Эпистемология и философия науки
2024. Т. 61. № 4. С. 73–96
УДК 167.7

Epistemology & Philosophy of Science
2024, vol. 61, no. 4, pp. 73–96
DOI: https://doi.org/10.5840/eps202461459

GALILEO'S TRUTH: PROLEGOMENA TO FEYERABENDIAN RESEARCH ETHICS

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This article considers the research ethics appropriate to Paul Feyerabend's notorious 'methodological anarchist' approach to the history and philosophy of science, concluding that it might be especially appropriate for our 'post-truth' times. The article begins by noting that Feyerabend favorite historical figure, Galileo, appears Janus-faced in his corpus. The article focuses on the positive image of someone who broke institutionalized rules of inquiry in pursuit of a 'higher truth' that was fully realized by Newton and his successors. The logic of Galileo's early seventeenth century situation was that decisions about permissible forms of inquiry and inference were based on mixed political and epistemic criteria – and that this was known, and sometimes admitted, by all parties. Galileo played with this ambiguity to some but by no means complete success, largely because he could not properly ground his 'higher truth'. The article proceeds to show that Galileo's situation was not unique but commonplace in the history of science, a point that has become clearer since the rise of archival historical research in the nineteenth century. Moreover, the institutional incentives to commit, cover up and detect what we now call 'research fraud' have been very uneven. Most such fraud has probably passed undetected sufficiently long to be incorporated in the body of accepted scientific knowledge. In recent years, however, increased attention has been given to research fraud due to the increased existential and financial stakes involved, which in turn have contributed to science's larger legitimacy crisis in the post-truth era. The article ends on a Feyerabendian note, suggesting that research findings should include sunset clauses and statues of limitations.

Keywords: Aristotle, Feyerabend, Galileo, Research Ethics, Research Fraud

ИСТИНА ГАЛИЛЕЯ: ПРОЛЕГОМЕНЫ К ФЕЙЕРАБЕНДИАНСКОЙ ИССЛЕДОВАТЕЛЬСКОЙ ЭТИКЕ

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В этой статье рассматривается исследовательская этика, соответствующая печально известному «анархистскому» подходу Пола Фейерабенда к истории и философии науки, и делается вывод, что он может быть особенно уместен для наших времен «постистины». Статья начинается с замечания о том, что любимая историческая фигура Фейерабенда, Галилей, в своем корпусе предстает с лицом Януса. Статья фокусируется на положительном образе человека, который нарушил институционализированные правила исследования в погоне за «высшей истиной», которая была полностью осознана Ньютоном и его последователями. Логика ситуации Галилея в начале XVII века заключалась в том, что решения о допустимых формах

исследования и вывода основывались на смешанных политических и эпистемических критериях и что это было известно, а иногда и признавалось всеми сторонами. Галилей играл с этой двусмысленностью с определенным, хотя и ни в коем случае не полным успехом, в основном потому, что он не мог должным образом обосновать свою «высшую истину». Статья показывает, что ситуация Галилея была не уникальной, а обычной в истории науки, что стало яснее с появлением архивных исторических исследований в XIX веке. Институциональные стимулы для совершения, сокрытия и обнаружения того, что мы теперь называем «исследовательским мошенничеством», были очень неравномерными. Большинство таких «мошенничеств», вероятно, оставались незамеченными достаточно долго, чтобы быть включенными в сумму общепринятых научных знаний. Однако в последние годы исследовательскому мошенничеству было уделено повышенное внимание из-за возросших экзистенциальных и финансовых ставок, которые, в свою очередь, способствовали более масштабному кризису легитимности науки в эпоху постистины. Статья заканчивается на фейерабендовской ноте, предполагающей, что результаты исследований должны включать положения об истечении срока действия и статуты исковой давности.

Ключевые слова: Аристотель, Фейерабенд, Галилей, исследовательская этика, исследовательское мошенничество

Introduction: Seeking Feyerabend's Galileo for a Feyerabendian Research Ethics

Would a 'Feyerabendian Research Ethics' simply amount to what Paul Feyerabend [1975] himself dubbed 'methodological anarchism', the 'anything goes' philosophy of science? The answer is not so obvious because Feyerabend routinely pitched his arguments simultaneously at the object level and meta-level. Consider his early defense of 'eliminative materialism', the doctrine that the brain-state discourse of science aims simply to replace the mind-state discourse of everyday life whole cloth without the sentence-to-sentence correspondence rules proposed by the logical positivists. Feyerabend [Feyerabend, 1963] was at once making a point about how the mind works and about how science works. The point about science, which he shared with Thomas Kuhn [Kuhn, 1970], was a consequence of their shared belief in the 'incommensurability' of scientific paradigms, which implied that science proceeds through a succession of winner-takes-all worldviews. For Kuhn, this process was inevitable and even to be welcomed, whereas for Feyerabend it was regrettable yet perhaps reversible, if the workings of science are deconcentrated from the power of the nation-state [Feyerabend, 1979].

The implications of Feyerabend's position were perhaps brought out most clearly in his posthumously published *Conquest of Abundance* [Feyerabend, 1999], which portrayed early modern art and science – of the sort championed by Galileo and other Renaissance figures – as

having reduced the plurality of perspectives that had supposedly flourished in the West up to that point and continue to flourish in other cultures. Much of this reduction, which Feyerabend calls 'abstraction', can be explained as an attempt to remake the world in the image of Euclidean geometry, which arguably served to impede the acceptance of the non-Euclidean geometries that eventually underwrote the revolutions of art and science starting with Cézanne and Einstein that took place in the early twentieth century [Heelan, 1983].

While the relatively negative image of Galileo that comes through in this strand of Feyerabendian thought would be familiar to readers of the later Husserl [Husserl, 1989], it fails to account for the more mischievously positive use of Galileo that Feyerabend makes in his breakthrough book, *Against Method* [Feyerabend, 1975]. Here Galileo appears as the nimble rhetorician who loses the battle with Rome but eventually wins the war over the truth. His professed practice fails by the methodological standards of his time, not least because he could not persuasively explain the optics behind his telescopic observations. Nevertheless, in his fabrications, Galileo gestured towards a worldview that others might bring about by alternative but related means: better mathematics, better instruments, better experiments. Unsurprisingly, after Galileo's house arrest, he was visited by some of the leading thinkers of the seventeenth century, including Thomas Hobbes and John Milton, who wanted to acquire greater insight into what Galileo himself called the 'new science'.

