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Special Issue
Paul Feyerabend and the History and Philosophy of Science

Find Men:
Paul Feyerabend and Richard Feynman on the Limits of Defining Science and Methodological Prescription

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Abstract:
This paper presents a re-evaluation of Paul Feyerabend's philosophy of science and connects him with an unlikely ally in the physicist Richard Feynman. The essay argues they share critical, latent insights into the dynamic nature of science via the ideas of Michael Polanyi. Where Feyerabend has acquired the label of "anti-science radical", this paper will contend that this is a fundamental misreading, mistaking his thoughts about science for prescriptive methodological claims for doing science. Such mis-readings play into a wider construction of the public image of both Feyerabend and Feynman that have been utilised in "science-culture wars". However, both thinkers recognised the fundamental distinction between doing (a tacit, lived practice) and thinking about science (explicit knowledge, philosophy) to the extent that "science" cannot be accurately defined without misrepresenting it. Ultimately, both Feynman and Feyerabend were concerned at the growth of scientism masquerading under the name of science.

Keywords: Culture war; Explicit; Scientism; Tacit.

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Introduction:
Anti-Science Feyerabend

Paul Feyerabend's philosophical contributions have frequently been characterised by extreme methodological and epistemological positions, leading to his widespread portrayal as a radical opponent of scientific rationality. He is often pejoratively labelled the "worst enemy of science" (Theocharis and Psimopoulos 1987), the "enfant terrible" of philosophy of science (Suppe 1991, 297), and an anti-science radical (Schnädelbach 1991) who controversially asserted that "anything goes". This provocative stance has led critics to accuse him of defending non-scientific practices such as astrology or voodoo (Schnädelbach

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1991), thereby implying a collapse of distinctions between scientific and non-scientific knowledge. Furthermore, Feyerabend has been significantly associated with "postmodern" thought (Kidd 2016a), with some scholars, like Lugg (1991) who accuse Feyerabend of "irrationalism, subjectivism, nihilism and anything goes relativism [reducing] the objective criteria of acquiring knowledge to personnel criteria" (Lugg 1991, 100-112). Laudan (1989, 299) dismissed his position as "a series of non-sequiturs". More recently Sidky (2023, 51) describes Feyerabend, along with Kuhn, as an "irrationalist philosopher" who contributed to the postmodern antiscience program. Reaven (2000, 23) suggests that Feyerabend's work provides the intellectual groundwork for a "dismissive, cynical attitude" towards science. Books with titles such as *Against Method*, *Farewell to Reason*, and *The Tyranny of Science* are often interpreted as direct challenges to scientific orthodoxy, a perception that resonates with contemporary culture wars. This alignment has further cemented his image as an "anti-science" thinker. Described by Pigliucci (2010) as a "Rebel with a Feeble Cause"; Gardner (1982) as "anti-Science" and even his *New York Times* obituary read "Anti-Science Philosopher" (Saxon 1994).

The above caricature, I argue, often stems from a fundamental misreading where commentators have mistaken Feyerabend's talk *about* science for *doing* science. Where texts like *Against Method* (1993) are often interpreted literally as being in opposition to *the* scientific method (singular), rather than a specific understanding of it. It does not help that Lakatos's response was never completed and put in dialogue with Feyerabend's, as was originally the intention (Oberheim 2006). However, when "anything goes" is construed as a competing methodological principle, it implies an equivalence of all methods, suggesting that practices such as prayer, tea leaf reading, or crystal healing are equally scientific. This interpretation, according to critics like Devitt (1979), ultimately renders the distinction between science and non-science meaningless. Lugg (1977) calls it a "non-method" (1997, 763), whereas Godfrey-Smith (2003, 111) asserts that Feyerabend "is opposed to all systems of rules and constraints in science", which then prompts the fundamental question "what is science" if it possesses no disciplinary boundaries and could potentially encompass magic or religion?[2] Feyerabend's assertion that "the only principle that does not inhibit progress [in science] is: *anything goes*" (Feyerabend 1993, 5-14, 1) is, I argue, ironic. He is voicing the response of the philosopher who has taken a look at the history of science and then at their own idealised abstract version being forced to concluded "anything goes".[3] Several factors contribute to this pervasive misinterpretation. He is "easy to misread" (Brown and Kidd 2016, 1), partly due to his deliberate agitative attitude and a sometimes enigmatic writing style. Kidd (2021, 186-187) suggests Feyerabend's approach aligns more with European Continental traditions than analytic philosophy, potentially depriving him of concepts and tools to better ground his ideas in a way accessible to a more analytic audience. Where an ironic approach is not appreciated, works like *Against Method* (1993) can appear as a sloppily argued polemic against the scientific community. From this his detractors have read him more than uncharitably. His "incommensurability thesis", more commonly associated with Kuhn, seems to state that scientific theories, languages, and cultures are radically incommensurable. The implication is that there is no possible way of directly translating terms or claims from one framework to another. Laudan (1977, 141) describes it as the thesis "that theories before and after a revolution are so radically different that we cannot even speak meaningfully of any similarities between them", further noting that "scientists working in different research

[2] It is interesting to consider the difference between "no-method" and a "non-method" as to what epistemological anarchism is.

