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Surprised by Science: The “Original Errors” of *Paradise Lost*

MICHAEL SLATER

What can it mean to be surprised by science in *Paradise Lost*? Some scholars have been surprised to discover that Milton, a radical in so many other respects, appears decidedly backward in his scientific positions and commitments.¹ Some have been intrigued by the close association between Satan’s legion of fallen angels and a new industrial technology, not unlike that which was sweeping through London in the seventeenth century.² Still others have been intrigued by the plurality of worlds Milton seems ready to entertain, at least in theory.³ While all these topics represent worthy critical investments, none adequately captures the sense of surprise this essay will investigate. To be surprised by science in *Paradise Lost*, I will argue, entails something like what Stanley Fish so famously described in 1967, a series of interactions between text and reader carefully designed to enthrall us, to remind us of our own complicity in the narrative presently unfolding.⁴ In the context of original sin, this surprise involves being reminded, more or less gently, that we have fallen for Satan’s trap, that we have been seduced—not unlike Eve in Book 9—by his dazzling rhetoric and charm. In the context of science, this surprise involves being reminded that we continue to repeat the same “original errors” as our first parents on earth.

Since *Surprised by Sin* first appeared, critics have mounted a variety of responses to it. Some have taken issue with its method, some with its conclusions.⁵ But the text remains indispensable for Milton scholars today. As many as three decades after its initial appearance, John Rumrich could still characterize its argument as the dominant paradigm within which studies of *Paradise Lost* operate, regardless of the various critical methods they ostensibly employ.⁶ In the context of Milton’s approach to science in particular, Fish intervened in what was becoming an increasingly common view—that Milton adopts a fundamentally classical and medieval perspective. For Fish, Milton rejects certain elements of the “new science” to be sure, but no more than he rejects medieval science, too. What seems so problematic in *Paradise Lost*, according to Fish, is the very attempt to attain knowledge about things deemed by God “too high” for mortal minds.

In the midst of efforts to recuperate Milton’s attitude toward early modern science, critics have routinely challenged elements of *Surprised by Sin*, whether directly or indirectly. Whereas for Fish Satan functions in *Paradise Lost* as a clear and problematic embodiment of empiricist epistemologies, for Daniel Fried he represents instead a “perverted” empiricism, to be contrasted with Milton’s own allegiance to its “truer” form.⁷ Against Fish’s claim that Eve falls largely as a product of her devotion to experience, Karen Edwards argues in *Milton and the*

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Natural World that her fall arises mostly because she fails to live up to the rigorous empirical standards of Milton's contemporaries like Robert Boyle.⁸ As with Fried's account of Satan, Eve represents for Edwards a corrupt empiricism Milton finally discounts. And far from disavowing the revelations of the "new astronomy" as Fish claims, Milton, according to Catherine Gimelli Martin, instead displays a clear "preference for the elegant rationality of the Copernican side of the argument."⁹ "In the cosmology of *Paradise Lost*," Harinder Singh Marjara writes somewhat more cautiously, "heliocentrism is present in the spirit if not in the letter."¹⁰ Whether Milton was of Galileo's party, and to what extent he knew it, continues to present readers with an interpretive dilemma.

My focus here is concerned somewhat less with deciphering Milton's particular scientific investments than with how he deploys scientific arguments and narrative structures throughout *Paradise Lost*. In the decades since Fish transformed the critical landscape by realizing the unique rhetorical effect of Milton's text, scholars in the history of science have similarly underscored the central importance of narrative technique for the development of a new empirical program in the seventeenth century.¹¹ This emphasis has two effects for how we read the status of science in *Paradise Lost*. On the one hand, to be an "empiricist" in the modern sense means more than valuing experience as the root of all knowledge.¹² As Peter Dear and other historians have noted, experience was just as crucial to the deductive program of Aristotelian science. To distinguish between an older paradigm and the "new science" of the seventeenth century, what matters is how experience gets construed and the kinds of experiences that count. Too frequently, discussions of Satan and empiricism fail to account for the different role experience plays for the "old science" and the "new," and consequently to distinguish adequately between deductive and inductive programs. As I detail in the final section, Milton's Satan displays a commitment to a decisively modern form of experience, one that fails him spectacularly. He does not, as critics have claimed, pervert empiricism in *Paradise Lost*. Instead, empiricism perverts his faith in God.

On the other hand, attention to the narrative forms of scientific argument primes us to consider the shape of Milton's examples with special care. This consideration certainly involves the kind of argument Fish has already made, noting the double rhetorical structure of enticement and reproach as it pertains specifically to our desire for knowledge. But it also involves another element somewhat less noticed in this context. *Paradise Lost*, I argue, overtly presents both Adam and Satan as archetypes for the errors endemic to the dominant modes of science in the seventeenth century—Adam as an archetype of the new astronomer, Satan as the new empiricist more broadly. Despite all the emphasis on innovation underlying the "new science" in its various forms (astronomy, empiricism, mechanism, etc.), Milton implies there is nothing terribly new there at all. In what amounts almost to an inversion of typological exegesis, Milton's text works back from the philosophy of his age, embodied by figures like Galileo and Bacon, to find the root of its errors in the first examples of scientific thought.

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“Already by thy reasoning”: Adam and the Archetypal Error of Astronomy

Heav'n is for thee too high
To know what passes there; be lowly wise:
Think only what concerns thee and thy being;
Dream not of other Worlds, what Creatures there
Live, in what state, condition, or degree,
Contented that thus far hath been reveal'd
Not of Earth only but of Highest Heav'n. (8.172-78)¹³

Dream not of other worlds, Raphael sternly instructs Adam. Couched amidst his notoriously evasive discussion of cosmology, Raphael proffers a principle of Socratic humility: to be lowly wise. He cautions Adam to recognize the limits of his perspective, since heaven is “too high” for human comprehension. But even as he abjures lofty speculations, Raphael persistently redirects Adam’s gaze upward to the heavens, to the very “worlds” he hopes—ostensibly at least—to bar from the imagination. Immediately upon warning that the “great Architect” did “wisely to conceal, and not divulge / His secrets,” Raphael invites Adam to consider a number of competing cosmological theories, from the “thwart obliquities” of the Ptolemaic model to the “three different motions” of earth in the Copernican (8.72-74, 133, 130). His initial dismissal of “heavenly conjecture” is thus followed, as Annabel Patterson notes, by “a series of hypotheses that admit Adam into that same conjectural discourse. Three times he encourages Adam to think *what if*. That is to say, to engage in scientific hypothesis.”¹⁴ Dream not, he says, but do consider this.