In stressing this side of Galileo, Feyerabend was taking a jab at what he called 'methodolatry', which he associated with the logical positivist – and to a certain extent Popperian – tendency to believe that truth is achievable only by following the right 'scientific' method. Galileo's inquisitors had emphasized his methodological shortcomings, yet he stuck to his Copernicanism and was eventually proven correct. Of course, this raises the question of exactly *why* Galileo thought he was correct. Was it just wishful thinking on his part or had he lived longer would he have recognized Newton as his successor? (Similar questions are routinely asked about science fiction authors vis-à-vis the science they inspire.) This is the context for understanding Feyerabend's 'anything goes' assertion, implying that there is no royal road to the truth, but only many different paths. Once again, it marked his strong disagreement with Kuhn's totalizing, paradigm-driven view of scientific change, in which 'progress' amounts to the elimination of alternative paths of inquiry.

We therefore see a tension in Feyerabend's representation of Galileo, based on his seeming endorsement of two epistemological or metascientific theses that are somewhat at odds with each other, which correspond to his two main metahistorical books:

(1) There are multiple truths, each of which can be pursued in its own way, but science insists on just one truth and one way of pursuing it. (*Conquest of Abundance*)

(2) There is just one truth, but it can be pursued in multiple ways, and science fails to achieve the truth if it sticks to just one way of pursuing it. (*Against Method*)

Thesis (1) supports a many-worlds realism, in which Galileo plays one of the villainous abstracters, whereas thesis (2), which advances a scientific realism underwritten by a pluralist epistemology, portrays Galileo as a hero of alternative methods. What follows takes thesis (2) as the point of departure for a 'Feyerabendian' research ethics, without presuming that the man himself would have wished to be associated with any such thing.

For my own part, I accept and develop what might be called Galileo's *metascientific foresight,* based on his widely noted self-consciousness about his own times, which has inspired one historian to cast Galileo's entire life as that of a 'courtier' [Biagioli, 1993]. In any case, such awareness led him to regard the Church's position on the norms of scientific inquiry as quite vulnerable, notwithstanding its repeated rhetorical reliance on ancient sacred and pagan authorities. I shall suggest that Galileo probably realized that the Church's epistemic control of Western Christendom could be destabilized beyond what the Protestant Reformers had so far managed to achieve. (This would certainly explain Hobbes' and Milton's interest in Galileo.) Specifically, it might extend to the free pursuit of the Copernican research program, which many early Protestants refused to engage with directly. Tycho Brahe and Johannes Kepler were notable exceptions.

In this context, Galileo regarded the Church's various appeals to human fallibility as simply a desperate attempt to limit the challenge that scientific inquiry can pose to established tradition. But of course, the charge of fallibility can be turned against clerical judgement too. This places Galileo in the company of such recent philosophers of science as Larry Laudan and Hilary Putnam, who have proposed a 'pessimistic meta-induction': namely, that a more profound truth than any theoretical statement that we currently hold to be true is that in the future these statements will be shown to be significantly not true [Leplin, 1984]. Thus was the nature of Galileo's metascientific foresight: the contingency through which epistemic authority is established and maintained never loses that contingency, and hence is always reversible. In terms of modal logic, it is the discovery that contingency is not itself contingent but necessary. This provided the basis for Epicureanism to be harnessed by Christianity as a philosophy of the will, which in Galileo's day was being most clearly developed by Pierre Gassendi. It effectively flipped the Church's own logic on its head, since the Church held that Aristotle or even the Bible revealed necessary truths even though their origins were contingent: that is, their truths are *contingently necessary* rather than *necessarily contingent*, as Galileo believed. However, overturning the established order requires a strategy that goes beyond flipping modalities. The next two sections successively present the logic of Galileo's situation in the spirit of historical re-enactment and the lessons that Galileo would have drawn at the time.

The Search for Truth in an Untrue World: The Logic of Galileo's Situation

Imagine that you are Galileo, a 'Renaissance man' of late sixteenth and early seventeenth century Italy. How would you characterize the state of knowledge in your day? Two facts would stand out. First, you would acknowledge that the institution that has been officially authorizing knowledge claims for more than a millennium, the Roman Catholic Church, is being subject to an unprecedented and perhaps irreversible schism, which started in the lifetime of your parents. Second, you would know that in your own lifetime, starting with the Council of Trent, the Church has attempted to consolidate its authority in a twofold fashion. One involves creating a new order of priests, the Jesuits, who are empowered to debate the schismatic 'Protestants' – and Galileo – on their own ground with the explicit aim of winning them back to the Church. The other involves shoring up the Church's own epistemic authority by certifying Thomas Aquinas' position as a 'Doctor of the Church'. Let's explore what all this means in a way that highlights the familiarity of Galileo's situation.

The Protestant Reformation was succeeding where past heresies had previously failed by persuasively relating its own doctrinal divergence to institutional malfeasance by the Church that upheld the doctrine. The relevant malfeasances ranged from accepting money for heavenly salvation to neglecting the plight of the poor. From a Biblical standpoint, the former promises something that cannot be delivered and the latter fails to deliver on something that is promised. Moreover, unlike most previous heretics, the Protestants did not claim to have a privileged 'mystical' access to God that circumvented Church authority. Instead, they proceeded more forensically, citing Biblical word against clerical deed, to argue that if the Church behaves in such an unreliable manner with the faithful, then why should their pronouncements on the faith be accepted?

Alongside this challenge, the Protestants encouraged and often created new modes of *linguistic* access to Christian doctrine by, on the one hand, returning to the Bible's original languages, Hebrew, Aramaic and Greek; on the other hand, translating the Bible into the emerging 'vulgar' languages of Europe. Taken together, they constituted a pincer attack on Latin, a language in which neither the sacred books nor the leading authorized pagan books (e.g., by Aristotle) were originally written. Rather, Latin's prominence followed from the Donation of Constantine, through which the fourth century Roman emperor supposedly not only made Christianity the official religion but also turned over temporal authority for Western Christendom to the Pope. Latin, already the imperial language of Rome, thus became the medium by which the Church's epistemic authority was codified, consolidated and conveyed.

Moreover, two additional events would have weighed on Galileo's mind. Both were from the mid-fifteenth century. The first was the introduction of the printing press, which the Protestants seized upon as an alternative technological means to transmit their message that circumvented Church authority. Traditionally, censors would simply prohibit the publishing of certain sorts of works, and so they were usually never written. It was this principled version of censorship that, say, Plato endorsed. However, the Church, now put on its back foot, was forced to prohibit the reading of books *after* they were already published. In Galileo's lifetime, this policy came into effect as the *Index Librorum Prohibitorum* ('Index of Forbidden Books'), which lasted until 1966. Of course, that did not stop the underground circulation of heterodox readings and even revisions of the Bible and affiliated pagan works. Nicolaus Copernicus was an obvious, if somewhat reluctant, beneficiary of this development, which decisively influenced Galileo's thinking.

