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Feyerabend on Pluralism, Contingency, and Humility ¹

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Abstract: Throughout the writings of Paul Feyerabend, there are constant references to the historical contingency of the scientific enterprise, often accompanied by philosophical claims about the significance of that contingency. This paper presents those contingentist claims, situates them in the context of more recent work on the contingency of science, and offers an interpretation of their significance. I suggest that Feyerabend's sense of contingency was connected to his defences of pluralism, and also to the "conquest of abundance" narrative developed in the very late writings.

Keywords:

contingency;
Feyerabend;
historiography;
pluralism

1. Introduction

An emphasis on the historical and social contingency of the scientific enterprise is a neglected theme in the work of Paul Feyerabend. The emergence and development of the intellectual and practical structures of the sciences, he argued, depended on events, trends, and developments which could have gone differently, or not occurred at all. Appeals to contingency recur, consistently if implicitly, through the classic papers of the late 1960s, in the books of the 1970s and '80s, continuing to his last writings. An important theme of **Conquest of Abundance**, for instance, is the role of "idiosyncratic historical developments" in shaping the

¹I am grateful for helpful comments on an earlier draft of this paper by Karim Bschrir, Paul Hoyningen-Huene, John Preston and an anonymous referee. These led to several improvements.



scientific worldview and its associated “form of life”.² In the 1970s, Feyerabend began work on an ambitious history of Western “philosophies of nature”, whose aim was “to understand the contingencies that helped the [scientific] endeavour to succeed”.³

Interpreting Feyerabend’s remarks on contingency is difficult. There are many of them, scattered across many different writings, and their purpose is often unclear. The appeals to contingency, indeed, were put to plausible and provocative purposes. In the 1960s publications, a sense of contingency is a concomitant of the serious study of history of science. From the mid-1970s, however, themes of contingency become tied to Feyerabend’s experiments in “relativism” and provocative counter-cultural polemics.⁴ The theme of contingency persisted into the 1980s. **Farewell to Reason** describes “powerful traditions” promoting “uniformity” competing with more pluralistic tendencies. The contingencies of science now include new and unanticipated theories, “interdisciplinary developments [...] grand unifying schemes” and a blurring of once-important distinctions.⁵ The sociology of science is cited in support of the massive, ineliminable role of material and social contingency. Into the 1990s, a longstanding interest in what Feyerabend called the “rise of rationalism” modulated into the titular theme of what we know as **Conquest of Abundance**.

In this paper I want to organise these remarks on the contingency of science and offer an account of their importance to Feyerabend’s developing ideas. I suggest that contingency can be intimately related to pluralism; that we can describe a shift from contingencies in science to the deep contingency of scientific enquiry; and that we can interpret the “conquest of abundance” narrative as the culmination of Feyerabend’s sensitivity to contingency.

² Paul K. FEYERABEND, **Conquest of Abundance: A Tale of Abstraction Versus the Richness of Being**, Bert TERPSTRA (ed.), University of Chicago Press, Chicago 2001, p. 144.

³ Paul K. FEYERABEND, **Philosophy of Nature**, in: Eric OBERHEIM and Helmut HEIT (eds.), *Polity*, Cambridge 2016, p. 205.

⁴ Martin KUSCH, “Relativism in Feyerabend’s Later Writings”, *Studies in History and Philosophy of Science Part A* 2016, Vol. 57, p. 110ff [106–113].

⁵ See Paul K. FEYERABEND, **Farewell to Reason**, Verso, London 1987, pp. 1–3ff.

2. Contingency

The contingency of science became a topic in philosophy of science in the last thirty years. Its early forms involved a dialectic between claims that the results of successful scientific enquiry are inevitable or contingent.⁶ Earlier forms of philosophy of science, however, were sensitive to contingency claims and their epistemic significance. Two important, if neglected examples are feminist epistemology of science and what came to be called postcolonial science and technology studies. Each explores the role of specific events and developments on our scientific inheritance. Colonial histories, gendered traditions of enquiry, technoscientific imperatives and much else helped shape the direction and ethos of what came to be called science. Feyerabend did not engage in any serious way with feminist approaches to science, but showed more interest in certain postcolonial accounts, if in unsystematic ways. **Farewell to Reason**, for instance, opens by announcing an interest in cultural diversity and its erosion by the imperialist-epistemic projects of Global North cultures. Contingentist accounts of science are also found in the later work of Edmund Husserl, whose **Crisis of European Sciences** — an account of the tendencies to abstraction characteristic of “post-Galilean” science — are praised by Feyerabend.⁷

The modern contingency debate moved past concerns with the polarised inevitabilist and contingentist stances. The main questions, currently, concern (i) the object of contingency claims and (ii) the significance, epistemic or otherwise, of their being contingent.⁸ Without good answers to this pair of questions, many contingency claims will be bland — no-one, after all, denies *any* role to social and historical developments that might not have occurred at all.⁹ On the first ques-

⁶ See Ian HACKING, “How Inevitable are the Results of Successful Science?”, *Philosophy of Science* 2000, Vol. 67, pp. 58–71.

⁷ See Edmund HUSSERL, **The Crisis of European Sciences and Transcendental Phenomenology**, Northwestern University Press, Evanston 1970.

⁸ See Lená SOLER, “Are the Results of our Science Contingent or Inevitable?”, *Studies in History and Philosophy of Science* 2008, Vol. 39, pp. 221–229, <https://doi.org/10.1016/j.shpsa.2015.05.013>; Lená SOLER, Emiliano TRIZIO and Andrew PICKERING, **Science as It Could Have Been: Discussing the Contingency/Inevitability Problem**, The University of Pittsburgh Press, Pittsburgh 2015.

