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Scientific Revolutions as Events: a Kuhnian Critique of Badiou

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Throughout the entirety of his book *Being and Event*, Alain Badiou says nothing about scientific revolutions. This seems, to me, like a rather odd exclusion in light of several considerations, but most basically, given the very term “scientific *revolution*”—if this term is accurate (if it scientific revolutions really are *revolutions*) it seems that it should be a point of discussion in a theory of the event. Badiou certainly intends to explain other kinds of historical revolutions, thus the status of the scientific revolution within his theory is ambiguous.

The purpose of this essay will be to exploit this ambiguity and demonstrate how a proper consideration of the historical phenomenon of the scientific revolution brings a weakness within Badiou’s theory to light—namely, Badiou’s theory cannot adequately explain the scientific revolution as an event. This thesis, if it is true, puts Badiou’s theory about the event in a position of being at best incomplete and at worst fundamentally flawed. In order to demonstrate the incompatibility of Badiou’s formulation of the event with the notion of the scientific revolution I will use the understanding of the scientific revolution as Thomas Kuhn develops in *The Structure of Scientific Revolutions*.

Preliminarily, it is important to establish what exactly an event is. Sometimes when “the event” is referred to as a broad philosophical concept it can seem more complicated than it actually is. For our purposes, “events” are quite simply isolatable moments in history of particular meaning or significance. They are the happenings or occurrences that play the role of dramatizing history, if you will. Throughout *Being and Event*, Badiou frequently references the French Revolution, but any other major moment in history according to the arm-chair historian

will count (e.g. the Protestant Reformation, the Council of Trent, Mohammed the Prophets conquering of Mecca, and so on).

It might also be fruitful to explain why the scientific revolution is an event. It will be largely just assumed here that a theory of the event should explain the phenomenon of the scientific revolution in the same breath that it explains every other kind of event. If this assumption is ultimately unjustified then the entire objection brought against Badiou here will be undercut: if scientific revolutions are not events then Badiou's theory cannot be criticized for its apparent non-inclusion of the scientific revolution. It seems clear to me, however, that a theory of the event should equally account for the scientific revolution for several reasons, but to put it most simply: from the retrospective position, scientific revolutions are typically placed in the same context as any other kind of event. For example, if one is to learn about the movements that brought Europe out of the Medieval Age into "modernity" one ought to learn about the protestant reformers for the same reason that one ought to learn about the achievements of Newton, Galileo, and so on. Thus, it seems that scientific revolutions should be given the same historico-evental significance as any other event.

I will also be assuming that Kuhn's formulation of the scientific revolution is basically accurate. In a larger project I would seek to further justify this assumption but here this will simply be assumed.



Summarizing the event as Badiou conceives it is a bit of a daunting task considering that Badiou devotes the first 180 pages of *Being and Event* to a preliminary groundwork before even mentioning the event. Perhaps a very rudimentary outline would begin with noting Badiou's

commitment to mathematics and set theory. He says in the introduction to *Being and Event*, “Ontology itself [is] the form of pure mathematics. This is precisely what delivers philosophy and ordains it to the care of truths.”¹ Accordingly, Badiou holds that the entire structure of being can be recapitulated in a set-theoretical system consisting of sets and subsets.

This movement towards a set-theoretical ontology might seem like a bolder stance at first than it actually is. All Badiou is really positing here is that the project of ontology generally tends to be taxonomical. Take, for example, the concept of the classification of animals, which typically starts with the general concept of “animal” broken into two terms: “vertebrates” and “invertebrates”. With the introduction of these terms, one can then break the system down into more specific types of animals, which can then be broken down even further. Set-theoretically this could be formulated in the following way:

$$A = \{[\text{Vertebrates}], [\text{Invertebrates}]\}$$

$$A_{\text{Vertebrates}} = \{[\text{Mammals}], [\text{Fish}], [\text{Birds}], [\text{Amphibians}]\}$$

$$A_{\text{Mammals}} = \{[\text{Bears}], [\text{Cats}], [\text{Dogs}], [\text{Humans}], [\text{Dolphins}], \dots\}$$

Here, the set of all animals has the terms of “vertebrate” and “invertebrates”. The classification can then break down into more and more particular sets which pertain to one or more of the terms in the set that precedes it. Thus, it seems that Badiou’s set-theoretical approach is merely an attempt to highlight a common theme throughout different ontologies. Badiou will call any set-theoretical system such as this a “situation”: a situation is any presented multiplicity.

