

No "Idle Fancy:" The Imagination's Work in Poetry and Natural Philosophy from

Sidney to Sprat

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Dissertation submitted in partial fulfillment of  
the requirements for the degree of Doctor  
of Philosophy in the Department of  
English in the Graduate School  
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2015

ABSTRACT

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## Abstract

When debating the structure of the cosmos, Raphael delivers to Adam perhaps Milton's most famous line: "be lowly wise." With the promise to "justify the ways of God to men," Milton does not limit man's knowledge to base matters, but reclaims the heights of "other worlds" for the poet. Over the course of the seventeenth century, the natural philosophers' material explanations of the natural order were slowly gaining authority over other sources of knowledge, the poets prime among them. My dissertation takes up the competing early modern claims to knowledge that Milton lays down for Adam. I argue that natural philosophy, what today we call "science," emerged as the dominant authority over knowledge by appropriating the poet's imagination.

The poet's imagination had long revealed the divine hand that marked nature—a task that, as Sidney put it, merited the poet a "peerlesse" rank among other professions. For Bacon, Galileo, and Royal Society fellows, the poetic imagination revealed material explanations of nature's order that other orthodox models and methods could not. For the first decades of the seventeenth century, the imagination aligned poetry and natural philosophy as complementary pursuits of knowledge: Sidney's poet was to imagine a "golden" world that revealed the divine order, the material cause of which Bacon's natural philosopher was to discover in nature. But as the Royal Society fellows countered the claim that they peddled fancies, they severed ties with the poet. In one ingenious rhetorical move, Royal Society fellows proclaimed themselves to have

perfected the poet's imaginative work, securing the imagination for natural philosophy while disavowing poetry as the product of an idle fancy. Such rhetoric proved as powerful then as it does now. For Margaret Cavendish, the poet occupies the supplemental role that "recreate[s] the mind" once it grows tired of the "serious" natural philosophical studies. After the Restoration, then, the important role of the poetic imagination would go largely unrecognized even as it set itself to work in what would become the separate disciplines of literature and science.

## **Dedication**

To those who keep my feet grounded and my eyes on the horizon,  
Kamran Ahmed, Ken Cowan, and Kaila Brown.

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## Acknowledgements

First and foremost, I am indebted to my team of committed and brilliant advisors. Maureen Quilligan brought life to old materials and taught me how to see the best in all things, not the least this dissertation. Charlotte Sussman provided an exemplary model of kindness and grace under pressure. Her guidance has eased the many challenges that have transpired over the last six years. When confronted with dense philosophical material, Andrew Janiak rendered complex ideas accessible, lucid, and exciting. His enthusiasm for natural philosophy continues to affirm my own.

Special thanks to Leonard Tennenhouse, who kept me afloat with his keen wit, pragmatic advice, and more than a little of his patience. His tireless dedication to this project and my academic development has made a world of difference. I could not have imagined a better dissertation director and I have been made all the stronger for his stellar advising.

I am also grateful to Clinton Smith, Leslie Thomson, Colin Hill, Mari Ruti, Alexandra Gillespie, Tyler Tokaryk, and, especially, Igor Djordjevic for building the confidence I needed to start this journey in the first place.

This dissertation has received generous support from the Social Science and Humanities Research Council of Canada and the Myra and William Waldo Boone Fellowship. I am also grateful for the helpful feedback from the editors at *Studies in*

*Philology*; their comments added strength and scope to many of my arguments and ideas.

Finally, I would like to acknowledge my beloved family and friends. Many heartfelt thanks are in order to: Linda and Royce, who have both provided sustenance, support, and love; to my grandfather, whose enthusiasm for life lifts me to new heights; to the Pawlowskis, who have cared for me; to Clare Callahan, George Vahamikos, and Whitney Trettien, who have all been instrumental in my growth as an academic and as a person; to Kamran Ahmed, who has been a pillar of support, a brilliant source of inspiration, and the truest companion; to Theia, whose stoic, yet sweet, disposition offers me endless comfort; and to Cameron Christou, who knows how to put a smile on my face, whatever the circumstance.

## Introduction

“The cosmos is all that is, or ever was, or ever will be. Our contemplation of the cosmos stirs us .... We know we are approaching the grandest of mysteries.” In these opening lines to the popular 1980s television show *Cosmos: A Personal Voyage* (lines repeated in the hugely successful 2014 reboot, no less), Carl Sagan waxes poetic about the world revealed to us by science. Scientists often make recourse to the language of poets to defend science, arguing that science can uncover nature’s most hidden wonders. For the last twenty years, Richard Dawkins has gone to great lengths to champion this line of scientific rhetoric. His *Unweaving the Rainbow: Science, Delusion, and the Appetite for Wonder* (1998) is a riposte against the claim that science denudes the world of meaning beyond its material substrates.<sup>1</sup> Far from a means to disenchant the world or, as Keat’s put it, “unweave a rainbow,”<sup>2</sup> Dawkins argues that science whets the “imagination” (16), drives us to seek new knowledge of nature, and ultimately reveals a wondrous world worthy of awe. “The feeling of awed wonder that science can give us,” he writes, “is one of the highest experiences of which the human psyche is capable. It is a deep aesthetic passion to rank with the finest that music and poetry can deliver” (x).

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<sup>1</sup> Richard Dawkins, *Unweaving the Rainbow: Science, Delusion, and the Appetite for Wonder* (New York: First Mariner Books, 1998). Hereafter cited parenthetically by page number(s).

<sup>2</sup> John Keats, “Lamia,” in *John Keats Selected Poems*, ed. John Barnard (London: Penguin Books, 2007), line 237.

Dawkins advocates a closer relationship between the poets, whom he considers the traditional source of wonder and enchantment, and scientists, whose understanding of the material world he thinks should merit aesthetic appreciation. Dawkins summarizes his vision for poets and scientists without sparing alliteration:

It is my thesis that poets could better use the inspiration provided by science and that at the same time scientists must reach out to the constituency that I am identifying with, for lack of a better word, poets. It is not, of course, that science should be declaimed in verse. Simple, sober clarity will do nicely, letting the facts and the ideas speak for themselves. The poetry is in the science. (17-18)

Dawkins' "thesis," however, is over three hundred years old.

In 1667, Thomas Sprat, a founding fellow of the Royal Society, made the same argument in an attempt to establish its natural philosophy, what today we would consider "science," as the dominant authority over knowledge of nature. Because modern science is widely acknowledged as the only reliable source for knowledge of the natural world, it is easy to forget that "science" once struggled to validate its practices in various circles of orthodox authority. Scholastics criticised Society fellows for deviating from the Aristotelian tenets and methods that directed natural philosophical studies for centuries upon centuries. The new science also faced staunch opposition from theologians. Galileo challenged the geocentric cosmos that was widely held to corroborate Scripture and argued that natural philosophical explanations of nature's workings should trump those offered by theological interpretations of the Bible. Galileo's famous debate with the church resulted in an inquisition and censure that

lasted until 1992, when Galileo was finally issued a pardon. Royal Society fellows, many of whom are considered founders of modern science, were laughed at by King Charles even after he granted them their Royal Charter in 1662<sup>3</sup>—a sense of humor shared by many poets who lambasted, parodied, and satirized the new science.

From the Latin *invenio*, “to come upon” or “to uncover,” a poet’s imaginative *inventio* was long trusted to discover knowledge of nature’s divine order; a task for which Philip Sidney proclaimed the poet “peerlesse” among other professions at the end of the sixteenth century. Over the course of the seventeenth century, however, the natural philosophers’ material explanations of the natural order were slowly gaining authority over other sources of knowledge, the poets prime among them. The Royal Society’s defense against the criticisms of poets, this dissertation shows, helped to bolster authority broadly against other sources of opposition. The rise of modern science, then, is inextricably linked to the fate of the poet.

Building on many of the natural philosophical reforms that Francis Bacon advocated decades earlier, the Royal Society defended their new natural philosophy in the *History of the Royal Society*. Sprat takes great pains to assuage poets that their profession would not come under threat from experimental philosophy, a branch of natural philosophy. He assures his reader that:

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<sup>3</sup> Samuel Pepys describes the laughter he and Charles II shared when they learned that Gresham College attempted to weigh air. (Samuel Pepys, “February 1, 1663/4” in *The Diary of Samuel Pepys*, ed. Henry B. Wheatley, Vol 3 [London: George Bell and Sons, 1897], 27.

I will make no scruple to acquit *experimental Philosophy*, from having any ill effects, on the usual *Arts*, whereby we are taught the Purity and Elegance of Languages. Whatever discoveries shall appear to us afresh, out of the hidden things of *Nature*, the same words, and the same ways of Expression will remain. Or if perhaps by this means, any change shall be made herein; it can only be for the better; by supplying mens Tongues, with very many new *things*, to be nam'd, and adorn'd, and describ'd in their discourse.<sup>4</sup>

Sprat argues that experimental philosophy will furnish poets with ample material for their poems, delineating the same relationship that Dawkins will advocate for poetry and science centuries later. For both Sprat and Dawkins, the poet is beholden to scientific discoveries for the growth of their art. And why not? Sprat contends that experimental philosophy pushes humankind toward the “highest pitch of *humane reason*” (110)— a sentiment repeated by Dawkins nearly to the letter when he proclaims that science offers “one of the highest experiences of which the human psyche is capable.” Sprat promises that “The Beautiful Bosom of *Nature* will be Expos'd to our view [through experimental philosophy]; we shall enter into its Garden, and taste of its Fruits, and Satisfy ourselves with *Plenty*” (327). Stripped of its Biblical associations, Dawkins frames science in a similarly florid fashion. Science’s great discoveries, they both argue, promote a vision of nature so wondrous that it could have been crafted by a poet. Far from antagonistic pursuits, poetry and experimental philosophy or science are thought to reveal the beauty and wondrousness of nature together.

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<sup>4</sup> Thomas Sprat, *The History of the Royal-Society for the Improving of Natural Knowledge* (London: Printed by T.R., 1667), 324. Hereafter cited parenthetically by page number(s).

But this particular commensurability involves a hierarchy between poetry and natural philosophy, one that I argue Sprat helps to establish during the Restoration. In the first half of the seventeenth century, “arts” and “sciences” were not distinct categories in the way they are today. Instead, the term “science” was aligned with many types and modes of labor and skilled craft, even including sewing, shoe-making, baking, and writing.<sup>5</sup> Indeed, Carla Mazzio explains that “science” and “arts” were often used “interchangeably,” referring to both the medieval quadrivium (arithmetic, geometry, astronomy and music) and trivium (rhetoric, grammar, and logic).<sup>6</sup> This broad understanding of a science is indebted to its Latin roots in *scientia* or “knowledge” — knowledge that could be attained through poetry and natural philosophy alike. The hierarchy between the Humanities and Sciences today is often erroneously mapped onto the early modern relationship between the arts and the sciences, obfuscating the shared work of the poet and natural philosophy that I aim to identify. The term “scientist,” for instance, only begins to occur in the nineteenth century.<sup>7</sup> Mazzio even goes so far to quip that “‘Science’ as a term has now accrued meanings and forms of cultural capital that would have made Shakespeare’s eyeballs start from their spheres.”<sup>8</sup>

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<sup>5</sup> Carla Mazzio, “Shakespeare and Science, c. 1600,” *South Central Review* 26, no.1&2 (Winter & Spring 2009): 1–23, at 2.

<sup>6</sup> Mazzio, “Shakespeare and Science,” 2.

<sup>7</sup> Mazzio, “Shakespeare and Science,” 1.

<sup>8</sup> Mazzio, “Shakespeare and Science,” 1.

Shakespeare might arguably have the same reaction to our current understanding of poetry. In the seventeenth century, the term “poetry” was applied to various forms of writing and oration, including drama, lyric, and other types of prose narrative. Poetry was not demarcated from other forms of writing or oration in the way it is today. Instead, a poet was a craftsman or craftswoman who called upon their imagination to craft language, regardless of the form the language took. And this craft was thought to discover the divine signatures that marked nature, revealing an ideal order. Shakespeare and his contemporaries also understood language differently from the way we conceive of it now. For early modern poets, language was a type of material that could be crafted for a variety of tangible effects. Rayna Kalas argues that “[n]ot only did Renaissance writers treat the word as thing, they also granted that temporal and worldly effects are wrought in and through language”.<sup>9</sup> “Because words and things were of this world,” Kalas continues, “the work of the imagination—the imagination itself being a worldly instrument of sensory perception—was comparable to any other artisanal skill.”<sup>10</sup> Literary scholars often use the connection between natural philosophy and poetry as early modern arts—arts that importantly attain *scientia*—to answer one of the fundamental questions that preoccupies the field: how and why did literature and science emerge as distinct, hierarchical disciplines?

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<sup>9</sup> Rayna Kalas, *Frame, Glass, Verse: The Technology of Poetic Invention in the English Renaissance* (Ithaca: Cornell University Press, 2007), xiii.

<sup>10</sup> Kalas, *Frame, Glass, Verse*, xvi.

Howard Marchitello identifies two main waves of literary scholarship on early modern “science.”<sup>11</sup> He argues that the first wave occurred between the 1930s and the 1980s and the second wave from the 1980s until today.<sup>12</sup> Marchitello summarizes these waves and their foundational assumptions, explaining that:

In its first wave, this criticism was especially devoted to the study of the ways in which early modern science influenced ... imaginative writing of the period. This understanding was itself underwritten by prevailing notions of science as both an autonomous and a privileged discourse ... that staked exclusive claims to truth. Recent work in the expanding fields of science studies over the past twenty years, however, has served to dislodge this scientific exceptionalism .... As a result, in second wave criticism of early modern science and literature, ... [these arts] are set in a creative dialectic with each other that denies priority and scientism and helps to offer a more powerful understanding of the dynamic between these two complexly related cultural practices.<sup>13</sup>

Largely inaugurated by the work of Marjorie Hope Nicolson, the first wave was interested in understanding how literary forms responded to (and challenged) the developments in natural philosophy, astronomy, chemistry, and other investigations of nature that we today blanket under “science.” Heavily influenced by the historians of science Steven Shapin and Simon Schaffer’s *Leviathan and the Air Pump* and Bruno Latour’s *We Have Never Been Modern*, the second wave began to focus on how the very categories of “science” and “literature” emerged in interconnected, if not mutually constitutive, ways. Some literary scholars, notably Denise Albanese, advocate a model

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<sup>11</sup> Howard Marchitello, “Science Studies and English Renaissance Literature,” *Literature Compass* 3, no. 3 (2006): 341–65.

<sup>12</sup> Marchitello, “Science Studies,” 334-345.

<sup>13</sup> Marchitello, “Science Studies,” 341.

where these arts emerged as modern, distinct disciplines through a binary opposition. Albanese contends that “the emergence of modern scientific ideology in the seventeenth century resulted in the positing of fiction, of literary representation, as its binary (and prospectively devalued) opposite.”<sup>14</sup> Rather than a binary model, Bruno Latour contends that the categories that produce modernity are supported by a set of “paradoxes.”<sup>15</sup> For Latour, the paradoxes that connect “Nature” and “Society” simultaneously produce a “separation” that divides these two categories. “Nature” can be said to lack our construction and be transcendent if we take “Society” as our own construction. At the same time “Nature” can also be said to be constructed in the laboratory if we take “Society” as transcendent and not constructed by human efforts (32). The paradoxes at the heart of the modern division between Nature and Science, he argues, allows us to “mobilize Nature, objectify the social...even while firmly maintaining that Nature escapes us, [and] that Society is our own work.” This dissertation suggests that a similar paradox lies at the root of the modern separation between “literature” and “science.” I argue that the separation between poetry and natural philosophy did not stem from a binary opposition but emerged through what these arts methodologically shared, the imagination. Because natural philosophy relied on the imaginative faculty that it disavowed in poetry, “No ‘Idle Fancy’” shows how the

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<sup>14</sup> Denise Albanese, *New Science, New World* (Durham: Duke University Press, 1996), 3.

<sup>15</sup> Bruno Latour, *We Have Never Been Modern*, trans. Catherine Porter (Cambridge: Harvard University Press, 1993), 32.

emergence of modern science was decidedly “unscientific.” To paraphrase Latour, then, perhaps we have never been “scientific.”

The modern narrative that distinguishes science as separate from, and largely impervious to, literature gains credence from the commonplace early modern denouncement of poetry as an “idle fancy.” But as I will show, all manner of early modern poets *and* natural philosophers defended their art from being cast as an idle fancy: Bacon lodged this criticism against some forms of poetic language, advocates of geocentrism used it to denounce Galileo and his supporters, and, as Thomas Sprat lamented, the Royal Society was under “the imputation of those very faults, which it endeavors to correct in the *Verbal*.”<sup>16</sup> The ubiquity of this accusation, I contend, attests to the imagination’s shared work in poetry and natural philosophy and unearths the common ground out of which both arts were redefined during the seventeenth century.

The poet’s imagination had long revealed the divine hand that marked nature. For Bacon, Galileo, and fellows of the newly chartered Royal Society, the poetic imagination revealed material explanations of nature’s order that other orthodox models and methods could not. For the first few decades of the seventeenth century, the imagination aligned poetry and natural philosophy as complementary pursuits of knowledge: Sidney’s poet was to imagine a “golden” world that revealed the divine order, the material cause of which Bacon’s natural philosopher was to discover in

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<sup>16</sup> Sprat, “*History of the Royal Society*,” 26.

nature. But as the Royal Society fellows countered the claim that they peddled fancies, they severed ties with the poet. In one ingenious rhetorical move, Royal Society fellows proclaimed themselves to have perfected the poet's imaginative work, securing the imagination for natural philosophy while disavowing poetry as the product of an idle fancy. Such rhetoric proved as powerful then as it does now. For the brazen Royal Society critic Margaret Cavendish, the poet occupies the supplemental role that "recreate[s] the mind" once it grows tired of the "serious" natural philosophical study of nature.<sup>17</sup> Beginning in the mid-seventeenth century, the important role of the poetic imagination would go largely unrecognized even as it set itself to work in what would become the separate disciplines of literature and science.