If Raphael’s cosmological lecture leaves Adam ultimately uncertain as to the nature of the heavens, it has left critics equally perplexed about the place of scientific investigation in Milton’s narrative. For an older generation of critics, this lecture and others like it cemented Milton’s scientific “backwardness,” his refusal to accept the (obviously true) propositions of the “new astronomy” instituted theoretically by Copernicus and demonstrated factually by Galileo.¹⁵ Others, however, have worked to recuperate Milton’s attitude toward science in *Paradise Lost*, emphasizing against his alleged backwardness Milton’s considerable knowledge of contemporary scientific issues and his generally progressive response.¹⁶ That we continue to debate Milton’s scientific alliances seems to me symptomatic of the puzzling inconsistencies scattered throughout *Paradise Lost*. Raphael warns against cosmic speculations only to invite Adam to partake in them. Galileo holds a place of unparalleled honor as the only contemporary directly named in the text, and yet Milton apparently dismisses his telescopic observations as “less assured” and “imagined” (5.262-63). And even if Raphael does in fact subtly betray a preference for the heliocentric hypothesis in Book 8, Uriel, an angel of “unsurpassed sight,” describes a cosmos definitively Aristotelian five books earlier (3.694-735). How can readers, both early modern and modern, reconcile

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these discrepancies? Amid the many competing pictures and theories represented in *Paradise Lost*, where does Milton's allegiance lie?

My aim is partly to substitute a different question, not least because this one by all appearances stubbornly resists any clear answer. I am less interested here in how to resolve the apparent tension between Raphael's advice and his practice, or between his two cosmic schemes, than I am in the conflict itself, its very presence in the narrative. *Why* does Raphael encourage, even as he forbids and rebukes, Adam's contemplation of the heavens? That rhetorical pattern by this point is familiar to nearly all of Milton's readers. As he does in other contexts, Milton will consistently elaborate a scientific dispute only to remind us, as it were, of its fruitlessness—or perhaps more accurately of its “fruit-fullness,” its origin in and/or relation to an act gluttonous consumption. In *Paradise Lost*, the Ptolemaic and Copernican depictions of heaven both suffer reproach, rivals more in their vanity than in their accuracy. If, as Peter Herman notes, a persistent need to reconcile what appear to be contradictions in the poem largely defines the history of Milton criticism, in this particular case that need is precisely what is under assault.¹⁷ Adam yearns to resolve the nature of the heavens, to determine which of two competing possibilities more accurately reflects their reality. Raphael warns in response that certainty and resolution, however desirable, lie inveterately beyond Adam's reach. His dialogue in Book 8, far from demonstrating any clear preference for one position or the other, stages the history of astronomical debate as a caricature of Adam's fundamental errors in reasoning.

The specific content of that dialogue is less significant than its frame(s), at least inasmuch as it might reveal how scientific reasoning gets deployed in *Paradise Lost*. Raphael's brief sketch of the two dominant and as yet undecided cosmic models sits conspicuously amongst not one, nor even two or three, but four rebukes, with Adam contributing a fifth himself.¹⁸ Just as Milton often warns readers both before and after Satan speaks of the arch-tempter's hypocrisy, Raphael warns Adam doubly (or quadruply) of the dangers lurking in astronomical science. We do well to remember that the explicit purpose of the angel's visit is to “admonish”—in the double sense of to *caution* and to *reprimand*—Adam and Eve about the dangers of temptation and transgression. Altogether Raphael divides roughly sixty-eight lines between the different scientific models he describes, with another sixty-one lines devoted to admonitions.¹⁹ The dialogue in Book 8 thus places at least as much weight on the latter as the former. When we consider that it discourages astronomical speculation at nearly twice the length it devotes to any single paradigm, that weight appears to shift a good deal more.

We have been disinclined as modern readers to believe that Raphael carefully designs his disputation, as he claims, only to quell Adam's speculations, rather than to urge any particular position.²⁰ But given the evidence, this may have more to do with our own scientific investments than with his. We tend to marshal Raphael's dialogue either to fault Milton for his failure to accept the new Copernican science or to praise him for embracing it. From the perspective of *Paradise Lost*, however, our desire to judge Milton's account of the heavens against reality is itself a condition of the fall inherited from Adam. *Our* desire reflects *his*. We presume to know the nature of the heavens, just as Adam had presumed. By

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our need to resolve a question left painfully open in the text, we commit the same “crime” that is the primary source of Raphael’s dialogue, at least for Milton: we reach “too high.”

Adam’s astronomical conjectures at this point in Book 8 are not yet a product of fallen knowledge, to be sure. They are, nonetheless, bound up in the temptation to fall. Eve’s violation of God’s law will eventually transpire because of her ambition to acquire knowledge deemed too high—a height that Satan, at least, figures explicitly in terms of astronomy. Characterizing his alleged transformation upon eating the fruit, the serpent claims that

Thenceforth to *speculations high* or deep
I turned my thoughts, *and with capacious mind*
Considered all things visible in heaven,
Or earth, or middle, all things fair and good. (9.602-05; emphasis
mine)

When the serpent later promises the fruit will allow Eve “not only to discern / Things in their causes, but to trace the ways / Of highest agents,” the knowledge he evokes is astronomical: to traces the *ways*, or motions, of “things visible in heaven” (9.681-83). The fall, despite Eve’s transgression in this specific historical moment, is only the fulfillment of an ambition already latent in Adam’s “speculations high.” Her desire to ingest the fruit’s “sciential sap” serves as the final realization of Adam’s “*thirst* for knowledge,” a thirst he describes explicitly in the midst of his conversation with Raphael (8.8). If Adam does not share in Eve’s culpability for that first bite, he at the very least shares in her desire. And so too do we, according to Milton.

That we share in this desire is one of the overarching implications of *Paradise Lost*, the demonstration of which is also one of its principal rhetorical effects. Raphael condemns the future dispute between cosmological paradigms as the height of vanity, a struggle to know the nature of the heavens as fruitless as it is proud (8.75-79). Perhaps most significantly, he positions that dispute as the logical result of Adam’s original mistake, as if Galileo’s new astronomy is only the latest in a long string of errors that reverberates through history. Raphael explicitly depicts Adam as a *type* for Galileo and other seventeenth-century innovators, who continue to repeat the original errors of the former by an even more pronounced presumption of knowledge, a presumption made especially possible by the telescope. “Already *by thy reasoning* this I guess,” Raphael reproaches Adam (8.85-86; emphasis mine). What the angel guesses so prophetically, with the benefit of Milton’s hindsight, implicates both the Ptolemaic and the Copernican astronomers:

how they will wield
The mighty frame, how build, unbuild, contrive
To save appearances, how gird the sphere
With centric and eccentric scribbled o’er
Cycle and epicycle, orb in orb:

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Already by thy reasoning this I guess,
Who art to lead thy offspring, and suppos'st
That bodies bright and greater should not serve
The less not bright, nor heaven such journeys run,
Earth sitting still, when she alone receives
The benefit... (8.80-90)

