pathways and channels created by an accumulation of previous similar iterations. All organisms embody habits of various kinds that spring into action, usually when appropriate to conditions and circumstances or when there is 'a trigger.' Habits in the organic world can be structural, like skeletons or hexagonal honeybee combs. They may be primarily growth and movement oriented, as in fetal development or bike riding. And there is a third category: habits of social encounter and engagement as observed in the coherent flocking of starlings and mating rituals of cranes. Such habits that involve connection at a distance between organisms or groups of organisms may help to explain the surprising internal coherence observed in all living organisms. In fact, habits are ubiquitous in the world of organisms and it seems clear that they can be roughly classified as either structural, growth/behavioral, or interactive, often manifesting as some combination of the three.

B. Two kinds of habit

When you think about it, there are actually two different types of habit. There are those habits that are *inherited* and supposedly exist as a code in the DNA, like tooth shape and fetal growth. And there are those individual habits that have been *acquired* through experience, like bicycle riding and pet tricks, which supposedly exist as some encoded 'memory traces' in the brain. DNA *and* memory traces. This widely accepted, bifurcated model of memory is suspicious on its face because a single, recognizable phenomenon – habit – seemingly springs from two separate, completely different, storage faculties.

This is really highly problematic for the mechanistic model. And another difficulty for the 'physically encoded' model of habit and memory: There is strong evidence that inherited and accumulated habits often overlap and can even morph into one another over time.

C. Habits and Whitehead's processes

Whitehead recognized the processes embodied by organisms as made up of a succession of actual occasions in which there is prehension, the development of inclinations, and then resolution or concrescence. Is it possible that Whitehead's processes and the habits of organisms are essentially one and the same? If so, then the organism forms inclinations—presumably according to habit—which may affect outcome, thereby resulting in a sort of agency. Observation suggests that the 'force' of habit is not quantifiable or the result of any universal law. Rather, a habit acts more like a local guiding force or pressure, always tending to keep the pattern 'on track' or 'returning to deeper channels', even in the face of unexpected circumstance.

D. Improvisation

The embodiment of a habit cannot occur blindly because improvisation will often be required for success. The baseball batter must adjust the swing according to the trajectory of the pitch and the spider must construct a web on the topology she encounters. Could the improvisation required during the embodiment of habit be a potential basis for free will?

E. Habit and memory

Habit must be based on the details of similar activities that took place in the past and so it represents a form of memory. A particular organism is an embodiment of a form generated by countless preexisting entities that contributed to its inheritance. It remembers them! An individual memory, on the other hand, apparently manifests in the brain as a re-creation of a neural firing pattern that occurred on a previous occasion. The neural 'circuit', given the right 'trigger', seems to re-member the pattern of movement within the neural structure. Viewed in this way, the phenomenon of habit has the potential to better account for most types of organic memory, including:

- re-experiencing, or being informed by, moments from the past,
- re-embodiment of the form and characteristics of the species, and
- re-creating correlated, purposeful movements within the extended parts of the body.

This analysis suggests that memory may be inherent in the material from which organisms are composed, rather than retained as some particular arrangement or code as in mechanism.

III. Comparison of Process Philosophy and Quantum Physics

So if habits, whatever they may ultimately be, affect the movement and flow of matter in the real world, then what about the predictions of mechanism. How is it that the force of habit manages to avoid violating mechanistic laws? Does the force of habit occur above and beyond the known forces of Nature? Why hasn't this force of habit been noticed before?

In order to consider these difficult questions, a comparison between quantum physics and process philosophy is a good place to start. Process philosophy and quantum physics are similar in that they both envision a physical, material system that exists as a superposition of many possible states, which abruptly reduces to a single, unequivocal state when the 'measurement' is made (or perhaps when participation occurs). The difference between process philosophy and quantum physics concerns agency. Under a modern scientific interpretation, the 'measurer' is incapable or unwilling to affect the result, so it must manifest randomly from among the possibilities. In this case, agency is ruled out at the quantum level and so in the broader scientific paradigm as well. According to the perspective of process philosophy, on the other hand, the inclinations of the interested organism(s) that are present may affect outcome that manifests from among the possibilities.