According to Badiou, in order for any ontology to succeed all the terms that are contained within the different sets must both *belong* and be *included* in the set-theoretical formalization (or the “situation”). In other words, *belonging* and *inclusion* are the two conditions that each term

¹ Alain Badiou, *Being and Event* (New York, NY: Bloomsbury Academic, 2007), 4.

must meet if they are to construct a proper ontological system. What exactly do these terms mean?

Badiou thinks that a term expresses belonging, “if it is presented [in a situation],”² and if it is, “counted as [one] element.”³ Simply put, if something is presented in this or that ontological situation, it must first *belong* to a set within the ontology. To use the example above, in order for the term “reptiles” to be presented within our animal taxonomy it must belong to the set of vertebrates, and it is by its belonging to the set of vertebrates that it is allowed to be presented in our animal taxonomy.

While belonging pertains to this or that element’s *presentation* in a set, “inclusion” is the term Badiou uses to describe how terms are *represented* by the terms of the previous set. Badiou says that each term contained in a set is “included” in the previous set as far as the terms of the previous set provide a conceptual schema, or representation, of the terms in the lower set. To use the example for the animals again, while the term “reptiles” does not belong to the set of all animals (it is not immediately presented in that set), “reptiles” is represented as far as “vertebrates” includes or entails “reptiles”.

Badiou summarizes this distinction between belonging and inclusion by saying, “Belonging refers to presentation, whilst inclusion refers to representation.”⁴ A term within an ontological schematization must both belong to a set that presents it, and be included/entailed within a term of the set that precedes it, and as such, offers further conceptual structure. “Vertebrates” offers a conceptual framework by which “Reptiles” may be further understood as far as “reptiles” is included in “vertebrates”. Once a multiplicity of terms is placed within a

² *Ibid*, 532.

³ *Ibid*, 85.

⁴ *Ibid*, 532.

greater system of belonging and inclusion (or presentation and representation), an ontology is constructed. The role of ontology conceived of this way is to normalize all elements within it by putting everything in relation to other terms in a taxonomical and hierarchical structure through the use of set theory. In other words, the set-theoretical model offers a conceptual “map” that allows beings to be understood in a consistent manner.

Now we can finally introduce the Badiouan event. While everything within a successful Badiouan ontology is normal as far as they are contained within a consistent structure, Badiou says that the event is entirely abnormal: for Badiou the event by definition cannot be accounted for by any ontological system. In order to explain this he uses the same terms that I have already discussed: the event belongs to a set, but it is not included within the terms of the previous sets; it is presented by a certain set but nothing of the previous sets represents it conceptually. In this way Badiou thinks that its abnormality and singularity are the event’s most premier qualities.

At this point we could refer back to the example of our animal taxonomy to demonstrate the abnormality and singularity of the event (e.g. if there eventually evolved a species of mammal that did not have a spine). However, this would not quite get at the significance of the event that Badiou attempts to establish in *Being and Event*. We must remember the historical significance of the event, and being the Maoist that he is, Badiou is uniquely interested in how the event frustrates the normative structures established by political authorities through its abnormality.