Raphael's condemnation exhibits a carefully crafted symmetry, attributing blame equally to both propositions. While beginning with a caricature of the Ptolemaic model, "With centric and eccentric scribbled o'er / Cycle and epicycle," it shifts suddenly and unexpectedly—i.e., surprisingly—to a curt dismissal of the Copernican. Upon our first reading, we assume that Raphael marks the Ptolemaic scheme as the epitome of Adam's fallacious reasoning in Eden, and rightly so. The colon that follows his description of that scheme in line 84 ("orb in orb:") leads us to associate the two thoughts, as though *this* in line 85 has for its antecedent everything that preceded it in lines 80 to 84. That's how colons work. But as Raphael continues, a shift in systems jars our reading experience. Adam's fallacious reasoning actually supposes, we learn, "That bodies bright and greater [i.e., the sun] should not serve / The less not bright [i.e., earth], nor heaven such journeys run, / Earth sitting still." This is a central assumption driving the Copernican philosophers—that the earth itself might move with far more simplicity than the heavens. The point is not that Raphael predominately faults this latter scheme, but that he faults both. The dispute itself, Raphael surmises, will serve only to provoke God's laughter at their "quaint opinions wide" (8.78).

Between the third and fourth rebukes in Raphael's dialogue, from lines 122 to 166, we find perhaps the most detailed description of the current state of astronomy in Milton's narrative. It includes allusions to Gilbert and Kepler, to Copernicus and Galileo, and to profoundly new concepts like "earthshine." The angel begins by evoking Kepler, particularly his conception of the sun's "attractive virtue," which had relied heavily upon Gilbert's work on the lodestone. "What if the sun be centre to the world," Raphael asks, "and other stars / By his attractive virtue ... dance about him various rounds?" (8.122-25). In his *Astronomia Nova* (1609) and in the second edition to his *Mysterium Cosmographicum* (1621), Kepler aimed to demonstrate a causal relation between the sun's rotation and the planetary orbits, which he eventually located in the sun's "virtue."²¹ As he continues to expound this heliocentric hypothesis, Raphael accumulates additional developments from the new astronomy, both theoretical and observational: he refers to the earth's "three different motions" (8.129-30), a central tenet in Copernicus; to the "terrestrial moon" famously observed by Galileo's "glazed optic tube" (8.142); and to Galileo's argument that earth, like all planets, reflects light from the sun (8.140-44).

Galileo considered this last point an important contribution for denying any essential difference between the terrestrial and the celestial bodies. The latter did not shine by their own internal light, he argued, but by reflecting light from the sun. If the earth similarly reflected light, we have no reason to assume it to be any different in nature from the moon or other planets. He claimed to observe the

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effects of this reflection in the moon, as he explains in *The Dialogue Concerning the Two Chief World Systems* (1632):

just as the moon supplies us with the light we lack from the sun a great part of the time, and by reflection of its rays makes the nights fairly bright, so the earth repays it by reflecting the solar rays when the moon most needs them, giving a very strong illumination—as much greater than what the moon gives us ... as the surface of the earth is greater than that of the moon.²²

In his dialogue in *Paradise Lost*, Raphael explicitly contemplates the broader implications of this future and highly specific claim. The Ptolemaic model, he urges,

needs not thy belief,
If Earth industrious of herself fetch Day
Travelling East, and with her part averse
From the Sun's beam meet Night, her other part
Still luminous by his ray. *What if that light
Sent from her through the wide transpicuous air,
To the terrestrial Moon be as a Star
Enlightening her by Day, as she by Night
This Earth?* (8.136-44; emphasis mine)

The syntax is a bit murky, but the implication is clear. Raphael consistently uses the masculine pronoun throughout his discussion to refer to the sun, and the feminine to refer to the earth and moon. What if the light sent from her (the earth) to the “terrestrial moon” is like that of a star, shining for her (the moon) by day *in the same way* that she (the moon) reflects light to earth by evening? When Raphael claims to anticipate the whole history of astronomy in Adam's high speculations, Milton ensures that he gets it right, up to and including these recent developments by Galileo and his peers.

Even as the “new astronomy” certainly dominates this discussion in Raphael's dialogue, it suffers from the rebukes that frame it no more or less than the old astronomy. “Whether thus these things, or whether not,” Raphael concludes his discussion,

Whether the sun predominant in heaven
Rise on earth, or earth rise on the sun,
He from the east his flaming road begin,
Or she from west her silent course advance
...
*Solicit not thy thoughts with matters hid,
Leave them to God above...
...heaven is for thee too high
To know what passes there.* (8.159-73; emphasis mine)

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If the new astronomy receives the bulk of Raphael's attention, this final summation serves neither as a subtle endorsement nor as a more thorough censure, as his final summation is careful to note. Such "discoveries" as these merely represent the pinnacle of astronomical "achievement" in Milton's age, and so stand as the final—but by no means best or worst—instantiations of Adam's error.

The rhetorical pattern established by Raphael's dialogue, wherein an auditor (or reader) is simultaneously encouraged and rebuked for his cosmic speculations, occurs frequently in *Paradise Lost*. Nearly all of the overt references to Galileo contain some deep-seated ambiguity, which helps to explain the critical controversy surrounding his presence in the text.²³ One of these, in Book 3, famously provides Fish with a classic example of rhetorical surprise. For him, the Galileo similes function as "a preparation for the moment in Book VIII when Adam responds to Raphael's astronomical dissertation: 'To whom thus Adam clear'd of doubt.'"²⁴ We are surprised by that summation, since the dialogue seems to have raised more questions than it has answered. But we are also prepared for that response, Fish argues: "He *is* cleared of doubt, not because he now knows how the universe is constructed, but because he knows that he cannot know."²⁵ What links this moment to so many others in the text is not just rhetorical surprise, but an unyielding indecision—an inability, Milton insists, to finally decide in matters of science. Despite our best efforts, speculation cannot aspire to knowledge. For Milton, the most recent "advances" in astronomical science, as I hope to have shown, serve only as echoes of Adam's "quaint opinions wide" (8.78). And if Adam provides a *type* for all subsequent astronomers, their errors only a repetition of his, the scientific dilemma he faces also models an overarching problem endemic to empirical investigation. Astronomy is only one embodiment of a broader speciousness in the text, one that incorporates not only Adam and Galileo but Satan as well.

The Arch-tempter, Satan: An Archetypal Experiment

Satan is certainly a perplexing figure in *Paradise Lost*, a mouthpiece for ideas and attitudes shared by many of Milton's contemporaries—indeed, according to some, by Milton himself. Among other things, he has been linked to revolutionary politics and radical egalitarianism, to an emergent mechanism or industrialism, to seventeenth-century philosophers like Hobbes and Descartes, and, more generally, to the new empirical reliance on experimentation.²⁶ Satan's associations with Galileo have also been well documented, if not entirely resolved.²⁷ The main question in such cases is whether Satan perverts or exemplifies these associations, and as a corollary whether the text valorizes or condemns the attitudes involved. Despite the moral judgment we expect to find implicitly attached to Satan, these issues admit no easy answers.

