

Novelty, historical science and the limits of objective language

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Earth and life: foundational themes

DIRECTIONALITY

Relevance of history, “non-ergodicity”

DISCONTINUITY

Major evolutionary transitions, punctuated equilibrium

FOUNDATIONAL CONNECTIVITY

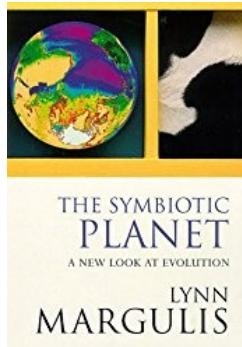
Feedbacks, cycling ratios, symbiosis, life arguably a planetary phenomenon.

DUALITY

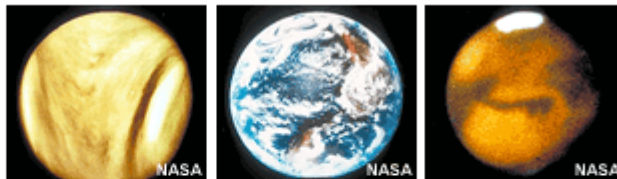
Tension between cybernetic/physiological and informational properties of life.

ORIGINS & “UNIQUENESS”

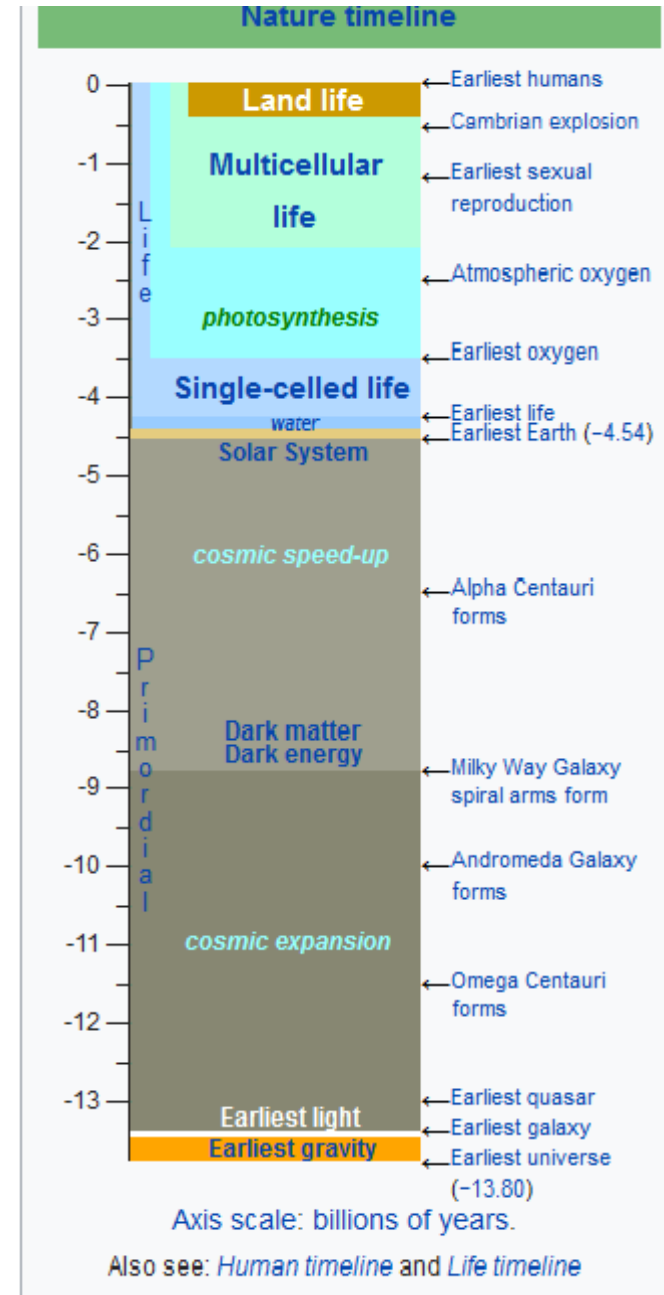
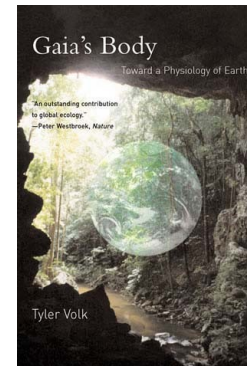
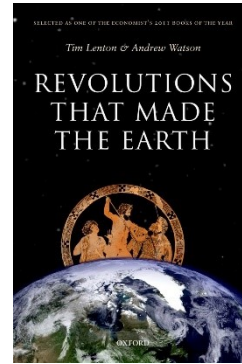
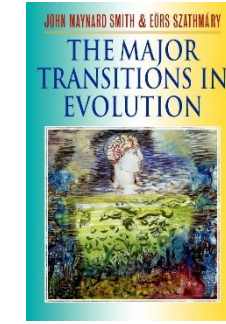
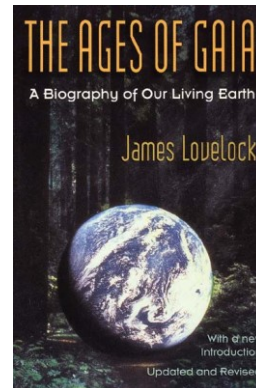
Humans (Language, tool use, sociality, intelligence), Earth; (habitability, sustainability, scale).