The first chapter looks to the debates over poetic language to explain how the imagination aligned poetry and natural philosophy as complementary arts in the pursuit of knowledge. As Sidney argues in his *Defense of Poesy* (1595), the poet crafts a "golden" world that discovers the hand of the divine, and in moving mankind to action, helps to stabilize the body politic. Bacon famously denounces ornate language (even as he calls it the "Idols of the Market") as "idle fancies" in the works that comprise his *Instauratio magna* (1620). But he nevertheless adapts poetry's golden world as the natural philosophical potential to "transmute" the natural world for utopian ends. Bacon

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<sup>17</sup> Margaret Cavendish, *The Blazing World and Other Writings*, ed. by Kate Lilley (England: Penguin Books, 2004), 124.

thought that this ability to “fundamentally alter” nature would contribute to the restoration, at least to a certain degree, of the Adamic sovereignty that was lost in the Fall—a grand instauration, indeed. Although they ply their trades in different domains, Bacon’s natural philosopher and Shakespeare’s Prospero both labor to restore a model of legitimate sovereignty. In Shakespeare’s *Tempest* (c. 1610), it is a matter of converting the power of stagecraft into the power of statecraft by revealing an ideal order, and in Bacon’s *Instauratio magna* it is a matter of how one discovers in nature the order that is to be presented by the poet. Poetry and natural philosophy worked together to discover the natural order and to set aright any political imbalance. Prospero’s ability to bring both fabled creatures and the natural elements under his sovereign rule dramatizes the complementary relationship between poetry and natural philosophy that Bacon codifies in his natural philosophical reforms.

The second chapter examines the complementarity between poetry and natural philosophy at work in the discovery of a new world in the moon. The debate over poetry as an “idle fancy” that is discussed in Chapter one was also at play in the debate over the structure of the cosmos. When Galileo first related his lunar discoveries, he and his supporters were accused of “hawking a fable” or of promoting “idle phancies.” I argue that this type of accusation was so often aimed at those we now consider the founders of modern science precisely because it denounced the work of the imagination that was central to their discoveries and methodologies. I show how Galileo’s *Sidereal*

*Messenger* (1610), John Wilkins' *Discovery of a World in the Moon* (1638), and Francis Godwin's *A Man in the Moone* (1638) each claim to have used the imagination to assess orthodox theories of the heavens and to discover new knowledge. Godwin's is a fanciful narrative where Galileo's and Wilkins' are serious works that report and extend astronomical discoveries, yet all three perform the same philosophical work: they each use *ingenium*, a mental skill or power that engages the imagination, to stake knowledge claims through the example of a world existing in the moon. *Ingenium* crafted similitudes that made the wonders of the heavens meaningful discoveries from which knowledge of the cosmos and the Earth could be obtained. In so doing, the imagination—often talked about in the language of “possibility”—helped to resolve how discoveries can be trusted when they are made through mechanical equipment, such as the telescope, and how these discoveries could be legitimated within the hermetic discipline of natural philosophy.

The third chapter returns to the debate over poetic language after mid-century to mark the decisive shift that separated the work of the poet from that of the natural philosopher. In *The History of the Royal Society* (1667), Thomas Sprat rejects the poet's “swellings of style” for a “close, naked, natural way of speaking.” But if elevated language was indeed deleterious to experimental philosophy, why do so many Royal Society members consistently use tropes and figures, the very practice Sprat denigrates? The rejection of elevated language, rather than a form of hypocrisy, was a constitutive

part of the redefined conceptions of “nature” and “art” intended to ground and defend experimental philosophy as a burgeoning means of attaining knowledge of nature. As the Royal Society seized on the poetic imagination as their own for the reasons addressed in Chapter two, they could then bolster the primacy of experimental philosophy by disavowing poetry as an idle play with language. In the process of claiming proprietorship over the imagination, the notions of “nature” and “art” with which the debate over language was waged were also changing. “Nature” came more exclusively to mean the material world for both poets and experimental philosophers while the conceptualization of the “arts” capable of discovering knowledge of nature came to diverge. I register these concomitant changes in poetry in Dryden’s *Essay of Dramatick Poesie* (1668) and his Restoration adaptation of Shakespeare’s *Tempest*, *The Tempest: or The Enchanted Island* (1670). When reimagined by Dryden, Prospero no longer exerts his sovereign control over the domains of the poet and the natural philosopher. Instead, the Restoration Prospero clings to his power in clumsy attempts at enchantment, dramatizing the disparity between the work of the poet and the natural, now experimental, philosopher.

The final chapter addresses how poets during the Restoration take up the imagination’s role in poetry and natural philosophy as these arts were becoming less commensurable under the Royal Society’s influence. Samuel Butler, Margaret Cavendish, and John Milton all criticize the Royal Society’s appropriation of the

imagination, rejecting Sprat's claim that experimental philosophy bested the poet at his or her own work. When used by the natural philosopher, these poets contend that the imagination produced the very chimerical images that the Royal Society fellows spurned. For Butler, Cavendish, and Milton, the new natural or experimental philosophers were little more than failed poets. The utopianism and *imitatio Adami* that were central features of the complementarity between poetry and natural philosophy discussed in earlier chapters persist in the poetic works of Cavendish and Milton. But these features have become the poets' lines of attack on the emerging experimental philosophy. Cavendish and Milton both labor to reclaim the poet's traditional role in the discovery of knowledge of nature. Milton's discussion of Galileo and heliocentrism reasserts the poet's epistemological work, staking a claim on the model of the cosmos. While Raphael warns the natural philosopher to remain "lowly wise," the poet is set to soar to the heights of discovery, deepening the disparity between these once compatible arts.

When a scientist waxes poetic about science, she or he perpetuates a rhetoric that originates in the seventeenth century. Over the course of four chapters, I will show why the natural philosophical appropriation of the poetic imagination established a divide between literature and science that only seems to become more entrenched when attempts are made to bridge the gap. For unbeknownst to Dawkins, the idea that the "poetry is in the science" summarizes the rhetorical move by which Sprat established

experimental philosophy as the primary authority over knowledge of nature.<sup>18</sup> When Dawkins suggests that the poetry of science makes it an apt partner for the poet proper, he thus reifies a connection to poetry that simultaneously excludes the poet from any scientific role. In a Latourian sense, Dawkins's recourse to Sprat's rhetoric only repeats the paradox out of which the distinction between "literature" and "science" first emerged: science relies on the poet's imagination to discover knowledge of nature, but only if the poet's imagination no longer produces that knowledge through poetry. If we are to engage literature and science on more equal terms, then, we will need at the very least to adopt a new line of rhetoric.

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<sup>18</sup> Dawkins does not cite or mention Sprat anywhere in *Unweaving the Rainbow*.

# 1. On Common Grounds: Bacon's Poetry and Shakespeare's Natural Philosophy

"Poesy," Francis Bacon argues, "[is] to be accounted rather as a pleasure or play of wit than a science."<sup>1</sup> Remarks like this have led scholars to assume that in the early seventeenth century, poetry was marginalized as an idle fancy and that natural philosophy was the medium for knowledge, technological advancement, and even modernity. In the early decades of the seventeenth century, however, poetry was broadly understood as an art that can attain *scientia*, the Latin term for "knowledge." This is also a conception of poetry to which Bacon adheres elsewhere in his works. One reason why scholars have perceived an opposition between poetry and natural philosophy in the early seventeenth century is because Bacon furthered the debate over poetic and rhetorical language. In the decades prior to Bacon's call for language reform, the merits and dangers of poetry were hotly debated even among poets themselves. The debate waged over poetry in the late sixteenth and early seventeenth centuries did not primarily attack poetic language, but more crucially aimed to address the imagination's

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<sup>1</sup> Francis Bacon, *Of the Dignity and the Advancement of Learning*, in *The Works of Francis Bacon*, ed. James Spedding, Robert Leslie Ellis, and Douglas Denon Heath, 14 vol. (London: Longmans & Co., 1857–1874), 9:62. The recent *Oxford Francis Bacon* editions of Bacon's works are used in this paper when possible. The *Works* are used when Bacon's texts have not yet been published in the *Oxford* volumes and when they are more relevant to the aims of this paper. Hereafter the *Oxford Francis Bacon* is abbreviated as *O* and the *Works* as *W*, cited parenthetically by volume and page number(s). Since some volumes contain more than one of Bacon's texts, those used in this paper are here listed for the convenience of the reader: *Oxford Francis Bacon*, 11: *Instauratio magna* Preliminaries, 2–25; *Novum organum*, 48–447; and 4: *The Advancement of Knowledge*. *Works*, 8: *The Great Instauration* Preliminaries, 15–54; *The New Organon*, 59–305; *Of the Dignity and Advancement of Learning*, Books II–III, 385–520; and 9: *Of the Dignity and Advancement of Learning* Books IV–IX, 13–357.

impact on the body politic and its role in the arts that could attain *scientia*, poetry and natural philosophy most especially. Bacon did not consider these arts opposed to one another, nor did he consider the poet's imagination to be opposed to the work of the natural philosopher. Rather, the poet and natural philosopher perform the same political work, but in different ways. Poetry makes an imaginary world that displays the lineaments of an ideal order. Natural philosophy makes visible the causes of that order in the natural world. And together, poetry and natural philosophy make intelligible the divine order and man's place within it. In focusing on the shared goal that underlies poetry and natural philosophy as arts that can attain *scientia*, I argue that the work of the poet and that of the natural philosopher were understood to be complementary.

Reading the natural philosophical works of Bacon, often touted as a father of modern science, alongside a dramatic work by Shakespeare, arguably the most celebrated English writer, illuminates both the complementary relationship between poetry and natural philosophy, and the shared cultural understanding that made this complementarity possible in the early seventeenth century.

Although they plied their trades in different domains, Bacon's natural philosopher and Shakespeare's Prospero both labor to restore a model of legitimate sovereignty. For Shakespeare's *Tempest* (c. 1610), it is a matter of converting the power of stagecraft into the power of statecraft by revealing an ideal order, and for Bacon's natural philosopher it is a matter of how one discovers in nature the order that is to be

presented by the poet. The knowledge produced by the labor of the poet and the natural philosopher serve common ends in the political order. Bacon argues that the reform of “all human learning” (*O*, 11:3), especially poetry and natural philosophy, can restore, at least to some degree, the Adamic sovereignty that was lost as a consequence of the Fall. To that end, Bacon makes a place for the imagination in his natural philosophy, adapting poetry’s perfected image of nature as the potential of natural philosophy to radically “transmute” the natural world (*W*, 8:410). Without the ability to “fundamentally alter nature” (*W*, 8:410) for the benefit of man’s knowledge and art—that is, without the exercise of the imagination and the transformative power of poetry—Bacon’s natural philosophy would be rendered fruitless. Bacon’s natural philosophical reform, then, emerges not in opposition to poetry, but by adopting the imaginative function that made poetry such a vital means to discover knowledge.

While today we would consider Bacon’s and Shakespeare’s works entirely distinct from each other, many of Bacon’s concerns are shared by Shakespeare. Shakespeare’s *Tempest* addresses the power and limits of poetic art alongside the role of art in natural philosophy. As a ruler whose art can be said to both fabricate spectacles and produce natural phenomena, Shakespeare’s Prospero dramatizes sovereignty over the imagination, a domain he shares with the poet, and over nature, a domain he shares with the natural philosopher. In *The Tempest*, the world of the imagination and the natural world are largely indistinguishable, thanks to Prospero’s art, and this enables

him to restore his dukedom from his usurper. Although he is neither a poet nor a natural philosopher proper, Prospero dramatizes the political ends to which both vocations worked and, in the process, illuminates the complementarity between poetic and natural philosophical art. While I do not claim any causal influence between Bacon and Shakespeare, I do suggest that they share a cultural understanding such that Bacon can codify or make explicit the underlying assumption that allows Prospero to regain his dukedom.

In the early seventeenth century, Bacon announced that it was imperative to “undertake a wholesale Instauration of the sciences, arts and all human learning, raised on proper foundations” (*O*, 11:3). And much of this reform would target language and its role in the arts that could arrive at *scientia*. In Bacon and Shakespeare’s day, poetry and natural philosophy were both considered an *ars*, an art, that could attain *scientia*, making them prime candidates for Bacon’s reforms. While *scientia* generally signified teleological knowledge, what constituted *scientia* varied among thinkers. For Bacon, natural philosophy arrived at *scientia* if it produced demonstrative knowledge of nature’s causes. Although poetry could not produce demonstrative knowledge for Bacon, it nevertheless attained knowledge. Bacon reduces human learning into three categories, including “poesy” as “one of the principall Portions” (*O*, 4:73). For Bacon and his contemporaries, God’s creation and God Himself is inextricable from the Word or Logos, intimately tying language with the discovery of the divine: “In the beginning was

the Word, and the Word was with God, and the Word was God.” (John 1:1). Knowledge of God’s creations was also revealed through language. In naming Eden’s creatures, innocent Adam distinguished one from another according to their essences, revealing the divine order of nature through language. Because of his labors to name all the creatures in Eden, Adam was taken up by seventeenth-century natural and experimental philosophers as their model.<sup>2</sup> This *imitatio Adami* helped them to defend their work against criticisms that their pursuit of knowledge reached too high. Language had the power to make worlds and reveal the divine hand that ordered them. As S.K. Heninger Jr. argues, “the system of language was perfectly analogous to the system of creation: each word was predetermined by something God had created, and Adam’s task was merely to render explicit for mortal comprehension what God had intended.”<sup>3</sup> The natural philosopher and the poet were one in this understanding of Adam.

Akin to Adam, the poet made God’s imprints visible to an earthly audience. Called *inventio*, the poet and rhetorician would discover a subject matter germane to the topic and to the desired effect of the poem or rhetorical tract — that is, they “invented” what would be discussed. And what the poet, and the rhetorician in particular, invented was intended to compel an audience to act in a particular way; their invention was

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<sup>2</sup> Joanna Picciotto, *Labors of Innocence in Early Modern England* (Cambridge: Harvard University Press, 2010), 3. See also Picciotto, *Labors of Innocence*, Chapter 2, “A Union of Hands and Eyes: The Royal Society of London for the Improving of Natural Knowledge.”

<sup>3</sup> S.K. Heninger, Jr., *Sidney and Spenser: The Poet as Maker* (University Park: Pennsylvania State University Press, 1989), 118.

persuasive.<sup>4</sup> Unlike the modern usage of the term “invention,” the poet’s invention also revealed or dis-covered things already present in the world, though otherwise hidden from view. From the Latin verb *invenio*, “to come upon,” a poet’s and rhetorician’s invention importantly discovered the divine signatures that marked nature and brought them to light. As Jonathan Sawday puts it, invention “expressed a sense of rediscovering what had been hidden by God from mankind after the Fall.”<sup>5</sup> In discovering the divine signatures that marked the natural world, poetry was understood as a means to gain knowledge of God’s handiwork and His ideal order; poetry was an art that could attain teleological knowledge. George Puttenham attests to the knowledge poetic art discovers, arguing that there “cannot be ... any scorn or indignity [that] should justly be offered to so noble, profitable, ancient, and divine a science as poesy is.”<sup>6</sup> Sir Philip Sidney similarly declares that “of all Sciences . . . is our Poet the Monarch.”<sup>7</sup> As we shall see, although many thinkers vied for the primacy of either poetry or natural philosophy, both were complementary arts in the discovery of knowledge.

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<sup>4</sup> Markku Peltonen emphasizes the persuasive function of rhetoric, arguing that “the aim [of rhetoric] was not to find out the truth or to reach consensus but to persuade the audience and to clinch the victory in the war of words” (*Rhetoric, Politics and Popularity in Pre-Revolutionary England* [New York: Cambridge University Press, 2013], 9).

<sup>5</sup> Jonathan Sawday, *Engines of the Imagination: Renaissance Culture and the Rise of the Machine* (London and New York: Routledge, 2007), 174.

<sup>6</sup> George Puttenham, *The Art of English Poesy: A Critical Edition*, ed. Frank Whigham and Wayne Rebhorn (Ithaca: Cornell University Press, 2007), 99. Hereafter cited parenthetically as *A* with page number(s).

<sup>7</sup> Sir Philip Sidney, *Defence of Poesie, Astrophil and Stella and Other Writings*, ed. Elizabeth Porges Watson (London: Everyman Paperbacks, 1997), 101. Hereafter cited parenthetically as *D* with page number(s).

Poetry, of course, was not specific to language that fit a certain meter or rhyme scheme. Instead, “poetry” can be more broadly understood as a fabrication of fiction in language. Bacon defines “poesy” as “nothing else than feigned history or fables; for verse is but a character of style, and belongs to the arts of speech” (*W*, 8:407).<sup>8</sup> Sidney similarly explains that “it is not riming and versing that maketh a Poet. . . . But it is that fayning notable images of vertues, vices, or what else, with that delightfull teaching, which must be the right describing note to know a Poet by” (*D*, 91). Even after mid-century, a poet’s art was not strictly defined by its versification or its form. John Dryden considers a dramatist a poet, a synonym he references in the title of his 1668 *Essay of Dramatick Poesie*. And it is in this broader sense of one who fabricates imagined worlds in language that the term “poet” is here used.<sup>9</sup>

Rather than being defined by rhyme scheme or meter, the poet was defined as a “maker.” Attributed to Puttenham and published in 1589, *The Art of English Poesy* opens by adopting the “Greek” understanding that a “poet is as much to say as a maker” (*A*, 93).<sup>10</sup> Sidney reiterates the idea that the poet is a maker for “wee Englishmen have mette

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<sup>8</sup> Heninger, Jr. explains that “poesy” is a derivative of the Latin *poesis* and that “poetry” derives from the Latin form, *poetria*. Heninger suggests that while there is little agreement on the distinction between poesy and poetry during the Renaissance, he notes that after the sixteenth century, “poetry” subsumes the terms “poem” and “poesy” (514 – 515n5).