Perhaps, then, formulating his frequently used example of the French Revolution will be of more use at this point:

$$F_{\text{Political Bodies}} = \{[\text{Monarchy}], [\text{Estates}], \dots\}$$
$$F_{\text{Estates}} = \{[\text{Clerics}], [\text{Nobility}], [\text{Rest of France}]\}$$
$$F_{\text{Rest of France}} = \{[\text{Laborers}], [\text{Peasants}], [\text{Secular values}], [\text{Democracy}], \dots\}$$

In this set-theoretical formulation of the French political system before the revolution, the Estates (classes) are presented by the set of French political bodies, which in turn represents the terms of the three individual Estates: the clerics (First Estate), the nobility (Second Estate), and the rest of France (Third Estate). The term “Rest of France” then represents the people physically present (laborers, peasants) in France but also post-enlightenment sentiments such as secular values and democracy; however, when the clerics and the nobility were given political privilege over the “Rest of France” the “rest of France” lost its representational position within the situation of French politics. The “Rest of France” belonged to the set of the Estates but is not included in the terms in French politics that refused to represent them. Thus, the “rest of France” was presented in the situation but was not represented—it belonged but it was not included.

This lack of representation/inclusion caused the “rest of France” to operate as an abnormal part of the political system and the exploitation of their abnormality, in Badiou’s analysis, is the event of the French Revolution. In other words, the French Revolution is only considered an event when it exploits the abnormality within the structure of France—namely where the underclass of France were present but not represented (i.e. where they belonged but were not included). As such, the French Revolution as an event is structurally abnormal.



With the concept of the Badiouan event outlined we can turn our attention to the structure that underlies scientific revolutions as Kuhn understood it, which should begin with his notion of a scientific paradigm. Kuhn says, “A paradigm is what members of a scientific community share, *and*, conversely, a scientific community consists of men who share a paradigm.”⁵ Paradigms,

⁵ *Ibid*, 175.

according to Kuhn, are what allow for the notion of a “scientific community” at all and without a paradigm, there can be no “scientific community”. This unification occurs by defining a relative scope by which a group of scientists may focus their work through a network of common assumptions about the world available to the empirical sciences.

Kuhn understands these networks of assumptions to be based on previous revolutions in science, “Aristotle’s *Physica*, Ptolemy’s *Almagest*, Newton’s *Principia*, and *Opticks*... these and many other works served for a time implicitly to define and legitimate problems and methods of a research field for succeeding generations and practitioners.”⁶ Thus, it is the success tied to a certain researcher or their work that grounds the construction of a paradigm.

The establishment of this research space is uniquely important to Kuhn because it implies that there are two factors that contribute to a certain paradigm’s success: firstly, it must better explain empirical phenomena relative to competing theories; secondly, it must provide a set of unanswered questions that are intriguing enough for researchers to pursue. For this reason, Kuhn calls the paradigm “open-ended” in its establishment, but implies that the goal of science is ordinarily to close a paradigm, or answer all of its unanswered questions. In other words, it was not only Newton’s account of physics in itself that established the paradigm of Newtonian physics, but also the need for further research to articulate more properly the Newtonian worldview. Further, the goal of a Newtonian physicist is to bring the Newtonian paradigm to a greater state of closure through successful acts of articulation.

According to Kuhn, the work of most of the scientific community falls into this category of paradigm articulation. He says, “[Ordinary science] consists of empirical work undertaken to articulate the paradigm theory, resolving some of the residual ambiguities and permitting the

⁶ *Ibid*, 10.

solution to problems to which it had previously only drawn attention.”⁷ Even further, though, Kuhn seems to think that there is an inherent sloppiness to a paradigm-establishing revolution when it initially establishes a paradigm. He says, “Few people who are not actually practitioners of a mature science realize how much mop-up work... a paradigm leaves to be done.”⁸ In other words, none of the revolutionary works of science are complete in their instantiation but leave their completion to later generations of scientists through inter-paradigm research.