	Venus	Earth	Mars
Carbon Dioxide (CO ₂)	96.5%	0.03%	95%
Nitrogen (N ₂)	3.5%	78%	2.7%
Oxygen (O ₂)	Trace	21%	0.13%
Argon (Ar)	0.007%	0.9%	1.6%
Methane (CH ₄)	0	0.002%	0



Venus Earth Mars



General principle: life drives geochemical variability

“Life remains unalterable in its essential traits throughout all geological times, and changes only in forms. All the vital films (plankton, bottom and soil) and all the vital concentrations (littoral, sargassic and fresh water) have always existed. Their mutual relationships and the quantity of matter contained within them have changed from time to time, but these modifications could not have been large, because the energy input from the sun has been constant, or nearly so, throughout geological time, and because the distribution of energy in these vital films can only have been determined by living matter - the fundamental part, the only variable part, of the thermodynamic field of the biosphere.”

Vladimir Vernadsky, 1926.

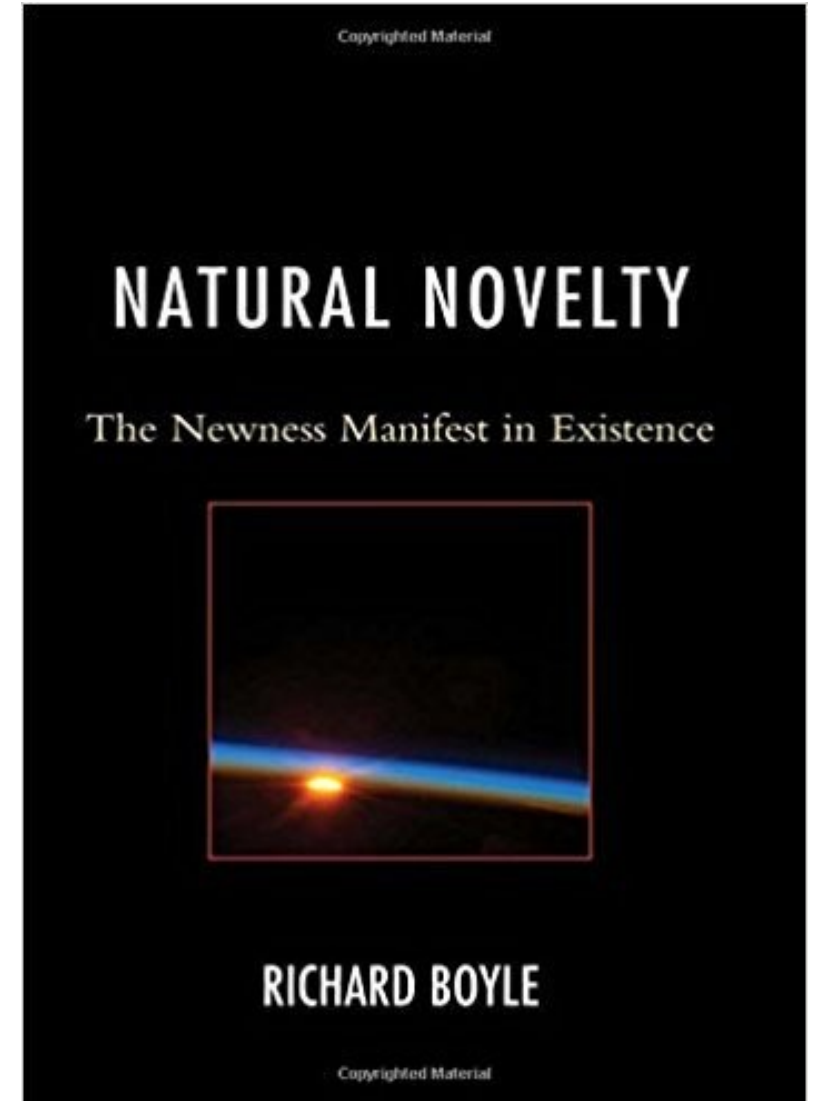
What do we mean by novelty?