⁹ See Katerina KINZEL, “State of the Field: Are the Results of Science Contingent or Inevitable?”, *Studies in History and Philosophy of Science* 2015, Vol. 52, pp. 55–66, <https://doi.org/10.1016/j.shpsa.2015.05.013>.

tion, many different aspects of science can be contingent. Some examples include, *inter alia*, concepts, values, methodological norms, aims of enquiry, institutional and disciplinary arrangements, and theoretical and metaphysical commitments. Such objects can be more or less contingent, and their actual degree of contingency can change over time. In the broader sorts of claims, what is contingent is very abstract and collective — “the scientific worldview”, “scientific culture”, or “the European sciences”. In narrower claims, contingency can best be attributed to objects with definitional specificity, such as a particular theory.¹⁰

On the question of why contingency claims matter, there are different opinions. Most discussions focus on the epistemological and historiographical implications. Early sociologists of science used contingency to probe the epistemic significance of social structures of enquiry.¹¹ Others have tried hard to identify possible alternatives to the scientific theories we did inherit.¹² Others appeal to contingency claims to motivate arguments for pluralism — as a means, for instance, to try and recover sciences that, due to historical contingencies, never came to be.¹³ Some philosophers of science also debate the implications of contingency for scientific realism.¹⁴

The discussion about contingency claims in relation to historiography are of-

¹⁰ See Joseph D. MARTIN, “Is the Contingentist/Inevitabilist Debate a Matter of Degrees?”, *Philosophy of Science* 2013, Vol. 80, No. 5, pp. 919–930, <https://doi.org/10.1086/674003>; Lená SOLER, “Revealing the Analytical Structure and some Intrinsic Major Difficulties of the Contingentist/Inevitabilist Issue”, *Studies in History and Philosophy of Science* 2008, Vol. 39, No. 2, pp. 230–241, <https://doi.org/10.1016/j.shpsa.2008.03.015>.

¹¹ See Andrew PICKERING, **Constructing Quarks: A Sociological History of Particle Physics**, University of Chicago Press, Chicago 1984; James T. CUSHING, **Quantum Mechanics: Historical Contingency and the Copenhagen Hegemony**, University of Chicago Press, Chicago 1994.

¹² See Jeroen BOUTERSE, “Contingentism for Historians”, *Studies in History and Philosophy of Science* 2022, Vol. 96, pp. 27–34, <https://doi.org/10.1016/j.shpsa.2022.08.001>; Veli VIRMAJOKI, “Could Science be Interestingly Different?”, *Journal of the Philosophy of History* 2018, Vol. 12, No. 2, pp. 303–324, <https://doi.org/10.1163/18722636-12341388>.

¹³ See Hasok CHANG, **Is Water H₂O? Evidence, Realism, Pluralism**, Springer, Dordrecht 2012, ch. 5.

¹⁴ See Howard SANKEY, “Scientific Realism and the Inevitability of Science”, *Studies in History and Philosophy of Science* 2008, Vol. 39, No. 2, pp. 259–264, <https://doi.org/10.1016/j.shpsa.2008.03.018>; Luca TAMBOLO and Gustavo CEVOLANI, “Multiple Discoveries, Inevitability, and Scientific Realism”, *Studies in History and Philosophy of Science* 2021, Vol. 90, pp. 30–38, <https://doi.org/10.1016/j.shpsa.2021.09.001>.

ten explored using counterfactual history. Gregory Radick has argued, at some length, for a contingentist stance on the history of biology. There was, he argues, nothing inevitable about the emergence of the genic biology central to modern biological thinking. Had history gone another way, our biology may have become non-genic.¹⁵ Other well-developed cause studies include oxygen and phlogiston chemistry¹⁶ and Darwinian forms of biology.¹⁷ Whatever one thinks of counterfactual scientific developments, one should recognise the historiographical lessons. Philosophers should not assume that successful sciences can only develop in a single way.¹⁸ Triumphant insinuations about only the "true theory" winning out should be rejected, as self-legitimizing conceits. If the history of science could have developed in quite different ways, then this is a fact worth taking seriously in historical practice.

This is a brief *resumé* of the contingency debates in the history and philosophy of science. Several potential points of contact with Feyerabend's work should already be obvious. Contingency resonates with his defences and celebrations of proliferation and pluralism. Contingency, as a feature of science, is a lesson of serious attention to its history and practice. Contingency also encourages the sorts of epistemic virtues celebrated by Feyerabend, such as imaginativeness, humility, and open-mindedness. This set of themes suggests lots of work to do. Surprisingly, though, there is little discussion of Feyerabend in current contingency scholarship. The few mentions are usually too brief to be really informative.¹⁹ An

¹⁵ See Gregory RADICK, "Other Histories, other Biologies", in: Anthony O'HEAR (ed.), **Philosophy, Biology, and Life**, Cambridge University Press, Cambridge — New York — Melbourne 2005, pp. 21–47; Gregory RADICK, **Disputed Inheritance: The Battle over Mendel and the Future of Biology**, University of Chicago Press, Chicago 2023.

¹⁶ See Hasok CHANG, "We Have Never Been Whiggish (About Phlogiston)", *Centaurus* 2009, Vol. 51, No. 4, pp. 239–264, <https://doi.org/10.1111/j.1600-0498.2009.00150.x>.

¹⁷ See Peter BOWLER, **Darwin Deleted: Imagining a World without Darwin**, University of Chicago Press, Chicago 2012.

¹⁸ See Steve CLARKE and Adrian WALSH, "Imperialism, Progress, Developmental Teleology, and Interdisciplinary Unification", *International Studies in the Philosophy of Science* 2014, Vol. 27, No. 3, pp. 341–351, <https://doi.org/10.1080/02698595.2013.825493>; Ian James KIDD, "Historical Contingency and the Impact of Scientific Imperialism", *International Studies in the Philosophy of Science* 2013, Vol. 27, No. 3, pp. 317–326, <https://doi.org/10.1080/02698595.2013.825494>.

¹⁹ See Ian HACKING, **The Social Construction of What?**, Harvard University Press, Cambridge 1999, pp. 98–99; Hans-Jörg RHEINBERGER, **On Historicising Epistemology: An Essay**, *Cultural Memory*

honourable exception is the work of Hasok Chang, whose own brand of “active normative epistemic pluralism” enjoys contingentist and Feyerabendian inspirations.²⁰

The failure to appreciate the philosophical interest of Feyerabend’s remarks on contingency is, however, partly his own fault. As everyone knows, he eschewed kinds of “systematic” treatments that offended his temperament but do make life easier for his readers.²¹ Moreover, some of Feyerabend’s remarks are too vague or too polemical. **Science in a Free Society**, a very hyperbolic book, announces that “science as we know it is not inescapable”, since “we can construct a world in which it plays no role whatever”.²² But none of these claims are explained, so readers cannot distinguish between banal and extreme interpretations. Similarly, the references to science depending on “historical processes”, while interesting, are too vague for one to draw any clear unambiguous conclusions.²³ As is often the case, Feyerabend’s remarks need interpreting carefully — and augmented, as and where necessary.