The second event was Lorenzo Valla's forensic demonstration that the Donation of Constantine was itself a forgery. Valla, a polymathic papal scribe, was employed by the King of Aragon to settle a territorial dispute with the Church which leaned heavily on the Donation's legitimacy. While many had already suspected the Donation's legitimacy, Valla mounted a systematic attack on the document that ranged from the style of Latin in which it was written to larger questions of historical plausibility about the circumstances under which the Donation supposedly happened. Nowadays, professional historians regard Valla's methodical procedure as having set the first standards for processing archival materials.

The overall picture that emerges from this account is one of a Church suffering from a crisis of legitimacy on several fronts, notwithstanding the power that it undoubtedly continued to wield. The very use of Latin symbolized an epistemic order founded on false intellectual and political premises, resulting in the enforcement of a worldview that merely simulated reality. In this context, the recently upgraded status of Aquinas would have caught Galileo's eye. It was also designed to deal with still another mid-fifteenth century event that was already troubling the Church prior to the rise of Protestantism: namely, the fall of Constantinople, the seat of Eastern (Orthodox) Christendom, to the Muslim Ottoman Empire. Here Aquinas proved useful because his original reputation was based on his subtle and systematic treatment of the ideological threat posed by Islam in the thirteenth century, which at the time was being played out in the battlefield as the 'Crusades'.

Aquinas' strategy was twofold. On the one hand, he refuted various claims of Islam's superiority to Christianity, with an eye to converting Muslims and reassuring wavering Christians. On the other hand, he incorporated into the Christian worldview what his contemporaries generally regarded as Islam's secret weapon drawn from classical culture,

namely, Aristotle, whose extensive works on nature had been largely neglected in Christendom up to that time. This point is worth bearing in mind as an antidote to the popular misconception that Aristotle was the dominant philosophical presence in the West from ancient times to the early modern period. On the contrary, Aristotle had to be translated into Latin from Arabic in the twelfth and thirteenth centuries because few Western Christian scholars knew Greek. Plato had been the more influential Greek philosopher throughout the history of Christendom, and his pointed revival in both dialogical style and cosmic aspiration among Renaissance Humanists targeted the relatively recent ascendancy of Aristotle, for which Aquinas served as the Christian figurehead, triggering the derisive use of the term of 'Scholastic', which continues to this day.

Two features of the Aristotelian mindset would have rung alarm bells for Galileo the Renaissance man. First is the attitude to language as inherently equivocal, whereby the same words may have both a religious and scientific meaning. Thus, Aquinas finessed the problem of divine creation by distinguishing between God's overall responsibility for creation (corresponding to Aristotle's 'primum mobile'), which is elaborated by theology, and the temporal order of creation, which is elaborated by natural history. To be sure, when Aquinas first aired this idea, he was accused of espousing a Christian version of the 'double truth' doctrine that had led Ibn Rushd ('Averroes'), the main Arabic commentator on Aristotle, to be ostracized from the Muslim community. However, Ibn Rushd had been making a much more Platonic point, namely, that the accounts of the creation in the Qur'an and in Aristotle contradict each other without any easy resolution, from which he concluded that the study of God and the study of nature should proceed as autonomous activities. This reflected Ibn Rushd's considered view that God created the only world he could have created, which is the best possible world, one that can be studied without reference to the creator. Meanwhile the masses should continue to be taught the 'truth' of the Qur'an and benefit from the fruits of natural inquiry. Although Ibn Rushd's Muslim contemporaries accused him of cynical atheism, his theological horizon would be later revived in the Enlightenment as 'Deism'. To avoid any such fate, Aquinas streamlined Ibn Rushd's controversial stance into a semantic distinction roughly corresponding to creation as a concept and creation as a fact. God is needed for creation to make sense as a concept, and theology provides the explication of that concept, which involves providing meaning to the facts of creation as compiled by Aristotle and other pagan authors focused on the empirical study of nature.

The second feature of the Church's Aristotelianism that would have disturbed Galileo is its metaphysically strong distinction between the natural and the artificial, which implied that human creativity is not only less valuable than divine creativity but may even serve to falsify the 'natural'

character of divine creation. This already placed Aristotelianism at loggerheads with the Renaissance spirit of the times. An obvious Church target was alchemy, given its claims to transform one substance into another and perhaps bring new substances into existence. But there were also more general restrictions on the use of mathematical and experimental reasoning, both understood as products of human ingenuity, which bore more directly on Galileo. Aristotle believed that mathematics should be developed and applied only in relation to things that are by nature quantitative, and experiments should be performed only to bring out aspects of nature that would be normally revealed in due course.

Against this backdrop, it is understandable that Galileo's academic rival, Giordano Bruno, who used geometry as a template for expanding his imagination to encompass the entire cosmos, was sentenced to death by the Church for refusing to back off from this heretical attempt to inhabit the mind of God. On the other hand, while Francis Bacon and Galileo do not seem to have known each other, despite being contemporaries, Bacon's relatively detached position in Protestant England enabled him to develop an account of the experimental method that made explicit what Galileo himself was claiming to exemplify in practice yet could only discuss in muted terms to Catholic authorities in his native Italy: namely, that without some clever artifice that places nature under 'unnatural' conditions, nature will *not* in due course reveal all of which it is capable. As Bacon clearly realized, the Aristotelian approach to the nature of things mistakenly reduces what is possible to what is probable, which means that serious inquirers into nature need to adopt a more suspicious attitude towards their object of inquiry – and be mentally prepared for the unexpected to be revealed as the outcome of a well-crafted experiment.

Finally, there are background metahistorical considerations that Galileo would have taken for granted but need to be made explicit to a twenty-first century audience. One is the length of the Church's hegemony relative to the overall history of humanity. It would have appeared then much greater than it appears now. At the same time, a persistent 'Augustinian' strand of Christian thinking contested the Church's elevation of Aquinas based on his relatively relaxed approach to Original Sin, which suggested that certainly through Jesus, if not earlier, the status of humans in nature has been substantially rehabilitated since the time of Adam and Eve's expulsion from the Garden of Eden. This seemed to imply that God is generally content with the actions of humanity and its institutions, a conclusion that of course the Church was keen to foster. However, on Augustine's reading of the Bible, humans are tainted by Original Sin until and unless it is explicitly removed by God, notwithstanding the hopeful signs found in the life of Jesus. At the dawn of what turned out to be the Protestant Reformation, the Dutch Humanist Desiderius Erasmus satirically highlighted various follies of priestly

thought and action, often in pagan guises, to suggest that the institutions of the Church may not have quite overcome the taint of Original Sin, after all. And despite Erasmus' own efforts in correspondence, Martin Luther did not find this matter either amusing or salvageable. In effect, by reasserting the Augustinian doctrine of Original Sin, the Protestants accused the Church itself as being the epicenter of a climate of corruption for what people at the time would have understood to be an enormous part of human history.