Why and how do new things happen?

What is the significance of novelty?

Key suggestions

- 1) Novelty is discontinuity within the distribution of cause and effect over time.
- 2) Novelty results when systems that function in similar ways but are built from different stuff, are forced together in the same time and space.
- 3) Novelty explains why language is temporal and evolving, and why the boundary separating the objectively describable from the ineffable is a function of time.



1. Novelty is discontinuity within the distribution of cause and effect over time.

SEMANTICS

- **A change is any aspect of experience exhibiting both identity and temporality.**
- **A causal rule is a meaningful description of an association between two particular changes, belonging to one of (only) two subsets; repetition and chaos.**
- **Repetitive causal rules describe associations between changes that occur consistently over time.** (Hume's problem of induction, scientific method, common sense use of the word "cause")
- **Chaotic "causal" rules describe associations between changes that do not occur consistently over time; i.e. occur inconsistently or do not occur at all.** (Jung's synchronicity/meaningful coincidence, existence ambiguous)
- **Novelty is the natural phenomenon whereby repetitive causal rules come into existence from a previous non repetitive state. A particular novelty refers to the first instance of operation of a specific, subsequently repetitive, causal rule.**

DEFINITION: Novelty is the set of all first instances of operation of particular, subsequently repetitive, causal rules.

$$\exists \overline{N} \mid \forall r_{PQ}(t_N) \in \overline{N} \Rightarrow$$

$$(r_{PQ}(t) \in \overline{R}_K, \forall t < t_N) \& (r_{PQ}(t) \in \overline{R}_R, \forall t \geq t_N)$$

There exists the set “Novelty”, such that for each time-specific instance of operation of a particular causal rule within that set, prior to this time-point that causal rule was chaotic, and at this and all subsequent time-points, that causal rule is repetitive.

NOTES

1. Novelty can only be identified retrospectively (Science/induction based reasoning presupposes repetition).
2. Reality of “chaotic causal rules” category is subjective.
3. Dismissing novelty as “illusory” is semantic (ad hoc assumption of “unobserved, implicit existence”).

Where:

$$\overline{R}_C = \overline{R}_R \cup \overline{R}_K$$

$$\forall r_{AB} \in \overline{R}_R \Rightarrow C_A(t) \xrightarrow{r_{C_{AB}}} C_B(t+1) \forall t$$

$$\forall r_{XY} \in \overline{R}_K \Rightarrow \neg(C_X(t) \xrightarrow{r_{C_{AB}}} C_X(t+1) \forall t)$$

$$(\overline{R}_R \cap \overline{R}_K = \Phi) \& \overline{R}_C \cap (\overline{R}_R \cup \overline{R}_K)^C = \Phi$$

2. Novelty occurs as a “symbiosis” between functional similarity and structural difference

- **Maximizing the number of interactions between systems is not sufficient for novelty; systems must be sufficiently functionally similar and the structural differences must be complementary.**
- **A system is a collection of connected repetitive causal rules, operating in a discrete, definable spatial/temporal frame of reference. One can distinguish the structure and function of any particular system.**
- **Function refers to internal, system specific causal rules.**
- **Structure refers to causal rules transcending the boundaries of the system, and linking it to its exterior.**
- **Structure affects function, not the other way around; this occurs through a system specific “structure-function mapping”.**