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My concern here is principally with experimentation, both its specific relation to the “tempter,” one of Satan’s most common epithets, and its general standing for Milton. The systematic program of experimentation we now inevitably associate with modern science, whereby an investigator forms a hypothesis, conducts an experiment (or series of experiments), and draws appropriate conclusions, was still under development in the latter part of the seventeenth century.²⁸ As a mode of investigation, experimentalism received some form of official sanction only a decade or so before Milton published his text, with the arrival of the Royal Society in 1660. But even the institutionalization of experimental science was no sure sign of its success, as Steven Shapin and Simon Schaffer have persuasively shown. Not all of the new scientists—much less the “old” ones—were convinced about the virtues of experimentation. Hobbes, in particular, delivered a series of trenchant critiques throughout the 1660s and 1670s regarding the assumptions and methods of “the Greshamites,” as he referred to members of the Royal Society.²⁹ It is in the midst of this contest over scientific legitimacy, by no means settled, that *Paradise Lost* emerges, and with it Milton’s portrayal of the grand experimenter Satan.

There can be little doubt that Milton makes of Satan an advocate for experiential knowledge. “By proof to try” becomes something of a motto for the fallen angels, and certainly Satan urges the value of experience to manipulate Eve in Book 9. With the exception of Milton’s poetic invocation, the very first thing a reader encounters in *Paradise Lost* is a conversation between Satan and Beelzebub about their failed “experiment” in heaven. “[S]o much the stronger *proved* / He with his thunder,” Satan claims, “and till then who *knew* / The force of those dire arms” (1.92-94). As the conclusion of lines 92 and 93 underscores, Satan posits an essential bond between proof and knowledge. To really know the force of God’s might, one must test it, just as he will advise before the battle in Book 5. Even Satan’s name may have suggested for Milton his connection to experimentation. For many of the new philosophers, the highest model of investigation was a kind of experiment Bacon had labeled “*lucifera*,” those that have no purpose but to discover causes and axioms.³⁰ Among members of the Royal Society, “luciferous” thus became a common adjective to describe their experiments.³¹ And although Milton rarely uses the name “Lucifer,” he does so for the first time, significantly, just as Satan formulates his experimental designs in heaven, his plot “by proof to try / Who is our equal” (5.865-66).³²

While the associations between “Lucifer” and experimentation may appear somewhat tenuous, Milton reinforces Satan’s experimentalism with another name he routinely provides as an epithet, the “tempter.” To “tempt” can carry a host of meanings in the seventeenth century, as Daniel Fried notes. “Temptation is to put to the test,” he writes, “to try, to attempt (a cognate Milton often puts in close proximity to *tempt* and *Tempter*). It can mean, following the Latin root *temptare*, ‘to attack.’ It can even carry the force of ‘to experiment.’”³³ In the earliest events of *Paradise Lost*, Satan has conflated all of these meanings in a single grand experiment: with his *attack* in heaven, he *tempts* his fellow angels to *test* the might (and ultimately the wrath) of God. He forms a clear hypothesis—that God has not created the angels and has no real power over them—and sets about to

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test it, to prove by experimental war whether the angels shall approach the throne of God “beseeking or besieging” (5.869). Having failed, he even projects his own temptation onto God, who, Satan claims, by concealing his strength “tempted our attempt, and wrought our fall” (1.642). For an experimentalist like Lucifer, “temptation” is a *modus operandi*.

Satan is not the only character in *Paradise Lost* to proffer the value of experience, nor is it any experience he values. He advocates a particular kind of experience, one that had only just gained prominence in the seventeenth century.³⁴ In one of the most pivotal scenes of the text, the debate between Satan and Abdiel before the war in heaven, Milton illustrates two profoundly different notions of experience. If Satan’s name and epithet both suggest for readers his relation to experimentation, Abdiel’s signifies instead his unyielding faith in God. “Abdiel” literally means “servant of God,” a duty he demonstrates in Milton’s text against overwhelming opposition. He only is “faithful found, / Among the faithless, faithful only he . . . unmoved / Unshaken, unseduced, unterrified” (5.896-99). We might be tempted, given the degree to which Milton marks it, to regard Abdiel’s “unshaken faith” as the epistemic counterpart to an insistence on experience. Satan’s skeptical argument that none can truly know God’s role as the creator since none has experience of creation (“who saw when this creation was?”) has no effect on Abdiel, but we would be mistaken to assume, as Satan does, that his faith is therefore blind. Faith in God is axiomatic for Abdiel, a first principle from which all subsequent reasoning proceeds. But even so, it is grounded in experience. Against Satan’s heresies, Abdiel counters that

Yet *by experience taught* we know how good,
And of our good, and of our dignity
How provident he is, how far from thought
To make us less, bent rather to exalt
Our happy state under one head more near
United. (5.826-31; emphasis mine)

From Abdiel’s unique perspective, the angels have had countless *experiences* to indicate the benevolence and omnipotence of God. It is simply not the kind of experience that satisfies Satan.

What Satan demands instead is “experimental” proof, the experience of a singularly contrived event that has been designed specifically to test his hypothesis. What separates modern empiricism from the deductive science of Aristotelian philosophers, as Peter Dear explains, is this different sense of how experience informs knowledge, not the fact that it does so. For a deductive science like Aristotle’s, philosophers require universal statements that can function as premises. Since these cannot be derived intuitively, “they must be rendered acceptable through appeal to experience,” as Dear notes.³⁵ In his *Opticorum libri sex* (1613), Franciscus Anguilonius describes how experience can furnish such premises:

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A single sensory act does not greatly aid in the establishment of sciences and the settlement of common notions, since error can exist which lies hidden for a single act; but having been repeated time and again, [the act] strengthens the judgment of truth until [that judgment] finally passes into common assent; whence afterwards they [i.e., the “common notions”] are put together, through reasoning, as with the first principles of a science.”³⁶

To a deductive scientist, experience is “what *happens*” in the everyday and the routine, a product of countless testimonies (of the memory and of others) that ultimately furnish an indisputably factual premise. A modern “experiment,” on the other hand, is “what *happened*” at a particular time and place, a singular spatiotemporal event that can be reported and construed so as to produce a knowledge claim.³⁷ Herein lies the fundamental dissimilarity between Abdiel’s and Satan’s respective appeals to “experience.” For the former, the collective experiences of the host of angels confirm the nature of God; for the latter, a single test artfully designed will suffice.