Generalizing the Lessons That Galileo Learned from His Situation

Given the logic of Galileo's situation, how would you go about searching for the truth? Needless to say, the path of inquiry would not be straightforward. You would be struck by the historically contingent yet institutionally entrenched standing of Aristotle as an epistemic authority. Had it not been for Islam's threat to Christendom, both in the past and in Galileo's own day, the Aristotelian corpus would not be serving as the ground of epistemic legitimation. In effect, courtesy of Aquinas, Aristotle provided a common understanding of reality for Christians and Muslims, in terms of which Christendom might prove its superiority. Galileo himself drew on Muslim scholars and did not seem to want to be part of this particular 'culture war'. From his standpoint, the privileging of Aristotle among pagan authors was a strategic ideological decision on the part of the Church. And in those terms, it made perfect sense.

Aristotle clearly gave the Earth the sort of pride of place that would be expected from an ordinary reading of the Bible. As Galileo fully realized, that was simply because Aristotle presupposed that reality itself is earthbound. This explains, for example, why he interpreted gravity as a teleological force, whereby earthly things ultimately aim for the Earth. As for the celestial bodies, they are conceived as radically different in nature yet terrestrially useful (for organizing the business of life, agriculture, navigation, etc.). That served to discourage any thinking that perhaps the Earth and the Heavens are not so different, including the prospect of life on other planets and stars, as Bruno had thought. Yet, the Bible itself does not rule out the possibility that the single act of divine creation simultaneously generated many worlds that have undergone the same general narrative recounted in Genesis. Certainly, if Christians have been willing to extend their understanding of Genesis from being specifically about the land of Israel to the entire Earth, then certainly it could be further extended to be about the entire cosmos, in which case one might at least seek a more unified understanding of reality than the one provided by Aristotle – even without drawing Bruno's more radical conclusions.

But more fundamentally, and here Aquinas is more directly implicated, the normalization of equivocal meanings in language combined with the restricted legitimacy of mathematical reasoning made it difficult to contest established doctrines in the name of some higher standard of truth. Put bluntly, it was rendered methodologically near impossible to show that a statement in the Bible or in Aristotle was false. Little surprise that Galileo resorted to a relatively new and unproven instrument, the telescope, to make many of his arguments, whilst speculating that the ancients failed to make correct inferences about the heavens because they lacked just such an instrument. And even though this novel rhetorical strategy failed to move the Jesuit Inquisitor Cardinal Bellarmine, at least it served to shift future debate to somewhat different ground, which began to call into question the Church's restrictions on the use of artifice to understand nature. In this small success, Galileo would have had the advantage of observing Bruno's ill fate at the hands of Bellarmine only fifteen years earlier. It contributed to the much greater subtlety in Galileo's presentation of many of Bruno's basic theses. Indeed, Galileo's fate was sealed only once he refused to admit that Copernicanism was no more than a plausible hypothesis lacking decisive empirical proof.

The trial of Galileo made clear that the Church was quite open to entertaining alternative scientific hypotheses. Indeed, Jesuit missionaries had been teaching Copernicanism to the Chinese to impress them with vanguardist European thinking. However, that apparent open-mindedness did not extend to accepting outright challenges to established interpretations of the Bible or Aristotle. The inherently equivocal nature of language combined with the remoteness of the matters at stake from the standpoint of natural observation were repeatedly presented to Galileo as insuperable barriers to the acceptance of his knowledge claims. But if you were Galileo, you might associate the Church's passive-aggressive brand of 'permissiveness' in the entertainment of hypotheses with its tolerant moral attitudes, which in turn allowed malfeasance not only to occur but also to go unpunished, if not excused, and sometimes even unrecognized. In this respect, the famous phrase that Pierre Duhem [Duhem, 1954] associated with Bellarmine's grounds for rejecting Galileo's knowledge claims – 'saving the appearances' – referred equally to the maintenance of the Church's simulated sense of moral sanctity.

From a logical point of view, the Church was on no better epistemic grounds than Galileo. Neither could prove their knowledge claims conclusively. However, the Church had the power to set the premises within which Galileo was forced to work. And even when, as he often did, Galileo tried to introduce new premises, they had to be compatible with premises derived from, say, Aristotle or authorized readings of Scripture. It resulted in some tortured presentations, many of which failed to persuade, but which nevertheless allowed Galileo to escape Bruno's death sentence. However, a much more straightforward way of reasoning would

start, so to speak, at the meta-level and consider the premises that language itself sets for making a knowledge claim, operating on the assumption that all humans possess language equally and hence are equally capable of articulating truths. This would establish a level playing field of discourse by removing the problem of 'burden of proof', which tends to favor tradition (aka 'presumption'), which boils down to privileging statements that have been made repeatedly over time [Fuller, 1988, ch. 4]. In contrast, any grammatically adequate string of words already asserts something about the world, and the question is how to show that it is true to one's fellows. This amounts to revealing the logic underlying the claim and illustrating its meaning in the world.

Such was the approach taken in the so-called 'Port-Royal Grammar', first published in France in 1660, a generation after Galileo's trial and in the same year as the Royal Society of London was founded. Its follow-up work, the 'Port-Royal Logic', was the paradigmatic French textbook in logic until the twentieth century. The main author of both works was Antoine Arnauld, a Catholic fellow traveler of Blaise Pascal in the Protestant revival of Augustine. Arnauld recast many of the conceptual innovations that Scholastics had introduced in the High Middle Ages, but in much more metaphysically neutral terms. Moreover, Arnauld adopted the signature Galilean tactic of referring to Aristotle's own catalogue of logical fallacies to reveal his failures in natural philosophical reasoning [Arnauld Nicole, 1996, ch. 19]. And while nowadays the Port-Royal Grammar is known for its formative role in Noam Chomsky's self-styled 'Cartesian linguistics' [Chomsky, 1966], it is worth noting the book's full title: 'General and Rational Grammar, containing the fundamentals of the art of speaking, explained in a clear and natural manner'. Assumed here is a distinction between what is said and how it is said, which Chomsky would later call the 'deep' and 'surface' structure of language. This way of understanding language implies that something may be said more or less clearly in the context of whatever else is said. In this respect, the familiar structural ambiguities in linguistic expression pertain to the 'surface', not the 'deep' level of thought.

