Eigenforms, Coherence, and the Imaginal

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> Upshot • This commentary reflects broadly on the concept of eigenform and reflexive domains, focusing on the idea that second-order science is neither the same as nor completely distinct from ordinary living.

« 1 » Beginning with the concepts of eigenform and "reflexive domain," Louis Kauffman's target article explores at a deeply abstract level the question of what constitutes second-order science. Kauffman has written a series of papers over the last 10 to 15 years that take as their point of departure the concept of eigenform, returning again and again to revisit and explicate the ideas of eigenform, reflexivity, and second-order cybernetics.

« 2 » In this commentary, I express fundamental agreement with Kauffman's formulation of second-order science. I also gather a succinct list of principles, to clarify and define the nature of second-order science in relation to reflexive domains.

« 3 » The idea of reflexivity, as Kauffman expresses it, is a formalization of the idea of circularity, defined and described in a process that is necessarily circular. A *reflexive domain* is the name of the space that can encompass this circularity. Kauffman uses a mathematical language, called the lambda calculus, which is simultaneously very simple and highly abstract. Readers who find this formalism difficult may find it useful to think of *the reflexive domain of everyday living* or even more simply *the space in which a conversation occurs*. The keys to note about reflexive domains are:

- the ability to make distinctions exists, and therefore every "element" in the domain has a name;
- every element is also subject to actions, or transformations; and
- transformations in turn may be referenced and thereby given names.

These simple rules describe the domain, and give rise to what Kauffman and Heinz von Foerster call "fixed points." Fixed points are recursions in which, for example, an observer observes itself observing (observing itself observing…). Finally, the reflexive domain itself is subject to reference, naming, and transformation, permitting sentences such as "this discussion would be easier without the mathematics!" or "cybernetics is self-referential."

« 4 » Von Foerster coined the terms *eigenform* and *eigenbehavior* (Foerster 2003a). He conceived that the perception and production of objects by an observer is circular, where the observer's percepts and conceptions iterate upon themselves as *coordinations of coordinations,* in potentially infinite recursion. When the process of eigenbehaviour is stable, when there is a fixed point, von Foerster says that the object is then a *token* for the coordinations that produced it.

> "Heinz performs the magic trick of convincing us that the familiar objects of our existence can be seen to be nothing more than tokens for the behaviours of the organism that create stable forms." (Kauffman 2003: 73)

« 5 » What distinguishes this article from his earlier writings on the theme is Kauffman's focus on the question of the production of "objective" knowledge in the practice of science and second-order science. Describing second-order systems, in which the observer too is observed, Kauffman states that…

> "domains with such circularity remain amenable to rational study […] In the face of the circularity of context and observer it is still possible to explore and come to agreements that have every appearance of being scientific facts." (§1)

Context: Science and anti-science

« 6 » In the summer of 2015 and winter of 2016, members of the American Society for Cybernetics (ASC) in cooperation with the Institute for the Study of Coherence and Emergence (ISCE) sponsored small conferences in Boston and Salem, MA to discuss the concept of second-order science. One concern addressed by these gatherings was the American public's lack of knowledge of science, its high level of skepticism about science's reliability and truthfulness, and the premise that second-order science be applicable to some of the problems.

« 7 » Every two years, the National Science Foundation and its controlling body, the National Science Board, publishes a comprehensive statement assessing the state of science in American society, the latest published being *Science & Engineering Indicators 2016.* Depending on their context, these findings are either quite disturbing, as (National Science Board 2016: 49f):

- 24 percent believe the sun goes round the earth
- 50 percent believe that electrons are bigger than atoms
- 41 percent do not know the father's gene determines the sex of the child
- 51 percent state they do not believe that humans evolved from other species
- 25 percent believe to some degree in astrology;

or, upon reflection, somewhat comforting: overall scores reported have remained incredibly constant over the last 22 years of publication (National Science Board 2016: 42), and the belief in astrology is hovering close to the recorded low.

« 8 » Writing in a student-published blog hosted by *Nature*, Ryan Hopkins cites a nearly identical set of facts from *Indicators 2012,* and then offers a plausible explanation:

> "So why do political and religious ideologies win when they come into conflict with science? A 2012 study on conspiracy theories offers an explanation. Psychologists found that conspiracy theorists can hold their beliefs in the face of contradictory facts because of a process called global coherence, by which subjects selectively chose to believe only those facts which supported their worldview."[1]

The study Hopkins cites, "Dead and Alive," examines the arising and co-existing of deeply contradictory beliefs held by conspiracy theorists: "Believing that Osama bin Laden is still alive is apparently no obstacle to believing that he has been dead for years," conclude its authors (Wood, Douglas & Sutton 2012: 6). There is no need to delve further into the study, but the key point is of the second order: the writers, who are keen observers, distance themselves from their subjects, maintaining their own coherence.

