The System of Systems Processes

Brian Hilton

Let there be nothing[1], no matter and no energy, and make the following two conjectures.

Conjecture 1 (the McIntyre Conjecture)

All processes are emergent from flow in a mobius field.

Conjecture 2[2]:

Linked slow and fast processes are necessary for boundaries and so structure and form and these degenerate in the limit to produce systemic emergent hierarchies and terminations.

If Conjectures 1 and 2 are true we have necessary and sufficient conditions for the holistic universe we can sense of infinitely diverse interconnected forms.

If one uses the mathematics of Rene Thom's highly regarded[3] "Structural Stability and Morphogenesis" and treat the above as axioms one gets this result as their consequence The diverse observed universe is an inevitable consequence of any flow in a mobius field. This field by definition, and observationally by conjecture, has only one side and one edge and must exist in three dimensions.

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[1] This only makes sense after you get to the point when it is worth reading footnote 4 but it is very profound and very hard to get your head around but it contains everything.

[2] *{Hypothetical Conjecture 2(???):*

All linkage propositions are isomorphies of the following 3.

Linked slow and fast processes are sufficient for boundaries and so structure and form.

Linked slow and fast process when dominated by the slow process leads to the degeneracy of boundaries and to the termination of structure and form, death.

Linked slow and fast process when dominated by the fast process leads to the "generacy" of new boundaries and so to the emergence of structures and forms, hierarchy.

However we only need one linkage proposition as 2 and 3 are degenerate cases of 1.

[3] *{NB. The only sustained criticisms made of this were not of Thom's work per se but of naïve scientific and non-scientific applications of it.}*

Let us consider a Möbius field of half-width w and a mid-circle radius R and zero height $z = 0$ Parametrically in time and on its own surface this has the following analytical expression

$$x \quad = \quad \left[R + s \cos\left(\tfrac{1}{2}t\right)\right] \cos t \tag{1}$$

$$y \quad = \quad \left[R + s \cos\left(\tfrac{1}{2}t\right)\right] \sin t \tag{2}$$

$$z \quad = \quad s \sin\left(\tfrac{1}{2}t\right), \tag{3}$$

for $s \in [-w, w]$ and $t \in [0, 2\pi]$.

The above function implies a differential in speed between any two points in the field. This makes it inevitable that it must develop a singularity. This will cause it to split along its length. This is the only means to reconcile the turbulence the singularity produces. This process will continue ad infinitum but this universe will always remain only one field and only one thing[4].

The first split produces a mobius strip with a double twist and the next two interconnected mobius strips one moving faster than the other – the universe and the anti universe. These in turn split as described producing an infinite hierarchy of interconnected mobius strips each of which contains all previous ones in the series of its advance. The second such split produces the physical and the energetic universe and their anti universe equivalents. This process of structure formation goes on in what we call evolution to produce the elements, then the galaxies, then the stars systems, then the planets, then the molecules, then single celled organisms, then multi-cellular entities, then trees and animals and so to us, societies, nations and now Gaia "and you ain't seen nothing yet".

This model produces a totally connected universe each component of which is an interconnection between a fast and a slow dynamic. This produces what we call form. This is a structure deriving "energy" from the universe. The fast dynamic produces positive feed forward(back) and the slow dynamic the negative feed forward (back) using

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[4] There is an interesting conundrum with respect to time as we normally conceive it in this model. As the universe and each of its infinity of distinct constituent parts all only have one surface edge and one edge any two adjacent points in this mobius field must be 2π units of length apart from each other. This produces a paradox that each is both later and earlier than its neighbor. In a very real sense therefore there can thus be no flow and no time in this sense. Ergo we do not even need process to have the universe. It can be constructed out of nothing – WOW – the initial statement of this paper . However time as we know it does it exist. We can distinguish between later and earlier entities in the hierarchy of structprocesses so we can have astronomical and evolutionary time but time is an absolute sense does not exist at all and so time travel must be possible, double WOW.

what we chose to call information to produce the shape of the form we see differentiated by a boundary at its edge. The linked fast and slow dynamic together form what could be described metaphorically as a local potential "mining" operation, an entity. This could be a galaxy, a solar system, an atom, a molecule, a single celled biological genus, a multi-cellular genus, humanity, human enterprises, societies of enterprises or a whole planet, seen as Lovelock has, as one totally interconnected integral organism, called Gaia by him in our instance of this process.