In what follows I offer a tentative interpretation of the remarks on contingency in Feyerabend’s work. The main themes are *pluralism* and *abundance*. I suggest that there is an enduring, if implicit conviction that appreciation of pluralism is sustained by a sense of contingency. Being a pluralist requires a sense of how different our inheritance could have been — something Feyerabend dramatizes as a “conquest of abundance”.

3. Pluralism and proliferation

The best-known theme of Feyerabend’s work are his defences of pluralism

in the Present, trans. David Fernbach, Stanford University Press, Stanford 2010, pp. 63–64.

²⁰ See CHANG, **Is Water H₂O?...**; Hasok CHANG, “Cultivating Contingency: A Case for Scientific Pluralism”, in: Lená SOLER, Emiliano TRIZIO and Andrew PICKERING (eds.), **Science as it Could Have Been: Discussing the Contingency/ Inevitability Problem**, Pittsburgh University Press, Pittsburgh 2015, pp. 359–382.

²¹ See Eric OBERHEIM, **Feyerabend’s Philosophy**, Walter de Gruyter, Berlin 2006, ch.1.

²² Paul K. FEYERABEND, **Science in a Free Society**, New Left Books, London 1978, p. 228.

²³ See e.g., Paul K. FEYERABEND, **Against Method. Third Edition**, Verso, London 1993, p. 215; FEYERABEND, **Conquest of Abundance...**, p. 15.

about science, and his related exemplification of a pluralist style of philosophy. There are different arguments for scientific pluralism, historical and epistemological, which evolved over time. There are also different conceptions of what it means for science to be pluralistic. The earlier writings, famously, focused on *methodological pluralism* — or, as Feyerabend came to call it, “epistemological Dadaism”. In one formulation, a study of the history of science reveals no single set of defined, formalised methodological rules: no Scientific Method. The physical, earth, life, and human sciences all employ a range of different investigative methods, which makes sense given their different objects of investigation and motivating aims and interests. Any references to *the* scientific method, therefore, falsifies the realities of what one finds in the laboratory or in the field. The real target of Feyerabend’s **Against Method** — or the several works sharing that title — is therefore *methodological monism*. The positive thesis — both descriptive and normative — is methodological pluralism, perhaps most clearly stated in the Preface to the Chinese edition of **Against Method**:

The thesis is: *the events, procedures and results that constitute the sciences have no common structure*; there are no elements that occur in every scientific investigation but are missing elsewhere. Concrete developments (such as the overthrow of steady state cosmologies and the discovery of the structure of DNA) have distinct features and we can often explain why and how these features led to success. But not every discovery can be accounted for in the same manner, and procedures that paid off in the past may create havoc when imposed on the future. Successful research does not obey general standards; it relies on one trick, now on another; the moves that advance it, and the standards that define what counts as advance are not always known to the movers.²⁴

Feyerabend emphasises both *methodological plurality* (as a descriptive, historical fact about the sciences) and *methodological pluralism* (as a normative ideal). Method is one possible dimension of pluralism; one can also add, as Feyerabend did, pluralism about *theories* and *values*. An “anarchistic” science, while over-dramatically named, is characterised by a plurality of aims, values, methods, theories and styles of reasoning — an ideal the best serves our epistemic interests and, for Feyerabend, enhances the “humanitarian” possibilities of scientific enquiry.

²⁴ FEYERABEND, **Against Method...**, p. 1.

My question in this section concerns the connections of epistemic pluralism to the theme of contingency. How could a sense of contingency contribute to the case for an normative epistemic pluralism? To answer that question I will draw on Eric Oberheim's analysis of Feyerabend as a philosophical pluralist.²⁵ Oberheim is careful to emphasise the changing forms of pluralism one can find across Feyerabend's writings; however there is, he argues, a fairly stable general structure to those forms. Oberheim calls this the *pluralistic test-model*, construed, not as "a cohesive, stable set of doctrines" or "principles", but as "a pluralistic philosophical method".²⁶ Some of its main components are the related concepts of *criticism*, *alternatives*, and *proliferation*. The general line thought, sufficient for my purposes, are that (a) criticism plays a variety of essential epistemic roles — strengthening theories; maximising empirical content; exposing contestable assumptions; (b) criticism is often most effective when using *alternatives* to the theories in question — since, for instance, a set of theories that share a questionable assumption by that fact tend to conceal it; (c) such alternatives, while sometimes naturally existing, often have to be deliberately generated, by the relaxation of constraints and/or acts and policies of *proliferation*. In Feyerabend's writings one finds variations of this line of thought, inspired — in an appropriately eclectic manner — by John Stuart Mill, Karl R. Popper and the philosopher-physicists beloved by Feyerabend.²⁷ An ideal scientific enterprise is therefore deeply pluralistic, a rich "ocean of alternatives", of robust and well-developed methods, theories, and projects. At certain points some of this naturally-occurring diversity might diminish, and the proper response — for Feyerabend but not for Kuhn — was to encourage proliferation. Alternatives must be carefully and deliberately created and supported, through historical identification of earlier underdeveloped ideas, supporting epistemic experimentation or innovation, and the eclectic appeals to disciplines and traditions outside the sciences.²⁸

²⁵ See OBERHEIM, *Feyerabend's Philosophy...*, pp. 286–283.

²⁶ OBERHEIM, *Feyerabend's philosophy...*, p. 287.

²⁷ See Elizabeth A. LLOYD, "Feyerabend, Mill, and Pluralism", *Philosophy of Science* 1997, Vol. 64, *Supplement. Proceedings of the 1996 Biennial Meetings of the Philosophy of Science Association. Part II: Symposia Papers*, pp. S396–S407.; Gonzalo MUNÉVAR, "Historical Antecedents to the Philosophy of Paul Feyerabend", *Studies in History and Philosophy of Science* 2013, Vol. 57, No. 3, pp. 9–16, <https://doi.org/10.1016/j.shpsa.2015.11.002>.

²⁸ See FEYERABEND, *Against Method...*, ch. 2–4.