Contra Aquinas, Arnauld argued that one can say things in a way that enables their truth (or falsity) to be demonstrated. This is the art of selecting a string of words that matches what one wishes to convey, or 'mapping a deep structure onto a surface structure', as Chomsky might say. Moreover, the relevant sense of demonstration is closer to deductive than inductive proof. As Plato has Socrates say in *Phaedrus* 265, one needs to 'cut nature at the joints', by which he is referring to the drawing of initial distinctions whose clarity comes from following the grain of reality in a way that is recognizable to the audience. This move, the source of the modern rationalist doctrine of 'clear and distinct ideas', aimed to produce a higher form of rhetoric that could command universal assent, not simply agreement among those within earshot of the speaker.

This is how Plato positioned Socrates as an improvement over the Sophists [Fuller, 2024]. Nevertheless, like rhetoric, the selection of premises remains crucial, on which basis a stepwise order of statements can then be produced that compels the conclusion in the minds of the widest audience, including those lacking first-hand experience of what is being stated.

In this context, Arnauld introduced the modern logical doctrine of *extension* and *intension* as inversely related forms of definition. The former aims for the widest coverage by focusing on shared properties, while the latter aims for the greatest specificity by focusing on individuating properties: in short, definition based, respectively, on the 'clarity' and the 'distinctness' of the thing defined, that is, 'group' or 'grid' in Mary Douglas' [Douglas, 1970] anthropological terms. Scholastics who were under the sway of Aristotle had understood extension and intension in terms of *genus* and *species*, which suggested that there is a 'natural' way of generalization and specification, which implies a hierarchical order of things. And notwithstanding modern evolutionary theory, this Aristotelian interpretation persists in biological taxonomy, courtesy of Linnaeus, bolstering what philosophers continue to defend in the name of 'natural kinds'. In contrast, Arnauld returned to Plato's original intuition that clarity and distinctness are features of the definer rather than the defined. For Chomsky, this reflected the 'creative' aspect of language, which allows the speaker to 'zoom out of' (extensionally) and 'zoom into' (intensionally) reality, depending on the context of utterance, implying that language can be calibrated to function as either like a telescope or a microscope. Such a conception underwrote the sort of 'natural law' that Galileo was proposing to Bellarmine, in opposition to Aristotle's 'natural kinds.' Thus, by the early twentieth century, when Einstein introduced new fundamental laws that once again disoriented our default sense of physical reality, it had become common for thinkers such as Ernst Cassirer [Cassirer, 1923] and Kurt Lewin [Lewin, 1931] to refer to a 'Galilean' sea change in the conception of science, which some at the time worried might falsify the human 'lifeworld' that still remained closely tied to Aristotle's worldview [Husserl, 1989]. As we have seen, the later Feyerabend [Feyerabend, 1999] had some sympathy with this latter point of view.

In short, the Port-Royal Grammar and Logic approach to demonstration provides the rudiments of what William Whewell began to identify in the nineteenth century as the 'context of justification', whereby the truth of a statement can be recognized against the backdrop of other statements that are accepted as true, which together comprise what Wilfrid Sellars famously called 'the space of reasons'. This is the sense in which a scientific discovery, no matter the arbitrariness of its origin, must be 'justifiable' [Nickles, 1980]. However, the relevant sense of 'demonstration' associated with such justification need not happen purely in the mind or only in words, as in the case of the 'thought experiments' that played

a pivotal rhetorical role in both Galileo's and Einstein's reasoning. So-called 'laboratory demonstrations' that are routinely used in teaching count as well. For example, if one wishes to demonstrate Galileo's law of falling bodies to students (or sceptics), one doesn't even try to reproduce Galileo's exact experiment; rather, one aims for *proof of concept* rather than *proof of fact*. This involves producing a functionally equivalent version of the experiment that can itself be easily reproduced. Such 'functional equivalence' is established by operationalizing the variables in the mathematical equation that defines Galileo's law. More generally, the art of experiment consists in isolating variables that can be empirically specified and systematically interrelated over the widest range of phenomena. It is akin to designing 'rules of the game', whereby the natural or human subjects are compelled to actualize their potential under certain prescribed conditions.

Contra Aristotle, experimental results can carry the weight of reality even though they may never have been previously observed in nature. This point can be understood as a reflexive reflection on Galileo's own situation. Francis Bacon, the lawyer who modeled his influential account of the experimental method on the tactics of the Papal Inquisition, would have had the Church generalize its treatment of Galileo to cover all forms of inquiry, including into nature. Just as Galileo had to be placed under intense scrutiny to reveal thoughts that he might not otherwise assert, something similar applies to nature, which is capable of much more than it normally reveals. In this regard, the Church's systematic application of the Inquisition to Galileo's but not to its own epistemic practices, let alone the workings of nature, would have been seen by a Protestant like Bacon as evidence of the Church's hypocritical sense of methodological scrupulousness.

Nevertheless, the above considerations leave open the question of the historical record's relevance to the truth of statements. After all, it seems that whatever fraud Galileo (or the Church) has committed could be excused if there is some experimental means of demonstrating the truth of their statements. This, in turn, may draw on forms of evidence markedly removed from the resources and circumstances of the person originally making the statement. For this reason, analytic philosophers of language since the 1970s have drawn a sharp distinction between *pragmatic* and *semantic* reference: roughly, what the speaker thinks makes their statement true and what really makes it true [Schwartz, 1977]. Indeed, much of the 'anachronistic' history of science that Kuhn [Kuhn, 1970] observed in science textbooks is a product of this systematic rereading of the pragmatic reference of a scientist's statements in terms of their semantic reference. Thus, Galileo's 'discovery' wasn't some secular miracle that needs to be fetishized as a singular instance in time that is commemorated through repetition. Rather, by whatever means, Galileo provided an exemplar of a statement that could have been – and can be – expressed in many better ways, both linguistically and non-linguistically.

So, is the authenticity of Galileo's original experiment necessary to validate its subsequent simulations? The answer is probably no. The result of Galileo's (supposed) experiment simply needs to be justifiable given other things that have come to be taken as true. It underscores the old deconstruction point that many beginnings can replace the idea of a single origin, when to comes to arriving at the truth [Said, 1976]. Moreover, the false textbook history of science observed by Kuhn is an open secret in science pedagogy. Indeed, a Harvard contemporary of Kuhn's, Gerald Holton, authored one of the best textbooks of that kind [Holton, Brush, 2001], and its general approach has been promoted as a philosophy of science under the rubric of 'rational reconstruction' by Feyerabend's friend and rival, Imre Lakatos [Lakatos, 1981]). Curiously, as we bring the argument up to date, we shall see that Holton has also helped to heighten the moral tension surrounding research fraud.