A. Choice may occur within the uncertainty quantum physics

Now consider the possibility that organisms, functioning according to a collection of habits – some inherited and some individually developed – do *exercise agency* in the course of actual occasions. How does the new organic model begin to account, in a substantive way, for the effects of inclinations in the physical system without breaking the laws of mechanism? Consider this: If coordination of parts of a system, or some process of selection, occurs within the uncertainty afforded by quantum physics, then no mechanistic laws are broken. Mind would then exist within the actual occasion as the capacity toprehend circumstances, form inclinations based on habitual preferences, and influence results accordingly. It would essentially be the embodiment of pre-established habit, and free will would be expressed in the course of any improvisations called for and executed in a constantly changing environment.

B. The link to determinism and free will

This issue of an organism's capacity to influence outcome of an actual occasion (or a quantum collapse) is actually the *free will vs. determinism* question in another guise. If the inclinations of the attendant entity potentially have the capacity for affecting outcome then agency may exist as organisms exploit the uncertainty established by quantum physics. Thus a quantum analysis informed by process philosophy, constituting an emerging model of organicism, may represent a way of recognizing and accounting for agency and free will without violating mechanistic laws.

IV. Entanglement and Relationship

This model of organisms embodying habits and interacting coherently in order to form the web of life accounts for much of what is observed in the world of organisms, yet important questions remain: Why do organisms tend to form ongoing mutual relations that result in coherence of the larger body or organism that they comprise? What effect can cause the parts to be on the same page? Minus the option of invoking DNA codes or memory traces, without any obvious locus of control, and without a supposed 'program' coordinating the parts, how can the amazingly organized movement, both inside and outside of organisms, be explained?

Consider this: Experiments at the quantum level have shown that separate, supposedly inert material 'parts' can become and remain affiliated and complementary even when separated by vast distances. Something that happens to one can immediately affect the status of the other. Is it possible that the entanglement observed among elementary particles could be the root of the 'entanglement' that naturally comes into being between larger organisms?

V. New Assumptions

A. Historical precedent

As a prelude to introducing the 2 new assumptions that may replace the outdated and highly questionable assumptions of mechanism, I want to tell a brief story from the history of science. I heard the story directly from Stanford physicist Murray Gell-Mann who, in 1964, made a startling proposal about elementary particles. It was known at the time that so-called elementary particles must have some internal structure in addition to spin, mass, and charge. Gell-Mann asked the question, "If there is another level of structure beneath the level of the presently observed hadrons, what is the minimum number of sub-particles that could account, through their various combinations, for all known particles? And what would be the characteristics of these sub-particles? He quickly saw that the minimum number was three but was chagrined to find that the sub particles would have some very strange characteristics, like electric charge of $1/3$ or minus $2/3$. Undaunted, he presented a paper based on these musings. Lo and behold, some experimentalists took it upon themselves to find evidence for the existence of these sub-particles which Gell-Mann was referring to as quarks, and they did! At first Gell-Mann was startled, and then later, after digesting the whole experience, he suggested a new metaphysical 'law' for physics: Whatever new particles are allowed to exist within the present scientific framework of science, will indeed be found.

Today our sciences operate, mostly unconsciously, on assumptions of mechanism, reductionism, dualism, and the existence of an objective world. Yet there is a lot of evidence of structure, below or behind the objective world described by mechanism. It behooves us, just as it did Gell-Mann in the sixties, to look carefully at any uncomplicated model that may account for the additional evidence, even if all of the aspects of the new assumptions are not initially appealing.