The basic unit in every part of this universe is therefore two interlinked mobius strips. The faster moving of these we generally label as energy. This produces positive feed forward. The other is a structure preserver using negative feed forward to sustain stability, homeostasis. This model works relatively well at the level of the atom[5]. It can also suffice to deal with astrophysical entities to a reasonable degree of short term accuracy. It immediately fails to be a sustainable perspective at the level of what we choose to call life.

Stafford Beer's Viable Systems Model (VSM) suggests that you need two such systems to be interconnected to produce a viable continuing entity. The "lower" one, what he called systems 1 and 2, tactically generating the resources the entity needs from its environment. The higher more slowly operating one, what he called systems 4 and 5, scanning the environment and strategically planning and organising the entity's capacity to respond to environmental change. What happened to Beer's System 3 ? You might well ask.

The model as we have presented deals with the energy mining and structure forming processes that are required but note that the "lower" structure is also interlinked with the "higher" structure and it is at that interface we find Beer's System 3.

Beer's work deals with managerial cybernetics and the processes of information and control it exemplifies. These processes occur at the interfaces between the two systems not within them. He calls this process "transduction" and it can involve negative feed forward," attenuation", or positive feed forward "amplification". System 3 provides the interface between the "strategy" determined by the higher level system and the "tactics" executed by the lower level systems in interfacing the entity with its environment. Level 3 thus runs the "operation" of the entity that locks its lower level function into the purpose fro it defined by its identity.

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[5] Please note this is not valid if one takes account of what goes on nowadays in high energy subatomic physics

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System 1s interfaces with the external environment to extract potential (energy) from it – note their can be many of these function within one entity (this is where James Grier Miller's huge variety of 20^6 not 19 functions come in)

System 2s interfaces with System 1s to regulate their responses to the environment in a manner consistent with the directed needs of the entity-

System 3 interfaces with the set of functions carried out by a number of systems 1 and 2 to monitor their performance and balance their access to supporting resources to ensure homeostasis and autopeosis occur.

System 4 scans the environment to interface with System 3 to ensure it is directing action in a manner leaving the entity viable

System 5 monitors the activities of System 4 to ensure these are consistent with the sustainable purposes of the entity, its distinct identity, and the long term viability of this.

Note that the identity, the distinct form of the entity, is maintained by the higher level slower processes (Systems 3 – 4) while the sustainment of the entity occurs at the lower levels in multiple functions (Systems 1 – 3).

A key feature of Beer's credo and approach to the oneness we are dealing with is that as it generates a nested infinite hierarchy of structproccesses to be effective in understanding them and their significance to us he to focus our minds on one, "the system in focus" , a Viable System. This consists of on one higher level interconnected pair of mobius fields, providing the entity's identity, coupled with a supporting, possible multiplicity, of lower level one(s) (functions) – James Grier Miller reckons there are 20 of these in a "living system".

In achieving such focus we have to also take account of the interface this entity has with its external environment. This is firstly all the systems below it the hierarchy into which it dips in its search for the energy it needs to survive and into which it excretes its waste. Secondly these are the systems above it in the hierarchy to which it must also stay connected and whose needs from it have to be eventually reconciled with its own needs. It is this higher level closure of the super system in which an entity is always embedded that is the focus of Howard Odum's work and his concept of "emergy" that forces us to consider not just on autopeosis of the entities we belong to, societies, economies and nations but their sustainable coherence (viability) in relation to what we like to call the "natural" environment we have non-constructed, Lovelock's "very old" new entity, "Gaia".

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[6] He introduced a 20th after his book was published.

Now this paper has not dealt with fractals. However this universe is fractal. The trigonometric functions we have used to parameterise it are defined over the whole complex field of numbers. The slow dynamic (feedback, negative feed forward, attenuation) provides a sequence of sub-entities parameterised on the real numbers and the fast entity (potentially explosive feed forward, positive feedback) an infinite variety in each of these parameterised over the imaginary numbers. We thus have a potentially infinite number of distinct genus, species/phenotypes and within these a similar infinity of potential forms, entities with a unique identity.

This model thus has embedded within it the Periodic Table which is defined over two dimension, atomic mass and electronic energetic intensity and a system of classification for biological if not all entities based on their position in the evolutionary tree and the initial specific singularity that caused their genus or species to come into being, emerge. We can quite comfortably consider a Super Perodic Table for these two systems of classification and if we take Odum's work into account a Meta-Periodic Table based on mass (biomass) and emergy based on what Troncale would call allometry.