Is Fraud a Normal Feature of Science? The Logic of Our Situation

Galileo Galilei and Gregor Mendel would have been regarded as research frauds by today's standards. Of course, they escaped that judgement in their own day, though their findings were far from accepted. On the one hand, Galileo's experiments were taken not to have provided the proof he had claimed because the instruments that he used did not appear adequate to the task. On the other hand, Mendel's experiments were largely ignored or misunderstood in his lifetime because natural historians did not believe that mathematics could be rigorously applied to 'qualitative' matters like the reproduction of life. In both cases, there were no specific methodological grounds for suspecting that the experiments had not been performed – or that their results were seriously misrepresented. It was only in the late nineteenth and early twentieth centuries, when statistical analysis became more widely accepted across the sciences, that doubts started to be raised about whether Mendel reported his experimental data properly and even whether Galileo conducted his experiments at all. However, by that point, scientists had arrived at largely the same results as Galileo and Mendel, sometimes by related experimental means, but increasingly by rather different means, which is reflected in the anachronistic character of science textbook portrayals of such historic episodes. But perhaps more importantly, later scientists were able to explain why Galileo's and Mendel's results should have been as they are. Thus, one may be inclined to dismiss their original frauds as historical curiosities of no serious consequence for the development of science. But matters are not so simple.

Galileo and Mendel were not isolated cases. In his 1974 Caltech commencement address, notoriously entitled 'Cargo Cult Science', Richard Feynman gave the impression that a kind of fraud was regrettably a routine feature of scientific practice. He bemoaned how he and his physics classmates would disregard data that didn't conform to the results of Caltech's first president Robert Millikan's famous oil drop experiments, enabling the measurement of the electron's charge, which subsequently won him the 1923 Nobel Prize in physics. A few years later, Harvard science historian Gerald Holton [1978] discovered that Millikan himself discarded 40% of his own data to achieve his results. And a few more years later, nudged by Holton, two *New York Times* science reporters made a splash by situating this episode in a larger pattern of scientific misconduct – including Galileo and Mendel – that has occurred across all fields in the modern period [Broad, Wade, 1982].

As might be expected, this sparked a backlash from the scientific community, which eventuated in what some considered a 'victory', but others might regard as merely a stalemate. For while the intent to deceive has never been proven in any of these cases, the alternative explanations offered for the missing and misreported data, the idiosyncratic procedures and improbable inferences point in too many different directions to offer any hope of resolution [Franklin, 2008]. Still more difficult to handle are the increasing instances of outright research fraud in cutting edge fields in the natural sciences, often published in such top-tier journals as *Science* and *Nature*. Perhaps the case of fallen nanotechnology *Wunderkind* Hendrik Schön at the start of the millennium has been the most dramatic [Fuller, 2006, p. 102–108]. In these more recent cases, the intent to deceive has been easier to detect because the areas of research are so 'hot' that many scientists have an ongoing vested interest in what their fellows are doing. Specifically, the significant commercial potential of such research heightens the urgency of being 'first' beyond the usual priority battles that Robert Merton and others have shown to be characteristic of modern science. In this context, claims by the suspects that their data reports and the machines generating them were lost or destroyed shortly after the research had been conducted are easily shown to be untenable.

However, there are more difficult cases of possible fraud relating to the normal practice of scientific research. For example, the large-scale character of most research nowadays in the natural sciences, including medicine, means that no individual researcher – including the so-called 'principal investigator' – has complete command over the details of what their team collectively claims in a publication. Considering the previously described 'pressure cooker' environment for research, a conspiracy of wishfulness and willfulness can easily produce false but desirable results that the team is loath to question. Even the very biggest names in science, not least the 1975 Nobel Prize-winning cancer researcher and

(yet another) President of Caltech, David Baltimore, have been caught vouching for careless and erroneous work that happened to be attached to their names [Judson, 2004, ch. 5]. Nevertheless, analytic social epistemologists have long taken a complacent attitude to this phenomenon, which they regard as indicative of something called 'trust' as the glue holding together 'big science' as a socially distributed system of inquiry [Fuller, 1996].

But even in the sort of research that might still count as 'little science', as done in the social and psychological sciences, have historically obtained their most striking results by deceiving subjects about the objective of the research to ensure a 'natural' response. And while such misdirection is arguably intrinsic to the 'artifice' of experimentation, certainly as Galileo exemplified in practice and Francis Bacon justified in theory, the potential harm to the human subjects involved has been increasingly highlighted, resulting in today's unprecedented level of 'ethical oversight' on the conduct of research. Yet, few doubt that the advancement of science has been facilitated by such morally dubious acts [Fuller, 2020, p. 79–87, 109–115]. A still subtler problem of deception relates to the form of mathematical representation used to present research data. Researcher discretion on such matters understandably results in the construction of graphs and diagrams that make the researcher's desired conclusions appear self-evident. This practice has been subject to increasing scrutiny and controversy in the case of climate science, which requires the synthesis of data streams acquired from different sources under different conditions, which somehow are meant to provide the empirical basis for potentially radical social and economic policies [Ibid., p. 38].

Although we have seen that proof of research misconduct can be difficult to pin down, even when one diligently looks for it, we might nevertheless admit that most researchers are not unethical. However, the drive for methodological rigor can itself result in an unwitting form of deception, perhaps even self-deception, whereby the researcher gives the impression of having shown something much important than they really have. In effect, the researcher errs on the side of caution by taking measurements that optimize the measuring instrument rather than enable conclusions that genuinely advance the line of inquiry. The classic case of such misplaced rigor – widespread in medicine, psychology and economics – is so-called 'statistical significance' testing, which fixates on the low likelihood that a finding is in error, even if the finding itself is relatively insignificant to what is of interest to researchers or policymakers [McCloskey, Ziliak, 2008]. Taken together, whether it is diagnosed as a moral or a cognitive failure, the generally unreliable nature of the people who undertake scientific research would seem to vindicate the meta-level advice common to Francis Bacon, Charles Sanders Peirce and Karl Popper, namely, that inquirers should be positioned as

mutual adversaries who advance the search for truth at least as much by troubleshooting the work of their colleagues as by advancing their own lines of inquiry.