B. Two assumptions

Mechanistic assumptions of atomism, reductionism, dualism, and the existence of an objective world are all flawed and need to be replaced. Any replacement assumptions must be in better harmony with emerging understandings of postmodernism, feminism, process philosophy, and quantum physics. The particular alternative to mechanism being proposed here, a postmodern, constructivist approach, can be substantially developed on the basis of two new assumptions, which can replace the outdated and overly constraining assumptions of mechanism:

1. The ***universe is composed of actual occasions*** which consist of both matter and mind.
2. Once an actual occasion is resolved in a particular manner, ***future similar occasions are more likely to go the same way*** and turn out the same. In this case, repetition would be slightly favored so regularities would inevitably form and habits would evolve.

The first assumption may be relatively easy for us to accept, if for no other reason than it was proposed by Alfred North Whitehead. The second may give one more pause ... if this is so then why haven't we considered the habit-forming nature of the universe before? Well, once you begin to see, with fresh eyes, how many of the processes in Nature are repeated over and over again – tulips blooming, cells dividing, protein molecules folding, DNA replicating, and wolf packs hunting – some type of habit forming inclination at a fundamental level begins to seem likely. Not only does this second assumption explain the habit forming tendency within organisms, it also provides a possible way of explaining the more general phenomenon of memory. With these two assumptions, and an observed tendency toward entanglement, we may have a competing model that accounts for virtually all of the evidence, in a simpler and more complete way.

C. Resulting ontology

Now, given these assumptions, one might ask: “At the most fundamental level, what is the universe actually composed of? Due to the first assumption, it is clear that **actual occasions** are basic, real, and actual. But now there is something else – there are the **habits of Nature** which guide organisms as they follow pre-established pathways. Since any occasion necessarily has a connection with, and may be guided by, individual past iterations, one must allow that **all past occasions** also remain fundamental and substantive, seemingly forever retaining the capacity to influence the imminent occasion.

VI. Habits and Consciousness

A. World without consciousness.

Habits are basically unconscious processes, which is not the same thing as saying that they don't involve experience. After all, to apprehend, form inclinations, and be present during concrescence is to experience the world. I think it is safe to say that a world where habits are the only causal factors (besides universal laws and chance) would be a disappointing world. What about inspiration? What about epiphany? What about love and respect? Now may be a good time to speculate about how consciousness (whatever it is) can come to exist in a world that is essentially habitual.

B. Explaining consciousness

To become increasingly aware of a habit, especially during its embodiment, is to begin to raise the habit to a conscious level. And we know that this is possible because we do it all the time. So we know in our hearts that consciousness does exist. But how to *explain* it? Could it be that organisms, especially as they are increasingly complex and relatively novel (a planet or a primate, for example), may attain consciousness in the immediacy of the actual occasion. Perhaps consciousness exists on a spectrum and even the most rudimentary examples (like a hydrogen atom) could, at least in theory, experience it. Explaining consciousness is no easy task, but at least a new organicism provides a space through which it might enter.

VII. Evolution

Under an organicism based on these two assumptions, what would actually be evolving, and what would be naturally selected for, are Nature's habits rather than species or genomic features. This is an important difference. Whitehead himself may well have appreciated this radical notion about evolution; certainly he would have considered it carefully. If true, the understanding that habits are the things that are evolving has significant ramifications.

VIII. Conclusion

Several conference track members reminded us of the effectiveness of modern mechanistic models and the importance of not throwing the baby out with the bathwater in our attempts at explaining organisms, memory, and life . . . and I agree. A new model can neither dismiss nor oppose mechanism. Yet consider this: The universally applicable model of special relativity reduces, gradually and seamlessly, to a classical Newtonian treatment when speeds slow down to normal levels. Quantum mechanics reduces to classical formulas when the systems become larger and averages begin to predominate. In a similar way,

The organic model of the world presented here reduces to the objective world described by the mechanistic model, and to its predictions, under

more limited and restrictive conditions . . . that is, whenever there is no entity present who has an interest in changing the outcome.