<sup>9</sup> Ben Jonson also shares this broader definition of poetry, arguing that a poet is “not hee which writeth in measure only; but that fayneth and formeth a fable, and writes things like the Truth” (*Timber: or, Discoveries, Ben Johnson*, eds. C.H. Herford and Percy and Evelyn Simpson, 11 vols. [Oxford: Clarendon, 1925-1952], 8:635).

<sup>10</sup> Although *The Art of English Poesy* was published anonymously, Whigham and Rebhorn argue that George Puttenham was most likely its author (18-23).

with the *Greekes* in calling him a Maker" (*D*, 87). While we might today call an eloquent speaker or writer a "wordsmith," this designation does not capture the materiality of language and the craftsmanship encapsulated by Renaissance poets and rhetoricians. Language in the Renaissance possessed a materiality that is largely unacknowledged today.<sup>11</sup> English poets often identified themselves as "makers" who labored with words and whose words moved an audience to labor.<sup>12</sup> The idea of a poet as a "maker" "captures something fundamental about the Renaissance apprehension of writing," explain Margaret Healy and Thomas Healy, because it emphasizes the poet as a "wordsmith," an "employer of language who is also, literally, a manufacturer of language."<sup>13</sup> Renaissance poetry was a form of *techne* or *poiesis*:<sup>14</sup> a skilled and creative

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<sup>11</sup> Margaret Healy and Thomas Healy argue that our current conception of writing, one influenced by Romanticism, accustoms us to conceiving writers as "authors," a term that largely lacks the materiality and craftsmanship that was so central to Renaissance writers. If we are to understand what it meant to write in the Renaissance, they stress, scholarship must emphasize the notion of manufacturing that pervades the poet's self-designation as a "maker" (*Renaissance Transformations: The Making of English Writing 1500-1650*, 2009: 4).

<sup>12</sup> Sawday points out that "one of the most frequently cited classical legends in defence of poetry was that of the construction of Thebes by the power of poetic harmony," linking the poet's linguistic material with the building materials of artisans and architects (175). Poetry's constructive power built not only architectural structures, but also the societies they housed. Puttenham proclaims poets the source of "ciuil society" (3): "[f]or it is written, that Poesie was th'originall cause and occasion of their first assemblies, when before the people remained in the woods and mountains, vagarant and dispersed like the wild beasts, lawlesse and naked, or verie ill clad" (3-4). Even John Locke intimated that societies were made possible by man's communication through language: "[t]he comfort and advantage of society not being to be had without communication of thoughts, it was necessary that man should find out some external sensible signs, whereof those invisible ideas, which his thoughts are made up of, might be made known to others" (*Essay Concerning Human Understanding* [Oxford: Oxford University Press, 1979], 404-405).

<sup>13</sup> Healy and Healy, *Renaissance Transformations*, 4.

<sup>14</sup> Martin Heidegger explains that "there was once a time when it was not technology alone that bore the name of *techne* [...]. when the bringing forth of the true into the beautiful was also called *techne*" such that "the *poiesis* of the fine arts was also called *techne*" ("The Question Concerning Technology" in *The Question Concerning Technology and Other Essays*, trans. William Lovitt [New York: Harper and Row, 1977], 34 also

craft.<sup>15</sup> Sixteenth-century language was considered sensible material; words were matter to be sensed by the eyes, as an inked mark on a page, or by the ears, as the textured sounds and intonations of an oration. Rhetoric books and poetry manuals detailed strategies to craft the sensible material of language in a myriad of ways and for a myriad of effects: tropes and figures worked to produce a desired result in an audience. The appropriate crafting of this sensible material produced certain effects in its audiences that in turn moved them to tangible actions in the world; poetry and rhetoric produced persuasion. Erasmus's 1512 *De Utraque Verborum ac Rerum Copia*, for example, shows its reader how to craft eloquence, including 150 variations for articulating "I was pleased to receive your letter," and Puttenham identifies over a hundred figures and tropes in his *Art of English Poesy*. The sounds and marks of language, for example, could be elongated (*copia*), or made succinct (*expeditio*, Puttenham's "Speedy Dispatcher," [A, 318]), or move an audience's mind from a word's literal signification to a figural one (*metaphor*, Puttenham's "Figure of Transport," [A, 262-3]). Margaret de Grazia explains that "[i]n the domain of rhetoric, whose purpose was persuasion ..., a word was permitted to

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qtd. in Rayna Kalas, *Frame, Glass, Verse: The Technology of Poetic Invention in the English Renaissance* [Ithaca: Cornell University Press, 2007]: xiii). Rayna Kalas argues that because the term "art" had not been "inflected by modern aesthetics" in the Renaissance as it is today, the current opposition between art and technology was not drawn in the sixteenth century (1). Rather than consider Renaissance poetry as a "concept that reflects reality by observing the mimetic conventions of pictorial representation," Kalas motions for a reassessment of Renaissance language and poetry that "tak[es] into account the techne of poesy" so as to "recognize poetic language as an instrument of figuration that partakes of worldly reality" (1).

<sup>15</sup> Rayna Kalas, *Frame, Glass, Verse*, xi; Sawday, *Engines of the Imagination*, 1.

retain its materiality, for it was the source of this power.”<sup>16</sup> The poet was a “maker” who discovered the divine signatures that marked nature and crafted a perfected vision of the world.

The fabulous images of poetry displayed a vision of nature that no other profession could. Bacon suggests that poetry “exceeds the measure of nature, joining at pleasure things which in nature would never have come together . . . [or] never have come to pass” (*W*, 8:407–8). Because “History” must recount the past as it was observed (or at least believed to have been observed by others), Bacon explains that history is “not so agreeable to the merits of Vertue and Vice, therefore *Poesie* faines them more iust in Retribution, and more according to Reuealed Prouidence” (*O*, 4:73). Poetry best instructs mankind about virtues and vices as it “serueth and conferreth to Magnanimitie, Moralitye, and to Delectation” (*O*, 4:73)—a sentiment that Sidney shares when he exalts the poet above all other professions.<sup>17</sup> “Onely the Poet,” Sidney explains, can “mak[e] things either better then Nature bringeth forth . . . [or] formes such as never were in nature” (*D*, 88).<sup>18</sup> Unlike the historian or natural philosopher (among other professions), the poet is free to engage the imagination in its multiple combinations and permutations of experience. And in so doing, Sidney argues that poetry surpasses nature in its

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<sup>16</sup> Margaret de Grazia, “Words as Things,” *Shakespeare Studies* 28 (2000): 234.

<sup>17</sup> See Daniel Fusch “The Spirited Mind: The Ethics and Epistemology of Early Modern Wonder,” *Mediterranean Studies* 17 (2008): 194.

<sup>18</sup> The Porges Watson edition uses the word “intention” where other editions of the *Defence* use “invention.” “Invention” is here used because it emphasizes the *inventio* involved in crafting a poem. See Sir Philip Sidney, *Defense of Poesy*, ed. Lewis Soens (University of Nebraska Press, Lincoln 1970), 9.

richness, for “*Nature* never set forth the earth in so rich tapistry as divers Poets have done,” (*D*, 88). For Sidney, the poet importantly transmutes the “brasen” material world into a perfected, “golden” one (*D*, 88). Unbound by experience, Bacon similarly explains that poetry “show[s] that there is agreeable to the spirit of man a more ample greatness, a more perfect order, and a more beautiful variety than it can anywhere (since the Fall) find in nature” (*W*, 8:440). Poetry perfected nature’s order, allowing man to see a utopian vision of the world where moral values were clearer and easier to approximate.

Poetry could not produce a perfected image of the world nor call the mind to virtuous action without the imagination. In the Middle Ages and the Renaissance, the mind was thought to be composed of three faculties: the imagination (*phantasia*), reason (*cogitatio*), and memory (*memoria*). If one was in good health, all three faculties worked together harmoniously, the imagination drew upon the contents of memory and relayed sense experience to be judged by reason. Furnished by the senses, the imagination fabricated a vast multitude of images. Much like Puttenham and Sidney, Bacon argued of the imagination that “beeing not tyed to the Lawes of Matter; may at pleasure ioyne that which Nature hath seuered: & seuer that which Nature hath ioyned, and so make vnlawfull Matches & diuorses of things” by manipulating experience or the content of the memory (*O*, 4:73).<sup>19</sup> For Bacon, the imagination was also the messenger that

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<sup>19</sup> For more on Bacon and the imagination, see Karl R. Wallace, *Francis Bacon on the Nature of Man* (Urbana: University of Illinois Press, 1967); Lisa Jardine, *Francis Bacon: Discovery and the Art of Discourse* (Cambridge: Cambridge University Press, 1974); Paolo Rossi, *Francis Bacon: From Magic to Science*, trans. Sacha

connected the “VNDERSTANDING and REASON” to “WILL, APPETITE,& AFFECTION” (O, 4:105-6). As a “common instrument” to reason and will (W, 9:61), the imagination was foundational to all mankind’s thought and action, and could not be avoided. The poet’s art in particular affected the imagination, for his words invited his audience to imagine the fabulous world he crafts. In an often quoted passage, Bacon explains that “*Ianus of Imagination hath differing faces; for the face towards Reason, hath the print of Truth. But the face towards Action, hath the print of Good; which neuerthelesse are faces, Quales decet esse sororum.*” (O, 4:106). The imagination looks toward reason to furnish it with images and to the will to elicit action, aligning “Truth” with the “Good.” The imagination’s “vnlawfull Matches & diuorses of things” furnished poetry with images of a beautiful world that could not be otherwise found in nature, and these perfected images could instruct the mind in moral actions.

But the imagination could also create monstrous images that led the mind astray. Ruth E. Harvey argues that Edmund Spenser ascribed to a traditional account of the mental faculties, or inward wits, when he describes Phantastes, one of Alma’s

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Rabinovitch (Chicago: Univ. Chicago Press, 1968); and Katharine Park, “Bacon’s Enchanted Glass,” *Isis* 75, no. 2 (1984): 293–297.

counsellors in his 1590 *Faerie Queene*.<sup>20</sup> Phantastes “had a sharpe foresight, and working wit” and his:

chamber was dispaigned all within,  
With sundry colours, in the which were writ  
Infinite shapes of things dispersed thin;  
Some such as in the world were neuer yit  
.....  
And all the chamber filled was with flyes,  
Which buzzed all about, and made such sound,  
That they encombred all mens eares and eyes,  
.....  
And [contained] all that fained is, as leasings, tales, and lies.<sup>21</sup>

Phantastes’s chambers exemplify the merits, dangers, and province of *phantasia* or the imagination. The imagination produced new and unique images by divorcing, combining and manipulating the experience of the world and nature. “Infinite shapes of things” could be contrived given the near limitless manipulations of nature possible with the imagination.<sup>22</sup> This multitude of unique permutations of nature and its experience could also overwhelm the other faculties and cloud “mens eares and eyes.” The imagination’s ability to manipulate images of nature also made possible “all that is fained:” the imagination received experience from nature, but its capacity to manipulate this experience divided *phantasia* from the world and gave it free rein to produce images

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<sup>20</sup> Ruth E. Harvey, *The Inward Wits: Psychological Theory in the Middle Ages to the Renaissance* (London: Warburg Institute at the University of London, 1975), 2.

<sup>21</sup> Edmund Spenser, *The Faerie Queene*, ed Thomas P. Roche, Jr and C. Patrick O’Donnell, Jr. (London: Penguin Books), II.ix, 50-51.

<sup>22</sup> Bacon, however, reminds his readers that the imagination was limited by sense experience, for it could not manipulate images of that which had not been experienced in the first place.

that exceeded nature itself. Indeed, the imagination combines (and thereby distorts) the image of man and the image of the horse to produce “Centaurs”<sup>23</sup>—a creature composed of two things that occur in nature, but never in that particular combination. If the imagination functioned in a healthy manner, Puttenham proclaims that this “phantasticall part of man (if it be not disordered) a representer of the best, most comely and bewtifull images or apparances of thinges to the soule and according to their very truth” (A, 15). “[W]ithout any subject of veritie” (A, 2) or accurate correspondence to what was experienced of nature, Puttenham suggests that the feigned and fabulous images produced by the imagination could convey a profound “truth” of nature to man’s “soule” (A,15). But because the imagination was not encumbered by what could actually be expected to occur in nature, it could also “breede Chimeres & monsters” (Puttenham A, 15), seduce man into a fabulous world cleft from nature, and consume “his ordinarie actions and life” (Puttenham A,15)—an apprehension shared by Stephen Gosson, Sidney and Bacon alike.

Many of the criticisms waged at poetic language stemmed from concerns over the use of the imagination. From Gosson, to Puttenham, to Sidney, and to Bacon, poetry was intimately linked to the imagination: it was the faculty that supplied poetry with the images expressed through language and the faculty impassioned by poetic language in turn. Poetic language had the potential to enflame the imagination over the reason and

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<sup>23</sup> Spenser, *Faerie Queene*, II. ix.49.

render man idle, grinding to a halt the harmonious functioning of the body politic and for Bacon, the march toward the utopian ends of his program. For this reason, I read this late sixteenth and early seventeenth century debate not as a contention over poetic language, but rather as a way to articulate an appropriate domain for the imagination: should the imagination be circumscribed by the limits of nature or should it be given free rein to manipulate nature's image beyond what could actually be found in nature? Both detractors and advocates of poetic language adduced support for their respective positions by identifying the epistemological value of the imagination for the attainment of knowledge. Katharine Park, Lorraine Daston, and Peter Galison argue that the imagination's importance was emphasized by some during the Renaissance, but fell into disrepute by the end of the seventeenth century:

Literary historians have long recognized the preeminence of the faculty of the imagination during the Renaissance, when it was rehabilitated from its subordinate and somewhat suspect status in scholastic logic and psychology. ... By the end of the seventeenth century, however, the faculty of the imagination was once more in decline in literary criticism, psychology, and natural philosophy, and its legitimate domain was narrowly circumscribed.<sup>24</sup>

These scholars have primarily accounted for the persistence of poetic and rhetorical language in the natural philosophical writings of the seventeenth-century by identifying the central role of analogy, a form of understanding rooted in the imagination, in the theories these natural philosophers held about knowledge acquisition. Indeed, in the last

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<sup>24</sup> Katharine Park, Lorraine Daston, and Peter Galison, "Bacon, Galileo, and Descartes on Imagination and Analogy," *Isis*, Vol. 75. 2 (Jun., 1984): 289.

few decades, there has been a more concerted effort to address the role of the imagination or fancy and its corollary wonder in the development of seventeenth-century natural philosophy.<sup>25</sup> More than just the recourse to analogy, I will show how the poetic imagination is central to the initial steps in Bacon's natural philosophical program—a codification of the complementarity between poetry and natural philosophy that Shakespeare earlier dramatized in *The Tempest*. By reading the debate over poetry as a means to address the dangers of the imagination, I am able to unearth the common ground or shared assumptions that made the differentiation of poetry and natural philosophy possible in the first place. The case for how this differentiation occurred will be made in Chapter 3 where I discuss the implications of the debate over poetry as it is taken up by Royal Society members after mid-century.

Critics of poetry, most notably Gosson, and its advocates, particularly Puttenham and Sidney, address the “abuses” of language. Among other concerns, Gosson worries that many poets are dissemblers who fashion language so sweetly that their malevolent intentions would go undetected: “[m]anie good sentences . . . [are] written by poets as ornamentes to beautifie their woorkes, and sette their trumperie too sale without suspect.” Worse still, he claims, poetry inflames the passions to such a degree that they

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<sup>25</sup> Lorraine Daston and Katharine Park's influential *Wonders and the Order of Nature, 1150-1750* (New York: Zone Books, 1998) charts how wonder affects the relationship among art, nature, and mankind, and the shifting connotations of each of these concepts as they develop in natural philosophy over the course of several centuries. Also see Daston, “Fear and Loathing of the Imagination in Science,” *Daedalus* 127. 1, *Science in Culture* (Winter, 1998): 73-95, for a discussion of the shifting valences of the imagination in the sciences and the arts in the eighteenth and nineteenth centuries.

overrule the reason and move the audience to vice: “by the privy entries of the eare sappe downe into the heart, and with gunshotte of affection gaule the minde, where reason and vertue shoulde rule the roste.”<sup>26</sup> Sidney complains that the “hony-flowing matron *Eloquence*” can be “disguised . . . in a Curtisan-like painted affectation” through which poets indiscriminately “cast sugar and spice upon every dish that is served to the table” (*D*, 125). Decades later, Bacon would take up the debate over language. In relating his efforts to lay the foundation for his program “raised upon the proper foundations” (*O*, 11:3), Bacon identifies four different types of obstacles, which he famously calls “Idols,” to the pursuit and growth of knowledge. He singles out those idols that “have slipped into the intellect through the alliance of words and names” as “the greatest nuisances of the lot” (*O*, 11:93). These Idols of the Market consisted of “shoddy and inept application of words” (*O*, 11:81): words that are “names of things which do not exist” or are “ill-defined” (*O*, 11:93). These types of words, Bacon explains, “overrule the understanding, and throw all into confusion, and lead men away into numberless empty controversies and idle fancies” (*W*, 8:78).<sup>27</sup> Natural philosophy, let alone civil discourse, could not progress nor better the state of mankind if men were distracted by debates incited by the Idols of the Market. In each case, poetic or elevated language can enflame the imagination such that it overrules reason, prohibiting the mind from attaining

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<sup>26</sup> Stephen Gosson, *The Schoole of Abuse, Containing a Pleasant Invective Against Poets, Pipers, Players, Jesters &c.* 1579 (London: The Shakespeare Society, 1841), 10, 22.

<sup>27</sup> “[I]dle fancies” has also been translated as “complete fictions” (*O*, 11:81). The *Works* is here used because “idle fancies” emphasizes the criticisms laid against rhetoric and poetry more broadly.

knowledge, be it knowledge of virtue or of nature. Whether detractor or defender, to these commentators poetry was a powerful means of persuasion, and such power could be used to render idle, confuse, or enflame the mind to nefarious ends.