In earlier work, I argued that *plagiarism* and *forgery* are complementary forms of fraud: the former takes credit for another's work, the latter cedes to another credit for one's own work [Fuller, 2007, p. 153]. Their negative normative status as 'fraud' rests on the intuition that judgements of value – including 'true' and 'false' – depend on an independently specified object of judgement, in terms of which various parties stand in a determinate relation, such as creator or faker. It suits today's intellectual property approach to plagiarism, which demands that every source be properly credited upfront, so that the author is presented as 'standing on the shoulders of giants' [Fuller, 2023, ch. 6]. However, in the paradigmatic act of judgement, a legal proceeding, the judge or jury faces a contested object of judgement, whose identity must be resolved to determine the truth value of the opposing claims made by the litigants. It takes us back to *Phaedrus* 265. The court's judgement determines the relative merits of the litigants' claims (i.e., which side bears its burden of proof more effectively) by converting the case into something that falls under the statutes and precedents set by the law. Only once the case is incorporated into the body of law is it then 'canonized'.

This helps to explain why, until the late eighteenth century, plagiarism was treated more as an aesthetic than a moral offense. Judgement was very much in the eye of the beholder. In this context, the plagiarist is an artist whose easily identifiable sources undermine their claim to originality. For the Yale literary critic Harold Bloom [Bloom, 1973], fear of being caught as a mere copier or imitator in this sense epitomized the 'anxiety of influence'. Here every artist is presumed to be a plagiarist whose art largely consists in the concealment of sources, which the expert critic then tries to deconstruct by interpreting the artist's work against its grain. This dialectic between artist and critic is a bit cat-and-mouse yet also an attempt to make evident the intricacies of craftsmanship, which results in the artist finding a place within the canon of their art.

Among modern aestheticians, the early twentieth century Russian Formalists were most sensitive to how a particular form of craftsmanship – the ability to get viewers to see old things in a new way – was most effective in diverting charges of plagiarism [Lemon, Reis, 1965]. These 'old things' might be folk myths or so-called 'low culture' whose overexposure has turned them into extended clichés, ripe for what Arthur Danto [Danto, 1981] called 'the transfiguration of the commonplace'. Alternatively, as was beginning to happen to Scholasticism in Galileo's day, an entire body of thought could be so disparaged that no one would wish to invoke its name when appropriating its ideas and insights. Such a degradation amounts to an intellectual 'fire sale', whereby one is virtually

invited to steal the ideas and the insights of the past for one's own purposes. Scholasticism fell fully into this condition once it was positioned as justifying the 'Dark Ages' vis-à-vis the 'Enlightenment' in the eighteenth century. Over the past three centuries, analytic philosophy has probably most benefited from the degradation of Scholasticism, allowing it to repackage medieval doctrines of reference, modality and the mind-body relationship.

As for Galileo himself, he was more forger than plagiarist, since he effectively presented his own fabricated craftsmanship as if it were that of a genuine experimenter or perhaps even a direct observation of nature itself. From that standpoint, Galileo's scientific successors might be seen as having backfilled an 'original' to match his forgery, somewhat in the spirit of how scientific achievements have realized the visions projected in science fiction films, starting with the famous countdown sequence in Fritz Lang's *Frau im Mond* [Woman on the Moon, 1929], which was adopted by NASA to launch its space missions. Jean Baudrillard [Baudrillard, 1983] famously described this process of life imitating art as 'hyperreality'. At first, he meant the Hollywood film industry, but he extended it to the Gulf War, which he notoriously claimed 'did not take place' because everything that we learned about it was through televised computer simulations of the West's largely aerial campaign against Saddam Hussein [Baudrillard, 1995]. And of course, over the past thirty years, the capability to produce such technologically induced effects has become widespread among social media users, resulting in the epidemic of 'deepfakes' countered by a self-organizing swarm of 'fact-checkers' that characterizes our 'post-truth condition' [Fuller, 2020].

The advancing technology surrounding deepfakes returns us to the Athenian courts, when the difference between right and wrong is ultimately a judgement call. An interesting recent case involved a deepfake vocal recording of the speech that US President John F. Kennedy had prepared to deliver in Dallas on the day he was assassinated in 1963. It was constructed from the already written text of the speech voiced by words spoken by Kennedy in other speech contexts [Rogan, 2018]. Should such a thing be considered a historical document worthy of placement in an archive? If nothing else, this prospect should remind us of the important, albeit typically neglected, role that editing, curating and restoring have played in ensuring a continuous sense of identity over time for objects perceived as possessing value. If Plato and Aristotle could travel to our time, would they recognize the texts of theirs that we admire, or would they see those texts as alien constructions? (If the Biblical authors were the time-travelers, the answers might be even more provocative.) An example that is perhaps more to the point is that we don't consider the multiple times that Notre Dame Cathedral has been rebuilt to imply that each new version – including the one currently in progress – is a 'forgery' of the one first built in twelfth century Paris.

Conclusion: Feyerabendian Research Ethics as the Transvaluation of Fraud

One might extend this line of argument still further, effectively embracing the Church's worst Aristotelian suspicions that experimentation is the thin edge of the wedge that eventuates in the wholescale replacement of nature with artifice. Indeed, nearly thirty years ago, *Scientific American* editor John Horgan [Horgan, 1996] presciently observed that greater reliance on computer simulations in cutting edge scientific research – replacing not only direct observation but also classical laboratory experiments – was turning the process of validating scientific theories and even specific results into aesthetic judgements based on the elegance of the mathematical models informing the programs running the computers. For Horgan, this inevitably followed from the complexity of the phenomena that science nowadays tries to understand, whereby the very idea of 'observation', even if technologically enhanced, no longer has a clear meaning. Within a decade of Horgan's pronouncement, a prominent physicist was claiming that his discipline had reached a dead-end because advances in mathematical modeling had enabled the proliferation of multiple conflicting cosmologies with no obvious means of empirical adjudication [Smolin, 2006]. Not only does this problem persist in physics and has spread across more sciences, but advances in artificial intelligence research also now offer the prospect of simulating an entire human brain on a computer, which could then be uploaded into a more powerful machine. In principle at least, such an 'emulation' might be able to think like – if not better than – humans [Hanson, 2016]. In short, we seem to be heading for a time when the fake outperforms the real, thereby making Aristotle's worst nightmare come true.