2(b). Novelty occurs as a “symbiosis” between functional similarity and structural difference

In the (rare) between-system interactions that do produce objective novelty:

1. The **functional repetition of the systems become correlated** because the functions of each system are compatible.
2. **The structure of the each system provides a chaotic “random input” that interferes with the function of the other system.**
3. This causes “transient repetition” changes in one or both systems become associated with each other that were not previously associated. **Chaotic fluctuations** occur, **either causing the interaction to break down, or:**
4. **A new, emergent structure-function mapping to arise at the level of both systems combined.**

Phenomenology of novelty in human consciousness as an interaction between objective and subjective thought...?

Unique capacity for technological/artistic/intellectual inventiveness(?)

Unprecedented capacity for human consciousness to envisage the hypothetical(?)

Why?

“Analytic” versus “continental” philosophy; differing sympathy for ambiguous language

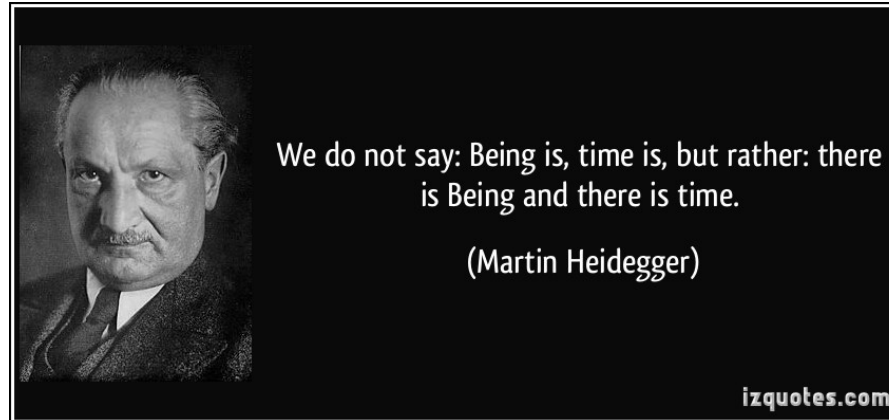
“The philosophical tradition that goes from Descartes to Husserl, and indeed a large part of the philosophical tradition that goes back to Plato, involves a search for foundations: metaphysically certain foundations of knowledge, foundations of language and meaning, foundations of mathematics, foundations of morality, etc.....Now, in the twentieth century, mostly under the influence of Wittgenstein and Heidegger, we have come to believe that this general search for these sorts of foundations is misguided.” John Searle, 1983

What can be said at all
can be said clearly; and
whereof one cannot
speak thereof one must
be silent.



Ludwig Wittgenstein
Austrian-British philosopher
1889 - 1951

QUOTEHD.COM



“To relegate the animated, vigorous word to the immobility of a univocal, mechanically programmed sequence of signs would mean the death of language”

Is the following statement true?

“If a question can be asked, it is either theoretically answerable, or it is meaningless.”

Why did Wittgenstein change his mind?

EARLY WITTGENSTEIN

A logical proposition in language is a picture of a fact. The grammatical structure of a language “shows” the structure of the fact it describes, but cannot describe that structure, because it cannot “step outside of” that structure; “...*though a picture that would contravene the laws of physics can be represented to us spatially, one that would contravene the laws of geometry cannot*”.

LATE WITTGENSTEIN


Languages are interactive social “games”, the rules of which are acquired by language use rather than prescriptive formulation. A logically perfect, final language is not possible, rather language are context specific games that exhibit a “family resemblance” when derived from the same context.

Games have a time component, pictures do not

3. The reality of novelty, in both the world and our consciousness, necessitates that meaningful language evolves over time, and explains why time is such a special part of our subjectivity.

