Toward a Big History 2.0: A brief position paper

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Abstract: We propose a "Big History 2.0" framework based on a time-by-complexity relationship that the two authors converge on, a synthesis from their prior independent work. In particular, the framework distinguishes a line of levels of combogenesis from quarks to culture, in contrast to patterns of emergence involving larger aggregates or groups. The framework identifies major transitions to novelty marked by innovations in general evolutionary dynamics (PVSR; propagation, variation, and selective retention), which have occurred multiple times following the Big Bang. As in Henriques' Tree of Knowledge System, we take the Mind-Animal plane of dynamics as one of these major transitions because of the innovative PVSR-dynamics in the mindedness of animals. We note the need to simultaneously attend to patterns and processes of formation, and we describe avenues of further consideration that follow from this framework. This position paper has been improved and slightly expanded from the version originally presented to the Big History Research Group for general discussion on November 20, 2022.

Keywords: Big History, Tree of Knowledge (ToK) System, combogenesis, dimensions, dynamical realms, general evolutionary dynamics, general evolution, thresholds, emergence.

1 Introduction

In their work in the *Journal of Big History* and elsewhere, both Tyler Volk (e.g., Volk, 2017; 2020) and Gregg Henriques (e.g., Henriques, 2022; Henriques et al., 2019) lay out new ways to conceptualize the "time-by-complexity" relationship that allows us to trace the line from the Big Bang to the present. This time-by-complexity relationship is at the center of the Big History formulation[1]. However, despite this being a fundamental frame, it also is the case that there are many questions regarding how scholars should conceive of the evolution of complexification that has taken place since the beginning of the observable universe until the present, and do so in a way that effectively includes humans building knowledge systems to map this process.

The traditional BH formulation as pioneered by David Christian (see Christian, 2018, and his other papers and books) has been to frame the evolution of time by complexity via different thresholds that have been crossed to add levels of complexity to the system. Although the eight thresholds are a useful starting point, we argue that they are not sufficient to map the nature of the transitions. The reason is that the thresholds are mostly educational anchor points (e.g., see Spier, 2022); they do not provide a clear enough model of a sequential emergence that can be debated through scholarly discourse to make progress in a big history 'science' of the process of complexification. Here we propose changes to advance in that direction.

Because of close overlaps in our models, independently developed, and the fact that our papers in the *Journal of Big History* were scheduled targets for discussion by the big history research group on November 20, 2022, we collaborated through zoom talks and emails to draft this position paper prior to that meeting. We have improved and slightly expanded it for this publication.

2 Five Key Points to Frame Big History 2.0

Here we share our convergence model of emergence that seems to result in a clearer and more comprehensive map of the time-by-complexity relationship. Its core consists of five key points of agreement that may set the stage for a shift to a "Big History 2.0" framework that advances from the initial model based on eight thresholds.

The first point to be clear about when we follow the trail from the Big Bang to the present, is to recognize that we are not following all things and processes of emerging complexity across the cosmos. Rather, we are tracking what Volk (2017) calls "combogenesis." This refers to the specific path of complexification that is the rhythm of sequential combination and integration of things from prior levels into patterns, in a "grand sequence" that ultimately connects the dots to us. Why is this relevant? Because it highlights that

some major types of things as aggregates, or collections (like stars, solar systems, and galaxies), which, although crucial, are not part of the direct stepping up through a sequence of levels that moves from quarks to culture.

This analysis sets up the second key point, about process itself, which is that there is an important logical distinction between the systematic and repeated level-creating process delineated by combogenesis and processes that results in those large-scale aggregates of things like stars and galaxies (i.e., threshold 2) and planets (i.e., threshold 4), or in biology's aggregates such as communities or ecosystems. As such, and related to the first point about the actual things or systems, it is crucial we distinguish the nested build-up lineage of complexification by combogenesis from the more general, aggregate patterns of emergence.

Near the end of his book *Quarks to Culture*, Volk (2017) makes the point that the threshold transitions from molecules to life and from life to human culture are marked by novel kinds of evolutionary dynamics (for the purpose of this essay, let us call them *PVSR-dynamics*). PVSR-dynamics can be framed as a braid-like process of propagation (or propagatability), variation, and selection and retention. Volk goes further and identifies Life and human cumulative culture as new evolutionary realms that have a fundamentally different character to them than a more standard "level" of integration. That is, whereas the jump from atoms to molecules is a leveling up of integration on the combogenesis trail, the jump from molecules to cells is a different kind of jump into a new evolutionary realm, because it put into place biological evolutionary dynamics (biological PVSR-dynamics). Similarly, we see a level jump from prokaryotes to eukaryotes in Volk's analysis, but the emergence of cumulative human culture is of a different kind (i.e., it results in a generative cultural PVSR-dynamic processes).

This brings us to our third key point, which is that there are foundational differences between thresholds that are either levels of ordinary combogenesis or the aggregates noted above in contrast to those thresholds that emerge by giving rise to new forms of PVSR-dynamics. The PVSR-dynamics are generative and produce new realms of complex adaptive behavior that allow and facilitate further ordinary levels.