Many of the criticisms of poetic language, however, were waged using the very same poetic language that was under attack. "The Schoole which I builde," proclaims Stephen Gosson in his 1579 *Schoole of Abuse*, "appeareth but a doggehole; yet small Cloudes carie water; ... the whole worlde is drawn in a mappe; Homers Iliades in a nutte shell; ... Little Chestes may holde greate Treasure" and, he concludes, "the harshest penne maye sette downe somewhat woorth the reading" (3-4). For a pamphlet that "set[s] vp the Flagge of Defiance" (frontispiece) against excessive poetic language, Gosson's list of metaphors (of which only a few have here been quoted) seems to engage in the "abuse" of language he aimed to curb. Sidney describes the abuses of poetry as a painted "Curtisan" (*D*, 125), a metaphor that John Locke also uses to explain the persistence of language abuses for "Eloquence, like the fair sex, has too prevailing beauties in it to suffer itself ever to be spoken against."<sup>28</sup> And Bacon, of course, eloquently describes the abuses of language as "Idols of the Market." Bacon's eloquence and rhetorical prowess have not gone unnoticed. Brian Vickers remarks how frequently "studies of Bacon pay incidental tribute to his literary art."<sup>29</sup> But if poetic language could

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<sup>28</sup> Locke, *Essay Concerning Human Understanding*, 508.

<sup>29</sup> Brian Vickers, *Francis Bacon and Renaissance Prose* (London: Cambridge University Press, 1968): 4.

be abused to such deleterious effects, why was poetic language so often used to criticise poetry? And if poetry and rhetoric were to have no place in natural philosophy, why were Bacon's natural philosophical writings laden with tropes and figures? I contend that the debate over poetry did not concern poetic language proper, but the mental faculty responsible for the poetic art. Poetry was crafted by and affected the imagination—a faculty that could overthrow reason to indulge in vice, frivolity, and most dangerous of all, idleness. Indeed, both parties in the debate over poetic language adduced support for their positions by recourse to the role of imagination and its impacts on human learning.

Crafted by the imagination, poetic language was not bound to represent nature as it was experienced and, without a tie to what occurs or what could be expected to occur in nature, poetry had no internal mechanism to prevent it from producing images that could deceive its audience. The division between nature and the imagination gave grounds for Gosson to imply that poets were dissemblers by the very nature of their craft. The frontispiece of Gosson's *Schoole* is telling: Gosson "Set[s] vp the Flagge of Defiance to [the poets and others] mischieuous exercise" and "overthrow[s] their Bulwarkes by Prophane Writers, Naturall reason, and *common experience*" (frontispiece; emphasis mine). The link that Gosson draws between "Naturall reason" and "common experience" aligns reason with accessible, commonplace experience and, by extension, divorces the imagination from the rational faculty its images had originally supplied.

When reason is linked to experience that is readily available to anyone, the divide between the imagination and nature produces a fissure between *phantasia* and *cogitatio*: once an ally of reason, the imagination becomes its foe. The fabulous images of poetry, then, become suspect not just as guises for the poet's intentions but because they do not represent nature as it was experienced.

The divide between nature and the imagination, however, was the source of poetry's epistemological value for Sidney. Sidney's famous essay *The Defence of Poesie*, posthumously published in 1595, may have been a response to Gosson's *Schoole*. Far from the dissemblers that beguile their audience in Gosson's tract, Sidney shares Puttenham's view and elevates the poet above all other professions. To return to Sidney's quote, the poet's laudatory position is achieved precisely because he is not bound to represent nature as it was presented through his experience:

There is no Arte delivered to mankinde that hath not the workes of Nature for his principall object, .... Onely the Poet, disdayning to be tied to any such subjection, lifted up with the vigor of his owne in[v]ention, dooth growe, in effect, into another nature, in making things either better than Nature bringeth forth, or, quite anewe, formes such as never were in nature (D, 87-88).

The historian, philosopher, natural philosopher, among other professions, are all bound to represent in language what was experienced of nature. The poet, however, is free to engage the imagination in its myriads of combinations and permutations. Because the imagination and, by extension, the images it expresses in poetry do not need to represent nature accurately, the poet is exempt from accusations of lying. Sidney argues

that where the "Astronomer," "Geometrician," "Physicians," and "Historian" frequently lie, "the Poet, he nothing affirmeth, and therefore never lieth: for as I take it, to lie, is to affirme that to bee true, which is false" (D, 111). The poet never claims to represent nature as it was experienced and, as a result, cannot dissemble to his audience about what has actually occurred in nature. Because the poet is not bound to represent nature as it was experienced, the epistemological value of poetry stems from its ability to craft fabulous images of nature.

Sidney contends that poetry perfects nature through its wonderful permutations of experience: "*Nature* never set forth the earth in so rich tapestry as divers poets have done; neither with pleasant rivers, fruitful trees, ... nor whatsoever els may make the too muchloved earth more lovely. Her world is brasen, the poets only deliver a golden" (D, 88). Poetry's ability to beautify nature not only makes its images more delightful to the audience or reader, but importantly encourages them to learn moral values. Because poetry need not represent nature accurately, abstract moral values are for Sidney best conveyed by the poet:

the poet ... with that same hand of delight, doth draw the mind more effectually then any other art doth: and so a conclusion not unfitlie ensue, that as vertue is the most excellent resting place for all worldlie learning to make his end of, so Poetrie, beeing the most familiar to teach it, and most princelie to move towards it (D,103).<sup>30</sup>

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<sup>30</sup> Peter G. Platt points out an ambivalence over poetry that runs through Sidney's *Defence*, *The Old Arcadia*, and *The New Arcadia*: "There seem to be two Sidneys," Platt surmises, "the Sidney who is the famous Renaissance defender of poetry and the Sidney who is portrayed in his own *Apology [Defence]*, as well as by his contemporaries, as one who has the capacity to see fiction not only as trivial but also potentially

Without being confined to an accurate relation of nature, the poet is granted license to draw moral values from experiences that may not convey these virtues in themselves. If poetry was dedicated to representing nature as it was experienced, the poet's didacticism would be fettered. The poet's most valuable work occurs when the imagination is free to manipulate experience. To return to an earlier quote, the poet "goeth hand in hand with *Nature*, not enclosed within the narrow warrant of her gifts," Sidney extols, "but freely ranging onely within the Zodiack of his owne wit" (*D*, 88).

The dangers of the poetic imagination, Sidney argues, are not the fault of poetry, but of the particular mind of the poet. Just as a sword can be equally used to kill as to protect, arguments against the destructive ends to which poetry can be affected are more appropriately arguments against the man who wields the instrument for those purposes. It is not accurate to say "that Poetrie abuseth mans wit," Sidney contends, "but that mans wit abuseth Poetrie" (*D*, 112). Even Gosson claims that those who "thinke that I banishe Poetrie, wherein they dreame" and clarifies that his attack on poetry "touche[s] but the abuses."<sup>31</sup> Although Bacon railed against the abuses of language, he does not

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dangerous, doing more harm than good" (*Reason Diminished: Shakespeare and the Marvellous*, (Lincoln: University of Nebraska Press 1997), 78). But whether Sidney was sincere in any of his works is less relevant for my purposes; I am more interested in how the relationship between language and the imagination is said to be crafted by advocates and detractors of poetic language than in whether or not these commentators believed what they said.

<sup>31</sup> Stephen Gosson, *The ephemerides of Phialo deuided into three books. . . . And a short apologie of the Schoole of abuse, against poets, pipers, players, [et] their excusers* (London: Thomas Dawson, 1579), 83.

equate the imaginative use of language with the Idols of the Market wholesale. For Bacon, poetry and rhetoric were useful not only to disseminate information to a varied audience,<sup>32</sup> but to the restored natural philosophy he sought to cultivate as well. When used appropriately, the poetic imagination could assist discovery and harness nature's wonders into the wonderful art of man. Bacon's suspicion of poetry and rhetoric instead stemmed from language that produced "*idle fancies*" (*W*, 8:78; emphasis added).

"Idle" and such related terms as "vain" or "superfluous" were prime among the charges laid against poetry in the late sixteenth and early seventeenth centuries. These charges held significant weight given their theological implications and their associations with social discord.<sup>33</sup> Because prelapsarian Adam labored in Eden, Peter Harrison suggests that "the vocation of Adam in paradise is ... the true calling for the Christian."<sup>34</sup> If reparations for the Fall were to be made, mankind could not risk falling idle—Adam was also a laborer. Gosson bolsters his criticism of poetry, among other arts, by arguing that the harmonious body politic is a laboring one:

For as to the body ther are many members serving to severall uses, the eye to see, the eare to heare, . . . the feet to beare the whole burden of the rest, and every one dischargeth his duety without grudging, so shoulde the whole body of the common wealth consist of fellow laborers, all generally serving one head, and particularly following their trade

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<sup>32</sup> Park, "Bacon's 'Enchanted Glass,'" 300.

<sup>33</sup> These charges would be renewed with added vigor as poetry, rhetoric, and eloquence were blamed in part for the English Civil War.

<sup>34</sup> Peter Harrison, *The Fall of Man and the Foundations of Science* (Cambridge: Cambridge University Press, 2007), 58.

without repining. From the head to the foote, from top to the toe, there should be nothing be vaine, no body idle.<sup>35</sup>

For Gosson, the healthy body politic consists of laborers who, if turned exclusively to the “vaine” or “idle” pursuits of poetry, would threaten the commonwealth. Sidney repeats this line of argument in his *Defence*, enumerating it as one of the abuses he aims to debunk. He ventriloquizes the criticism that poetry is the “nurse of abuse” that entices “the mind to the Serpent’s taylor of sinfull fancy. . . . as *Chaucer* sayth: . . . [how] before Poets did soften us, we were full of courage, given to martiall exercises, the pillars of manlyke liberty, and not lulled asleepe in shady idlenes with Poets’ pastimes” (*D*, 110). While Sidney admits that the abuse of poetry “can doe more hurt then any other Armie of words,” he contends that these abuses should not dissuade the production of poetry, for “beeing rightly used” poetry “doth most good” (*D*, 113). The criticism that poetry can move a mind to sleep “in shady idlenes” turns in on itself because poetry’s ability to move the imagination highlights one of the powers that makes poetry politically valuable: poetry calls the mind to action.

Sidney explains that the poet’s craft is the most laborious because it moves its audience to act in the world: “to be moved to doe that which we know, or to be moved with desire to knowe, *Hoc opus, hic labor est.*” (“Here is the work and the labor”) (*D*, 101). The poet, however, importantly did not create his golden world in the way God

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<sup>35</sup> Gosson, *Schoole of Abuse*, 40.

created;<sup>36</sup> Puttenham emphasizes that God created the world without labor. To return to the opening of *The Art*, Puttenham argues that: “[a] poet is as much to say as a maker. . . . Such as (by way of resemblance and reverently) we may say of God, who without any travail to his divine imagination, made all the world of nought.” (A, 93). Where God’s creation was made “without any travail” or work, the poet’s craft was labor-intensive. In this way, the labor that Sidney ascribes to the poet is also what distinguishes the poet from “the heavenly Maker of that maker” (D, 89). This difference between God’s and the poet’s respective creations framed poetry as reverent, not aggrandizing, and rebutted claims that it was vain or idle:<sup>37</sup> the poet labored to “make” language that celebrated God’s creations in the process of bringing them to light. The charge against poetry as idle ignored the defining feature of the poet and the labor that distinguished him from an irreverent imitator of the divine. As a “maker,” the poet crafted a perfected world that discovered the hand of the divine, and in moving mankind to action, helped to stabilize the body politic. To attribute idleness to either the poet or poetic works is to misunderstand what the poet does.

Because the poetic imagination called the mind to action, it was included into Bacon’s large-scale and laborious reform of “all human learning.” “[A]ll trial should be made,” Bacon proposes, “whether that commerce between the mind of man and the

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<sup>36</sup> The male pronoun is here used not to overlook the many important female poets in Bacon and Shakespeare’s age, but to correspond with the way the poet was most commonly described in the late sixteenth and early seventeenth centuries.

<sup>37</sup> Kalas, *Frame, Glass, Verse*, 140.

nature of things . . . might by any means be *restored to its perfect and original condition*, or if that may not be, yet reduced to a better condition than that in which it now is" (W, 8:17; emphasis added). The *Instauratio magna* (published posthumously in 1626) opens with the goal to restore mankind to the relationship that Bacon thought Adam shared with nature prior to the Fall.<sup>38</sup> This goal would be achieved by understanding the laws that governed nature and by yielding the fruits of new arts for "the benefit and use of life," what Bacon considers the "true ends of knowledge" (O, 11:23). Park explains that Bacon's *Instauratio magna* was a "public enterprise" in which the "personnel and resources of an entire society would be mobilized toward the advancement of learning and improvement of the human condition."<sup>39</sup> This enterprise ought to be supported by the monarch for, as Bacon argues, "of the sciences that contemplate nature . . . *the Glory of God is to conceal a thing; but the glory of a king is to find it out*" (O, 11:23). Bacon thought that just as innocent Adam, the world's first sovereign, named each "thing" in nature as he labored in Eden, natural philosophy was a means to establish the dominion over the natural world that was promised in Genesis.<sup>40</sup> "[B]y his fall," Bacon argues, "man lost both his state of innocence and his command over created things," but he continues,

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<sup>38</sup> Harrison, *The Fall of Man*, 4.

<sup>39</sup> Park, "Bacon's 'Enchanted Glass'," 300.

<sup>40</sup> Picciotto argues that "[i]n the seventeenth century . . . the basis of the first man's sovereignty was theorized anew: the notion that Adam was the first king *because* he was the first worker brought the delver, the namer, and the sovereign into relation" (*Labors of Innocence*, 3). Bacon and the experimental philosophers who would take him as a source of their "inspiration" later in the century, Picciotto continues, contributed greatly to this reimagining of Adam, sovereignty, and natural philosophy (3).

“both of these losses can to some extent be made good even in this life, the former by religion and faith, the latter by the arts and sciences” (*O*, 11:447). As Joanna Picciotto argues, Bacon reimagined innocent Adam as a natural philosopher:

[b]y transferring the primal scene of discovery from Eve’s eating of the fruit to Adam’s naming the creatures—and by linking the act of naming to the work of experiment— Bacon redeemed curiosity from its association with original sin: associated with investigative labor rather than appetite, the first sin became the first virtue.<sup>41</sup>

In Adam’s image, Bacon summarizes his *Instauratio magna* and the works of which it comprises as a means “to let the mind exert its proper authority over the nature of things” (*O*, 11:11).<sup>42</sup> As a way to restore Adamic dominion over nature, natural philosophy was, in an important sense, an extension of sovereign power writ large.

Bacon’s restoration was poised to move beyond what he saw as the limits of the knowledge of his predecessors, especially of Aristotle, Aristotelians, and of the thinkers of his own day. This task involved devising a new natural philosophy, cultivating a new type of natural philosopher, and inventing new forms of art. “It is idle to expect any great advancement in science,” Bacon argues, “from the superinducing and engrafting of new things upon old. We must begin anew from the very foundations” (*W*, 8:74).<sup>43</sup>

More than just natural philosophical reform, Bacon sought to restore most any body of

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<sup>41</sup> Picciotto, *Labors of Innocence*, 3.

<sup>42</sup> Bacon’s goal to restore mankind to its prelapsarian relation to nature is evident in the six part structure of his unfinished *Instauratio magna*. This six part work was modelled after the Bible’s six days of creation. For a brief explanation of the different component parts of *Instauratio magna*, see Graham Rees, introduction to *The Instauratio magna: Last Writings* (Oxford: Oxford University Press, 2000), xix.

<sup>43</sup> The word “idle” has also been translated as “useless” (*O*, 11:77).

knowledge that had become idle. To lay this foundation for human learning, Bacon envisioned a body politic that continually labored to advance its understanding and art. The ancients' methods and many of their discoveries were stagnant; pressing on through these well-trodden tracks would spin mankind "round in circles forever, with progress little or pitiable" (*O*, 11:77). Too many pursuits for knowledge had become idle: "Philosophy . . . and the intellectual sciences are, like statues, admired and praised but not pushed forward" or advanced (*O*, 11:13). Bacon again reiterates the idleness of his predecessors when he likens the Greeks' knowledge to that of a child. Knowledge derived by the Greeks, Bacon argues, "is what might be called the boyhood of science and, as with boys, it is all prattle and no procreation. For productive of controversies, it is barren in works" (*O*, 11:11). For Bacon, ancient knowledge produces idle debates but does not have the propensity to advance or grow. He faults those who engage in such debates:

authors who have elbowed their way into a kind of dictatorship in the sciences . . . take to whining about the subtlety of nature, the inaccessibility of truth, the obscurity of things, the intricacy of causes, and the weakness of human wit. . . . [And] when any art fails to achieve something, they insist that such achievement is impossible on the authority of that same art. (*O*, 11:15)

Having reduced their efforts to mere "whining," these "authors" obstruct the advancement of knowledge and art. Bacon's program, then, is a call to labor; he "ask[s] men to think of [his program] not as a question of opinion but as a job to be done" (*O*, 11:23–25). Bacon and those who undertake his program will not be discouraged by the

intricacies or “obscurity” of nature and will not abandon their goal to hone their arts. Indeed, Bacon rejects Acatalepsy, the incomprehensibility of knowing a thing, because “once the human soul has lost hope of discovering the truth, everything becomes more supine; and the result is that . . . [men] dodg[e] hard facts, rather than keep them in the way of rigorous inquiry” (*O*, 11:109). Instead, Bacon cultivates the “hope” that what his predecessors deemed “impossible” in both knowledge and art could be attained if natural philosophy is reformed. Bacon’s vision for science and mankind, then, is utopian: what he lays out in the *Instauratio magna* aimed to restore the eutopia lost after the Fall.