[3] Possibly aimed at Popper (Oberheim 2025).

traditions cannot communicate with, and cannot understand the statements of, their fellow scientists in other traditions [...] theories cannot be compared and rationally evaluated" (Laudan 1977, 142). Farrell (2003) notes that Newton-Smith's interpretation, which implies "that no theory can be compared, in any manner whatsoever, to any other theory" and excludes objective rational choice criteria, "is the standard interpretation of incommensurability" (Farrell 2003, 88). This version, however, I call the "strong reading" which gives a radical scepticism over the very possibility of a shared objective reality that science claims to be able to investigate. As part of this "strong reading" Feyerabend's highlighting of non-scientific factors in the practice of science puts significant weight on psychological, linguistic, political, and cultural factors, as determinants of scientific practice and knowledge. This emphasis on the influence of non-scientific elements, when misinterpreted as a methodological prescription for *doing* science, directly contributes to the perception that Feyerabend is "anti-science". Linked to this is Feyerabend's use of observational theory-dependence (Wilkins 2013). The strong reading posits that there is no "pure observation", and what people experience is determined by external and internal non-scientific factors, which resist any neutral description. This challenges the objectivity of science and the possibility of an apolitical or apsychological account of reality. From this there is the "Sapir-Whorf hypothesis". Snævarr (2022) suggests Feyerabend invokes a strong form of this hypothesis, where thought, as a function of language, creates and organises our experience of reality. This implies that "each language creates its unique reality, and truth is relative to languages" (Snævarr 2022, 279), meaning they cannot be compared, and a common shared reality is lost. Moreover, if a linguistic expression for something is absent, it literally does not exist as it would be unthinkable. When all this is misapplied as a methodological claim for *doing* science, it suggests scientists are fundamentally limited by verbal, conceptual, or symbolic expression, or that reality is for the most part socially determined by non-scientific factors. For many this is untenable.

We are not forced to accept these conclusions however. What I will argue is that the prevalent "anti-science" characterisation of Feyerabend partially derives from a conflation of his historical critique of an idealised, abstracted science with a prescriptive methodological claim. Why there should be this conflation also has a number of possibilities. Oberheim (2006) identifies at least six:

1. Attributing views to Feyerabend based on second-hand accounts.
2. Creating a "straw-man" caricature while adopting a similar position to criticize it (the Lessing Effect).
3. Feyerabend's use of obscure or diverse sources (Brecht, Robespierre, Lenin, Pirandello) when discussing science.
4. Feyerabend's historical-cultural analysis of fringe practices, like taking astrology seriously when it was largely ignored by mainstream academia.
5. Feyerabend's appeal to "showing but not saying" (akin to Wittgenstein or Michael Polanyi's "tacit knowledge"), suggesting that direct communication about scientific practice is impossible, necessitating art, myth, or metaphor for indirect insight into the limitations of formalism.
6. His writing style, characterised by humour, irony, rhetoric, provocation, hyperbole, and polemic, often clashed with analytic and "ordinary language" philosophy or academia generally.

Some of these more sophisticated readings of Feyerabend contend, for example, that the entire text of *Against Method* (1993) functions as a *reductio ad absurdum* argument against a universalistic understanding of method and reason within science (Munévar 2000, 63). Such a nuanced perspective, however, is not amiable to "science-culture war" rhetoric in which

Feyerabend readily appears as a straw-man. Next, we will look at how the science-culture wars manifest themselves and to what ends.

The Science-Culture Wars

The "science wars" reflect broader societal conflicts over disciplinary legitimacy and epistemology (Heise 2004, 149). This academic dispute features politicised science amid the depoliticisation of other fields – a key driver of contemporary "culture wars" (e.g., that "gender" is biological, not social in nature). Central to this conflict is science's elevated status, it accrues significant cultural capital by positioning itself as the bastion of Enlightenment values (i.e., reason, objectivity, egalitarianism). Consequently, challenges to scientific authority are framed as assaults on these values, paradoxically held as sacred, if only performatively (Lofton 2022). Feyerabend's portrayal as a radical, anti-science zealot tends to come from his "philosophical" rather than scientific background. This guilt by association has humanities and science departments in conflict, where trendy "postmodern" left-leaning academics obfuscate or muddy the waters (Appleby, Hunt and Jacob 1994; Dawkins 1998; Gross and Levitt 1994; Lynch 2020; Sidky 2023; Sokal and Bricmont 1998). Critics, such as Gross and Levitt (1994) or Sokal and Bricmont (1998) contend that a form of anti-intellectualism arises when academics assert that "social theory and literary analysis are equal in epistemic power to those of science" (Gross and Levitt 1994, 12). If true this marks a nihilistic and intellectually destructive attitude born of "a shared sense of injury, resentment, and indignation against modern science" (Gross and Levitt 1994, 5). Beyond the confines of academia, the underlying dynamics of the "science-culture wars" have permeated broader public discourse. The emergence of "dark web public intellectuals", post-truthers, and red-pillers act as self-proclaimed critics and experts on the decline of Western Civilization. From conspiracy theories and radicalism to free speech warriors and tech-billionaires, where all digital realities are true and false at the same time. In this environment, public intellectuals like Jordan Peterson, Steven Pinker, and Richard Dawkins have garnered new audiences, particularly among disaffected young white males, where the latest science-culture war is to frame "trans" or "feminist" thought as "ideological", inherently anti-scientific, anti-Enlightenment, anti-capitalism and anti-heteronormative (Klein 2018). Dawkins, in analysing this new form of anti-scientific rhetoric, quotes Cartmill:

> Anybody who claims to have objective knowledge about anything is trying to control and dominate the rest of us […]. There are no objective facts. All supposed "facts" are contaminated with theories, and all theories are infested with moral and political doctrines. Therefore, when some guy in a lab coat tells you that such and such is an objective fact […] he must have a political agenda up his starched white sleeve. (Dawkins 1998, 39)