This emerging paradigm is an extension of the mechanistic model to a larger realm – to what phenomenologists call the ‘life-world’– where entities have experiences, develop individual histories, and where inclinations exist and do have physical effects.

(This concludes the paper presented at the 6-15 Claremont conference as part of the “Emergence and Evolution of Living Agents” track. The following is additional material added for 10-14-15 presentation.)

IX. The Likely Role of DNA and Memory Traces

A. DNA and memory

A complex molecule spontaneously divides and forms a near perfect replica of itself as a preliminary to reproduction. Marvelous. This observation makes DNA a strong candidate when it comes to explaining why offspring resemble parents in form and function. Yet decades of research have failed to produce a credible mechanistic model that shows, in any detail whatsoever, how these DNA molecules actually source or organize the embodiment of habit. Certainly genes must play a role. My guess is that, like a tuning fork, a particular genetic pattern acts like an antenna connecting the individual more specifically to past individuals in its own biological lineage. This does not, however, mean that DNA is required for resonating with past, similar individuals nor that the information necessary for embodying the form of an organism exists as some sort of a code in the genes.

B. The role of ‘memory traces’

Since the majority of organisms have do not have any neurons and therefore must be bereft of memory traces as well, it must be the case that the source of inclinations that are based on past iterations cannot always be the result of memory traces. It is possible, however, that the ‘wiring’ of certain brains and the established connections within networks of neurons may be helpful in recreating patterns of excitation and flow that constitute what we refer to as ‘memories.’ Organisms without neurons, however, must experience memory in their own fashions as well.

X. The Spectrum of Organism (A New Animism?)

A. Smaller and smaller?

Certainly all members of recognized species qualify as organisms. Especially in the cases of DNA and protein, a persuasive argument can be made that molecules satisfy all of the requirements for being included as organisms. Even elementary particles like

electrons and protons are internally complex and coherent, exhibit patterned, characteristic external relations, and sometimes enter into complementary relations with others. Are they organisms? Do they ever improvise? Whatever the answers may be, this model recognizes the possibility that the spectrum of organism, and therefore the potential for agency, goes quite a way down in size.

B. Bigger and bigger?

The same is true in the other direction as well. Who is to say that planets, and even stars and solar systems, do not have a tremendous number of antecedents who may have facilitated the evolution of habits that affect our own particular locale?

C. Establishing contact

In theory, it is possible for communication to occur between any two organisms, though it seems more likely when the scale and ‘vibrations’ are similar. How might one go about trying to establish relations with a particular forest or river valley, or even with Gaia herself? Long-story short, we might refer to the practices of indigenous societies and those who have lived closer to the earth and the seasons; they would undoubtedly tell us that ritual, ceremony, tradition, and a respectful attitude are helpful in this regard. One thing for sure: Having a model that shows the possibility of relating to a broader and deeper spectrum of organism enhances the likelihood that it will actually happen.

XI. Ethics

First of all, free will is not being denied here so there actually *is* a basis for individual responsibility, which mechanistic models apparently fail to provide. Second, because of the centrality of relationship in this description of organisms, respect – the most important ingredient in any relationship – is now seen as a key virtue. The emerging model also gives one permission to trust deeper roots, as in the Taoist *wu wei*, where the body and its intuitions and inclinations can be trusted, along with the realization that individual experience and prehension of the immediate occasion may allow for innovative and corrective action when called for.

XII. Fit with Process Theology

I do not claim to have attained a complete understand process theology, yet there are some clear implications here. Who can claim to know all of the inclinations of an organism embedded in an actual occasion? Is it possible that a higher power, or a connection with a higher power, might affect the inclinations of an organism? Constructive organicism and process theology both call attention to the importance of recognizing and respecting the purposes and feelings of a broad spectrum of others. The powerful combination may illuminate a path to ecological civilization.

What could be more important than that?