Since Fish first argued that Milton, by “making Satan an empiricist,” warned his readers against intellectual pride, critics have endeavored to recuperate the role of empirical science in *Paradise Lost*, just as they have also endeavored to recuperate Milton’s attitude toward science more broadly.³⁸ By tracing in the Columbia Milton “a set of almost entirely positive references to experience,” Daniel Fried, for instance, makes of Milton an “implicit empiricist.”³⁹ “Satan is the clearest type of empiricist who appears in any of Milton’s poetry,” he admits, but a “perverted empiricist, constantly experimenting through violence to determine the limits of divine sovereignty, and constantly refusing to acknowledge the resulting proofs that there are no such limits.”⁴⁰ John Rogers similarly refers to Satan’s “vulgar empiricism,” even as he traces—in the best account to date—the rigorous logic underwriting Satan’s argument to be “self-raised, self-begot,” along with its possibly empirical basis.⁴¹ But “by representing Satan as lying about the fruit,” as Karen Edwards urges, “Milton shows that Satan has abused the potential of the new experimental philosophy for instilling wisdom – *not that it has no such potential.*”⁴²

The critical dispute, to the extent that there is one, is not whether Satan is an empiricist, but whether he is a good one. By beginning *in media res*, Milton places front and center the disastrous consequences of what amounts to the first experiment (and the first “temptation”) in history. We do not yet know in Book 1 how fully the angels conceive the war in heaven as a *test* of God’s might. We realize primarily that despite his loss, Satan claims to find comfort in what has been discovered in the process, “since through *experience* of this great event,” he cries, the fallen angels are “in foresight much advanc’t” (1.118-19). They have not achieved their ends to be sure, but they have not failed entirely either. Any experiment, mistaken or not, produces knowledge; the angels understand God’s nature better than they had, and thus “may with more successful hope resolve / To wage by force or guile eternal War” (1.120-21). An unsuccessful test is only an occasion for further testing in Satan’s reasoning. We might expect as much from

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any scientist worth his salt. By the time of *Paradise Regained* millennia later, Satan's optimism has waned, but his persistence has not. "So Satan, whom repulse upon repulse / Met ever," Milton relates, "gives not o'er though desperate of success, / And his vain importunity pursues" (4.21-24). As an experimenter, Satan perfectly encapsulates Edison's doctrine that scientific achievement is "one percent inspiration and ninety-nine percent perspiration."⁴³ And yet, his relentless determination has been cited as the clearest evidence for his perversion of empirical reasoning. As Fried writes, "Satan remains 'by success untaught': he has absorbed none of the lessons."⁴⁴ In the place of genuine inquiry, he displays instead willful ignorance.

To better grasp the stakes and implications of Satan's experiment in heaven, we must wait until Book 5. There we witness its formulation in much greater detail. Only by considering more carefully its design can we finally judge Satan's relative success or failure and determine whether continued experiments, however "vain" and "importunate," are either a perversion or an exemplar of the empirical method. When first encouraging disobedience, Satan counsels his fellow angels to question received wisdom:

That we were form'd then say'st thou? and the work
Of secondary hands, by task transferr'd
From Father to his Son? strange point and new!
Doctrine which we would know whence learnt: who saw
When this creation was? remember'st thou
Thy making, while the Maker gave thee being?
We know no time when we were not as now;
Know none before us, self-begot, self-rais'd
By our own quick'ning power, when fatal course
Had circl'd his full Orb, the birth mature
Of this our native Heav'n, Ethereal Sons.
Our puissance is our own, our own right hand
Shall teach us highest deeds, by proof to try
Who is our equal: then thou shalt behold
Whether by supplication we intend
Address, and to begirt th' Almighty Throne
Beseeching or besieging. (5.853-69)

His rhetoric, if not necessarily his logic, is perfectly in keeping with the spirit of empiricism that flourished in seventeenth-century England. He sounds a bit like Francis Bacon, who similarly complained in his *Natural History* (1622) that too often "authority is taken for truth, not truth for authority."⁴⁵ Satan proposes "by proof to try" doctrines held by the authorities—to try Authority itself, actually. To do so he very deliberately engineers an experiment. But in my opening qualification ("if not necessarily his logic") lies nearly everything.

At least since C. S. Lewis remarked that Satan, "being too proud to admit derivation from God, has come to rejoice in believing that he 'just grew' like Topsy or a turnip," critics have questioned the logical consistency of Satan's central

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“heresy” of self-generation.⁴⁶ For Lewis, the logic “produces as proof of his self-existence what is really its disproof,” an exercise in utter “nonsense.”⁴⁷ But while nearly everyone agrees on the crucial significance of this moment for Satan’s character and revolt, critics “have been curiously silent on the actual content of these lines,” as John Rogers notes.⁴⁸ According to the animist materialism of *Paradise Lost*, Rogers demonstrates, to claim that the angels have *grown* by their “own quick’ning power” may not be so absurd at all. Milton’s monism, however, is not necessarily Satan’s.⁴⁹ Instead of weighing the relative merits of his argument against the natural philosophy of *Paradise Lost*, we might also weigh those merits against the empirical framework Satan explicitly invokes.

As so often in Milton’s text, the crux of the argument is entangled in surprise. Satan’s rhetoric, not unlike his logic, is carefully designed to elicit a specific response from his auditors (and Milton’s readers). I do not deny that Satan’s claim is finally sophistical: in the blandest logical terms, it amounts to something like “not P, therefore Q.” But there is a devilish method in that sophistry, a cleverness lurking dangerously beneath the surface. He begins his diatribe with perfectly plausible questions, at least from an empirical perspective. If knowledge originates in experience, the angels might well wonder “whence learnt” this “strange point and new.” Who among them has *experience* of this creation, who remembers when the “Maker” gave them being, as God alleges to have done? Obviously, the answer is none. Our interest is piqued, as is theirs. Then comes the heresy. “We *know* no time when we were not as now;” he urges. Still on firm empirical ground, the link between knowledge and experience remains intact. Satan seems only to reformulate his earlier remark with this line, that none knows any time before their own existence, such that they might know the “Maker” to have made them. The semicolon at the end of this line helps to shape our expectation for what follows, implying a strong relation to what precedes. “Know none before us, self-begot, self-rai’d,” he continues in the following line. This appears to be a sufficiently reasonable extension of his previous claims: not only do we not know any time when *we* were made, we also know of no being(s) before us who was self-created. That is, we have no experience of such an event, when a prior being was “self-begot, self-rai’d.”