Dawkins' views however are a reactionary response to the sort of misrepresentation Feyerabend has suffered. Dawkins' in his caricature repeats the "us-them" dynamics of a culture war. According to Hunter (1991) a "culture war" describes a fundamental societal tension between opposing forces of stagnation and change, or traditionalist and progressive viewpoints. This conflict is often perceived as reflecting a deeper struggle concerning identity and moral authority. Historically, institutions such as religious bodies, academic institutions, and governmental structures played a mediating role in these conflicts, providing a common framework for discourse and resolution. However, the advent of digital technologies and the neoliberalisation of the political economy have seemingly eroded this collective agreement over a shared societal reality. Today key characteristics and manifestations of contemporary culture wars include contested victimhood, a contrarian

dispute over the roles of "aggressor" and "victim". At its most divisive, this dynamic can reproduce authoritarian narratives, notably the notion of an "invading minority" imposing beliefs and practices upon broader society. The perceived threats underpinning these conflicts are diverse, ranging from concerns over reproduction rates and historical revisionism to anxieties about the erosion of the rule of law, democracy, and freedom of speech. Historically, the rise of New Atheism, which launched Dawkins into the spotlight, grew in response to the perceived threat of radical Islam. Prior to this, Communism served as the antagonist. Currently, discourses around "cultural Marxism", "race critical theory", and "Trans-ideology", are framed as affronts to tradition and Enlightenment values (Ayres 2024; Davies and MacRae 2023; Fekete 2024; Sandel 2018). Conversely, any critique suggesting capitalism's potential culpability in societal issues or its status as an existential threat is often met with counter-accusations of "Marxism", "Fascism", or being "woke". According to an *Ipsos* (2021) report terms like "being woke", "cancel culture", and "white privilege" receive widespread exposure but remain vaguely defined in the public sphere. This vagueness is politically useful as it allows these terms to apply to everything and nothing. Ironically, this seems quite "postmodern" to use a term that has no clear meaning to describe social phenomena. In a 2020 letter by the British "Common Sense Group", comprised of fifty-nine Conservative MPs and Peers they wrote how the silent majority are:

> tired of being patronised by elitist bourgeois liberals whenever issues such as immigration or law and order are raised. Part of our mission is to ensure that institutional custodians of history and heritage, tasked with safeguarding and celebrating British values, are not coloured by cultural Marxist dogma, colloquially known as the "woke agenda". (Hayes 2020)

They go on to accuse the director of the National Trust of "cultural Marxism" for factually pointing out the historical links between Chartwell House, the former family home of Sir Winston Churchill, and colonial slavery. They wanted the organisation's funding reviewed in the light of "snowflake preoccupations". The concern is that "British heroes" are undergoing "postmodern" historical revisionism, being recast as villains by a small group of liberal (academic?) elites. If the world, and by extension truth-claims and knowledge, are founded on strong relativistic conditions, then objective truth, fact, and justice become impossible, leading to what is perceived as a form of nihilism (Gross and Levitt 1994; Sokal and Bricmont 1998). This seemingly Protagorean position implies an inability to compare knowledge-claims or even experiences, as individuals are confined to their own cultural discourses that constructs reality (Preston 1997). If a Newtonian and an Einsteinian cannot compare their descriptions of "mass", then comparing more complex, historical, and culturally sensitive events like slavery or genocide seems hopeless. Thus, the "science-culture wars" illuminate a persistent contention over who holds legitimate authority in knowledge production and validation, sometimes reflecting deep-seated ideological divisions that continue to shape both scholarly debate and broader cultural narratives.

Reclaiming Feyerabend

As Munévar (1991, ix) puts it, "some philosophers think Paul Feyerabend is a clown, a great many others think that he is one of the most exciting philosophers of science of this century", so why the polarising attitudes? To get to Feyerabend's often perceived "anti-science" position, it is crucial to comprehend his historical critique of the abstract definition of science as a competing methodological claim. One of Feyerabend's central arguments is that science is not synonymous with a single methodology, however, if we argue that it is it reveals two significant issues: 1) that it is demonstrable that this singular methodology was not

exclusively followed in historical episodes that are today recognised as being "scientific", and 2) that if this conception of science had been rigidly and dogmatically applied it would have fundamentally impeded scientific advancement.

As a way to reclaim Feyerabend, this analysis intends to draw a connection to the physicist Richard Feynman, a figure often considered antithetical to someone like Feyerabend. It will be argued that Feyerabend and Feynman share striking commonalities in their perspectives on science and the communication of scientific ideas. Both thinkers essentially underscore a critical distinction: the difference between talking and thinking *about* science (philosophy, education, policy formation) and *doing* science (lived-historical practice).

A widely held view, arguably attributed to Francis Bacon, is that *science is its method* (Bauer 1992, 19). It is observation based, that allows for hypothesis formation that gives predictions, which are then tested by experiment. The hypothesis is then either refined or discarded altogether depending on the results. Now whilst this is at least one way of doing science, is "anything goes" any better?

> One might therefore get the impression that I recommend a new methodology which replaces induction by counterinduction and uses a multiplicity of theories, metaphysical views, fairy-tales instead of the customary pair theory/observation. This impression would certainly be mistaken. (Feyerabend 1993, 23)

The prefaces to the 2nd and 3rd editions of *Against Method* clarify that Feyerabend was not proposing a new principle or general solution for how science *should* be done. He was not offering an alternative set of rules or methodological principles. Instead, he was ironically concluding that "anything goes" is "the terrified exclamation of a rationalist who takes a closer look at history" (Feyerabend 1993, vii). Brush (1974) makes a similar point where he argues that the history of science is harmful if the public have an overly idealistic conception of how science is done. Indeed, the history of science yields counterexamples to every rule deemed necessary for scientific conduct, indicating these rules are either inapplicable or detrimental to advancement. This historical perspective demonstrates the absence of a generalisable scientific method (Giere 2016). Feyerabend thus critiques the philosophical pursuit of universal definitions or criteria, instead emphasising the lived socio-historical experience of scientific practice.

What then about the charge of postmodern relativism?

According to Brown and Kidd (2016), there is "nothing recognisably postmodern" about Feyerabend's work and instead reveals a "humanitarian vision of the value of science, that is, strikingly modern" (Brown and Kidd 2016, 1). Feyerabend was more worried about what is done in the name of science, particularly practices based on the notion that "science equals method" or the unacademic dismissal of fields such as "astrology" or "witchcraft". Feyerabend defended these against the hubris of intellectuals who spoke with authority despite lacking arguments or being uninformed (Kidd 2016b, 172). The over-representation of science as its method leads to a form of scientism. He termed this forced alignment with a non-existent, abstract scientific ideal the "mythical monster" (Feyerabend 1993, 245). This "monster" limits possibilities by demanding diverse human practices conform to a method that does not reflect science's historical reality. Feyerabend instead advocated for a pluralistic, perspectivist approach as a more accurate description of how science is done (Giere 2016). He called this "epistemological anarchism", which has since been developed into "active normative epistemic pluralism" (Chang 2012, 268-269).