- 1. Novelty provides an underlying explanation for the fact that meaningful language needs to evolve over time, and why an internally consistent, fixed, meaningful/useful language can never be permanently temporally fixed.**
- 2. Novelty is the reason why we can sometimes “think what we cannot say”.**
- 3. Novel ideas derive from an interaction between logical thought, which is amenable to objective language, and subjective thought, which is not.**
- 4. Novelty imparts a time component to truth; (Heidegger’s aletheia; truth is “disclosure” as well as “mind-world correspondence”).**

Novelty is a “bridge concept” between objective and subjective/allegorical forms of thought..



Whatever the imagination
seizes as Beauty must be truth -
whether it existed before or not.

John Keats

quote fancy

Acknowledgements



Mark Claire



<http://mif.wp.st-andrews.ac.uk/>

D·IAS

Carolyn Loscher



https://www.researchgate.net/profile/Carolyn_Loescher

Dan Mills

Don Canfield

Tais Dahl

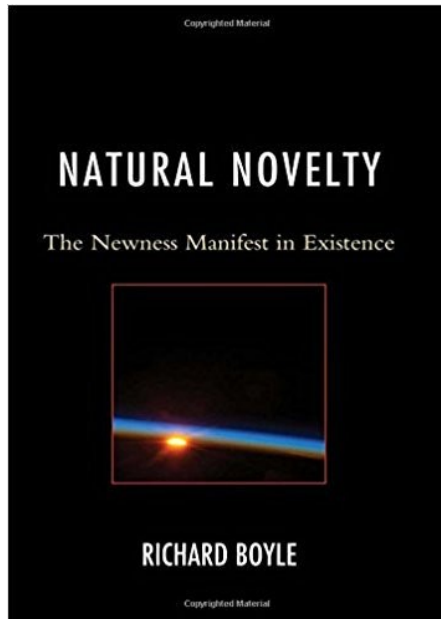
Tim Lenton

Andy Watson

Antonios Karatzas

Summary:

- 1) Novelty is discontinuity in the distribution of cause and effect in time.
- 2) Novelty (sometimes) happens when systems that function in similar ways but are built from different stuff, are forced together in the same time and space.
- 3) Novelty explains why language is temporal and evolving, and why the boundary separating the objectively describable from the ineffable is a function of time.



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Boyle, R. "Natural Novelty: The Newness Manifest in Existence"

University Press of America
(Rowman & Littlefield) 2015

pdf available on request

EXTRA

Examples of my own theoretical generalizations

<https://naturalnovelty.wordpress.com/>

- 1. Symbiosis may reinforce physiological diversity, statistically biasing towards climatic regulation by stabilizing two-way integral rein control**

Boyle, R.A., Lenton, T.M & Watson, A.J. 2011. *“Symbiotic physiology promotes homeostasis in Daisyworld”*. Journal of theoretical biology, 274(1). 170-182.

- 2. Significant, qualitative increases in biological complexity may be coupled to extreme climatic situations that cause survival, rather than fecundity, to be the dominant component of fitness.**

Boyle, R.A. Lenton, T.M., & Williams, H.T.P. 2007. *“Neoproterozoic ‘snowball Earth’ glaciations and the evolution of altruism”*. Geobiology 5(4). 337-349.

Boyle, R. 2017. *“Eukaryotic origins and the Proterzoic Earth system: A link between global scale glaciations and eukaryogenesis?”* Earth Science Reviews (in press)

Tentative attempts at tangible examples: Novelty by forcing together different systems for “random” reasons

Origin of life models:

Duality/“symbiosis” between information-transfer and metabolism/cybernetic control.

Serial endosymbiosis:

Information-driven function of either species must accommodate the physiology and physical basis of the partner, nature of the interaction not explicable in terms of what brought the species together in the first place).

Nucleosynthesis(?):

Temperature and pressure conditions of the star’s life cycle random with respect to “function” of elements with different that are forced together (loose example).

Defining novelty in terms of a “common sense” concept of cause and effect

$$\exists \bar{C} \mid \forall C_P \in \bar{C}$$

$$\exists id(C_P) \mid id(C_P) = C_P \ \& \ \exists f_{C_P} \mid C_P = f_{C_P}(t)$$

$$\exists \bar{R}_C \mid \forall r_{C_{JK}} \in \bar{R}_C :$$

$$\exists C_J, C_K \in \bar{C} \ \& \ C_J(t) \xrightarrow{r_{C_{JK}}} C_K(t+1)$$

There exists the set of all changes, such that for any particular change that is a member of that set, this particular change exhibits both tangible identity, and a definable relationship to time.