To erect “all human learning” upon “proper foundations,” Bacon rejected the Aristotelian scholasticism that saturated sixteenth and seventeenth century universities and promoted a new natural philosophy—a grand “job to be done” indeed.<sup>44</sup> For Aristotle, the study of *poiesis*, man’s art or craft, revealed only the intentions of the human mind; *scientia*, teleological knowledge of things in nature, alone was considered to ascertain certain knowledge of necessary truths.<sup>45</sup> Nature and man’s art were fundamentally different. Where the things of nature could grow and reproduce

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<sup>44</sup> Harrison notes that Aristotle’s *Organon* was still widely read in universities throughout most of the seventeenth century. “All undergraduates,” he explains, “were expected to become familiar with its contents, and until well into the seventeenth century university statutes prescribed monetary penalties for those guilty of transgressions against Aristotle’s logic” (*The Fall of Man*, 173).

<sup>45</sup> On Aristotle’s understanding of what constitutes knowledge and its rejection by Bacon as well as Shakespeare in his *Tempest*, see Elizabeth Spiller, “Shakespeare and the Making of Early Modern Science: Resituating Prospero’s Art,” *South Central Review* 26, no. 1/2 (2009): 24–41.

themselves by some internal principle, the things of art could not;<sup>46</sup> and where the things of nature were thought to originate in nature, the things of art originated in the mind of man. Bacon, however, argued that *poiesis* was an important means by which to discover nature's workings. In an oft quoted passage, Bacon argues that "nature's secrets betray themselves more through the vexations of art than they do in their usual course" (*O*, 11:157). While much scholarly ink has been spilled over Bacon's "vexations of art" — their implications for nature, modern science, and gender in particular — these "vexations" were novel in Bacon's day because, counter to Aristotle, they applied art to nature so as to discover natural knowledge.<sup>47</sup> Bacon's emphasis on empirical manipulations of natural phenomena was equally matched by an emphasis on the intellect in natural philosophy. As Rhodri Lewis explains, Bacon "attack[s] the shortcomings of ... exclusively empirical philosophy, and ... [of] scholastic philosophers who excluded empirical data from their elegant speculations."<sup>48</sup> Instead, Lewis continues, Bacon's program included elements of both, for "neither the *empirici* nor the *dogmatici* were [to be] discredited in themselves, but only in as much as they were used

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<sup>46</sup> Lorraine Daston and Katharine Park, *Wonders and the Order of Nature 1150–1750* (New York: Zone Books, 1998), 264.

<sup>47</sup> There has been much debate over Bacon's "vexations of art" and its implications for gender and the conceptualization of nature. See Peter Pesic, "Wrestling with Proteus: Francis Bacon and the 'Torture' of Nature," *Isis* 90, no. 1 (1999): 81–94; Carolyn Merchant, "'The Violence of Impediments': Francis Bacon and the Origins of Experimentation," *Isis* 99, no. 4 (2008): 731–760 and "Secrets of Nature: The Bacon Debates Revisited," *Journal of the History of Ideas* 69, no. 1 (2008): 147–162; and Brian Vickers, "Francis Bacon, Feminist Historiography, and the Dominion of Nature," *Journal of the History of Ideas* 69, no. 1 (2008): 117–141.

<sup>48</sup> Rhodri Lewis, *Language, Mind and Matter: Artificial Language in England from Bacon to Locke* (Cambridge: Cambridge University Press, 2007), 6.

(and therefore abused) to the exclusion of one another."<sup>49</sup> Knowing the "form or certain law" of nature (*O*, 11:297), discovering her "secrets," also meant that even nature's most marvelous phenomena could be known and regulated by man's art, all for the betterment of the human estate. In this way, man's art was as epistemologically valuable as nature itself, distinguishable by efficient cause only.<sup>50</sup> Rejecting Aristotle's distinction between art and nature was essential to Bacon's natural philosophy because Bacon's "vexations of art" could neither produce knowledge nor the art that would help restore the Adamic dominion over nature to which Bacon's program aimed.

"Human knowledge and power come to the same thing," Bacon declares, "for ignorance of the cause puts the effect beyond reach. For nature is not conquered save by obeying it" (*O*, 11:65). Nature could not be transformed by art unless her inner workings were first understood. At the outset of his 1620 *Novum organum*, Bacon invites the "true sons of the sciences" to join in his quest to "penetrate" nature further than his predecessors, to discover "certain and ostensive knowledge," and "leave behind nature's entrance halls (trodden by countless feet), and at last throw open the doors to her inner sanctum" (*O*, 11:59). Once nature and its laws have been mapped out, these

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<sup>49</sup> Lewis, *Language, Mind and Matter*, 7.

<sup>50</sup> Moreover, Sophie Weeks argues that the Baconian doctrine of the unity of nature suggests that "regardless of the source of motive power, the same formal causes (forms) are at work in natural and artificial operations" ("The Role of Mechanics in Francis Bacon's *Great Instauration*," in *Philosophies of Technology: Francis Bacon and his Contemporaries, Intersections: Yearbook for Early Modern Studies vol. 11*, eds. Claus Zittel, Gisela Engel, Romano Nanni, and Nicole C. Karafyllis [Leiden: Brill, 2008]: 133–195, at 155–156).

“Wonders of Nature” would lay the “passage towards the Wonders of Arte” (O, 4:63).<sup>51</sup>

But this “passage” could not be traversed unless art was potent enough to transform nature:

[a] subtle error which has crept into the human mind; namely, that of considering art as merely an assistant to nature . . . but by no means to change, transmute, or fundamentally alter nature. And this has bred a premature despair in human enterprises. Whereas man ought on the contrary to be surely persuaded of this; that the artificial does not differ from the natural in form or essence, but only in the efficient; in that man . . . can put natural bodies together, and he can separate them; and therefore that wherever the case admits of the uniting or disuniting of natural bodies . . . man can do everything; where the case does not admit this, he can do nothing. (W, 8:410–11; emphasis added)

In rejecting Aristotle’s distinction between *poiesis* and *scientia* and between art and nature, Bacon elevates art as a means to gain the dominion over nature that he thought Adam enjoyed as the first sovereign. “Gold,” Bacon explains, “is sometimes found refined in the fire and sometimes found pure in the sand, nature having done the work for herself” (W, 8:411). “[T]he rainbow is made in the sky out of a dripping cloud,” he adds, and “it is also made here below with a jet of water” (W, 8:411). Man’s art can produce natural phenomena in ways that nature does not, such as through the scorching fire of a kiln, and can introduce these phenomena to locations where they could otherwise not occur, such as inside a laboratory with a jet of water. Bacon “fundamentally” alters nature not by changing its order, but by displaying this order

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<sup>51</sup> Bacon’s inclusion of marvels into natural philosophical study also rejects Aristotle’s argument that *scientia* could not be gained from accidents since they could not be generalized to nature’s workings at large. See Spiller, “Resituating Prospero’s Art,” and Daston and Park, 160, 290–296.

under man-made circumstances; he cannot usurp nature's laws, but exerts dominion over where these laws are discovered. Man can "fundamentally alter nature" and still be governed by its laws.<sup>52</sup>

Poetry could attain teleological knowledge when the imagination perfects an image of nature so as to invent, discover, or make explicit the divine signatures that marked nature. And it is the poet's imaginative ability to perfect an image of nature that becomes so important to the trajectory of natural philosophy as it turned away from its Aristotelian roots. Bacon's natural philosophical reforms appropriated the poet's imagination as a means to reveal knowledge in nature. Rhodri Lewis argues that Bacon's art of discovery consisted of two distinct and hierarchical modes of investigating nature that were also, and importantly, complementary: *experientia literata* or "literate experience" and *novum organum* or "new organon," also called the *interpretatio naturae* or "interpretation of nature."<sup>53</sup> The *novum organum* produced demonstrative knowledge of the laws that ordered nature—it attained *scientia*—and called exclusively upon the intellect to do so.<sup>54</sup> The *experientia literata* produced knowledge in two ways. Firstly, it produced *experimenta lucifera* or "experiments of light" that are "experiments of no use in themselves but which only contribute to the discovery of causes" (*O*, 11:157-159).

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<sup>52</sup> Bacon also writes that "it seemeth to me, there can hardly bee discovered any radicall or fundamentall alterations, and innouations in Nature, either by the fortune & essayes of experiments, or by the light and direction of Phisical causes (*O*, 4:89). But here he is discussing nature proper, not the art that can "transmute" nature by producing it through means or in locations not possible by nature alone.

<sup>53</sup> Rhodri Lewis, "Francis Bacon and Ingenuity," *Renaissance Quarterly* 67, no. 1 (2014): 113–163, at 137.

<sup>54</sup> Lewis, "Francis Bacon and Ingenuity," 139, 143–144.

Secondly, and more importantly, it organized the otherwise scattershot materials of natural history such that a natural philosopher can extend or translate these older discoveries into new fields or apply them onto new natural phenomena.<sup>55</sup> Although *experientia literata* does not attain *scientia*, it is vital preparatory work for the *novum organum*, which can.<sup>56</sup> Unlike the *novum organum*, however, *experientia literata* cultivated the *ingenium* in order to attain knowledge of nature. The *ingenium*, a notoriously slippery term, involved the imagination and was essential to poetic art. As Lewis puts it, “ingenium was the imaginative talent through which the poet, painter, or sculptor was able to imitate, and even to surpass, the created world in his works.”<sup>57</sup> In order to advance knowledge, the imagination needed to be cultivated such that it could extend older discoveries into the recesses of nature that were otherwise thought impossible to “penetrate.” Bacon’s natural philosophy, then, cannot be divorced from the imagination.<sup>58</sup>

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<sup>55</sup> Lisa Jardine explains that “*experientia literata* is the material of the natural history organised in such a way as to suggest to a perceptive mind the possibilities for enlarging [experimental] knowledge by applying techniques successful in one field in similar fields, or by applying experiments successful on one type of material to similar materials” (*Discovery and the Art of Discourse*, 144). See also Sophie Weeks, “The Role of Mechanics in Francis Bacon’s *Great Instauration*.”

<sup>56</sup> Lewis, “Francis Bacon and Ingenuity,” 143-144.

<sup>57</sup> Lewis, “Francis Bacon and Ingenuity,” 121.

<sup>58</sup> While many scholars have argued that Bacon’s suspicion of the imagination left it little room within his natural philosophical reforms, others have attempted to rehabilitate the imagination within Bacon’s works. Park argues that because Bacon thought that similitudes were necessary for philosophical invention, the imagination could not be excluded from his program. For Bacon, “man cannot thrust his understanding into the unknown but must proceed in steps, by analogy with that which is already understood. From this point of view, imagination is a powerful, even a necessary, instrument in the hand of the scientist (“Enchanted Glass,” 294). For a discussion of the work of *poiesis*, the imagination, and language in Bacon’s natural

Like Sidney who argues that the poet's art transmutes the "brassen" natural world into a perfected, "golden" one (*D*, 88), Bacon also uses an alchemical metaphor to describe the relationship between art and nature in his natural philosophy. For Bacon, the material world was a fallen world that, through man's art, could be "transmute[d]" (*W*, 8:410) into one where an Adamic sovereignty over nature is, at least partially, restored. The poet, of course, did not have the power to alter nature itself—he was a "maker" and not a "creator"—but could transform nature through artifice such that, like Adam, it revealed the divine order. While Bacon cautioned against extrapolating knowledge of nature to knowledge of God's intentional causes, natural philosophy could discover the laws by which God ordered the natural world. Man's art, he argued, could "fundamentally alter" nature insofar as it produced natural phenomena in ways that nature alone did not or in man-made environments. More than just sharing an alchemical metaphor to describe the work of their respective art, Bacon's application of art in the pursuit of natural knowledge works analogously to the means by which Sidney's poet discovered knowledge: both use art, be it language or mechanical aids, such that it reveals in nature otherwise hidden knowledge.

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philosophical project, see Michael C. Clody, "Deciphering the Language of Nature: Cryptography, Secrecy, and Alterity in Francis Bacon," *Configurations* 19, no.1 (2011): 117–142.

More than any of the Idols, Bacon intimates that the lack of imagination is the greatest hindrance to the pursuit of knowledge. “[B]y far the greatest obstacle to the advancement of the sciences and the adoption of new tasks and provinces therein,” Bacon argues, “lies in men's despairing belief that the job is impossible” (*O*, 11:149). The boundaries ascribed to art and the pursuit of knowledge needed to be eliminated, a task that could be accomplished by the imagination. Because the imagination could produce images of nature in a multitude of permutations, it was required to exceed the limits of what was deemed possible in art and knowledge if the chains of despair were to be broken. Recall Bacon’s description of the imagination as a faculty that “make[s] vnlawfull Matches & diuorses of things,” his explanation of poetry as that which “exceeds the measure of nature, joining at pleasure things which in nature would never have come together . . . [or] never have come to pass,” and his discussion of man’s ability to influence nature with art by “uniting and disuniting of natural bodies . . . [whereby] man can do everything.” The poetic imagination performs the tasks that Bacon ascribes to man’s ability to alter nature: man “can do everything” by making “vnlawfull Matches & diuorses of things” that in nature would “never have come to pass” without his art.<sup>59</sup> While nature’s laws cannot be broken through natural

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<sup>59</sup> Bacon also argues that “where the case does not admit” the “uniting and disuniting of natural bodies,” man “can do nothing.” It is possible to read such cases as “vnlawfull Matches & diuorses of things,” straining the similarities between the work of Bacon’s imagination and of his natural philosopher. Clearly, the imagination can operate outside of nature’s laws where a natural philosopher must work within them. Nevertheless, Bacon’s penchant to achieve what was once deemed “impossible” and to “fundamentally alter

philosophy, these imaginative permutations can produce in art what nature alone could not. For if, as Bacon believes, man can “fundamentally alter” nature, what was once deemed “impossible” in nature is held possible through natural philosophical art. Just as a poet whose golden world “exceeds the measure of nature” to display knowledge of an ideal order, Bacon’s natural philosophical art displays nature in man-made environments to discover the knowledge that advances man toward the utopian ends of his program at large. Bacon’s natural philosophical art harnessed the poetic imagination to regulate nature such that it was subject to man’s control, repairing the dominion over nature that was lost in the Fall. *Experientia literata* and *novum organum*, then, were complementary modes of investigating nature because without such an interpenetrative compatibility, natural philosophy could not reach the ends to which Bacon aimed. In this way, Bacon’s natural philosophy is set to craft in art what poetry crafts in language, producing a world of “a more perfect order” (*W*, 8:440) once reserved for fables.

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nature” aligns the scope of the imagination with that of his vision of natural philosophy. Provided nature’s laws do not intercede, man can achieve “everything,” including things thought possible only in fables. Consider the scientific wonders of the Bensalemites in Bacon’s *New Atlantis*. While these wonders of art are described within a utopian narrative, some were extensions of the wonders Bacon sought to produce in his other works. Bacon discusses the prolongation of life in Book IV of his *Of the Dignity and Advancement of Learning* (*W*, 9), a topic he also addresses in *The New Atlantis* when the Bensalemites’ abilities to preserve and prolong life are described (*New Atlantis*, in *Francis Bacon: A Critical Edition of the Major Works*, ed. Brian Vickers [Oxford: Oxford University Press, 1996] 480–482). And the submarines, the “ships and boats for going under water,” related in the *New Atlantis* (489) is most likely informed by the actual incipient submarines brought to English court by Cornelis Drebbel in the early seventeenth century mentioned in *Novum organum* (*O*, 11:421). Man could not subvert his body’s need to breathe, but he could devise a machine that would allow him to breathe in environments where he otherwise could not. Although man’s art must obey nature’s laws, Bacon thought they could be imaginatively manipulated to the benefit of mankind and to achieve what would otherwise be impossible.

As a program set to achieve the “impossible,” Bacon’s natural philosophical art used the imagination to discover and perfect nature for man’s use. This utopian goal required the labor of the natural philosopher to be undaunted by the ancients and by despair—the pursuit for knowledge could no longer be idle. The utopian qualities that Bacon ascribes to his enterprise are also those he ascribes to poetry. For his program to achieve the goals he envisions, Bacon’s natural philosopher must perform the work of the poet: he must invent nature through art in ways deemed “impossible.” What poetry and the imagination do in language is what natural philosophical art is set to do in nature. The fabulous images of poetry, then, are aligned with the wonders made possible through Bacon’s natural philosophy, blending the respective domains of each art. In this way, Bacon’s natural philosophical art can be considered an expression of the poetic imagination. When Bacon argues that he “finde not any Science, that doth properly or fitly pertaine to the IMAGINATION” (*O*, 4:106) or that poetry should “be accounted rather as a pleasure or play of wit than a science” (*W*, 9:62), it is because his natural philosophers have taken up the task of the poet, and ushered the imagination from the province of eloquent language into the world of empirical nature. Through Bacon’s scientific reforms, the language with which the poet crafted his utopia became more closely aligned with the natural phenomena studied by the natural philosopher, more closely approximating the Adamic unity between word and thing in turn. In the

image of man's first sovereign, poetic language and natural philosophy made manifest the political order in word and world.

The complementarity between poetry and natural philosophy and the work they perform is especially evident in Shakespeare's *The Tempest*. Bacon and Shakespeare were contemporaries whose respective works, I argue, participate in a shared cultural understanding that saw poetry and natural philosophy as essential to the political order. Where Bacon makes explicit the role of these arts in the political order most pointedly in his natural philosophical writings, Shakespeare exemplifies it through dramatic artifice. *The Tempest* simultaneously addresses the power and limits of poetic art and natural philosophical art by staging their role in the restoration of legitimate sovereignty. Prospero's art can be said to work on the imagination, a province he shares with the poet, and on nature, a domain he shares with the natural philosopher, exemplifying the work poetic and natural philosophical art perform in the political order in the early seventeenth century. Prospero's art has been considered a metaphor for the imagination<sup>60</sup> or as a "farewell to a whole region of the human imagination,"<sup>61</sup> and many have considered Prospero as Shakespeare's ventriloquization of the process of producing dramatic art. And described as a "spectacle" (1.2.26) that elicits "amazement" (1.2.14) even to the extent that it can "infect" one's "reason" (1.2.208), the imagination

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<sup>60</sup> Barbara Mowat, "Prospero, Agrippa, and Hocus Pocus," *English Literary Renaissance* 11 (1981): 281-303.