Whilst he may not be "postmodern", he does propose a moderate form of relativism. So, to move away from the "strong reading" does incommensurability mean incomparable? Incomparability requires lacking a shared framework for recognising similarities and

differences, precluding translatability. However, Farrell (2003) argues that Feyerabend does not say this. Feyerabend (1970) clarifies that paradigms are not absolutely incomparable, where "succeeding paradigms can be evaluated only with difficulty and [...] they may be altogether incomparable at least as far as the more familiar standards of comparison are concerned (they may be readily comparable in other respects)" (Feyerabend 1970, 219). Indeed, much of science is metaphorical and analogical, comparing one "thing" with another until we get a type of identity e.g., an atom is bit like a mini solar system. This is at its most pure in mathematical language where some believe nature is really just numbers. However, I think Feyerabend is also making a deeper point about the limitations of language; linguistic expression; conceptual representation in the role of science. His thoughts on the relationships between language, meaning and practice are predated by Ludwig Wittgenstein and Michael Polanyi. Common to both is the understanding that just as science is not only its method, *meaning* is not just linguistic or symbolic representation. Both take meaning to come from use and use comes from a world of lived practices, which are themselves historical. Meaning is external, not internal to the subject. Polanyi, who is only mentioned once, both by Kuhn and Feyerabend, put forward the idea that science only understood in terms of explicit knowledge either about it or the knowledge it produces, is a mistake (Jacobs 2002). "Explicit knowledge", commonly equated with knowledge itself due to its predominance in educational and professional contexts, comprises codifiable, symbolically transmissible information (e.g., text, speech, data). It aligns with factual propositions and underpins computation, LLM's and computer coding. However, Polanyi (1964) contends that explicit knowledge depends fundamentally on *tacit knowledge*: embodied, non-symbolic understanding that resists direct articulation (i.e., it involves practice). Polanyi argues that scientific practice also relies on unarticulated tacit foundations. Reducing science to its explicit outputs (theories, methods, principles) invites a problematic understanding of science where methodological rigidity contradicts actual scientific practice. Polanyi argues that science persists, even in the absence of formal codification, because of tacit-knowing. Polanyi, Wittgenstein, and Feyerabend appeal to a kind of *showing* but not *saying* strategy to illustrate how scientific understanding transcends explicit representation, necessitating indirect demonstration over direct description. Tacit knowledge enables cross-framework intelligibility despite explicit incommensurability. Feyerabend's use of metaphor, art, and myth underscores the limitations of symbolic abstraction, revealing shared phenomenological grounding that facilitates interpretation in absence of formal rules.

The final and most substantial part of the reclaiming of Feyerabend, will be to argue that Feyerabendian philosophy of science is latent in the works of the physicist Richard Feynman. That Feynman's goal, like Feyerabend, was not to make science comprehensible through everyday experiences (received understanding) of "what science is", but to *prevent* people from trying, at least until they developed a new intuition/experience based on critiques of what it was supposed to be. Moreover, I will examine Feynman's deployment as an authoritative figure in the "science-culture wars" where humanities versus sciences discourses are put into conflict, but I will question the extent to which this "Feynman" is a myth, a literary fictional creation used to in the same way Feyerabend has been ridiculed for.

Find-Men

Since the emergence of New Atheism, conservative and neoliberal intellectuals have increasingly dismissed philosophy's value, framing it as obsolete science. Figures such as Hawking and Mlodinow (2010, 5) declared philosophy "dead", whilst Krauss, a Feynman disciple, asserted its stagnation and inherent conflict with scientific progress that creates "a natural resentment on the part of philosophers" (Andersen 2012). Krauss (2012) also believed

he'd answered the metaphysical question why there is something rather than nothing, that has long since evaded theologians and philosophers.[4] This general antipathy towards philosophers as "failed scientists" can be traced partly to Popper and Hayek (Peters 2022), whose postwar scepticism of centralised state power extended to philosophy. Popper (1952) equated unfalsifiable beliefs with societal danger, critiquing Platonic and Hegelian idealism as totalitarian precursors due to their reliance on abstract epistemology over empirical inquiry. Hegel's association with Marx further fuelled conservative critiques of "cultural Marxism" that worries the likes of the "Common Sense Group". Here Feynman is frequently put among those thinkers who thumbed his nose not just at the uselessness of philosophy, but the pomposity with which philosophers regard themselves:

> My son is taking a course in philosophy, and last night we were looking at something by Spinoza – and there was the most childish reasoning! There were all these Attributes, and Substances, all this meaningless chewing around, and we started to laugh […]. You can take every one of Spinoza's propositions, and take the contrary propositions, and look at the world – and you can't tell which is right. (Feynman 2001c, 195)

Probably his most well-known "anti-philosophy" line is the "philosophy of science is as useful to scientists as ornithology is to birds" (Trubody 2016, 10). Feynman was known for his no-nonsense pragmatic approach to problem solving, from safe cracking and lock picking, to visual representations of quantum calculations, to solving what caused the Challenger space shuttle to explode on take-off. Once labelled the "smartest man in the world" (Feynman 2001c, 189), if Feynman says philosophy is useless, it's useless. The is no hint of Feyerabendian "PoMo" about Feynman. However, Feynman, like Feyerabend, enjoyed creating a mythology around himself. The persona of the "street talking wise-guy', the "intuitive genius", "rebellious maverick", "womanising Lothario" are images he encouraged and co-authored. The "myth" not only glosses over the complexity of the individual, who was both highly philosophical and flawed, but it hides its own origins. From 1978 Feynman was dying of cancer and it was the brainchild of friend and colleague Ralph Leighton that his life be documented. Feynman's declining health precluded a first-hand memoir, making all biographical and "auto-biographical" sources secondhand. His most recognised work among science students, *The Feynman Lectures on Physics* (1963-65), represents a mediated text. Robert Leighton transcribed, structured, and edited the lecture recordings, selecting essential material and compensating for the absence of in-person delivery. Ralph Leighton's texts, based on years of personal interactions and recordings, constitute the primary source of many biographical narratives. Whilst Feynman may have told those stories, it is not his writing, telling, editing or him publishing them.