This is a very generalised account of Feyerabend's style of argument for epistemic pluralism, which requires a well-developed social epistemology of enquiry. It does, however, help us connect pluralism to contingency. I will mention two connections, the first being that alternatives, as Feyerabend well-knew, do not always emerge, due to diverse kinds of contingent events and developments. To take some examples: social, material, historical, cultural and religious contingencies can shape the *kinds* of theory favoured in a community of enquiry; or establish certain developmental trajectories to the exclusion of others; or encourage cross-fertilisation with some disciplines to the exclusion of others; and so on. These kinds of influence are better described in a vocabulary of "encouraging", not one of "determining". Some social constructionists spoke as if the content and course of scientific enquiry is utterly unconstrained by objective facts. Most contingentists are more sensible. For a Feyerabendian pluralist, the point is that certain alternatives fail to emerge — or fail to develop — due to contingent events. Crucially, we should not infer from these failures the demerits of those alternatives. The failure can be explained in other ways — for instance, that alternative emerged too late with rival theories already in place, or the person and resources needed to develop that epistemic possibility into a compelling alternative did not appear or were obstructed.²⁹

The second connection of contingency to pluralism concerns the possibility of proliferation. Many things are needed to imagine, generate and sustain a diversity of robustly well-developed alternative theories, methods, and projects. These can include personnel, technologies, funding and material investment, institutions, specialist equipment, rare or expensive materials, supportive social and political conditions and epistemically supporting intrapersonal and inter-community relationships. What Feyerabend appreciated in the history and sociology of science was, among other things, the articulation of this complexity. However, social and material complexities are always products and causes of contingencies. Funds, equipment, artefacts, social institutions and other aspects of scientific enquiry are massively structured by socio-historical contingencies. Our scientific inheritance, while extremely rich, is a product of both deliberate decisions, at local

²⁹ Think of the impact of David Bohm's exile from the United States on the subsequent fortunes of Bohmian mechanics. Matthew J. BROWN, "The Abundant World: Paul Feyerabend's Metaphysics of Science", *Studies in History and Philosophy of Science* 2016, Vol. 57, pp. 142–154, <https://doi.org/10.1016/j.shpsa.2015.11.015>, § 3.4.4.

and more global levels, but also of contingencies playing out at different levels and different timescales. In Feyerabend's famous Galileo case study, there are many references to such contingencies — the sorts of “natural interpretations” of natural phenomena typical of the time; the empirical and theoretical content of Copernicanism; a particular set of “paradigmatic cases” for theorising about motion; the rhetorical and “propagandistic” tricks used by Galileo; new epistemological ideas about experiment and proof; new mathematical philosophies; reactions to these astronomic claims shaped by then-prevailing theological views — and so on.³⁰

In a summary of some of his main epistemological and historical points, Feyerabend remarks:

We see here very clearly how misguided it is to try reducing the process “Copernican Revolution” to a single principle, such as the principle of falsification. Falsifications played a role just as new observations played a role. But both were imbedded in a complex pattern of events which contained tendencies, attitudes, and considerations of an entirely different nature.³¹

Scientific enquiry proceeds within an inherited array of social, material, historical and cultural contingencies — a “pattern of events” which could unfold in different ways, whose “tendencies, attitudes, and considerations” could have been quite different. Decisions and actions do play a role, for sure, but as responses to an epistemic context whose structure, content, and possibilities are inherited, and not self-consciously created. How does this relate to the possibility of proliferation?

For Feyerabend, our scientific inheritance incorporates certain epistemic possibilities but not others. Some kinds of scientific theory, say, come to be serendipitously well-supported by the resources, opportunities, and structures already in place. Others are not, which does not preclude their becoming well-established, even if it does mean the process of their development requires far more work. As a case in point, consider Feyerabend's criticism of what he calls *the consistency condition*, which “demands that new hypotheses agree with accepted theories”, and which he criticises as “reasonable because it preserves the older the-

³⁰ See FEYERABEND, *Against Method...*, pp. 6–10.

³¹ FEYERABEND, *Against Method...*, p. 145.

ory, and not [necessarily] the better theory”.³² The consistency condition is problematic for several reasons; for instance, it entrenched problematic kinds of conceptual conservatism and finds little support from the history of science.³³ However, the consistency condition also fails to account for the contingencies of the history of science. Consistency with the established can only be defended *if* that establishment was a result of careful procedures of careful deliberation and decision. But this is not the case. Many contingent factors cooperated to help establish the scientific inheritance with which consistency is being demanded. The consistency condition works to conceal this contingency by pretending that what was established was established for procedural reasons.

The upshot is that certain kinds of proliferation can be obstructed because the epistemic possibilities latent in our scientific inheritance are products of contingencies. In many cases, efforts to proliferate are obstructed by the lack of necessary resources, political obstruction, vested interests, dogmas, and other social-epistemic factors. The deeper obstacle, however, is the constrained range of epistemic possibilities that we, contingently, came to inherit. Had our history gone in other ways, other kinds of proliferation could have become possible. To put the point another way, contingencies shape the actualities of the sciences and also their developmental possibilities. In Gregory Radick’s felicitous contingentist slogan, “Other histories, other biologies”.³⁴

Contingency should be understood as a source of at least two problems for the ideal of normative pluralism in the sciences. Our scientific inheritance is a product of a complicated multigenerational history shaped in many ways at different levels by social, material, historical and intellectual contingencies. Such contingencies will affect (a) the kinds of theories that emerged and the alternatives that did or did not emerge and (b) the possibility of kinds of proliferation available to us. Feyerabend was sensitive to these contingencies, I think, even if they were implicit, background worries. The consistency condition, for one, should be interpreted as a failure to appreciate the messy contingency of our scientific inheritance.

³² FEYERABEND, *Against Method...*, p. 24.

³³ See PRESTON John, *Feyerabend: Philosophy, Science and Society*, Polity Press, Oxford 1996, p. 83ff; OBERHEIM, *Feyerabend’s Philosophy*, p. 91.

³⁴ Gregory RADICK, “Counterfactuals and the Historian of Science”, *Isis* 2008, Vol. 99, pp. 547–551.

In the next section I turn to more explicit discussions of contingency in Feyerabend's writings, which focus on the implications of contingency for our attitudes towards our scientific achievements.

4. Competition and confidence

The debate about contingency in science includes reflections on two questions: how should contingency affect scientific practice, and, relatedly, how should it affect our epistemological relationship to our actual scientific theories? The assumption is that reflection on contingency is not idle. It can change scientific practice and also change our epistemic relationship to scientific knowledge. One can, for instance, use contingency-based arguments to argue for scientific antirealism, or persuade us to sympathetically revisit seemingly "dead" theories, or even to "foster a profound change of spirit regarding science".³⁵ The hope is that reflection on contingency offers us real practical implications for how we perform, organise, and understand scientific enquiry.