I introduced this article by indicating that, based on his main posthumous work, Paul Feyerabend himself would probably *not* support the sort of 'Feyerabendian research ethics' proposed here. Feyerabend [Feyerabend, 1999] presents a view of the human condition that is not so very far from that of Aquinas, according to whom humanity's privilege among God's creatures rests on our multi-perspectival ability to represent the abundance of God's creation; hence, the stress that Aquinas placed on our intellect as a 'reflective' faculty. In effect, Aquinas would like us to believe that we are best at *catching* – as opposed to *generating* – the divine light. However, the Biblical phrase 'image and likeness of God' has suggested a stronger interpretation of humanity's role in nature, namely, that our creations (aka 'artifices') might improve if not replace what naturally exists. In that respect, nature appears as both a challenge and an opportunity to uncover insights that might help to restore humanity's full creative potential in the eyes of God. Certainly, Francis Bacon thought of matters this way, which led him to give qualified support for Galileo's efforts [Harrison, 2007].

Many scientists and philosophers of science have characterized science as a 'self-correcting' enterprise. However, the only evidence for this bit of wishful thinking is that there is a form of organized inquiry that society continues to recognize as 'science'. The self-correction doctrine is more a profession of faith in science than an empirical truth about science. Of course, 'falsehoods' of various kinds have been caught over the history of science, and if they are caught sufficiently soon after their commission, the consequences for the culprit can be substantial. Take the case of Galileo. But is science itself much affected by such 'trials of truth', especially when many falsehoods are caught long after their commission – and indefinitely many of them are never caught at all? I have suggested that perhaps it does not matter so much. A more rational way to approach this situation is to recall the words of the early film star and intuitive Hegelian thinker Charlie Chaplin, who said, 'Life is tragedy in closeup but comedy in the long shot'. From that standpoint, one expects a reversal of fortunes and a leveling of fates of the characters over time. The Church starts by triumphing over Galileo, but ultimately he is vindicated, and the Church then needs to keep up with the progress of science. This is a compelling plotline because it reinforces the persistence of human fallibility, largely in the form of blindspots that function as latencies that only come into play later in the narrative, resulting in overall comic release [White, 1973].

If there is one device that enables this comic view of history to work, it is the manipulation of context, specifically the deterritorialization and reterritorialization of objects, which serves to shift their value over time and space. (Recall the earlier reference to Russian Formalism.) It is only through these shifts that one discovers the object's true identity. Thus, when the Church prosecuted Galileo, it focused on the specific means by which he reached his heretical conclusions. Understandably perhaps, it did not suspend disbelief to consider the conditions under which Galileo's claims might be shown to be true and what that would imply for the Church's own established beliefs. However, with the passage of time (and space), it becomes easier to liberalize one's intellectual horizons, which may lead to the conclusion that the Church failed to attend adequately to the aspects of the phenomena that Galileo was (albeit imperfectly) trying to highlight. In that new context, Galileo's prosecution becomes something other than what it originally seemed to be: It starts to look like a *persecution*.

To ensure that history does not simply dissolve into a comedy of errors, the 'genetic fallacy' was introduced in the twentieth century to designate a failure in informal reasoning [Cohen, Nagel, 1934]. It is perhaps best seen as the complement to the 'context of justification', which was being formalized by Hans Reichenbach, Karl Popper and others in the philosophy of science at the time. The underlying principle is that the truth of a statement is independent of its origins. Its truth value neither

benefits from the authority of the person who makes the statement nor is it harmed by prejudice against that person. However, the use of logic to ground such a principle of fair judgement opens the door to potentially endless reformulations of the original statement to remove any trace of its history that might stray from the statement's ability to be validated properly. (Little wonder that Kuhn regarded the sense of history conveyed in science textbooks as 'Orwellian'.) Clearly, we have entered the realm of what Nietzsche called the 'transvaluation of all values' (*Umwertung aller Werte*), whereby any statement currently taken as true is a proxy for some future statement of that truth, which may need to be expressed – and perhaps even validated – radically differently to cohere with the rest of the body of accepted truths at that time. In short, the pursuit of truth through the maintenance of a statement's logical form is ultimately about the continual rewriting of history.

However, this need not be the final word on Feyerabendian research ethics. A more radical proposal would aim to bring the idea of a 'scientific law' in line with the conception of law found in jurisprudence and politics. It would amount to openly accepting that humans have the creative capacity of a divinity, which is an assumption of modern 'positive' law, at least starting with the early nineteenth-century British jurist John Austin. (The complement to that capacity, previously made explicit by Hobbes, is the lawgiver's capacity to enforce its will.) To be sure, this leaves open many ways to go. One need not be radical even under such circumstances. In the case of modern constitutionalism, as pioneered by the United States, one lays down fundamental laws that are relatively difficult to change. They are presumed to be in force in perpetuity, unless overturned by 'amendments', which require a high threshold of assent for passage. Indeed, there is evidence that the US founding fathers had in mind their 'laws of man' as analogous to the 'laws of nature', as proposed by Isaac Newton, who permitted divine intervention in creation only under exceptional circumstances [Cohen, 1995]. This idea of the American republic as a 'second creation' has been sustained by so-called 'originalist' legal interpreters of the Constitution over the centuries, who tie the spirit of the law closely to its letter and thus tend towards political conservatism. They are like Kuhn's 'normal scientists', whose research fixates on extending and elaborating the canonical interpretation of their field's generalizations. Thus, a scientific revolution, like a constitutional crisis, is usually accompanied by a short-lived social upheaval that results in the restoration of order.

However, a still more radical proposal would be to model the 'laws of nature' on the 'laws of man' in the sense of enacted legislation and periodic elections. In other words, 'laws of nature' would have explicit boundary conditions for their application, which could be explicitly revised (e.g., to cover an unanticipated finding or to extend into a new domain of phenomena). But more to the point, they would be up for regular review and potential replacement, regardless of their current empirical

standing. In this way, what counts as the relevant 'scientific community' would have the opportunity to consider whether they want to change course, perhaps given shifting judgements in the field about what is worth pursuing and how it should be pursued. The various contenders for a 'law of nature' would also need to mount their empirical case on currently available evidence and methods and rely as little as possible on legacy results, which, as we have seen in this article, very often have not stood the test of time. (And yes, it would mean that even the most fundamental of principled generalizations would need to be routinely reestablished.) In effect, scientific laws would have 'sunset clauses', which would help to take much of the heat out of discussions of past cases of alleged fraud [Fuller, 2023, p. 84–92]. Of course, the price would be that, metaphysically speaking, the 'laws of nature' would become as conventional as the 'laws of man', and the 'scientific community' would literally become a 'republic' in some formal relationship to the political state [Fuller, 2000]. This still leaves open the very controversial question of who would count as a 'citizen' in this newly constituted 'republic of science', especially given the increasing access to education, information and communication across the world? Taking our cue from Feyerabend, the answer is probably *not* the current professional guilds that control the means of production and distribution of scientific knowledge. Feyerabendian research ethics will likely extend both the range of activities permitted as science and the range of people eligible to judge its value.

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