The two most well known texts to a lay audience are *Surely You're Joking, Mr. Feynman!* (1985) and *What Do You Care What Other People Think?* (1988). It's clear that Ralph Leighton attempts to write in Feynman's "voice" and presents what is being written as fact. Whilst both are written and presented as "autobiographies", the author explains this is a mistake. In the preface to *What Do You Care What Other People Think?* (1988) Ralph Leighton explains that there is a loose chronology, where he had adapted and pieced together many of the stories from various sources and over a number of years, refining multiple versions into a facsimile. In the preface to *A Life in Science* (2018) John and Mary Gribbin ask the question, "how reliable are these stories", in which Feynman is constantly the hero? Quoting from an

[4] Ironically this led to a metaphysical and ontological debate on the nature of "nothingness". Is Krauss' "nothing" "something"?

interview, Feynman's sister Joan explained that "my brother doesn't lie".[5] Murray Gell-Mann, the equally brilliant physicist who worked next to Feynman at CalTech, threatened to sue Leighton-Feynman over the description of the discovery of the weak nuclear interaction in *Surely You're Joking* (1985), that implied Feynman alone had discovered it. This story was altered in later editions where "Feynman conceded that Gell-Mann and two other physicists had also thought of the idea" (Johnson 2000, 83). Ralph Leighton's own explanation is that the stories were about real events that happened, but Feynman would embellish, re-tell, re-work until he was happy with how the story went. So an audience is justified in being a little sceptical.

This in itself is an interesting area for analysis that someone like Feyerabend would have appreciated. That such popularised works could serve as a type of propaganda for a romanticised, elitist (neoliberal?) vision of scientific practice. The popular image of Feynman as a quirky, womanising, bongo-playing brilliant lone wolf is both dangerous and a simplification. This image could be used as a tool of scientism, a cult of personality and rationality. For example, in *The Character of Physical Law* (1965) his representation of the scientific method as being only falsification, "if it doesn't agree with experiment, it's wrong" (Feynman 1965, 156) is contradicted elsewhere by his own critique of scientific practice. For example, he notes the discrepancies, like Feyerabend did, in the Millikan oil-drop experiments, which technically were falsified (Niaz 2020). Millikan's manipulation of the data to confirm his own theory led to an approximate value for the electron, but weirdly (as Feynman points out), other scientists also got similar results. They did not falsify Millikan's value straight away, but it diverged incrementally over time to the number we have today (Feynman 2001a). Feynman says, "It's a thing that scientists are ashamed of – this history – because it's apparent that people did things like this" (Feynman 2001a, 211), meaning that whilst some scientists chose not to discard a theory after falsification, other scientists will consciously (or unconsciously) conform to expected results even when they're wrong. According to the physicist Schwinger (1989), Feynman had a disdain for the "renormalisation" process in quantum field calculations. Described by Feynman as "hocus-pocus" and a "dippy process" it was pragmatic, but it also involved manipulating infinities so they did not exist or were hidden (Schwinger 1989, 13). Feynman found it unsatisfactory that no one knew why the infinities were there and that this work-around only acted as a barrier to understanding the quantum world. Then there is the appeal to authority in Feynman's dismissal of other subjects, like philosophy. The earlier quote about the absurdity and uselessness of Spinoza rests upon the mistaken view that science and philosophy are in conflict. Of course, Spinoza becomes nonsensical when taken as a scientific claim, but that's not what he's doing. Spinoza's foundational propositions are pure metaphysics. Finally, the clearly celebratory tone in which Feynman's misogyny is portrayed is harmful. Historically, science as an institution has a problem with sexism and misogyny, a context in which contributions by both white women and women of colour have been unacknowledged or simply stolen. This speaks to a bigger "postmodern" point that by creating a myth of lone wolf genius, its masks power structures. Those same power structures which meant Feynman as a celebrity-scientist could sexually harass his female students and have it published, celebrated in books. The myth depoliticises science obscuring funding, politics and institutional bias, which historically has been anti-women (Harding 1986; 1990).

If the image of "Feynman" is a literary creation, I would now like to re-tell this story with a Feyerabendian inflection. One that highlights some of those Feyerabend-isms, such as the difference between talking *about* and *doing* science, the negative definition of science in which they try to prevent people from forming an understanding of science based on

[5] Not-lying and being truthful are not the same thing.

misrepresentation, and finally, the poetic and rhetorical flourishes where direct communication about science becomes impossible.