Feyerabend certainly thought contingency could yield epistemic and practical changes in the sciences. I want to reconstruct one argument for this claim. The general idea is that a cultivated sense of contingency fosters a kind of epistemic humility concerning our scientific inheritance. To start the argument, consider the claim — which no-one would deny — that the emergence and entrenchment of the sciences owed to a complex series of contingencies. Feyerabend refers to the sciences' "historical grounding", and the ways the modern scientific enterprise depends on a complex "historical process [it] did not initiate".³⁶ This grounding consists of events, processes, and "idiosyncratic historical developments", that change over time as they become more or less entrenched, rather like Wittgenstein's "river-bed propositions".³⁷ The shape and direction of the sciences, as Feyerabend often says, depends on experiments and reasoning, but also on "an entire arsenal

³⁵ COOPER, *The Measure of Things...*, p. 202ff; CHANG, "We Have Never Been Whiggish..."; SOLER, TRIZIO and PICKERING, *Science as It Could Have Been...*, p. 42.

³⁶ FEYERABEND, *Against Method...*, p. 214; FEYERABEND, *Conquest of Abundance...*, p. 15.

³⁷ FEYERABEND, *Conquest of Abundance...*, p. 144; Ian James KIDD, "Reawakening to Wonder: Feyerabend, Science, and Scientism", in: Karim Bschrir and Jamie Shaw (eds.), *Interpreting Feyerabend*, Cambridge University Press, Cambridge 2021, pp. 172–190.

of reasons, facts, prejudices [and] social pressures”.³⁸ Such contingencies play out at different levels—the lives of individual scientists; their interpersonal and social circumstances; the epistemic and cultural dialectics of enquiry. In the writings of the 1960s and 1970s, Feyerabend’s point was that development of the sciences is “more complex, more conjectural” than was recognised by then-popular philosophical models of science.³⁹ But these points were later used in quite different ways.

The next stage of the argument involves making two comments on these points about dependence on various contingent events and developments. First: they might not have happened. Certain events, decisive for science as we know it, might not have happened. History could have gone other ways. Certain developments might not have developed. Second: the establishment of what was received by us, as our scientific inheritance, was not the outcome of long careful processes of deliberation and decision, informed by critical competition between well-developed rivals.⁴⁰ As Feyerabend put this point, the triumph of certain theories “depended on historical conditions”, of a contingent kind, and not “a critical study of alternatives”.⁴¹ The entrenchment of one research programme, far from being an inevitable convergence on truth, may be explained by a community becoming “swept along by overwhelming historical forces”.⁴² Feyerabend need not deny *any* role for successful rational competition: some theories or research programmes *do* prove their empirical, predictive or explanatory superiority over their rivals. But this may be the *exception* rather than the *rule*. Feyerabend’s worry was that, too often, “ideas are rejected before they can show their strength”, since entrenched theories have contingent advantages — they emerged first and accrued, *inter alia*, attention, credibility and resources — that make it far easier for them to “assemble successes”.⁴³ In some writings, Feyerabend gives examples, including

³⁸ FEYERABEND, *Philosophy of Nature...*, p. 168.

³⁹ See FEYERABEND, *Against Method...*, p. 136.

⁴⁰ See COOPER, *The Measure of Things...*, p. 193f; Ian James KIDD, “Inevitability, Contingency, and Epistemic Humility”, *Studies in History and Philosophy of Science* 2016, Vol. 55, pp. 12–19, <https://doi.org/10.1016/j.shpsa.2015.08.006>.

⁴¹ FEYERABEND, *Against Method...*, p. 216.

⁴² FEYERABEND, *Conquest of Abundance...*, p. 101.

⁴³ Paul K. FEYERABEND, “Introduction: Proliferation and Realism as Methodological Principles”, in: Paul K. FEYERABEND, *Philosophical Papers, Vol. 1, Realism, Rationalism & Scientific Method*, Cam-

the gatekeeping methods used by Big Bang cosmologists to lock out research supporting steady-state cosmologies.⁴⁴ More recent work in sociology and social epistemology of science could offer more detailed cases. Established theories can find it easier to “win out”, to the point that, in some cases, no fair critical competition can occur. To be fair, Feyerabend sometimes put this point too strongly. *Science in a Free Society* — a notoriously polemical book — declares that, with science, “the show has been rigged in its favour”.⁴⁵ But that is too strong.

The more moderate claim is this: one can only warrant confidently claims about the superior or privileged status of a scientific theory *if* that status has been established by sustained critical competition with robust alternatives. As Oberheim emphasises, this point is vital to the pluralistic test-model. Any “final assertion” of the superior status of a theory must, says Feyerabend, come *after* it has been “confronted with alternatives”.⁴⁶ In the absence of such confrontations, assertions cannot be made about its superiority, since that is a comparative notion. Assertion of superiority without the proof of any successful in critical competition has “success — but it is the success of a maneuverer carried out in a void”.⁴⁷ Confident assertions would require the advocates of a theory to have “gone through all possible trials”, and, if certain trials are not possible, then to remain silent.⁴⁸ Some trials cannot be performed because the rivals in question never emerged. A critic may reply that, even if a trial cannot be practically performed, it could still be abstractly performed, in a kind of simulation. Feyerabend anticipated this response and rejected it. Competition and trials are practical endeavours. Simulation cannot capture their complexities — a point nicely described by Emiliano Trizio. The “hopelessly collective and highly specialized character of enquiry pre-

bridge University Press, Cambridge — New York — Port Chester — Melbourne — Sydney 1981, p. 139.

⁴⁴ See FEYERABEND, *Conquest of Abundance...*, pp. 149, 151.

⁴⁵ FEYERABEND, *Science in a Free Society...*, p. 102.

⁴⁶ OBERHEIM, *Feyerabend's Philosophy...*, p. 243.

⁴⁷ FEYERABEND, *Against Method...*, p. 30.