There exists the set of all causal rules, such that for any particular causal rule within that set, this causal rule describes a specific association within time between two specific changes.

$$\bar{R}_C = \bar{R}_R \cup \bar{R}_K$$

$$\forall r_{AB} \in \bar{R}_R \Rightarrow C_A(t) \xrightarrow{r_{C_{AB}}} C_B(t+1) \forall t$$

$$\forall r_{XY} \in \bar{R}_K \Rightarrow \neg(C_X(t) \xrightarrow{r_{C_{AB}}} C_X(t+1) \forall t)$$

$$(\bar{R}_R \cap \bar{R}_K = \Phi) \ \& \ \bar{R}_C \cap (\bar{R}_R \cup \bar{R}_K)^c = \Phi$$

The set of all causal rules is the union of the set of all repetitive causal rules, which operate consistently over time, and the set of “chaotic” causal rules, which do not. These two categories exhaustively cover all causal rules and do not intersect.

(It is a question of perspective whether such a thing as a “chaotic”, i.e. temporally inconsistent causal rule is meaningful)

Describing novelty in terms of a semantic distinction between “structure” and “function”, relative to the spatial frame of reference of causal rules

$$\forall C_P \in \overline{C}, \exists id(C_P) \mid id(C_P) \equiv C_P = f(Sp)$$

For all changes, the idea that any given change must exhibit a tangible identity is synonymous with the idea that that change is a function of space

$$\forall \sigma \mid \exists \overline{F_\sigma} \ \& \ \overline{St_\sigma} \ \& \ \overline{Sp_\sigma}$$

$$\forall r_{JK} \in \overline{F_\sigma} \ \& \ \in \overline{R_R} \Rightarrow C_J(Sp_\sigma) \xrightarrow{r_{C_{JK}}} C_K(Sp_\sigma)$$

For any system, it is possible to categorize the repetitive causal rules operating within that system as “functional” (connecting changes within the spatial boundary of that system) or “structural” (connecting changes outside the spatial boundary of that system to changes within that spatial boundary).

$$\forall r_{AB} \in \overline{St_\sigma} \ \& \ \in \overline{R_R} \Rightarrow C_A(Sp_\sigma^c) \xrightarrow{r_{C_{AB}}} C_B(Sp_\sigma)$$

$$\therefore \forall \sigma, St_\sigma \rightarrow F_\sigma \ \& \ \neg F_\sigma \rightarrow St_\sigma$$

This implies that the structure of the system constrains its function, but not the converse.

Describing Novelty as an emergent consequence of a “symbiotic” interaction between systems with similar function and different structure

$$\exists \sigma_1, \sigma_2 \mid \exists I_{\sigma_{12}}(t) \Rightarrow \sigma_1(t) \Leftrightarrow \sigma_2(t)$$

$$\overset{I_{\sigma_{12}}}{(F_{\sigma_1} \Leftrightarrow F_{\sigma_2})_{(t)}} \Rightarrow \overset{I_{\sigma_{12}}}{(F_{\sigma_1} \Leftrightarrow F_{\sigma_2})_{(t+1)}}$$

$$\overset{I_{\sigma_{12}}}{(St_{\sigma_1} \rightarrow F_{\sigma_2})_{(t)}} \& \overset{I_{\sigma_{12}}}{(St_{\sigma_2} \rightarrow F_{\sigma_1})_{(t)}} \Rightarrow \exists I_{\sigma_{12}}(t+1)$$

$$\Rightarrow \exists r_{NM}(t_{new}) \in \overline{N}$$

$$(\Rightarrow r_{NM} \notin \sigma_1, \sigma_2)$$

There exists (a small subset of) the interactions between different systems such that:

The interaction between the functions of the systems is self-perpetuating

The impact of the structure of each system on the function of the other is compatible with the interaction continuing (rare)

Novel causal rules (as above defined) subsequently occur in this interaction (that, by definition were not present in either initial system).