1| "Unbelievable: Why Americans mistrust science," http://www.nature.com/scitable/blog/scibytes/unbelievable

Eigenforms and the imaginal

« 9 » The concept of eigenform applies both to ordinary objects, as well as to non-physical objects (let us call them *extraordinary objects*, or *ideas*). The criteria that is advanced by both von Foerster and Kauffman, stability, applies equally to ordinary or extraordinary eigenforms. The idea, simply, is that eigenbehavior presents sufficient stability that it can be distinguished, named, and referenced. Ordinary objects include most of the artefacts and many of the natural phenomena that we encounter, that we pick-up, hold, touch, drive, and control, while extraordinary objects include concepts, abstractions, archetypes, and myths. Science, too, is an extraordinary idea. Bigfoot, unicorns, the characters in certain films and novels, the pantheon of Greek gods, each have persistence in being named and woven into stories that are repeated again and again. Hallucinations, rumours, lies, falsehoods, and similar non-existent forms are also objects, provided they are persistent.

« 10 » Von Foerster, describing how "objectivity" emerges in the world of objects as we know it, contends that objects arise in the form of agreements that are like circular conversations.

> "Under which conditions, then, do objects assume 'objectivity?' Apparently, only when a subject, S_1, stipulates the existence of another subject, S_2, not unlike himself, who, in turn, stipulates the existence of still another subject, not unlike himself, who may well be S_1." (Foerster 2003a: 266f)

« 11 » Kauffman is very clear: although they must be circular, eigenforms can be precise (§§23–32). In my conversations with Kauffman about such extraordinary eigenforms as Bigfoot,[2] unicorns, and generally recurring fictional characters such as Sherlock Holmes, Kauffman pointed out that mathematical objects are evaluated based both on their precision and their internal logical consistency. We also evaluate their more literary cousins, Sherlock Holmes for example, based on a sense of their coherence and consistency; when we encounter the instantiation of such a character, in the performance of a play, we readily determine if the actor is in-character, and whether the performance coheres.

Second-order objectivity, precision, and coherence

« 12 » The view of second-order science that Kauffman describes is deeply grounded in constructivism and second-order cybernetics. I would like to entertain the idea, inherent in the concepts of eigenform and reflexivity as Kauffman states them, that the distinction between scientific inquiry and other forms of constructing knowledge (if we choose to make one) should not be considered fundamental. Rather, it is better to believe that science is one aspect of the imaginal, lived and performed in conversational community, in reflexive domains, neither separate from nor different than other aspects of living – where scientific facts and truths, like all extraordinary objects, are tokens for the stable eigenbehaviors that produce them.

« 13 » This perspective raises a number of issues, not least of which being that the ability to discern truth, reliability, accuracy, and credibility in the claims of others is highly useful. Constructivism and second-order cybernetics reject the idea of the *objective observer* and the correspondence theory of truth. The emergence, as implied by von Foerster's definition of objectivity (quoted in §10 above), of numerous, splintered conversational communities, each with a common set of perspectives and beliefs that diverges from all other groups, can readily be observed in matters of contemporary public discourse, and is bound to create a clamor for objective knowing that cannot be easily satisfied. Kauffman does not explicitly address such a fracturing or multiplicity of worlds of discourse, but the idea is presaged in his use of the plural term *domains*.

« 14 » Given the consideration I have given to the idea of the imaginal, I offer the following three principles (or feed-back loops if one prefers), which I imagine to apply to the practice of second-order science and cybernetics:

- Second-order science is lived and performed within reflexive domains and in conversational community. The coherence, or the logical, emotional, and behavior consistency, of such a conversational community, be it scientific or otherwise (e.g., Thagard 1989), should be determined based on internal rather than external observers. Such coherence, or lack thereof, will be identical to the stability of eigenbehaviors that have produced the agreement of perspective within the conversing community.
- Precision is an indicator (but not necessarily a determining factor) of the degree to which a community discourse is scientific or, more generally, rational. Precision in this sense includes the numeric and statistical, compliance with sound logical inference, and acceptable conformance with well-formulated standards and methods.
- Finally, second-order cybernetics and second-order science are, or should be, committed to perturbing their own coherences and to increasing the varieties of their own perspectives – for example by engaging in transdisciplinary research and discussion, by engaging energetically in dialogue and dissent, and by observing itself reflexively. Such an approach contrasts with extra-rational fringe groups (such as Bigfoot researchers), which maintain coherence by releasing themselves from any particular obligation to comply with method or logic, and also contrasts with establishing and maintaining coherence through a strict enforcement of methodological and linguistic constraints.

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2| I live in the Town of Red Hook NY, home of Bard College, 100 miles north of New York City. Red Hook is also home to "Bigfoot Researchers of the Hudson Valley," which claims as its purpose collecting evidence and conducting research to support the contention that Bigfoot individuals are living inhabitants of the Hudson Valley. The organization has received 1 426 likes on its Facebook page to date.