But this is not in fact what Satan argues, of course. It is what Satan *should* have argued, what we might expect him to argue as a “good” empiricist. Such a claim would have extended the doubt already cast on the act of creation to the status of the alleged creator. “Do we really believe that God is *causa sui*?” Satan might have insinuated. Instead, his logic runs something like this: we know none before us [hard-pause], hence we are self-begot by *our* own quickening power. In that pause, Satan implies a logical relation that is, to all appearances, specious. “What he means,” Fish writes in his 1997 preface, “is that his first creation (out of primordial matter or out of nothing) was self engineered by his ‘own quick’ning power’ (V.861), a conclusion he draws (absurdly) from the fact that he doesn’t remember being created by anybody else.”⁵⁰ That the notion of self-generation follows as a conclusion from his lack of memory is only implied, however; it’s an impression of juxtaposition. And because of the enjambment at line 860, we have an equally strong, if only temporary, impression that Satan claims to have no

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experience—and therefore no knowledge—of any being before him for which “self-existent” is an appropriate predicate. Both impressions linger. If one is clearly “absurd,” the other is not entirely without reason.

It is the potential relation between those two impressions that most reveals the cleverness of Satan’s argument, and may help to explain what would otherwise be an inexplicable effect. If Satan’s reasoning is so obviously absurd, how does it succeed in convincing all but Abdiel? Are we to believe that all the fallen angels are less sophisticated logicians than Milton’s readers? Satan’s argument actually breaks down into two stages. In the first half, from lines 853 to 860, he aims primarily to question the preeminence of God and Christ. His method here is patently empirical. It works by persistently denying any experiential knowledge for God’s claims to have created the whole host of heaven. The second half, from lines 860 to 866, works at the self-promotion of Satan and the other angels (“our puissance is our own”). These two strategies temporarily merge at the enjambment (lines 860-61), where for an instant both meanings will hang in contradictory suspension (i.e., that they know none self-created; and that they are themselves self-created). If Satan succeeds in convincing his fellow angels of his latter assertion that their puissance is their own, this conclusion will of course entail the former denials of God’s preeminence and power. The angels cannot be self-begot *and* created by God. But if Satan fails to convince others of his latter claim for self-derived power, it does not thereby entail the negation of the former, too. It is of course conceivable that the angels are not “self-rai’s’d” and yet still not created by God. Despite any possible charges of absurdity from listeners and readers, Satan is still justified, empirically if not morally speaking, to propose his experiment, his attempt “by proof to try” God’s power.

The issue with Satan’s empiricism is not logical absurdity. Here is the real problem that Satan faces with the specific experiment he has concocted. The war in heaven *might* indeed offer proof that God is not the “Almighty Maker,” in the event the rebels win. It cannot, even in such an event, prove that the angels are “self-raised,” though. There are still other possibilities this particular experiment cannot eliminate—that an as yet unknown being created everything and everyone, including God, for instance. But what if, on the other hand, the rebel angels lose? What does this prove? That God *is* the Almighty Maker? For a moment, Beelzebub at least thinks so. After the fall to hell, he says of their conqueror that “I now / *Of force* believe [him] almighty, since no less / Than such could have o’erpowered such force as ours” (1.143-45; emphasis mine). Beelzebub has fully, if somewhat mistakenly, internalized the logic of Satan’s bid for war in heaven, resting his conclusion that God is Almighty Maker (the question from the first half of Satan’s argument) on the self-promotion of Satan and his comrades (the second half of the argument). Only omnipotence could have defeated such a force as ours, he reasons. Unlike Beelzebub, however, Satan does not draw the same conclusion, resolving to wage eternal war as a continued test of God’s power. He thus “*perverts*” empiricism, Fried suggests, by “constantly refusing to acknowledge the resulting proofs that there are no such limits [to God’s power].”⁵¹ But it is Beelzebub, not Satan, who temporarily perverts the tenets of empiricism by ascribing more to the

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experiment than reason would allow. The loss in heaven proves only that the angels have not succeeded in deposing God, not that God is impervious to assault.

Milton's text thus exploits a problem implicit to the nature of experimental investigation, which can validate only (1) that things have happened, or (2) that they have *not yet* happened. Satan, it is true, fails to demonstrate in his siege on heaven that God is not Almighty as he had hoped to do, but he certainly does not thereby demonstrate that God *is* Almighty. That latter claim is impossible to validate empirically. No amount of experimentation, and no expanse of time, will ever demonstrate the proposition that "God *cannot* be defeated," that his sovereignty is without limit. This explains why Satan, the arch-tempter, continues to try in *Paradise Regained* to thwart God, despite his countless failures. Each individual attempt, each reiteration of that archetypal experiment in heaven, can reveal at most that he still has not yet succeeded. For Satan to function in the text as a *perversion* of empiricism as Fried and others have claimed, he more likely would need to accept, as Beelzebub momentarily does, that God is the Almighty creator purely on the basis of his experiment, rather than by faith. What *Paradise Lost* really stages in the association between Satan and empiricism is the radical limitations of the latter. If Satan's continued experiments are at some point laughable, it is only because he had hoped to prove, or to disprove, God's preeminence in the first place. Not because he failed to accept the proof.

Satan, like Adam later, reaches too high. He endeavors to know with proof something that cannot be known by the standards of empirical reasoning. In effect, *Paradise Lost* pushes empiricism to its logical and unsettling conclusion. What Satan cannot *experience* by any number of experiments is the extent of God's power. If he could ever confirm this power has no limit, any subsequent experiment would follow only from the willful ignorance Fried describes. But experience, as David Hume would later write, "only teaches us, how one event constantly follows another; without instructing us in the secret connexion, which binds them together, and renders them inseparable."⁵² Satan challenges God, Satan fails. Even should he reiterate this pattern for all time, he could never *know* by experience the "necessary connection" between these events. Consequently, he cannot empirically predict the inevitability of his defeat, as Milton can by faith. That he continues to "give[] not o'er though desperate of success" so many years (and experiments) later in *Paradise Regained* is perhaps the best, if not also the most tragic, indication of his unfaltering commitment to an overly strict empiricism. For "there is nothing in a number of instances, different from every single instance, which is supposed to be exactly similar."⁵³ Each individual attempt reveals nothing more than the last. God's power remains elusive, beyond the limits of experimental discovery. And so, Satan continues to experiment *ad infinitum*. He is, by his very nature, the arch-tempter.

Satan's empiricism and his experimental tendency to test the limits of God's power, his ambition for knowledge and his desire for independence, link him firmly with Adam (and Eve) in Milton's text. By extension, *Paradise Lost* links him to us as well. His very nature as the "tempter" is to test or to assay, to try or to experiment. Satan's "original sin" is an experiment, an attempt to prove his hypothesis that God is not all-powerful. Likewise, Adam's "original error," his first

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scientific mistake about the nature of celestial motions, is born of an ambition to reach beyond his station, a presumption to know things not within human comprehension. Just as Satan's sin prefigures our own according to Milton's text, Adam's error likewise prefigures the rampant miscalculations of seventeenth century scientists—Gilbert, Kepler, and Galileo, among others. Given its rigidly providential view of history, *Paradise Lost* takes as one of its principle aims an exploration of the relations between past and future mistakes, both moral sins and cognitive errors. Only in such a scheme can Raphael, speaking with Adam at the outset of earth's history, glimpse well into the future: "Already by thy reasoning, this I guess..." In Milton's text, the greatest "advances" in science to date serve only to fulfill that original error.