⁴⁸ See Paul K. FEYERABEND, “Concluding Unphilosophical Conversation”, in: Gonzalo MUNÉVAR (ed.), *Beyond Reason: Essays on the Philosophy of Paul K. Feyerabend*, *Boston Studies in the Philosophy of Science*, Vol. 132, Kluwer Academic Publishers, Dordrecht — Boston — London 1991, pp. 516 [487-527].

vents, in practice, any private reconstruction of the entire edifice of knowledge”.⁴⁹ Moreover, a simulated trial is vulnerable to self-vindication. As Chang argues, it is all-too-easy to assume that one’s own theories will prevail in critical competition with rivals — especially if one *knows* one will never actually have to engage in the competition.⁵⁰ Too often, adds Chang, presupposing the inevitable success of one’s own theories against their rivals is an “unreflective triumphalism that celebrates the winning side in an episode, whichever it may happen to be”.⁵¹ Or as John Preston puts the point in a discussion of Feyerabend, the relevant competition “has never been staged, and we cannot even anticipate its outcome”.⁵²

5. Humility and “Abundance”

How does this argument foster a kind of humility? In my reconstruction, Feyerabend argued (a) our scientific inheritance is significantly the product of historical and social contingencies; (b) a variety of actual or possible alternatives to our inheritance never emerged or emerged too late to become established; (c) the relative superiority of our actual inheritance over these alternatives could be confidently asserted only after long critical competitions; (d) these competitions did not take place and cannot be simulated, predicted, anticipated or otherwise confidently determined; therefore (e) we cannot confidently issue the ‘final assertion’ of the superiority of what we inherited in relation to possible alternative inheritances. The outcome should not be radical epistemic anxiety, the abandonment of our inheritance and all our trust in it. That would be an overreaction. Nor is the correct response a retreat into the extreme constructionism voiced by Richard Rorty.⁵³

⁴⁹ Emiliano TRIZIO, “How Many Sciences for one World? Contingency and the Success of Science”, *Studies in History and Philosophy of Science* 2008, Vol. 39, No. 2, pp. 253–258, <https://doi.org/10.1016/j.shpsa.2008.03.017>, p. 258; KIDD, “Inevitability, Contingency...”, § 3.

⁵⁰ Hasok CHANG, “The Hidden History of Phlogiston: How Philosophical Failure can Generate Historiographical Refinement”, *Hyle* 2010, Vol. 16, No. 2, pp. 47–79.

⁵¹ CHANG, “We Have Never Been...”, p. 240.

⁵² PRESTON, *Feyerabend: Philosophy...*, p. 205.

⁵³ Richard RORTY, *Contingency, Irony, and Solidarity*, Cambridge University Press, Cambridge 1989, p.16.

The correct response is more like the one described by Trizio. Confronted with a sense of contingency, a mature and reflective scientist should:

accept the existing science, without being able to rule out the possibility that it would have been different if the decisions of our predecessors had been different. And there is no way to prove that our predecessors had no choice, but to do what they did.⁵⁴

Feyerabend was sometimes unusually moderate when he put the point. The “Interlude” in **Conquest of Abundance**, for instance, reminds us that, not matter how successful or “obvious” our inherited systems of thought seem to us, we must appreciate that “this is not the only possible approach, that there are alternatives, and that they may lead to different conclusions”.⁵⁵ We can continue to employ and esteem our scientific inheritance, or as much of it as proves epistemically and practically valuable. But we should avoid triumphalism, abandon premature “final assertions”, and recognise our scientific inheritance as an impressive if contingent edifice. Retrospectively we are well-advised to actively search history for undeveloped and underdeveloped alternatives. Chang has defended an ideal like this in the form of *complementary science*.⁵⁶ Prospectively we must be receptive to possible alternatives and try to create conditions which actively foster epistemic plurality. If we appreciate the contingency of our inheritance, then we can come to see its *particularity*. Our inheritance enables certain kinds of scientific projects while also disabling others. This could encourage certain kinds of epistemic attitudes, many that invite description using a vocabulary of humility. We can appreciate our successes without assuming that no other kinds of success could be possible. We can trust and take pride in our scientific achievements without prematurely issuing “final assertions”. We can regard the prospect of alternative epistemic possibilities with curiosity or even wonder, rather than dismiss them out of hand.⁵⁷

⁵⁴ TRIZIO, “How Many Sciences for one World?...”, p. 258.

⁵⁵ FEYERABEND, **Conquest of Abundance...**, p. 87.

⁵⁶ See CHANG, **Is Water H₂O?...**, p. §5.3.4.

⁵⁷ See Alex AYLWARD, “Against Defaultism and Towards Localism in the Contingency/Inevitability Conversation: Or, why we Should shut up about Putting-up”, *Studies in History and Philosophy of Science* 2019, Vol. 74, pp. 30–41, <https://doi.org/10.1016/j.shpsa.2019.01.008>; Luca TAMBOLO, “An Unappreciated Merit of Counterfactual Histories of Science”, *Studies in History and Philosophy of Biological and Biomedical Sciences* 2020, Vol. 81, A:101183, <https://doi.org/10.1016/j.shpsc.2019.101183>.

I have only indicated some general modes of humility in connection to contingency and science. More detailed accounts are available elsewhere.⁵⁸ These modes of humility are all either indicated by Feyerabend's remarks or consistent with the ethos of his philosophical pluralism. Contingency fosters an appreciation of alternatives — our inheritance is partial rather than comprehensive. Contingency fosters criticism by encouraging us to be perpetually alert for problems or objections that were not part of our inheritance. Some of the most important objections to our theories may remain currently unrealised. Contingency also makes us think in new ways about proliferation. On the one hand, the deep contingencies of our inheritance constrain our ability to proliferate. Certain epistemic possibilities were not part of our inheritance and it may be difficult, or impossible, to retrieve them. On the other hand, proliferating *now* to reduce the future effects of contingency seems a prudent strategy. Contingency also energises our appreciation of alternatives — a sense of contingency, at its broadest, will include a sense of possible alternatives to our scientific inheritance.

Feyerabend would endorse all these points. A sense of contingency can reinforce his arguments for pluralism, and also resonate with his hostility to dogmatism and his celebration of creativity, imaginativeness, and open-mindedness. A sense of the contingency and particularity of one's own received ways of thinking should sustain an emancipatory sense of there being *other* ways. The other ways could be found in many places — other scientific communities, earlier traditions, or other cultures. All this fits the expansive historical and cultural vision expressed in **Against Method**, **Farewell to Reason**, and **Conquest of Abundance**. Contingency and pluralism can even be seen as mutually reinforcing themes. Feyerabend's later ideas about the "conquest of abundance" are complex and need further study. One can, however, interpret them as a call to humility. The world is "abundant" because it inspires, sustains and rewards a diversity of perspectives, theories, and worldviews.⁵⁹ Such abundance can be understood as a feature of the world — its ontological complexity. But it also reflects the marvelous richness, variety and changeability of human interests, sensibilities and

⁵⁸ See David E. COOPER, **The Measure of Things...**; KIDD, "Inevitability, Contingency..."; Ian James KIDD, "Humility, Contingency, and Pluralism in the Sciences", in: Mark ALFANO, Michael LYNCH, and Alessandra TANESINI (eds.), **The Routledge Handbook on the Philosophy of Humility**, Routledge, New York 2020, pp. 346–358.