Kuhn claims, though, that the attempt to articulate typically causes a problem for a paradigm on a large enough timeline. Even if over time a paradigm becomes more and more successfully articulated, it simultaneously becomes less stable because not all attempts to articulate a paradigm succeed. This failure reveals where a paradigm fails to offer a satisfactory answer—where the paradigm cannot be completed or articulated clearly. Kuhn terms these ambiguous, unanswered areas within a paradigm’s structure “anomalies”. These are the situations in which, “nature has somehow violated the paradigm-induced expectations that govern normal science.”⁹

It seems historically clear that as the life of a paradigm progresses the number and difficulty of the anomalies grows, and a paradigm as a result becomes more problematic as the foundation for empirical study. Once there are enough recognizable ambiguities within a paradigm it enters a stage that Kuhn calls “crisis.” Here the major structural issues that prevent the paradigm from accounting for empirical phenomena adequately must be resolved at the risk of the paradigm falling apart altogether. The scientific community is, at this stage, presented with an ultimatum: either continue to attempt solutions within the paradigm (which in the later stages

⁷ *Ibid*, 27,

⁸ *Ibid*, 24.

⁹ *Ibid*, 53.

of a paradigmatic crisis is generally unlikely) or provide an answer for the anomalous problems through extra-paradigmatic methods.

It is at this stage that the scientific revolution enters Kuhn's theory: a scientific revolution is what brings a scientific crisis to an end by accounting for problematic or anomalous empirical phenomena in a way that the articulated paradigm could not. When anomalies become too problematic and crisis pervades through a paradigm a new and inventive solution to the anomalies is left to be discovered. Such a discovery though, when a paradigm is already at the point of crisis, requires one to step outside of said paradigm. Kuhn defines the revolution when he says, "scientific revolutions are here taken to be those... developmental episodes in which an older paradigm is replaced in whole or in part by an incompatible new one."¹⁰ Crisis, Kuhn thinks, is how Ptolemy, Newton, Lavoisier, et cetera became motivated to formulate new theories. It is also how such theories were able to gain the groups of loyal apostles that they did—their capacity to deal with the problems that plague a scientific community and cause crisis is a beneficial quality for scientists.

To reiterate: as far as scientific revolutions are the response to a particular crisis within a given paradigm, scientific revolutions are paradigm-foundational. Thus, the structure of scientific revolutions as Kuhn conceives it is cyclical: the movement of the scientific community is from paradigm to paradigm via the medium of revolutionary discoveries in the face of crisis.

What then can be said of the scientific revolution in summary? The scientific revolution, as far as it opens up space for further articulation in a scientific paradigm, is necessarily incomplete. It represents a grand moment historically speaking but ultimately it requires, as Kuhn says, further explication and "mop-up work" in order to be successful. In this way the

¹⁰ *Ibid*, 92.

revolutions of science are not self-sufficient but instead belong to the paradigm that follows and articulates them, bringing their revelations to a greater actualization.

This summary of the structure underlying the scientific revolution as Kuhn sees it is enough to address the question of this article: whether the Badiouan notion of the event can account for the revolutions of science. It seems clear that we can answer this question negatively—Badiou's event cannot explain scientific revolution in the same way it explains other historical events.

This is because Badiou's theory paints a picture of the event that is inherently abnormal, singular, and unaccounted for by ontology. But Kuhn's conception of the scientific revolution is quite different. For him the scientific revolution cannot be singular because it is need of a greater level of actualization through an entire scientific worldview. It seems even further from being abnormal because the revolutionary discovery will fit coherently into the proceeding paradigm once it is sufficiently articulated. It could be said even that the entire role of a paradigm is to normalize the content of a scientific revolution. To put Kuhn's scientific revolution in Badiouan terms, and this will especially help elucidate the point, the scientific revolution is both presented and represented within the ontological structure of a scientific paradigm: the revolutionary theory is presented as a term within the articulated paradigm and is simultaneously represented by a theoretical structure that better explains it. Thus, the scientific revolution is normal and not abnormal.

If, then, we are to continue to affirm our assumptions that (a) a theory of the event should explain scientific revolutions and (b) Kuhn's theory of the scientific revolution is generally accurate, what has been presented here is enough to demonstrate that Badiou's theory is at least incomplete and potentially in need of serious reworking.