Notes

1. See in this context Arthur Lovejoy, "Milton's Dialogue on Astronomy," in *Reason and the Imagination: Studies in the History of Ideas, 1600-1800*, ed. Joseph A. Mazzeo (New York: Columbia University Press, 1962); Kester Svendsen, *Milton and Science* (Cambridge, MA: Harvard University Press, 1956); Francis R. Johnson, *Astronomical Thought in Renaissance England* (New York: Octagon Books, 1968); E. M. Tillyard, *Studies in Milton* (London: Chatto and Windus, 1951); and Douglas Bush, *Science and English Poetry* (Oxford: Oxford University Press, 1950). For more recent essays that continue to see Milton's position toward the "new science," and Galileo specifically, as hostile, see also Donald Friedman, "Galileo and the Art of Seeing," in *Milton in Italy: Contexts, Images, Contradictions*, ed. M. A. Di Cesare (Binghamton: Medieval and Renaissance Texts and Studies, 1991); and Neil Harris, "Galileo as Symbol: The 'Tuscan Artist' in *Paradise Lost*," *Annali dell' Istituto e museo di storia della scienza de Firenze* 10.2 (1985): 3-29.

2. See, for instance, Jonathan Sawday, *Engines of the Imagination: Renaissance Culture and the Rise of the Machine* (New York: Routledge, 2007), esp. chapter 7.

3. See Harinder Singh Marjara, *Contemplation of Created Things: Science in Paradise Lost* (Toronto: University of Toronto Press, 1992), esp. 76-83.

4. Stanley Fish, *Surprised by Sin* (Cambridge, MA: Harvard University Press, 1997).

5. See, among others, William Kerrigan, *The Sacred Complex: On the Psychogenesis of Paradise Lost* (Cambridge, MA: Harvard University Press, 1983), esp. 98-9; Bill Readings, "On the New Forcers of Conscience: Milton's Critics," *Oxford Literary Review* 7.1/2 (1985): 131-47; John Rumrich, "Uninventing Milton," *Modern Philology* 87.3 (1990): 249-65; and William Walker, "On Reason, Faith, and Freedom in *Paradise Lost*," *Studies in English Literature, 1500-1900* 47.1 (2007): 143-59.

6. John Rumrich, *Milton Unbound: Controversy and Reinterpretation* (Cambridge: Cambridge University Press, 1996), esp. 2-4.

7. Daniel Fried, "Milton and Empiricist Semiotics," *Milton Quarterly* 37.3 (2003): 117-38.

8. Karen Edwards, *Milton and the Natural World: Science and Poetry in Paradise Lost* (Cambridge: Cambridge University Press, 1999). See also in this connection Angus Fletcher, *Time, Space, and Motion in the Age of Shakespeare* (Cambridge, MA: Harvard

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University Press, 2007), esp. “Milton and the Moons of Jupiter” (Chapter 8), which argues that Milton regards many of these scientific contemporaries, especially Galileo, as “heroes” in his text.

9. Catherine Gimelli Martin, *The Ruins of Allegory: Paradise Lost and the Metamorphosis of Epic Convention* (Durham, NC: Duke University Press, 1998), 101-02.

10. Marjara, *Contemplation of Created Things*, 46. See also p. 8, where he writes: “If Milton’s attitude to science was determined by a teleological, theocentric, and moral view of nature, it was not because he was stuck in the backwaters of medieval science.”

11. See, for example, Peter Dear, “Narratives, Anecdotes, and Experiments: Turning Experience into Science in the Seventeenth Century,” in *The Literary Structure of Scientific Argument: Historical Studies*, ed. Peter Dear (Philadelphia: University of Pennsylvania Press, 1991); Steven Shapin, “Pump and Circumstance: Robert Boyle’s Literary Technology,” *Social Studies of Science* 14.4 (1984): 481-520; and Simon Schaffer and Steven Shapin, *Leviathan and the Air Pump: Hobbes, Boyle, and the Experimental Life* (Princeton: Princeton University Press, 1985).

12. Experience was crucial for the older paradigm insofar as Aristotelian philosophers relied upon the frequency of their routine experiences to formulate first principles and axioms for their deductions. The premise, for instance, that “all men are mortal” arises from countless experiences that men die. For the new experimentalists of the seventeenth century, what matters is a singular, contrived experience that can be replicated by others. This proves enormously consequential to how experience is treated in *Paradise Lost*, as I detail in section 2 below.

13. John Milton, *Complete Poems and Major Prose*, ed. Merritt Y. Hughes (Indianapolis: Hackett, 2003). All subsequent citations of the poem are from this edition and will be cited parenthetically by book and line numbers.

14. Quoted in John C. Ulreich, “Two Great World Systems: Galileo, Milton, and the Problem of Truth,” *Cithara* 43.1 (2003): 23-35, esp. 27. On the significance of the phrase “what if” to the new astronomy of Tycho and Copernicus specifically, see Dennis Danielson’s insightful reading in *Paradise Lost and the Cosmological Revolution* (Cambridge: Cambridge University Press, 2014), esp. 123-28.

15. See Lovejoy, “Milton’s Dialogue on Astronomy,” who argues that Milton’s position on astronomy here represents a break in the “great chain” of scientific advancement characteristic of the Scientific Revolution. Kester Svendsen, in *Milton and Science*, similarly describes a “gulf between Milton’s lore and the experimental science of [the] middle and late seventeenth century” (42). See also Grant McColley’s “Milton’s Dialogue on Astronomy: The Principal Immediate Sources,” *PMLA* 52.3 (1937): 728-62, which faults Milton for, among other things, not engaging the full range of possible models for his cosmology. Lawrence Babb, in *The Moral Cosmos of Paradise Lost* (East Lansing: Michigan State University Press, 1970), laments that “The world of *Paradise Lost* is obviously Ptolemaic” (80). Finally, Fabio Toscano, in “The Tuscan Artist: Images of Galileo in Milton’s Works,” *Journal of Science Communication* 3.3 (2004): 1-7, asks in the same vein: “Why, despite his tributes to Galileo, does the poet not explicitly pronounce himself in favour of the heliocentric theory?” (4)

16. See in this context Marjara, *Contemplation of Created Things*; Martin, *Ruins of Allegory*; Edwards, *Milton and the Natural World*; Fletcher, *Time, Space, and Motion in the Age of Shakespeare*; Anita Lawson, “‘The Golden Sun in Splendor Liked Heaven’: Johannes Kepler’s *Epitome* and *Paradise Lost*, Book 3,” *Milton Quarterly* 21.2 (1987): 46-51; Julia Walker, “Milton and Galileo: The Art of Intellectual Canonization,” *Milton Studies* 25 (1990): 109-23; Maura Brady, “Galileo in Action: The ‘Telescope’ in *Paradise Lost*,” *Milton Studies* 44 (2005): 129-52; and Danielson, *Paradise Lost and the Cosmological Revolution*.