⁵⁹ See FEYERABEND, **Conquest of Abundance...**, p. 3; FEYERABEND, **Farewell to Reason...**, p. 179.

forms of life. This is one way to interpret the cryptic remark — in one of the essays — that “abundance occurs in history, not in the world”.⁶⁰ Or better: what we see across the history of human cultures are wonderfully rich experiments with a plurality of ways of experiencing and engaging with the world. Such “abundance” is impressive — which is why Feyerabend lamented its “conquering” by processes of epistemic and cultural homogenisation.

I see contingency as a rich theme in Feyerabend, one that resonates with many of his ideas and concerns. This includes his advocacy of pluralism, criticisms of closed-mindedness and dogmatism, celebrations of “abundance” and, at a more abstract level, the ethos of humility that is such an attractive feature of his work. In her Preface to **Conquest of Abundance**, Grazia Borrini-Feyerabend notes that, compared to earlier works, it has “a quieter, more wondering attitude”.⁶¹ One of the things that invites our wonder is the “abundance” manifested in the history of human life. Another object of wonder, though, are the unrealised alternatives — the other histories, other sciences and other forms of life whose possibilities show the wonderful richness available when human beings live in ways that are creative, humble, tolerant, and humane. I see this same sensibility in Hasok Chang’s own defences of a pluralistic science, whose debts to Feyerabend’s own work he openly acknowledges:

The most fundamental motivation for pluralism is *humility*: we are limited beings trying to understand and engage with an external reality that seems vastly complex, apparently inexhaustible, and ultimately unpredictable [...]

[M]ature scientists and mature scientific communities would value tolerance, humility and circumspection, combined with a tough questioning attitude. They would display an awareness of humility fragility and fallibility and the multifarious complexity of nature, and try to create institutional structures that can handle this awareness.⁶²

Feyerabend would applaud this richly humane conception of science and human life, and, if my remarks in this paper are correct, then the cultivation of a sense of contingency will help us to achieve it.

⁶⁰ FEYERABEND, **Conquest of Abundance...**, p. 134.

⁶¹ FEYERABEND, **Conquest of Abundance...**, p. xi.

⁶² CHANG, **Is Water H₂O?...**, p. 255, 238.

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References

1. AYLWARD Alex, "Against Defaultism and Towards Localism in the Contingency/Inevitability Conversation: Or, why we Should shut up about Putting-up", *Studies in History and Philosophy of Science* 2019, Vol. 74, pp. 30–41, <https://doi.org/10.1016/j.shpsa.2019.01.008>.
2. BOUTERSE Jeroen, "Contingentism for Historians", *Studies in History and Philosophy of Science* 2022, Vol. 96, pp. 27–34, <https://doi.org/10.1016/j.shpsa.2022.08.001>.
3. BOWLER Peter, **Darwin Deleted: Imagining a World without Darwin**, University of Chicago Press, Chicago 2012.
4. BROWN Matthew J., "The Abundant World: Paul Feyerabend's Metaphysics of Science", *Studies in History and Philosophy of Science* 2016, Vol. 57, pp. 142–154, <https://doi.org/10.1016/j.shpsa.2015.11.015>.
5. CHANG Hasok, "We Have Never Been Whiggish (About Phlogiston)", *Centaurus* 2009, Vol. 51, No. 4, pp. 239–264, <https://doi.org/10.1111/j.1600-0498.2009.00150.x>.
6. CHANG Hasok, "The Hidden History of Phlogiston: How Philosophical Failure can Generate Historiographical Refinement", *Hyle* 2010, Vol. 16, No. 2, pp. 47–79.
7. CHANG Hasok, **Is Water H₂O? Evidence, Realism, Pluralism**, Springer, Dordrecht 2012.
8. CHANG Hasok, "Cultivating Contingency: A Case for Scientific Pluralism", in: Lená SOLER, Emiliano TRIZIO and Andrew PICKERING (eds.), **Science as it Could Have Been: Discussing the Contingency/Inevitability Problem**, Pittsburgh University Press, Pittsburgh 2015, pp. 359–382.
9. CLARKE Steve and WALSH Adrian, "Imperialism, Progress, Developmental Teleology, and Interdisciplinary Unification", *International Studies in the Philosophy of Science* 2014, Vol. 27, No. 3, pp. 341–351, <https://doi.org/10.1080/02698595.2013.825493>.
10. COOPER David E., **The Measure of Things: Humanism, Humility, and Mystery**, Clarendon Press, Oxford 2002.