Feyer-amen

Following his 1965 Nobel Prize award, Feynman addressed the National Science Teachers Association (NSTA) in 1966. Despite resigning from the California State Curriculum Committee (CSCC) in 1964, Feynman maintained his affiliation conducting peer-review of elementary science textbooks. In a letter to the CSCC he explained what made certain textbooks poor, citing the vacuous and uninformative use of the word "energy" as an explanation for what makes things move. He wrote: "One gets the impression then that science is to be a set of pat formulas to standard questions [...]. Energy makes it move, gravity makes it fall [...] just words, nothing is explained. It is like just saying "'Because of God's will'" (Feynman 2005, 215). Feynman observes that pedagogical value can be added or lost if the teacher chooses to focus on learning definitions rather than physical processes. Despite demonstrating and having a reputation for being a great science communicator, Feynman denies possessing any pedagogical expertise: "I'm not a teacher who knows what he's doing" (2001c, 203); "after many [...] years of trying to teach [...] I really don't know how to do it" (2001e, 21); and like Socrates, "I know that I don't know how to teach" (2001b, 171). Whilst some of this is meant tongue-in-cheek, does any educator know how they are good at teaching? Why can't a teacher simply instruct understanding via direct communication? This returns us to Polanyi's concept of tacit-knowledge in that "we know more than we can tell" (Polanyi 1964, 173). I would consider myself fluent, and to some degree an expert, in speaking the English language as it's what I do everyday. Could I tell you how I know, or even worse, efficiently teach someone else how to speak English? No. Not without either considerable re-training, or simply immersing the other person in an English speaking culture, which is how I learned. As someone who tacitly acquired the ability to comprehend and speak English, including the accent I have, there is much I do not know about the explicit aspects of the language I claim to be "fluent" in. From the constituent parts of grammar to how the sounds are physiologically produced and vocally expressed. Being ignorant of what ablaut reduplication or a diphthong is, yet being able to do them, means on some level I possess this knowledge without ever formally studying and acquiring it. Indeed, it is only when one tries to learn a language in its explicit form, such that you would find in a textbook, do you understand how little you know about the explicit representation of language, yet can tacitly do it! That while it probably does help to know the technical parts of language, so when someone says "noun" or "past-participle" you understand what parts of speech they are referring to, one could still learn to speak and communicate expertly without explicitly knowing them, as many do. Indeed, something like grammatical perfection or "received pronunciation" could even get in the way of communicating in a world where most people use language skilfully, but imperfectly. I believe this is Feynman and Feyerabend's point, that the attempt to produced an abstract, idealised explicit version of science not only misrepresents it, but would actually get in the way of the business of doing science.

Let us revisit Feynmen's statement: "the philosophy of science is as useful to scientists as ornithology is to birds" (Trubody 2016, 10). For some, like Krauss, this clearly indicates the inferiority of philosophy to science (Andersen 2012). On one level this is trivially true if you think philosophy is trying to do science.[6] However, on another level this is a more aphoristic claim. Why would ornithology be useless to a bird? Ornithology is done by humans and not

[6] Timothy Williamson (2021), for example, argues that philosophy is a non-natural science.

birds. Ornithology is the explicit study of birds from a human perspective. Nothing an ornithologist has to say about birds would be recognised by a bird, maybe even if they could speak to them.[7] The objective study of birds and the subjective lived experience of what it is like to be a bird are not the same (Nagel 1980). Whilst a bird just is, an ornithologist tries to codify, categorise and formalise all the ways we could think-talk *about* birds. No matter how much we talk and know about birds it will never be identical with what it is like to be a bird. *There will always be something left out.*

Where most philosophers of science have tried to develop an explicit account of science it has always necessarily left something out, which for Polanyi is the most important part. The world of meaning that gives rise to any attempt at objectifying it. As Polanyi says, "The act of knowing is an act of commitment. We are not merely passive observers of the world; we are active participants in its creation. We choose what we will pay attention to, and in doing so, we give meaning to the world" (Polanyi 1964, 385).

Here the tacit part of scientific-doing escapes formal symbolic representation. That science above anything is an ethical relationship about valuing truth or knowledge, but that "valuing" is not found in words, concepts or arguments. It's an attitude. However, philosophers here since Descartes have tended to get this exactly the other way around. We value the world because we are a part of it, and it's only when we attempt to prove things, such as a healthy scepticism would allow, we are forced to produce an abstracted version for how knowledge is possible. Popper's hypothetico-deductive model by falsification being a prominent abstraction for how we know the world. Whilst this "methodology" is a way we talk and think about science, is it necessarily how it is done? What Feynman argues, like that of Feyerabend, is no and indeed a belief in the completeness or totality of this abstract description is at best a hindrance to scientific progress, and at worst a championing of "scientism", if all subjects are to conform to this (mis)representation.

Feynman begins his NSTA talk by pointing out an irony to the audience. Why would professional science teachers attend a lecture on "what is science"? Shouldn't they know what it is already if they teach it?

> What can I say? If you don't know, every teacher's edition of every textbook gives a complete discussion of the subject. There is some kind of distorted distillation and watered-down and mixed-up words of Francis Bacon from some centuries ago, words which then were supposed to be the deep philosophy of science. (Feynman 2001b, 172-173)

For as simple as the question "what is science" seems, Feynman points out a profound difficulty with answering it. First, the "what" question seems to demand a definition or criteria, by which we can identify and separate scientific from non-scientific things. In fact, he dislikes the question because it reminds him of philosophical sophistry, where the "essence" of science is extrapolated through reasoning about definitions. The futile attempt at trying to go from precise definitions and ideas to knowledge is what Feynman thinks is wrong with bad science education. In the *Feynman Lectures* he says:

> We cannot define *anything* precisely! If we attempt to, we get into that paralysis of thought that comes to philosophers [...] one saying to the other, "you don't know what you are talking about!" The second one says, "What do you mean by *know*? What

[7] Similar to Wittgenstein's hypothetical lion conversation.

> do you mean by *talking*? What do you mean by *you*?," and so on. (Feynman 1963-1965, 82)

To focus on the explicit definition of words, rather than the tacit practice of meaning, then starts to resembles a parody of the strong incommensurability thesis, where scientists are unable to communicate with each other. Secondly, the "what is" question, whilst sounding reasonable, creates a conflict between the desire for a generalisable definition and a pluralistic set of practices that historically change so as to always undermine said given definition. Feynman paraphrases William Harvey's quip to Francis Bacon, that his pontificating on natural philosophy is the "science [natural philosophy] a Lord Chancellor would do" (2001b, 173). Harvey as the physician to the Lord Chancellor Bacon, seems to imply that Bacon's "method" is more style over substance, more concerned with rhetoric than with rigorous scientific observation (Williams, O'Dell and Aronson 2021). Bacon's writings on the "method" were more akin to the formal, eloquent pronouncements expected of a high-ranking official, than the labourious fieldwork done by someone like Harvey. Feyerabend uses Bacon in *Against Method* (1993) as primary illustration of the failure and impracticality of science being identical with rigid methodological rules. He also points out the contradiction in Bacon's description verses how he actually did science (Feyerabend 1993, 152).