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17. Peter C. Herman, *Destabilizing Milton: "Paradise Lost" and the Poetics of Incertitude* (New York: Palgrave Macmillan, 2005). See also in this context the introductory chapter to *The New Milton Criticism*, ed. Peter C. Herman and Elizabeth Sauer (Cambridge: Cambridge University Press, 2012). While the present article is notably indebted to the work of Stanley Fish, I also attempt to recognize here the importance of "incertitude." To the degree that Milton presents any consistent attitude at all with regard to astronomy, this is only to suggest that inconsistency cannot be resolved.

18. See *Paradise Lost* 8.70-76; 8.85-6; 8.119-22; and 8.167-78.

19. His discourse takes place from lines 66-178 in Book 8.

20. Danielson even argues that Raphael does not actually discourage astronomical observation and speculation at all. See Danielson, *Paradise Lost and the Cosmological Revolution*, esp. 3-4, 123-28.

21. On the connection between *Paradise Lost* and Kepler specifically, see Lawson, "The Golden Sun in Splendor Likest Heaven," as well as Martin, *Ruins of Allegory*, who writes that the preference in *Paradise Lost* for the Copernican model "is clearly in harmony with Milton's characteristic preference for Kepler's 'dancing stars' rather than Ptolemy's static spheres" (101-02).

22. Galileo Galilei, *Dialogue Concerning the Two Chief World Systems*, trans. Stillman Drake (New York: The Modern Library, 2001), 76-77.

23. Several critics have argued for Galileo's positive role in the text. See in this vein Walker, "Milton and Galileo;" Brady, "Galileo in Action;" and Fletcher, *Time, Space, and Motion in the Age of Shakespeare*. Others, however, regard Galileo's place in the text as far more vexed. See in this vein Friedman, "Galileo and the Art of Seeing;" Harris, "Galileo as Symbol;" and Ulreich, "Two Great World Systems."

24. Fish, *Surprised by Sin*, 28.

25. Fish, *Surprised by Sin*, 29. See also his brief discussion of this episode later in the text at pp. 246-47.

26. On the politics of Satan, see, for example, John Rogers, *The Matter of Revolution: Science, Poetry, and Politics in the Age of Milton* (Ithaca, NY: Cornell University Press, 1998), esp. 103-43; on the connection between Satan and Hobbes and Descartes, see Stephen Fallon, *Milton Among the Philosophers: Poetry and Materialism in Seventeenth Century England* (Ithaca, NY: Cornell University Press, 1991), esp. 194-222; on the connection between Satan and both industrialism and machinery, see Sawday, *Engines of the Imagination*, esp. 257-93; and on the connection between Satan and empiricism, see both Fish, *Surprised by Sin*, and Fried, "Milton and Empiricist Semiotics."

27. See note 20 above.

28. See especially in this context Schaffer and Shapin, *Leviathan and the Air Pump*.

29. See in particular his *Dialogus physicus de natura aeris*, which is the most significant text in his dispute with Boyle on experimentation and the nature of air. It is translated as an appendix to the first edition of Schaffer and Shapin, *Leviathan and the Air Pump*. See also their remarkable analysis of this text in Chapter 4, "The Trouble with Experiment: Hobbes Versus Boyle" (110-54).

30. See Francis Bacon, *Novum Organum*, trans. James Spedding et al. (London: Longman and Co., 1861), Book 1, Aphorisms 70 and 99 (among others).

31. See the *Oxford English Dictionary Online*, s. v. "luciferous, adj," esp. definition 2: "fig. Affording illumination or insight; luminous, illuminating. In 17th c. common in *luciferous experiment*, after Bacon's *lucifera experimenta*." Oxford University Press (Accessed April 11, 2019).

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32. In book 5, at line 760, Milton uses the proper name “Lucifer” immediately before Satan launches into his discourse to convince the angels to undertake his experiment.

33. Fried, “Milton and Empiricist Semiotics,” 130.

34. On these different notions of experience, see Dear, “Narratives, Anecdotes, and Experiments.” See also Peter Dear, *Revolutionizing the Sciences: European Knowledge and Its Ambitions, 1500-1700* (Princeton: Princeton University Press, 2009), esp. 1-9.

35. Dear, “Narratives, Anecdotes, and Experiments,” 139.

36. Quoted in Dear, “Narratives, Anecdotes, and Experiments,” 139.

37. See in this regard Dear, “Narratives, Anecdotes, and Experiments,” 140-41.

38. Fish, *Surprised by Sin*, 251.

39. Fried, “Milton and Empiricist Semiotics,” 124.

40. Fried, “Milton and Empiricist Semiotics,” 130.

41. Rogers, *The Matter of Revolution*, 123. For Rogers’ more general account of Satan’s reasoning and logical mishaps, see also 122-29.

42. Edwards, *Milton and the Natural World*, 18. Emphasis original. Indeed, Fish himself acknowledges that Satan formulates general rules from insufficient data, misusing—and not simply embodying—empirical methods of inductive reasoning. See Fish, *Surprised by Sin*, 250.

43. Thomas Edison reportedly claimed, for instance, “None of my inventions came by accident. I see a worthwhile need to be met and I make trial after trial until it comes. What it boils down to is one percent inspiration and ninety-nine percent perspiration.” Quoted in James D. Newton, *Uncommon Friends: Life with Thomas Edison, Henry Ford, Harvey Firestone, Alexis Carrel, and Charles Lindbergh* (New York: Harcourt, 1987), 24.

44. Fried, “Milton and Empiricist Semiotics,” 131.

45. Francis Bacon, *The Natural and Experimental History for the Foundation of Philosophy: Or the Phenomena of the Universe*, in *The Works of Francis Bacon*, ed. and trans. James Spedding *et al.* (London: Longman and Co., 1861-79), vol. 5, 132.

46. C. S. Lewis, *A Preface to Paradise Lost* (Oxford: Oxford University Press, 1942), 98.

47. Lewis, *A Preface to Paradise Lost*, 98.

48. Rogers, *The Matter of Revolution*, 123.

49. On the fallen angel’s use of Cartesian dualism, for example, see Fallon, *Milton Among the Philosophers*, esp. 203-06.

50. Stanley Fish, *Surprised by Sin* (Cambridge, MA: Harvard University Press, 1997), xxxi.

51. Fried, “Milton and Empiricist Semiotics,” 130.

52. David Hume, *An Enquiry Concerning Human Understanding*, ed. Eric Steinberg (Indianapolis, IN: Hackett, 1993), 43.

53. Hume, *Enquiry*, 50.

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