11. CUSHING James T., **Quantum Mechanics: Historical Contingency and the Copenhagen Hegemony**, University of Chicago Press, Chicago 1994.
12. FARRELL Robert, **Feyerabend and Scientific Values: Tightrope-Walking Rationality**, Kluwer, Dordrecht 2003.
13. FEYERABEND Paul K., **Against Method. Third Edition**, Verso, London 1993.
14. FEYERABEND Paul K., “Concluding Unphilosophical Conversation”, in: Gonzalo MUNÉVAR (ed.), **Beyond Reason: Essays on the Philosophy of Paul K. Feyerabend**, *Boston Studies in the Philosophy of Science*, Vol. 132, Kluwer Academic Publishers, Dordrecht — Boston — London 1991, pp. 433–448.
15. FEYERABEND Paul K., **Conquest of Abundance: A Tale of Abstraction Versus the Richness of Being**, Bert TERPSTRA (ed.), University of Chicago Press, Chicago 2001.
16. FEYERABEND Paul K., **Farewell to Reason**, Verso, London 1987.
17. FEYERABEND Paul K., “Introduction: Proliferation and Realism as Methodological Principles”, in: Paul K. FEYERABEND, **Philosophical Papers, Vol. 1, Realism, Rationalism & Scientific Method**, Cambridge University Press, Cambridge — New York — Port Chester — Melbourne — Sydney 1981, pp. 139–145.
18. FEYERABEND Paul K., **Philosophy of Nature**, in: Eric OBERHEIM and Helmut HEIT (eds.), Polity, Cambridge 2016.
19. FEYERABEND Paul K., **Science in a Free Society**, New Left Books, London 1978.
20. HACKING Ian, **The Social Construction of What?**, Harvard University Press, Cambridge 1999.
21. HACKING Ian, “How Inevitable are the Results of Successful Science?”, *Philosophy of Science* 2000, Vol. 67, pp. 58–71.
22. HUSSERL Edmund, **The Crisis of European Sciences and Transcendental Phenomenology**, Northwestern University Press, Evanston 1970.
23. KIDD Ian James, “Historical Contingency and the Impact of Scientific Imperialism”, *International Studies in the Philosophy of Science* 2013, Vol. 27, No. 3, pp. 317–326, <https://doi.org/10.1080/02698595.2013.825494>.
24. KIDD Ian James, “Inevitability, Contingency, and Epistemic Humility”, *Studies in History and Philosophy of Science* 2016, Vol. 55, pp. 12–19, <https://doi.org/10.1016/j.shpsa.2015.08.006>.
25. KIDD Ian James, “Humility, Contingency, and Pluralism in the Sciences”, in: Mark ALFANO, Michael LYNCH, and Alessandra TANESINI (eds.), **The Routledge Handbook on the Philosophy of Humility**, Routledge, New York 2020, pp. 346–358.

26. KIDD Ian James, “Reawakening to Wonder: Feyerabend, Science, and Scientism”, in: Karim BSCHIR and Jamie SHAW (eds.), **Interpreting Feyerabend**, Cambridge University Press, Cambridge 2021, pp. 172–190.
27. KINZEL Katerina, “State of the Field: Are the Results of Science Contingent or Inevitable?”, *Studies in History and Philosophy of Science* 2015, Vol. 52, pp. 55–66, <https://doi.org/10.1016/j.shpsa.2015.05.013>.
28. KUSCH Martin, “Relativism in Feyerabend’s Later Writings”, *Studies in History and Philosophy of Science Part A* 2016, Vol. 57, pp. 106–113.
29. LLOYD Elizabeth A., “Feyerabend, Mill, and Pluralism”, *Philosophy of Science* 1997, Vol. 64/4, “Feyerabend, Mill, and Pluralism”, *Philosophy of Science* 1997, Vol. 64, *Supplement. Proceedings of the 1996 Biennial Meetings of the Philosophy of Science Association. Part II: Symposia Papers*, pp. S396–S407.
30. MARTIN Joseph D., “Is the Contingentist/Inevitabilist Debate a Matter of Degrees?”, *Philosophy of Science* 2013, Vol. 80, No. 5, pp. 919–930, <https://doi.org/10.1086/674003>.
31. MUNÉVAR Gonzalo, “Historical Antecedents to the Philosophy of Paul Feyerabend”, *Studies in History and Philosophy of Science* 2013, Vol. 57, No. 3, pp. 9–16, <https://doi.org/10.1016/j.shpsa.2015.11.002>.
32. OBERHEIM Eric, **Feyerabend’s Philosophy**, Walter de Gruyter, Berlin 2006.
33. PICKERING Andrew, **Constructing Quarks: A Sociological History of Particle Physics**, University of Chicago Press, Chicago 1984.
34. PRESTON Jonh, **Feyerabend: Philosophy, Science and Society**, Polity Press, Oxford 1996.
35. RADICK Gregory, “Other Histories, other Biologies”, in: Anthony O’HEAR (ed.), **Philosophy, Biology, and Life**, Cambridge University Press, Cambridge — New York — Melbourne 2005, pp. 21–47.
36. RADICK Gregory, “Counterfactuals and the Historian of Science”, *Isis* 2008, Vol. 99, pp. 547–551.
37. RADICK Gregory, **Disputed Inheritance: The Battle over Mendel and the Future of Biology**, University of Chicago Press, Chicago 2023.
38. RHEINBERGER Hans-Jörg, **On Historicising Epistemology: An Essay**, *Cultural Memory in the Present*, trans. David Fernbach, Stanford University Press, Stanford 2010.
39. RORTY Richard, **Contingency, Irony, and Solidarity**, Cambridge University Press, Cambridge 1989.

40. SANKEY Howard, "Scientific Realism and the Inevitability of Science", *Studies in History and Philosophy of Science* 2008, Vol. 39, No. 2, pp. 259–264, <https://doi.org/10.1016/j.shpsa.2008.03.018>.
41. SOLER Lená, "Are the Results of our Science Contingent or Inevitable?", *Studies in History and Philosophy of Science* 2008, Vol. 39, pp. 221–229, <https://doi.org/10.1016/j.shpsa.2015.05.013>.
42. SOLER Lená, "Revealing the Analytical Structure and some Intrinsic Major Difficulties of the Contingentist/Inevitabilist Issue", *Studies in History and Philosophy of Science* 2008, Vol. 39, No. 2, pp. 230–241, <https://doi.org/10.1016/j.shpsa.2008.03.015>.
43. SOLER Lená, TRIZIO Emiliano and PICKERING Andrew, **Science as It Could Have Been: Discussing the Contingency/Inevitability Problem**, The University of Pittsburgh Press, Pittsburgh 2015.
44. TAMBOLO Luca, "An Unappreciated Merit of Counterfactual Histories of Science", *Studies in History and Philosophy of Biological and Biomedical Sciences* 2020, Vol. 81, A:101183, <https://doi.org/10.1016/j.shpsc.2019.101183>.
45. TAMBOLO Luca and CEVOLANI Gustavo, "Multiple Discoveries, Inevitability, and Scientific Realism", *Studies in History and Philosophy of Science* 2021, Vol. 90, pp. 30–38, <https://doi.org/10.1016/j.shpsa.2021.09.001>.
46. TRIZIO Emiliano, "How Many Sciences for one World? Contingency and the Success of Science", *Studies in History and Philosophy of Science* 2008, Vol. 39, No. 2, pp. 253–258, <https://doi.org/10.1016/j.shpsa.2008.03.017>.
47. VIRMAJOKI Veli, "Could Science be Interestingly Different?", *Journal of the Philosophy of History* 2018, Vol. 12, No. 2, pp. 303–324, <https://doi.org/10.1163/18722636-12341388>.