Fourth, these insights all align with the formulation given by Henriques in his Tree of Knowledge System (Henriques, 2003; 2011). Specifically, with his Periodic Table of Behavior (PTB) Henriques (2022) explicitly separates combogenic levels of integration (such as particles to atoms or cells to multi-cells) on the complexification trail from the Big Bang to modern science from the larger aggregate patterns, such as Stars/Galaxies or Earth/Solar System thresholds, or ecosystems. In addition, Henriques' PTB also differentiates ordinary levels of emergence from emergence processes that give rise to novel realms. In Henriques' system of understanding, these realms of complexification are complex planes of adaptive existence, or new "dimensions." Thus, Henriques' model aligns directly with Volk's on these points.

Although these aspects align directly, there is one notable difference, which leads to our final key point. Specifically, Henriques offers a new map that adds a whole new realm in addition to Volk's original three. In addition to the Life-Organism plane that emerges approximately 4 billion years ago, and the Culture-Person plane that has emerged in the last several hundred thousand years, Henriques adds the Mind-Animal plane of existence. Consistent with both Skinnerian behavioral science and modern cognitive science, Henriques frames the Mind-Animal plane in much the same way that Volk does (but as an ordinary level), in terms of an emergent plane framed by PVSR-dynamics. Specifically, complex adaptive patterns of neurocognitive/behavioral activity in animals can be framed by the processes by which animals engage in a PVSR relation with their world specifically through learning, involving the selection from trials and retention of novel patterns of animal behavioral investment. As such, we now together arrive at our fifth key point, which is that the mindedness of animals is akin to the livingness of organisms and the cumulative cultural processes in human persons. This realm of the animal using senses in networks is missing entirely from the BH 1.0 classical thresholds, which do not use PVSR as markers, and represents a significant shift in the map related to our framework.

3 Summary

To summarize, for BH 2.0 we are suggesting the following crucial revisions to the BH 1.0 modeling of the time-by-complexity relations as set forth by eight thresholds.

- We recommend an explicit shift from the emergence of complexity in general to the combogenesis layering process of complexification that tracks us from the Big Bang to human culture.
- We advocate for a difference between emergence that is characterized by combogenic leveling and other emergences that arise from aggregate patterns.

- We also advocate for a difference between emergence that characterizes levels versus emergence that characterizes entire new realms of existence formed by new PVSR-dynamics and containing multiple levels.
- In aligning Volk's analysis with Henriques', we argue that in fact there is an entire realm or complex adaptive plane that needs to be clearly identified, which is the Mind-Animal realm of existence explicitly delineated by PVSR-dynamics of the animal brain and behavior in Henriques' ToK System.
- We summarize our model of convergence and agreement as follows. If we define the emergence of major realms by the creation of new types of evolutionary dynamics (PVSR), we have the realms of:
    1. the physical-chemical (Henriques' dimension of Matter; Volk's dynamical realm of physical laws). But this realm's start was not necessarily from PVSR dynamics, see below.
    2. the biological (Henriques' dimension of Life; Volk's dynamical realm of biological evolution). A new form of PVSR-dynamics.
    3. the animal-mental (Henriques dimension of Mind; Volk's combogenesis level 8 with animal-cognitive PVSR). A new form of PVSR-dynamics.
    4. the human socio-cultural (Henriques' dimension of Culture-Person and Volk's dynamical realm of cultural evolution). A new form of PVSR-dynamics.

4 Additional Considerations

There are several possible auxiliary arguments that are potentially relevant. First, given the general pattern for new realms post-Big Bang, the question arises whether we might model the emergence of the Matter dimension in the Big Bang as an example of PVSR. There are some models like Lee Smolin's (1992) cosmological natural selection that suggest we might be able to do that. But given current knowledge, this is significantly more hypothetical than the known transitions to new realms of PVSR-dynamics described above.

Second, can we identify aspects of evolutionary dynamics leading into the emergence of a full scale biological PVSR evolutionary dynamics? For example, there are numerous suggestions of a kind of era of "chemical evolution" that may have given rise to Life, prior to the Last Universal Common Ancestor (LUCA) and the origin of classical Darwinian biological evolution (Pross, 2012; Tang, 2020).

Third, can we consider the human social process of science as a new form of PVSR-dynamics (as articulated by scholars such as Karl Popper and Donald Campbell, etc.) emerging from older cultural evolutionary dynamics (see, e.g., Cziko, 1995; Azarian, 2020)? Furthermore, can we consider cultural evolutionary dynamics as dual-scale (within the human mind, i.e., making personal decisions; and socially among people, i.e., group decisions making)? What happens to cultural evolutionary dynamics during the combogenesis of early human groups with plants and animals into agrovillages, and then with the discovery of takeover and expandable hierarchies into the level of geopolitical states (writing) and eventually to science? We suggest it would be of interest to look into shifts in PVSR-dynamics within the Culture-Person realm. Finally, exosomatic evolutionary dynamics involving technology is now occurring, for better or worse, which can be debated.

Our proposed start to a Big History 2.0 sets these questions up to be tackled by big historians, while also providing a core taxonomy of emergence into aggregates, levels, and realms that represent, we submit, an advance over the current threshold model because of a consistent way to define types of patterns and processes.

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Notes: 1. As we noted in the meeting of November 20, 2022, we cannot cover all prior BH work in this brief position paper. For example, in addition to the classic BH 1.0 formulation of thresholds, there has been significant work in using energy to define the time-complexity relation. We also recognized that one of the scheduled respondents, Anton Grinin, has developed BH models with the emergence of kinds of evolutionary dynamics, and we noted that we look forward to his comments on our approach and collaboration in the future. Here we also include David LePoire and his work on periodization in this acknowledgement.

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