Feynman continues, unlike Bacon's purest "inductive method", one does not merely observe, but there is always a *judgement* made about what to pay attention to and it is *this* "judgement" as a kind of learned skill that suggests what science might be.[8] Polanyi (1964, 352) calls this in-dwelling, that the scientist is immersed in subject that is part of a pre-existing world. Thus, for Polanyi and Feynman theory-dependence observation is a brute fact. The world comes already interpreted for us and this interpretation can inform or mislead, but is *always present* if one is to be doing science, that is paying attention to the world. However, Feynman finds himself at a loss to give any kind of sufficient definition as to what science *is*. He concludes, "And so what science is, is not what the philosophers have said it is, and certainly not what the teacher editions [science textbooks] say it is. What it is, is a problem which I set for myself" (Feynman 2001b, 173).

Feynman confesses that even though he has known all his life how to do science, the task of expressing it faithfully "I am unable to do" (Feynman 2001b, 173). He is reminded of a child's poem in which a toad asks a centipede "how do you run?" and in trying to recall those complex habituated somatic actions falls over seemingly not knowing how to run. This is familiar to anyone who has tried to explicitly teach a tacit skill – where we hit upon the limits of our language and ability to describe what might be indescribable. Thus, what science is exists *in* the actions, as a tacit part of the practice, and not in the explicit knowing of facts about science. Feynman's route into addressing the question is to either say *what it is not*, or *what science is like for him*. He goes on to tell childhood stories of learning what science is like – from feelings of wonder and mystery that drive enquiry, to a type of honesty and integrity that is required to not fool oneself. This would also seem to conflict with the neutral-objective positivist stance that science is dispassionate, rather than a meaning-seeking/making endeavour. It was also this unstructured approach to learning about nature which has Feynman say the best approach "is to have no philosophy, [it] is to be chaotic and [to] confuse it in the sense that you use every possible way of doing it" (Feynman 2001e, 20). Here we have strong parallels with Feyerabend's "*anything goes*" epistemological anarchism.

[8] Daston and Galison (2007) argue that "trained judgement" became the twentieth century heuristic for how science should be done, compared to the mechanical and structural objectivity of the nineteenth century.

If we were being uncharitable we could render a "postmodern relativist" Feynman due to his inability to state what science is, his deferral to personal-subjective experience, as well his substitute maxim approximating "anything goes". Maybe that would be a "science-culture war" too far?

Feynman's inability to directly articulate what science is indicates a problem with the question, rather than his vague answer. Feynman appears to intuitively understand this due to his dislike of the question and his offering of a historical-hermeneutical and phenomenological approach to giving an answer. All people, including scientists, experience the world *as something*. This experience is an interpretation, which is historically conditioned. It is never neutral. This would put both Feynman and Feyerabend at odds with a lot of mainstream philosophy of science (Babich 2024, 135). Whilst Kidd (2021, 187) notes Feyerabend's affinities with continental philosophers like Heidegger and the critical theory of the Frankfurt school, imagine drawing the same parallel's with the "hater of philosophy" Feynman? Feynman argues that science could be understood as the need "to find out *ab initio*, again from experience, what the situation is, rather than trusting the experience of the past in the form in which it was passed down" (Feynman 2001b, 185). He seems to be articulating a "theory-ladeness" interpretation of scientific knowledge, and a type of incommensurability between old and new experience. Next we get Feynman in a most provocative Feyerabend-esque mode, where he offers a negative definition for science: "Science is the belief in the ignorance of experts. When someone says 'science teaches such and such', he is using the word incorrectly. *Science doesn't teach anything*; experience teaches it" (Feynman 2001a, 187).

A strong reading of this that a science-culture war Dawkins might give is that Feynman is arguing for anti-intellectualism. However, why doesn't Feynman's definition that we *must* doubt the experts and that science does not teach *anything*, not sound like the postmodern "anything goes"? For if science is not what the experts say and it's not the knowledge that science gives you, what else could it be? Here he is saying that science is neither its form nor its content; it is not its methods, nor the theories or knowledge it produces, as it is all these that potentially change. *Science is the overcoming of experience*. The ability to replace one interpretation with another means that the action's of scientists are rooted in something other than the explicit knowledge that is typically identified with science. According to Niaz (2020) Feyerabend, like Feynman, appears to share Polanyi's understanding that the explicit aspects of science are only possible because of a tacit understanding that already grounds the meaning of scientific activity. The implication of this is that science can happen even if all the formalised and articulated aspects are either not known, doubted or are changed. Here Feynman says science is to: "accept and reject the past with a kind of balance that takes considerable skill. Science alone of all the subjects contains within itself the lesson of the danger of belief in the infallibility of the greatest teachers of the preceding generation" (Feynman 2001b, 188).

Whilst theories, concepts, definitions, and equations are the tools of a scientist, they do not encompass science in its entirety (Feynman 2001b, 177-178). Whilst grammar is a part of speech, it is not *speaking*. The activity comes first, then we abstract. In all of these abstractions there is the necessarily missing aspect of the tacit doing, which skews education, yet if we are to teach science it does seem unhelpful to say "doubt everything" or "anything goes". Feynman's dedication to not misrepresenting science has him criticise educational science textbooks for conflating the tools of science with doing science. Feynman notes that the reductive, idealised cases in textbooks reduce lessons to definition learning rather than actual science. In both a letter to the CSCC (Feynman 2005) and his NSTA lecture he takes issue with the idea that science is about learning definitions and getting correct answers to pre-set questions, "it's a good idea to know when we are teaching the

tools of science, such as words, and when we are teaching science itself" (Feynman 2001b, 178). His worry is that by teaching definitions and learning what things are called, you learn about language and cultural imagination, and nothing about nature or the enquiring attitude. By saying a plant grows or a ball moves due to 'energy' is as meaningless as saying "God made it move", because it explains nothing beyond the usage of the word "energy" (Feynman 2001b, 178-79). The seemingly pre-determined nature of said textbooks in which experimental set-up, expected observation and scientific answer, all of which in fact explain nothing about science or nature, has a smattering of Feyerabend's Brechtian concerns. It was here that theatre and the arts could undermine a stable notion of reality, alienate its audience and make strange what was once familiar (Feyerabend 1967). If science is presented as a "set of pat formulas to standard questions" which is neither historically accurate, nor ethically-intellectually revealing, it can have the opposite effect (Feynman 2005, 215). Feynman leaning into this Brechtian mode lets the audience in on a secret. *You sometimes have to misrepresent science so it can be taught*. In the pre-amble to a lecture on quantum electrodynamics he relays a short history of the problem he would come to win the Nobel Prize for. He says,