<sup>61</sup> David Gwilym James, *The Dream of Prospero* (Oxford: Oxford University Press 1967), 68.

cannot be bracketed from Prospero's art.<sup>62</sup> All of these readings presuppose Prospero as one who fabricates fiction with his command of language—that is, as a poet of sorts. Indeed, Prospero need only to utter a few words and Ariel manifests Prospero's magical command to "th'syllable" (1.2. 498). Many scholars, however, have also identified Prospero as a Renaissance magus, some intimating the character as an incipient scientist,<sup>63</sup> and recently the play as a whole has been considered an example of art's role in natural philosophy's rejection of some of its Aristotelian roots.<sup>64</sup> Sawday even claims that "Prospero is a truly Baconian figure, overmastering nature by means of his superior technology."<sup>65</sup> While some scholars have resisted the reading of Prospero as an incipient scientist,<sup>66</sup> I do not claim Prospero as a natural philosopher but rather argue that Prospero's art addresses the concerns that natural philosophy faced at the beginning of the seventeenth century. Prospero's art demonstrates that contrary to Aristotle, man's art is indistinguishable from nature save for its efficient cause—a central concern for

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<sup>62</sup> For discussions of amazement or wonder in *The Tempest*, see Peter G. Platt, *Reason Diminished: Shakespeare and the Marvelous* (Lincoln & London: University of Nebraska Press, 1997), Chapter 9 and Mary B. Moore, "Wonder, Imagination, and the Matter of Theatre in *The Tempest*," *Philosophy and Literature* 30, no. 2 (2006): 486–511.

<sup>63</sup> See Hugh Kearney, *Science and Change 1500–1700* (New York: McGraw-Hill, 1971); Frances Yates, *Shakespeare's Last Plays: A New Approach* (London: Routledge and Kegan Paul, 1975); and Denise Albanese, *New Science, New World* (Durham: Duke University Press, 1996), 6, 66–70.

<sup>64</sup> Spiller, "Resituating Prospero's Art."

<sup>65</sup> Sawday, *Engines of the Imagination*, 305.

<sup>66</sup> Barbara Mowat, "Prospero and the Renaissance Scientist," *New Directions for Teaching and Learning*, no. 8 (1981): 77–84 and Stephen Orgel, "Prospero's Wife," *Representations*, no. 8 (1984): 1–13. Where Mowat considers reading Prospero as a scientist "an aberration of intellectual history" ("Renaissance Scientist," 78), Orgel acknowledges some value in "talk[ing] about Prospero as a Renaissance scientist" but concludes that "what the play's action presents is not experiments and empiric studies but a fantasy about controlling other people's minds" (9).

Bacon when he advocates “vexations of art” to discover the workings of nature. When investigating the domains over which Prospero’s art works, it is not important that his art works to compel (or, as the case may be, fails to compel) his audience to a particular end as would a poet proper, nor that his art produces natural phenomena as would a natural philosopher’s Baconian vexations. Rather, it is especially noteworthy that Prospero’s art exerts influence over both the imagination and nature because, in sharing these domains, his art dramatizes a complementarity between the poet’s and the natural philosopher’s labors that Bacon codifies throughout his *Instauratio magna*.

Shakespeare’s *The Tempest* exemplifies the political ends to which both poetry and natural philosophy worked—a shared sphere of influence that is introduced at the play’s outset. Within the first 24 lines, the relationship among the natural order, political order, and man’s role within them is ushered onto center stage. The Boatswain and Gonzalo’s debate over the dangers of the tempest contrast sovereign authority with the force of nature, bringing into relief the supposed disparity between political and natural orders. “What cares these roarers,” the Boatswain chides, “for the name of king?”<sup>67</sup> But as the means by which Prospero initiates his plan to restore his dukedom under a legitimate crown, these “roarers” do indeed “care for the name of king.” Prospero’s art calls the political order and natural order into disorder, restoring each under legitimate

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<sup>67</sup> William Shakespeare, *The Tempest*, ed. Peter Hulme and William H. Sherman (New York: Norton and Company, 2004), 1.1.16–17. Hereafter cited parenthetically with act, scene, and line number(s).

sovereignty at the play's close when he ensures that the ship carrying his once-enemies is met with "calm seas, [and] auspicious gales" (5.1.314) on their journey back to Naples. This state of disorder, however, is as much a "spectacle" (1.2.26) as the tempest that produced it. The tempest, like the fabled creatures Prospero later crafts, casts the usurpers into a state of chaos where they can no longer assert power over their happenstance, environment, and even over their own minds. While the tempest poses no real threat to the men aboard the ship, the effects of this artifice are wrought in the political order. Prospero's art produces an illusion of disorder so as to reproduce the political order under legitimate sovereignty. Put differently, the artifice of his stagecraft is a form of statecraft.

Prospero crafts a tempest, not a fabled leviathan or plague of sea monsters—though such feats are conceivably within the purview of his art—to bring his enemies ashore, producing a natural phenomenon that mirrors his and Miranda's marooning on the island. This signal event suggests that man can indeed produce natural phenomena as an expression of power. In this way, Prospero's production of nature through art is akin to the vexations of art that Bacon tasks to his natural philosopher in the works that comprise his *Instauratio magna*. The ship members' response to the storm furthermore suggests that Prospero's tempest demonstrates that man's art is indistinguishable from nature, at least in appearance: the ship members believe they are about to be wracked by a violent sea storm. In rejecting Aristotle's distinction between art and nature, Bacon too

argues that man's art differs from nature only in its efficient cause. In *The Tempest* as well as for Bacon, man's art, be it the poetic imagination or natural philosophical vexations, is difficult to differentiate from nature on any other grounds than its creator, importantly aligning the poet and the natural philosopher.

The forms of writing respectively associated with the imagination and with the description of nature as it exists are also conflated in Prospero's art. Prospero asks Ariel if the tempest was "performed to the point" of his commands (1.2.194), bidding Ariel to relate an exact account that is true to the tempest's occurrence. Although Ariel is to report the tempest as though it were a natural historical account, Ariel's "flamed amazement" (1.2.198) situates his narrative as though it belongs in ancient fables: his "fire and cracks / Of sulfurous roaring" (1.2.203) are so powerful they "besiege" (1.2.205) the "most mighty Neptune" (1.2.204). In this way, Ariel's retrospective account of the tempest conflates fable and natural history, blending a world fabricated entirely by language with one that consists of natural phenomena. Just as Ariel's reference to Neptune blends what could have been a natural historical account of the tempest with fables, so Prospero's enemies' recourse to travel narratives blends imagined and natural worlds. Stranded on an uncharted island, Prospero's enemies turn to travel narratives to reference their amazement and explain the marvels they witness on the island. "Now I will believe," Sebastian proclaims, "that in Arabia / There is . . . one phoenix / At this hour reigning there" (3.3.21-24). "I'll be sworn 'tis true. Travelers ne'er did lie," Antonio

agrees, “Though fools at home condemn ‘em” (3.3.26–27). The strange banquet and the harpy that would otherwise be reserved for poetry may indeed belong to the natural world as well. What was once suspected as fable is given grounds for empirical existence, aligning once more the fables of the poet and the natural marvels that travel literature marks out for (Baconian) natural philosophical investigation. While natural history, inquiries into what existed in nature, was distinct from natural philosophy, inquiries into nature’s causal order, they worked together in Bacon’s program.<sup>68</sup> Similarly in the *Tempest*, Prospero’s enemies inquire about the island’s strange phenomena—phenomena that they grant empirical existence based on the precedence of travel narratives—in an attempt to understand their cause. In the very language used to describe the effects of Prospero’s art, the province of the poet, the imagination, and the domain of the natural philosopher, nature, are largely indistinguishable.

But art and nature are indistinguishable only under Prospero’s hand. Prospero crafts a plan to restore his lineage and regain the glory Milan lost in its subjection to Naples under Antonio’s rule. Prospero alone is privy to the knowledge of his art and the unfolding of his plan. Ariel’s complaints over his labor suggest that he does not possess

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<sup>68</sup> Peter Anstey, “Francis Bacon and the Classification of Natural History,” *Early Science and Medicine* 17, no. 1/2 (2012):13, 24–25; Brian W. Ogilvie briefly notes the complementarity between Bacon’s natural history and natural philosophy when he suggests that “proper natural philosophy” would be “the basis for a new science of forms and causes” (*The Science of Describing: Natural History in Renaissance Europe* [Chicago: The University of Chicago Press, 2008], 7). Lorraine Daston argues that “[p]art of Bacon’s innovation was to invert the relationship between natural history and natural philosophy, elevating the former to the status of foundation and corrective to the latter” (“Baconian Facts, Academic Civility, and the Prehistory of Objectivity,” in *Rethinking Objectivity* ed. Allan Megill [Durham: Duke University Press, 1994, 1997]: 45).

full knowledge of Prospero's plan, even though he is the means by which it is enacted. Prospero elides Alonso's query over the strange happenings on the island, emphasizing his power over knowledge: "Do not infest your mind with beating on / The strangeness of this business. At picked leisure, / Which shall be shortly, single I'll resolve you" (5.1.246–248). Prospero is the "single" holder of knowledge who will relate it at a "picked leisure," a power he exerts by identifying to whom this knowledge can be shared and when it will be disseminated. None but Prospero knows whether his art affects the imagination or produces natural phenomena, and such knowledge is inconsequential to the play. To be enchanted by Prospero's fabulous images and to seek the cause of the natural phenomena his art produces is to know his power as the legitimate duke of Milan. The "business" of restoring the body politic through art, *The Tempest* demonstrates, also restores a hierarchy of knowledge.

Throughout the play, the ship's members wonder whether their imaginations have infected their reason or whether they witness natural phenomena. Their query is not resolved even when Prospero identifies himself as the source of their amazement. Is the tempest a feature of the imagination or is it a simulation of a natural phenomenon? Does Prospero's art vex the mind or, as Bacon's natural philosophers sought to do, nature itself? Is Prospero a poet of sorts or does he also address natural philosophical concerns? It is difficult to disarticulate imagined from natural worlds in *The Tempest*, I submit, because they were not disarticulated in the early seventeenth century.

Prospero's art can be said to affect both the imagination and nature because there had been no division between the sphere that poetry and natural philosophy influenced in the early seventeenth century: the knowledge ascertained through both affected the political order. Had the poets and their imagined world been entirely opposed to the natural philosophers' study (and Baconian "vexation") of nature, Prospero's art would affect either the imagination or nature, but could not be said to affect both. The world of the imagination, commonly thought to be the province of the poet, and the world of nature, the domain of the natural philosopher, are importantly conflated in Prospero's art to serve political ends. Both poetry and natural philosophy labor to invent knowledge of an ideal order such that it can be reproduced in the political sphere. Where Bacon produces natural phenomena through vexations of art to reproduce the model of Adamic sovereignty, Prospero's art produces natural and political disorder so as to reproduce the conditions of his usurpation<sup>69</sup> and restore his legitimate ducal line. Man's art, then, can permeate the natural world in important ways.

But this art cannot change a thing's essential nature, whether it is that of one "not honored with/A human shape" (1.2.283-4) or the heart of a usurper. The power of the poet's and natural philosopher's art is limited to a display. While Sidney's poet can craft a perfected image of nature, he cannot perfect the material world itself. Similarly, when

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<sup>69</sup> More than just conjuring a tempest that reproduces his strife at sea, Prospero sends Alonso and Gonzalo into a sudden slumber, prompting Antonio and Sebastian's plot to usurp Naples. Ariel awakens Gonzalo, not Alonso, in time to save the duke, mirroring Gonzalo's role in keeping Prospero and Miranda alive.

Bacon's natural philosopher applies art to nature to produce natural phenomena, this production is an artful display crafted in a man-made environment; he does not alter nature's laws, but he does control where these laws can be best discovered. Prospero's attempts to cultivate a human nature in the "freckled whelp" (1.2.283) Caliban, then, fails because Caliban is "a born devil; on whose nature/ Nurture will never stick" (4.1.188-9). In Bacon and Shakespeare's day, Caliban's inherent disposition excludes him from any permanent position among Prospero's and Miranda's rank in the natural order, despite the shipwrecked pair's best efforts. In the early seventeenth-century, Caliban can only be read as a ruler once he is left to the island at the play's close and is no longer inserted into the natural order among men. Caliban's nature similarly prevents his mutiny from succeeding. Trinculo, a jester, and Stephano, a butler, can no more be inserted into the natural order as rulers than their would-be island subject. As the trio attempt to overthrow Prospero, they are thwarted in the very moment Trinculo and Stephano stop to assume the outward display of rank they seek. Adorning themselves with a "gown" (4.1.226) and a "jerkin" (4.1.235) not only gives Prospero time to sick on them dreadful spirits, but further exemplifies their exclusion from places of higher rank: the mere possibility that they could raise their rank higher in the natural order is comically cut short when they opt to don the wardrobe of a woman, not a man. The threat to the political order is doubly contained as it is staged as dramatic folly.<sup>70</sup>

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<sup>70</sup> Shakespeare also dramatizes the relationship between one's nature and one's rank in the political order in

The power of art's display, however, should not be understated. For it is by the artful display of nature that the poet and natural philosopher discover the order that the political hierarchy is to emulate. And it is through his art that Prospero restores his dukedom under legitimate rule.

*The Tempest* suggests that the power of the sovereign is to allot the members of the body politic into their natural place in the political order, and this is the end to which Prospero's art works while he is on the island. While in Milan, Prospero's neglect of his political duties for the "bettering of [his] mind" (1.2.90) betrays the political ends to which his art should work. In the process, Prospero "awaked an evil nature" (1.2.93) in his brother who orchestrates Prospero's usurpation while Prospero was distracted with his studies. But as an illegitimate ruler, Antonio could but "execut[e] th'outward face of royalty" (1.2.104); as younger brother to a ruler with a female heir, his born nature precludes his legitimate rule while Prospero and Miranda still live. Antonio, then, cannot wield the sovereign's power. When Antonio strategically "grant[s] suits" (1.2.79) to secure his usurpation, he can raise his men only superficially. Prospero specifies that these suits were not "new-created" (1.2.81), but Antonio's attempt to raise certain men more accurately "changed'em /Or else new-formed'em" (1.2.82-3). Only Prospero, and

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*A Winter's Tale*, where Perdita, the King of Sicily's daughter, can once again assume her royal rank after being brought up by a shepherd.

eventually Miranda and Ferdinand, can instate members of the body politic into the political hierarchy without also toppling the natural order.

Although Prospero restores his dukedom under legitimate rule, Antonio's persistent refusal to repent for his treachery renders him "[u]nnatural" (5.1.79). Prospero scorns Antonio by claiming that in reaching too far above his natural station, he has rejected and overturned the natural order: Antonio's "ambition/ Expelled remorse and nature" (5.1.75-6). Just as Prospero cannot cultivate in Caliban a "human" (1.2.284) nature, Prospero's art cannot transmute his brother's treacherous heart. Prospero's art compels his enemies' imaginations to usurp their reason but not so as to gain complete and permanent control over their minds. Instead, Prospero chooses the "rarer action" (5.1.27) of mercy so as to prevent his "so potent art" from degrading entirely into a "rough magic" (5.1.50). Because Prospero releases his enemies' imaginations from under his control, his art commands the imagination and nature primarily to reveal the order by which Milan and Naples should be restored. When Prospero reveals himself to his enemies, then, he "present[s]/ As [he] was sometime Milan" (5.1.85-86) and trades his magic cloak for his "hat" and "rapier," lest he go unrecognized as the legitimate ruler (5.1.82-84). Lacking the power to soften one's heart let alone alter one's essence, Prospero exerts control over the imagination and nature to exemplify his art's role in revealing the order to which the political hierarchy ought to be restored.

But if Prospero's art ultimately restores his dukedom, how could it also be the catalyst of his usurpation? A healthy body politic, to recall Gosson, is one that labors. Prospero's "secret studies" (1.2.77) distracted him from his duties as duke and, "by being so retired" (1.2.91) he is unable to protect himself, his daughter, and his dukedom from his brother's plot. If Prospero is to restore his dukedom, his art can no longer be idle. Prospero's plan, then, is described as a series of labors: Prospero encourages Ariel, "there's more work" (1.2.238); Prospero assures his "industrious servant" (4.1.33), "[s]hortly shall all my labors end" (4.1.264); and Ariel reminds Prospero that their "work should cease" (5.1.5). Labor—that which Prospero shirked in Milan—is acknowledged as necessary to restore his dukedom. Indeed, Gonzalo's utopia is "laughed at" (2.1.172) precisely because it is idle. In Gonzalo's commonwealth "[a]ll things in common nature should produce / Without sweat or endeavor" (2.1.155–6) and its inhabitants would have "[n]o occupation, all men idle, all" (2.1.150). Without a laboring body politic, Gonzalo's "golden age" (2.1.164) would collapse. Whether in Milan, on the island, or in an imagined commonwealth, *The Tempest* suggests that labor is a corrective to political instability.

And more than just a corrective, it is through labor that Prospero deems Ferdinand and Miranda a couple worthy of inheriting Naples and Milan. Prospero presents Ferdinand with the same work with which he charges Caliban: carrying logs. But where Caliban complains and attempts to shirk this work, Ferdinand extols the

virtue of "labor" (3.1.1). However "mean" his task (3.1.4), Ferdinand's labor not only demonstrates his love for Miranda and gains her hand, but also shows Prospero that the suitor is worthy of such a match; love's labors are not here lost. Prospero explains that Ferdinand's laborious "vexations" (4.1.5) have "strangely stood the test" (4.1.7), making Miranda an "acquisition / Worthily purchased" or earned through his work (4.1.13-14). Ferdinand's work also purchases Prospero his dukedom from Antonio. Once Miranda and Ferdinand wed, Antonio's line can no longer inherit the crown and the two dukedoms will be unified through Prospero's lineage. Gonzalo hints as much when he asks "[w]as Milan thrust from Milan that his issue / Should become kings of Naples?" (5.1.205-6). Here again labor is a foil to Gonzalo's failed utopia. Idleness precludes marriage in Gonzalo's commonwealth, for when Sebastian asks "[n]o marrying 'mong [Gonzalo's] subjects?" (2.1.161), Antonio responds "None, man, all idle: whores and knaves" (2.1.162). The courtship that will both restore Prospero's dukedom and ensure peace with its neighbour is one consolidated through labor.

The restoration of Milan would not be complete unless Prospero abjured his art. In setting aside his art, Prospero's privileged position is passed down to Miranda and Ferdinand, consolidating a legitimate lineage across two now peaceful dukedoms. Milan would be restored but not assured legitimate perpetuity unless Prospero relinquished the power that situates him as the head of the body politic, both as its ruler and, by extension, as the site of knowledge. In a similar manner, Prospero asks the play's

audience to take up his art and release him from the “bare island” (Epilogue, 8)<sup>71</sup> on which he was marooned “[w]ith the help of [our] good hands” (Epilogue, 10) and “[g]entle breath” (Epilogue, 11). Prospero asks two things of the audience in the epilogue: to take up the labors of the poet by imagining him off the island and to acknowledge their enchantment with the play by clapping and cheering. If the audience fails to take up Prospero’s art, then Prospero’s “project fails” (Epilogue, 12) too. Prospero explains that his project “was to please” (Epilogue, 13), making explicit the audience’s role in the political work performed by the products of the imagination.

But what does it mean to “please” an audience? While few critics would claim Prospero as one of their more beloved Shakespeare characters, it is Prospero’s art, not him, that pleases his audience.<sup>72</sup> Because Prospero’s art exemplifies the alignment between the world of the imagination and the world of natural phenomena, the audience can acknowledge that the golden world of the poet could also be their own material world. The domain of the poet and the natural philosopher meet in the political sphere. For the body politic to be restored, it must be aligned with the order of nature—the roasters must care for the name of king. In other words, if the golden world imagined by the poet is to become manifest, then man’s art must be able to align the order of nature with the order among men. In pleasing his audience, Prospero’s epilogue does

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<sup>71</sup> The island, of course, is not left bare of inhabitants: Caliban is left to the island or, read differently, the island is left to Caliban.

<sup>72</sup> Harold Bloom, one can assume, is exaggerating when he writes that “[n]o audience has ever liked Prospero” (*Shakespeare: the Invention of the Human* [New York: Riverhead Books, 1998], 669).

just that: in praising the play as artifice with claps and cheers, the audience acknowledges that man's art can influence the natural order. *The Tempest*, then, dramatizes the relationship among poetry, natural philosophy, and sovereign power: poetry and natural philosophy both reveal the order that the sovereign is to maintain in his political hierarchy.

Even though they plied their labors in different domains, the poet and natural philosopher were complementary in the political work they performed during the early seventeenth century. As Prospero demonstrates, the realm of the imagination and the world of natural phenomena are indistinguishable under the hand of the legitimate ruler. When the play's characters and its audience question whether Prospero's art works on the imagination or on natural phenomena, either answer reflects the ruler's power and, in so doing, reproduces it in both imaginary and natural worlds. In *The Tempest*, Prospero's art addresses the power and limits of poetic and natural philosophical art for the restoration of the political order, dramatizing the complementary relationship between poetry and natural philosophy in the early seventeenth century. In his endeavor to restore an Adamic sovereignty over nature, Bacon's scientific reforms reject all distinctions between man's art and nature, save its efficient cause. The imagination, commonly wielded by the poets, becomes essential to achieving what was otherwise thought "impossible" in natural philosophical knowledge and art. Bacon infused the imagination's ability to perfect nature into his

conceptualization of his natural philosophy, making manifest the utopianism of poetry as the eutopianism of his program. Bacon emphasizes the primacy of the natural philosopher because his natural philosophical reforms have appropriated the poet's function, overlapping golden and natural worlds. Because *experientia literata* and *novum orgnum* must, in many senses, work together if Bacon is to restore an Adamic sovereignty over nature, Bacon codifies the complementarity between poetry and natural philosophy that allows Prospero to exert dominion over the imagination and nature. In the early seventeenth century, poetry and natural philosophy each express versions of sovereign power that reproduce the political order. The power of the imagination in both Bacon and Shakespeare was also the power to open up new and wonderful worlds. And as we shall see next, the ingenious explorers of the cosmos would also draw upon the imagination's power to discover new celestial bodies and the wonderful possibility of life on the moon.

## 2. Imagining the Moon in Fact and Fiction

In a letter to James I, Henry Wotton, the English ambassador to Venice, reports “the strangest piece of news yet received from any part of the world.” The news concerns a man who will soon prove “to be either exceeding famous or exceeding ridiculous.”<sup>1</sup> Wotton’s strange news was the 1610 discovery of four moons orbiting Jupiter and the fortune he predicted was the satellites’ discoverer, Galileo Galilei. Rather than weigh in on the matter of the astronomer’s fortunes, I want to explain what a literate man such as Wotton understood as the larger stakes in this rumoured discovery of moons circling a celestial body other than the Earth. Galileo would only be famous if he had discovered hidden moons around Jupiter. By the same token, he would inevitably be the source of ridicule if those Medicean stars proved not to exist. Put in terms we would use today, Galileo’s fortune relied on whether his *Sidereal Messenger* was a work of fact or the craft of fiction. It was common in the early modern period to discredit a new theory that challenged the reigning orthodoxy by calling the new claim a “fiction”<sup>2</sup>—and Galileo was indeed accused of “hawk[ing] fables.”<sup>3</sup> To discredit Galileo’s

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<sup>1</sup> Henry Wotton, *The Life and Letters of Sir Henry Wotton*, ed. Logan Pearsall Smith, vol.1 (Oxford: Oxford Clarendon Press, 1907), 486-487.

<sup>2</sup> Frédérique Ait-Touati, *Fictions of the Cosmos: Science and Literature in the Seventeenth Century*, trans. Susan Emanuel (Chicago: University of Chicago Press, 2011), 74.

<sup>3</sup> Martinus Horky, *Brevissima peregrination contra nuncium siderem nuper ad omnes philosophos et mathematicos emissum a Galileo Galilaeo*, (Bologna, 1610), in *Le Opere di Galileo Galileo*, Edizione Nazionale, ed. Antonio Favaro, (Florence 1890-1909; reprinted 1964-1966), 3:43. Since I do not read Italian, I have used Albert Van Helden’s translation as it appears in his edition of Galileo’s *Sidereal Messenger* (Galileo Galilei, *Siderius Nuncius or The Sidereal Messenger*, ed. and trans. Albert Van Helden, [Chicago and London: The University of Chicago Press, 1989], 93).

discovery as a fiction was also to attribute it to the work of the imagination, the faculty readily engaged by the poets. This accusation lays bare the imagination's role in the new, anti-Aristotelian means to discover knowledge advocated by Galileo and, as we shall see in this and later chapters, reveals how these new means became distinguished from other sciences. The imagination had been an important instrument in the work of many early modern philosophers who were exploring the boundaries as well as the wonders of the natural world. More than merely denying the validity of Galileo's discovery itself, what made this type of attack so dismissive was its focus on the means by which the discovery was made.

Astronomers, poets, and natural philosophers alike called upon the imagination to discover and convey knowledge about the cosmos and all the wonders concealed therein. Where Aristotelian natural philosophers excluded marvels from the study of nature, the astronomers and natural philosophers dissatisfied with the purview of the older philosophy welcomed wonders as important objects of study, opening up new worlds to investigation. And progressing beyond already well trodden ground of Aristotelian natural philosophy was made possible by the imagination of astronomers, natural philosophers, and poets. Just as Galileo's discoveries inspired the imagination of the poets,<sup>4</sup> the imagination convinced the astronomers that such marvels were worthy of

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<sup>4</sup> Marjorie Hope Nicholson *Science and Imagination* (Ithaca: Great Seal Books, 1956). Nicholson argues that "[t]he poetic and religious imagination of the [seventeenth] century was not only influenced, but actually changed, by something latent in the 'new astronomy'" (2). Nicholson lists John Donne, John Milton, Joseph

study. This chapter will explain how the imagination was put into the service of constructing a new model of the cosmos and of legitimating these new cosmological discoveries within the strictures of natural philosophy – the understanding of the heavens and of the discipline of natural philosophy underwent profound changes.

I will show how Galileo's *Sidereal Messenger* (1610), John Wilkins' *Discovery of a World in the Moon* (1638), and Francis Godwin's *A Man in the Moone: or a Discourse of a Voyage Thither by Domingo Gonsales The Speedy Messenger* (1638) utilized the imagination to assess orthodox theories of the heavens and to discover new knowledge. Godwin's is a fanciful narrative where Galileo's and Wilkins' are serious works that report and extend astronomical discoveries, yet all three perform the same philosophical work: they each use *ingenium*, a mental skill or power that engages the imagination,<sup>5</sup> to stake knowledge claims through the example of a world existing in the moon. The imagination could suspend the long-held belief in geocentrism,<sup>6</sup> allowing new discoveries to be used in the service of competing models of the cosmos where the Earth

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Campanella, Francis Godwin, and Jonathan Swift among those whose writing reveals the impact of Galilean discoveries or address the debate over the structure of the cosmos.

<sup>5</sup> As we shall see later in the chapter, *ingenium* is a difficult term to define with precision. I, however, focus on its inextricable relation with the imagination in the discovery of knowledge.

<sup>6</sup> Ait-Touati, *Fictions of the Cosmos*, 10. Ait-Touati makes the useful point that couching astronomical discussions in the guise of fiction helped to shield any contentious arguments from being discredited wholesale by critics and religious clerics, for "[o]nly the imagination can give form to the 'new world' of Copernican cosmology in a context where political and religious upheavals make suspect any overly innovative discourse" (10); if an astronomical work identified itself, at least in part, as a work of fancy, it was less likely to be taken as a serious threat to those invested in maintaining orthodoxy.

moved around the sun. *Ingenium* crafted similitudes that made the wonders of the heavens meaningful discoveries from which knowledge of the cosmos and the Earth could be deduced. In so doing, the imagination—often talked about in the language of “possibility”—helped to resolve how discoveries can be trusted when they are made through mechanical equipment, such as the telescope, and how these discoveries could be legitimated within the discipline of natural philosophy. The wonders of this new cosmos, however, often resisted the demonstrative reasoning that was traditionally held as the primary, if not only, means of attaining knowledge of nature in natural philosophy. To validate this new model of the heavens, I argue, its proponents worked to open natural philosophy and astronomy to the notions of the probable that allowed them to account for their wonderful discoveries. Instead of relying on demonstrative reasoning, the imagination was called upon to craft possible accounts for celestial wonders, sidestepping the certainty sought in natural philosophical demonstration. Once these imagined accounts satisfied reason, they were considered “probable” opinions that could importantly be counted alongside knowledge in the natural philosophical study of nature. And it is because of this probable opinion that astronomers and natural philosophers could advance the territory of what could be made known and protect their discoveries from being criticised as a flight of fancy. Although the imagination was championed in terms other than the “fancy,” it was far

from being excluded from the study of nature's order. As Galileo, Godwin, and Wilkins show, the imagination made it possible to open up new worlds for discovery.

Even if Galileo was proven to be "exceeding ridiculous," his supposed fable nevertheless carried heavy stakes. If Galileo's observations about the Medicean stars and the pock-marked lunar surface, among other celestial discoveries, could be trusted as knowledge, Aristotle's crystalline spheres would be shattered, the quintessence of the supralunary celestial bodies would be discredited, and the Earth may no longer hold the stationary position that was thought to corroborate Scripture. But these discoveries were difficult to replicate, opening Galileo and other advocates of heliocentrism to criticism. For one thing, the telescope was subject to distortion and aberration, which raised a number of questions: on what grounds could astronomers claim telescopic discoveries as knowledge? Does the telescope offer authoritative sight over the naked eye? How were these discoveries to be understood if the telescope could indeed be trusted? Because the telescope espied wonders, how could these discoveries be used to claim knowledge of the cosmos at large? Underlying these criticisms were even more serious questions of authority that put at stake not just a cosmological model, but also who could claim knowledge of the cosmos and how this knowledge could be discovered. For Galileo's contemporaries, astronomy was useful as a kind of knowledge that could predict the movement of the heavens. It was not, however, entrusted to discover knowledge of its order. How the cosmos was formed and how the heavens

were structured were questions more appropriately reserved for the natural philosophers and the theologians. Hence, when Galileo argued that his telescopic discoveries supported Copernican heliocentrism, he was also declaring that astronomy could not only lay claim to the knowledge about the cosmological order once enjoyed only by theology and natural philosophy, but also, and more importantly, that the use of the telescope could provide sense experience that disputed and unsettled the natural order of things.

When Galileo's *Sidereal Messenger* appeared in print in the early seventeenth century, natural philosophy and theology were the authoritative sciences on the order of the cosmos. By way of contrast, astronomy was an ancillary science tasked to predict the movement of stars with mathematical calculations.<sup>7</sup> As Albert Van Helden puts it, "mathematics could predict where a planet would be in the heavens at a particular time, but it could not inform us on how the heavens were constructed" — the latter concern was reserved for natural philosophy and theology.<sup>8</sup> Mathematical models, Van Helden continues, were not considered descriptions of the physical cosmos; they were "mere devices" that "were not regarded as having anything to do with reality."<sup>9</sup> Some astronomers, not the least among them Galileo and Johannes Kepler, contended that

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<sup>7</sup> Ait-Touati, *Fictions of the Cosmos*, 37.

<sup>8</sup> Van Helden, introduction to *The Sidereal Messenger*, 88.

<sup>9</sup> Van Helden, introduction to *The Sidereal Messenger*, 88.

astronomy could indeed reveal the physical order of the cosmos.<sup>10</sup> And the cosmos, they argued, contained physical bodies that could neither be seen by the naked eye nor be accounted for by the geocentric model. But how could these observations be trusted when astronomy was primarily set to predict the cosmological bodies described in natural philosophy?

While glass lenses were used to magnify objects, most especially to aid in reading<sup>11</sup> centuries before Galileo raised his spyglass to the night sky,<sup>12</sup> Galileo needed to convince his audience that his telescope could indeed magnify celestial images such that otherwise invisible physical bodies could be brought into view. “Sparing no labor or expense,” Galileo explains in the opening of his *Sidereal Messenger*, he crafted an “instrument so excellent that things seen through it appear about a thousand times larger and more than thirty times closer than when observed with the natural faculty only.”<sup>13</sup> In anticipation of potential criticism, Galileo offers an experiment such that “anyone may, with little trouble, make himself certain about the magnification of the instrument” (38). In order to verify his claims, Galileo asks that his readers draw two shapes onto paper, one four hundred times larger than the other, and to observe these

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<sup>10</sup> Ait-Touati, *Fictions of the Cosmos*, 37; Albert Van Helden, conclusion to *Sidereus Nuncius or The Sidereal Messenger*, by Galileo Galilei (Chicago: University of Chicago Press, 1989), 88-89.

<sup>11</sup> Van Helden, introduction to *The Sidereal Messenger*, 1-3.

<sup>12</sup> Galileo is popularly believed to be the first to turn the telescope to the night sky. Thomas Harriot, however, had used a spyglass to observe the moon in 1608, but with a spyglass that could magnify an image a mere six-times of that seen by the naked eye (Van Helden, introduction to *The Sidereal Messenger*, 9).

<sup>13</sup> Galileo Galilei, *Sidereus Nuncius or The Sidereal Messenger*, ed. and trans. Albert Van Helden (Chicago: University of Chicago Press, 1989), 37-38. Hereafter cited parenthetically with page number(s).

shapes from a distance through a spyglass and with the naked eye. If the smaller shape looks the same size as the larger shape through the telescope as the larger shape looks to the naked eye, then the viewer can trust that the instrument is indeed able to magnify its espied objects. Having challenged his readers to experience for themselves the spyglass's power of magnification, Galileo proceeds to relate his surprising observations of the moon, the celestial bodies he discovered to orbit Jupiter, and the Milky Way. But despite Galileo's efforts to support his claims about the spyglass's power, not just "anyone" (Galileo 38) had access to a powerful telescope and those that did often had a great deal of "trouble" (Galileo 38) seeing what Galileo claimed to have espied in the heavens.

Spyglasses were not uncommon in Europe by the early seventeenth century.<sup>14</sup> Indeed, they were often praised for their ability to read from a distance, but few were powerful enough to corroborate Galileo's celestial observations. When Galileo sent a copy of his *Sidereal Messenger* to an important figure or patron, he would often send a powerful spyglass in accompaniment.<sup>15</sup> But even with a powerful telescope, Galileo's observations could not always be replicated. The Galilean spyglass is a refracting telescope that operates by funneling light from celestial bodies through a convex objective lens that condenses the gathered light and projects it to an eyepiece optic lens

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<sup>14</sup> Van Helden, conclusion to *The Sidereal Messenger*, 91.

<sup>15</sup> Van Helden, conclusion to *The Sidereal Messenger*, 91.

which then magnifies the image. Because the light rays gathered from the object of gaze are funnelled directly from the objective lens to the optic lens, the colored rays of light produce a distorted image (*ie.*, chromatic aberration). The celestial body would have a halo of color distorting its contours, rendering its real shape difficult to discern.<sup>16</sup> This chromatic aberration, moreover, was but one distortion produced by the telescope. There was also the problem of spherical aberration which occurs because the light rays that pass through the center of a spherical lens and the light rays that pass through the edges of the lens do not meet in a focus point, rendering the image blurry. Because of such technological imperfections, many adherents of the Ptolemaic cosmos rejected Galileo's evidence for the Copernican model. Martinus Horky, for example, denounced Galileo in a letter to Kepler in 1610, arguing that "on Earth [the telescope] works miracles; in the heavens it deceives, for other fixed stars appear double."<sup>17</sup> By the same token, many believed that spyglasses which may be useful for seeing objects at a distance on Earth could not reliably be used to read the stars. The spyglass continued to be distrusted by some throughout most of the seventeenth century. Samuel Butler, for example, satirized lunar discoveries in his 1676 poem "The Elephant in the Moon:" what

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<sup>16</sup> Van Helden, conclusion to *The Sidereal Messenger*, 106.