> What I have just outlined is what I call a "physicist's history of physics", which is never correct. What I am telling you is a sort of conventionalized myth-story that the physicist tell to their students, and those students tell to their students, and it is not necessarily related to actual historical development, which I do not really know. (Feynman 1990, 6)

The uncritical acceptance of this myth as dogma by an entire scientific community promotes a fanaticism or authoritarianism (Stuart 2021, 272-73). Feynman states that the uncritical simulation of science-like forms, tools, methods, and procedures has had a tyrannical effect on society, leading to accelerated pseudo-science, or scientism (Feynman 2001a, 205-216). He warns, "we all suffer from the kind of tyranny we have today in the many institutions that have come under the influence of pseudoscientific advisers" (Feynman 2001b, 186). He likened the trend of making everything "science-like" to the "cargo cult science" of the South Sea Islanders, where the performative simulation of expertise and knowledge did not produce any real outcomes and it is from *this* that we have a duty to doubt expertise. Here he takes aim at educational and psychological studies in which the infinitely more complex phenomena of human learning and meaning-making, as opposed to the path of a photon, is treated as if it were scientific and can produce science-like results. He is aware that telling teachers and educators how to make their discipline more science-like is part of the problem as it only improves the ineffective simulation. As with his attempt to show what science is, by saying what it is not, he states "in school we never *explicitly* say what this [science] is, but just hope that you catch on by all the examples of scientific investigation" (Feynman 2001a, 209). Science here is communicated tacitly, by students being exposed and immersed in the varieties of scientific practice.[9] Feynman is aware, however, that the scientific world-view that he's trying to impart is gradually being dominated by different forms of expertise, that desire to have the authority of science, but lacks any of its integrity or critical rigour. He says professional institutions, like Universities, and even NASA, have been taken over by managers, marketing and public-relations experts, and where their claims have any stakes in reality they are either a misrepresentation or fantastical. He points out how managerial experts, for example, produce unrealistic expectations, contrived outcomes, and cost-cutting exercises that literally conflict with engineering reality when technologies fail (Feynman 2001f, 169). This was the conclusion of his investigation into the Challenger shuttle

[9] Wittgensteinian family resemblances.

crash. Whilst it would be easy for him to criticise parapsychology, homoeopathy or cryptozoology as being pseudosciences, Feynman makes another Feyerabendian move. His only real criteria for being scientific is that one must have integrity or honesty when pursuing knowledge. It is an attitude, a set of values, an ethics echoing Polanyi (1964, 354) "science is not a system of self-evident truths; it is a passionate search for truth". Feynman is also honest enough to recognise that "bad science" gets done because non-scientific factors like "group think"; "peer-pressure" and "expectation" condition scientists into what they're supposed to find or how science is *supposed* to be done. He insightfully asks why doesn't scientific innovation and discovery happen all-at-once? If scientists are objective and pursue truth with honesty and integrity, why does error not immediately become apparent? As part of his negative definition of science he is interested in all the ways we fool ourselves. He cites the incremental alterations to the charge measured for the electron (Feynman 2001a, 211). This story begins with Millikan, an example that Feyerabend liked, as it just showed one of the ways science gets done. According to Feyerabend, Millikan proceeded with a hypothesis even despite the contradictory evidence his experiments were producing. Here theory guided evidence rather than the normative opposite. Niaz (2020) notes that Ehrenhaft allowed experimental data to alter his theory, while Millikan selected data to support his theory, championing an idea uncorroborated by 59% of his data. Why Feyerabend uses this example is that Millikan turned out to be approximately correct. Feynman's interest is why so many experimenters after Millikan obtained values close to his, rather than the more accurate value known today? His explanation is that the history and methods of science includes people who do not want to falsify, but rather confirm out of peer-pressure, professional security, group-think or any number of non-scientific factors. Feyerabend's point was that by the standards of "good science" Millikan could never have made his discovery, Feynman's point is that "scientists are ashamed of this history" so it gets redacted in textbooks and made into neat "just-so" stories (Feynman 2001a, 211).

Conclusion

What I have argued here is for a novel re-evaluation of Richard Feynman and Paul Feyerabend, moving beyond their popular, often caricatured images. It significantly argues that despite their contrasting public personas, both thinkers shared critical insights into the dynamic nature of science. Here I highlight their instinctive understanding of the fundamental distinction between talking *about* science (philosophy, education – explicit) and *doing* science (its lived, socio-historical practice – tacit). By re-interpreting Feyerabend's "anything goes" as an ironic critique of rigid methodologies rather than irrationalism, and by revealing Feynman's latent "Feyerabendian" scepticism towards idealised scientific representations, the essay offers a fresh perspective. It demonstrates how both warned against "scientism" and the "myth-story" of science, emphasising the inherent fallibility and non-rational elements in scientific practice. Ultimately, the essay's original insight lies in showing how the misrepresentation of figures like Feyerabend (and the simplified "myth" of Feynman) serves to politicise scientific discourse within "science-culture wars", often to justify authoritarian reactions in the name of a misrepresented science. This re-contextualisation provides a more nuanced understanding of their contributions and their relevance to contemporary debates.

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