<sup>17</sup> Horky, qtd in Van Helden, conclusion to *The Sidereal Messenger*, 93. Van Helden notes that Horky's criticisms may not be representative of Galileo's detractors: "Horky's case is extreme. He was ambitious, unscrupulous, and clearly very jealous of Galileo's success." Mario Biagioli (*Galileo, Courtier: The Practice of Science in the Culture of Absolutism* (Chicago: The University of Chicago Press, 1993), 137, 71. And as Biagioli points out, Galileo did not respond to Horky despite the fact that this attack was "widely publicized" because Horky was not among those interlocutors who were "protected by patrons that Galileo could not ignore. But as we shall see, Horky was not the only one to criticise the reliability of the telescope or the discoveries that it made possible.

a “learn’d society” excitedly declares to be an elephant on the moon is none other than a “small field-mouse” that had the found itself trapped between the “two glass windows” in the “hollow telescope.”<sup>18</sup>

Perhaps worse than mistaking a mouse for an elephant was failing to see anything at all. In his letter to Kepler, Horky relates that he has “witness[ed] most excellent men and most noble doctors” who have all tried and failed to espy the satellite stars around Jupiter that Galileo named in honor of Cosimo Medici II. When Galileo claims to espy the Mediciean stars, Horky contends, Galileo actually “sees four fictitious planets” —Galileo did not discover any hidden celestial bodies, but he instead “hawked a fable.”<sup>19</sup> Horky’s criticism suggests more than a snide swipe at the telescope’s ability to discern celestial bodies. Horky’s accusation that the Medicean stars are “fictitious” and the stuff of a “fable” discredits Galileo not just because these celestial bodies could not be seen, but because these sights were the products of the fancy. In his *The New Planet No Planet* (1640), Alexander Ross also launches the same criticism at those who argue for “the new found world of the Moon” and who think “that it is the Earth which moveth,” discrediting these astronomical claims as the product of a “false imagination.” Indeed, Ross refutes Wilkins’ argument about the moon by identifying his cosmological work as a fiction and as the product of “idle phancies:”

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<sup>18</sup> Samuel Butler, “The Elephant in the Moon,” in *The Poetical Works of Samuel Butler*, vol. 2, (William Pickering, London, 1835), 359, 360, 361. Butler rewrote this poem in long verse, and it is this version that is here quoted.

<sup>19</sup> Horky, qtd in Van Helden, conclusion to *The Sidereal Messenger*, 93.

for your whole booke is nothing else but a heap of fictions; your world in the Moone, your moving earth, your standing heavens, your figures and characters, what are they else but pleasant dreames, and idle phansies, fit enough to be inserted into *Ovids Metamorphosis*, if you could digest them into good verses? <sup>20</sup>

This type of criticism more importantly demonstrates that these astronomical observations could not have been made without the imagination—a sentiment we will later see John Milton express when he writes that “As when by night the glass Of Galileo, less assured, observes/ *Imagin’d Lands and Regions on the Moon*” (emphasis mine) in his 1666 *Paradise Lost*.<sup>21</sup> And however caustic these remarks may be, this type of criticism was correct.

Galileo’s celestial discoveries are indeed the products of his imagination. But this is not to say that Galileo’s Medicean stars do not exist—they do. Rather, it is to suggest that the imagination was an essential component of discovery as championed by the influential astronomers, poets, and natural philosophers whose work this chapter investigates. When Horky criticised Galileo’s observations as a “fable,” this criticism was trenchant precisely because it denounced the work of the imagination that was central to these discoveries. Galileo and those who defended his observations could not have used their discoveries in the service of Copernican heliocentrism, let alone convey these

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<sup>20</sup> Alexander Ross, *The New Planet No Planet; or, The Earth No Wandring Star: Except in the Wandring Heads of Galileans . . . and Copernicus his opinion, as erroneous, ridiculous, and impious, fully refuted* (London, 1646), “To the Right honourable GEORGE Lord BERKLEY,” 105. For a brief discussion of Ross’s criticism of Wilkins, see David Cressy, “Early Modern Space Travel and the English Man in the Moon,” *The American Historical Review* 111, no. 4 (October 2006), 975.

<sup>21</sup> John Milton, *Paradise Lost*, ed. Scott Elledge, 2<sup>nd</sup> ed. (New York: W.W. Norton, 1993), 5. 261-263 (references are to book and line numbers).

discoveries to a wider audience, without the imagination and its language of wonders. Galileo and Wilkins, among others, encouraged the advancement of knowledge beyond the Ptolemaic understanding of the cosmos. The imagination was intimated as a precursor to a fair evaluation of these claims and, as a result, the new discoveries were aptly described as wonders or marvels.

Once turned to the heavens, the telescope made discoveries that not only challenged an older model of the cosmos, but more importantly could advance knowledge of nature far beyond the purview of the Aristotelianism that dominated universities. Galileo opens his *Sidereal Messenger* by “propos[ing] great things for inspection and contemplation by every explorer of Nature” (35). “Great,” he continues, “because of the excellence of things themselves, *because of their newness, unheard of through the ages*, and also because of the instrument” by which they are discovered (35; emphasis mine). As we saw in Chapter 1, Francis Bacon’s program to reform and advance the sciences worked to eradicate “men’s despairing belief that the job is impossible,” encouraging the growth of knowledge so as to restore an Adamic dominion over nature.<sup>22</sup> Even before he took part in founding the Royal Society, Wilkins worked to “Raise up some more Active Spirit to a Search after other hidden and unknown Truths” because it is “a great Impediment unto the Growth of Sciences, for men still to

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<sup>22</sup> Francis Bacon, *Novum organum*, in *Oxford Francis Bacon*, ed. Graham Rees and Maria Wakely, vol. 11 (Oxford: Oxford University Press, 2004), 149.

Plod upon beaten Principles" (Epistle) in his *A Discovery of a New World*.<sup>23</sup> These beaten principles included those of Aristotle, for it would be a "lazy Opinion, to think that *Aristotles* works the Bounds and Limites of all Humane Invention, beyond which there could be no possibility of reaching" (21–22). Equipment such as Galileo's telescope, Wilkins suggests, would help natural philosophers make manifest the possibility of discovering "unknown Truths." Such new technology, he argues, would usher in a new era of discovery that "these latter ages of the world may justly boast, and for this expect to be celebrated by posterity" (66–67). Each of these "explorer[s] of Nature," though by no means alone, worked to surpass the boundaries of older, "beaten Principles" to advance the sciences into new, fruitful areas once thought "impossible" to discover. Rather than deal exclusively with the commonplace phenomena investigated by Aristotelian natural philosophy, figures like Galileo, Bacon, and Wilkins included the study of wonders into their quest for knowledge.

In welcoming phenomena "unheard of through the ages" (35) into his study of the cosmos, Galileo challenged the Aristotelian exclusion of wonders or *praeter naturam* ("beyond nature") from natural philosophical investigation. Aristotelian natural philosophy took commonplace and regular phenomena as the objects of study; anomalous phenomena, like marvels or wonders, were excluded because revealing their

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<sup>23</sup> John Wilkins, *A discovery of a new world, or, a discourse tending to prove ... there may be another Habitable World in the Moon ... in Two Parts* ([London], 1640) fourth ed., "Epistle." Hereafter cited parenthetically by page number(s).

cause, though possible,<sup>24</sup> was unlikely and because these phenomena were not held to be representative of nature more broadly. In the late sixteenth and seventeenth centuries, however, the study of wonders was encouraged by some astronomers and natural philosophers, not the least Galileo, Bacon, and Wilkins.<sup>25</sup> The study of nature's wonders was also a study of that which elicited wonder. As Daniel Fusch explains, "the verb wonder indicates an emotional response to a marvelous incident; the noun wonder indicates both the name for that response and the marvelous incident that provoked it."<sup>26</sup> Since Aristotle, the state of wonder was often linked to knowledge.<sup>27</sup> Wonder, as Aristotle had it, was the origin of philosophy: "For by way of wondering, people both now and at first began to philosophize."<sup>28</sup> Wonder is elicited when the knowledge of causes is absent, motivating the pursuit of this knowledge in turn.<sup>29</sup> But where Aristotelian philosophers found wonder in regular phenomena, Lorraine Daston

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<sup>24</sup> Lorraine Daston, "What Can Be a Scientific Object? Reflections on Monsters and Meteors," *Bulletin of the American Academy of Arts and Sciences* 52, no. 2 (Nov. - Dec., 1998): 39.

<sup>25</sup> Daston specifically lists Bacon, Pietro Pomponazzi, Girolamo Cardano, and Bernard Palissy as natural philosophers who included anomalous phenomena in their studies ("Scientific Object," 39), but other figures important to this and future chapters such as Johannes Kepler and members of the Royal Society also welcomed wonders into their investigation of nature and the cosmos.

<sup>26</sup> Daniel Fusch "The Spirited Mind: The Ethics and Epistemology of Early Modern Wonder," *Mediterranean Studies* 17 (2008): 186. Fusch importantly reminds us of the ethical dimension in the epistemological value of wonder, especially in early modern poetry: "the particular delight that poetry evokes, and by which poetry arouses our desire both to seek goodness and to understand that goodness we seek, is wonder; by means of invention and marvels, the poet might inspire a reader with the vision of a "golden" world" (194; here Fusch is quoting Philip Sidney's famous argument that poetry crafts a "golden world" (Sir Philip Sidney, *Defence of Poesie, Astrophil and Stella and Other Writings*, ed. Elizabeth Porges Watson [London: Everyman Paperbacks, 1997], 88).

<sup>27</sup> Peter G. Platt, *Reason Diminished: Shakespeare and the Marvelous* (Lincoln & London: University of Nebraska Press, 1997), 1.

<sup>28</sup> Aristotle, *Metaphysics*, 982b12-13, ed. Joe Sachs (Santa Fe: Green Lion Press, 1999), 4.

<sup>29</sup> Daston, "What Can Be a Scientific Object?," 45.

explains that the preternatural philosophers found wonder most poignantly in nature's anomalies.<sup>30</sup> "[R]are and strange works of nature, Bacon argues, "stir and raise the intellect to investigate and discover forms capable of encompassing them."<sup>31</sup> René Descartes similarly argued that "wonder is a sudden surprise of the soul which makes it tend to consider attentively those objects which seem to it rare and extraordinary."<sup>32</sup> And later in the century, Thomas Sprat would argue for why earlier ages were unable to achieve the natural philosophical progress that the Royal Society would obtain by taking wonders as a primary object of study:

The Greeks "had almost a perpetual Warr, at home, or abroad: which kinds of busie, and active life, breed men up indeed for great Employments: but not so well for the diligent, private, and severe examination of those little and almost infinite Curiosities, on which the true Philosophy must be founded."<sup>33</sup>

By including wonders into their studies, preternatural philosophers could boast a base of knowledge far beyond what Aristotle's *Organon* could support.<sup>34</sup> Regardless of what

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<sup>30</sup> Daston, "What Can Be a Scientific Object?," 45.

<sup>31</sup> Bacon, *Novum organum*, 11:301.

<sup>32</sup> René Descartes, *The Passions of the Soul*, trans. Stephen H. Voss (Indianapolis: Hackett, 1989), 58. Wonder should not here be confused with astonishment, which for Descartes arrested natural philosophy entirely. For him, astonishment "makes the entire body remain immobile like a statue, and renders one incapable either of perceiving anything of the object but the face first presented, or, consequently, of acquiring a more specific knowledge of it." For a discussion of astonishment and the dangers of wonder in natural philosophy throughout the seventeenth and eighteenth centuries, see Lorraine Daston and Katharine Park, *Wonders and the Order of Nature 1150–1750* (New York: Zone Books, 1998), 316–328.

<sup>33</sup> Thomas Sprat, *The History of the Royal-Society for the Improving of Natural Knowledge*, (London: Printed by T.R., 1667), 8.

<sup>34</sup> For a concise explanation of wonder in early modern natural philosophy, see Daston and Park, Introduction in *Wonders*.

phenomena were taken to elicit wonder, wonder was essential in the pursuit of knowledge of nature's workings on Earth and in the heavens.

What Galileo espied on the lunar surface, to cite but one example, was nothing short of a wonder. Contrary to the "great crowd of philosophers [who] have believed" that the lunar surface was "perfectly spherical," the moon's terrain was seen to be "crowded with depressions and bulges" in Galileo's "oft-repeated observations" (40). Aristotle envisioned the cosmos as a series of nested spheres consisting of the Moon, Mercury, Venus, the Sun, Jupiter, and Saturn, all surrounding an immobile Earth. All but the Earth consisted of immutable and immaculate quintessence. The sublunar sphere of the Earth consisted of four degraded elements (earth, air, fire, water) that were subject to change and decay. Galileo's repeated telescopic observations of the moon's rough terrain could not be accounted for by an Aristotelian model of the heavenly spheres. What Galileo saw of the moon's surface was "observed by no one before us" (40), emphasizing the marvelousness of his discovery. Galileo's discovery, then, not only challenged Aristotle's model of the cosmos but privileged wonders as an object of study. Although Galileo was convinced of the importance of his "great" discoveries, he would need to persuade his readers to trust in the observations that challenged established knowledge and the disciplines to which this knowledge was entrusted. To do so, Galileo describes his marvels in language that could solicit a matching sense of wonder in his audience: the language of the poet. Set to exceed the limits of established knowledge,

Galileo describes his discoveries in the language of poetic wonder. Stephen Greenblatt argues that those who related wonders were more likely to be believed if they could elicit a sense of wonder in their audience, “for that wonder will link whatever is out there to inward conviction.”<sup>35</sup> Poetic language could elicit the sense of wonder that motivated the pursuit of knowledge. As we saw in Chapter 1, the poet’s imagined worlds discovered (*inventio*) in nature what had been otherwise hidden and his language ignited his audience’s imagination so as to call them to action. And Galileo’s descriptions of celestial marvels would indeed inspire a sense of wonder in his audience—notably Kepler whom is later discussed.

The very title page of *Sidereal Messenger* announces the “unfolding of great and very wonderful sights,” including the Medicean stars that fly around Jupiter “with wonderful swiftness” (title page). When espied through his telescope, Galileo observes that the lunar surface was “crowded everywhere with vast prominences” (36) that cause a “sinuous” terminator line in which “more and more bright points light up, as if they are sprouting, in the dark part” (42) when it is increasingly bathed in the sun’s light. “This lunar surface,” Galileo waxes poetic, “is decorated with spots like the dark blue eyes in the tail of a peacock, is rendered similar to those small glass vessels which, plunged into cold water while still warm, crack and acquire a wavy surface” (43).

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<sup>35</sup> Stephen Greenblatt, *Marvelous Possessions: The Wonder of the New World* (Chicago, University of Chicago Press, 1991), 22. Greenblatt makes this claim in relation to the travel narratives of Jean de Léry but this sense of wonder was also equally as important for the astronomers and natural philosopher discussed in this chapter.

Galileo's description of the moon animates the lunar terrain—it is "crowded" with mountain peaks that "sprout" out of the dark—and renders its wonders more vivid, if not intelligible, with similes. Jean Dietz Moss argues that Galileo used rhetoric to persuade his audience of his discoveries and that Galileo's eloquent descriptions suggest that he also used the language of the poet.<sup>36</sup> Galileo's "poetic language," Dietz Moss contends, "illustrates well the unusual blend of science and poetry in [Galileo's] nature."<sup>37</sup>

Galileo's language of wonder, however, does more than just eloquently describe his cosmological observations; Galileo's poetic language also bolsters his argument for Copernican heliocentrism. Although Galileo explains that this argument is too broad for the scope of his *Sidereal Messenger*, he refers his interlocutors to his *Dialogue Concerning the Two Chief World Systems* in which "we will demonstrate that [the Earth] is moveable ... and that she is not the dump heap of filth and the dregs of the universe, and we will confirm this with innumerable arguments from nature" (57). These "innumerable arguments from nature"—also translated as "an infinitude of arguments drawn from nature"<sup>38</sup>—links Galileo's language of wonder to his philosophical arguments through

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<sup>36</sup> Jean Dietz Moss, *Novelties in the Heavens; Rhetoric and Science in the Copernican Controversy* (Chicago: The University of Chicago Press, 1993), 81. Dietz Moss identifies Galileo as an adept rhetorician but concludes that the "rhetoric of [Galileo's works] was probably most effective in its impact on the opposition; it strengthened and unified them. The damage done by it to the cause of science in Rome and the Italian universities at the time was far greater than its aid" (330).

<sup>37</sup> Dietz Moss, *Novelties in the Heavens*, 81.

<sup>38</sup> Dietz Moss, *Novelties in the Heavens*, 82. Dietz Moss offers this translation.

the poetic figure of *copia*. And this type of poetic language was not reserved for the wonders of the cosmos alone. The microworld espied through the magnifying lens was also described in elevated language. Even the most pestilent object of study was an occasion to wax poetic about nature's marvelousness when placed under the magnifying lens. One of the sober virtuosi of the Royal Society, Robert Hooke, would later describe the flea as a knight donning a "polish'd suit of *sable* Armour" and the book worm as "one of the teeth of Time."<sup>39</sup> Far from the "dregs of the universe" (Galileo 57), the Earth could be revealed as a magnificent wonder to eyes willing to accept this new magnified sight. The poet's language, then, was important for astronomers and natural philosophers to describe wonders and to articulate their discovery as claims to knowledge.

The language of poetic wonder worked to bolster the natural philosophical arguments for the order of the cosmos in works that related actual observations of the heavens and those identified as fanciful as well. The wonders described in Godwin's *Man in the Moone* are used to evaluate competing claims about the structure of the heavens, suggesting that poetic language is most persuasive when arguing for the significance of wonders, whether discovered through actual experience or crafted solely in a flight of fancy. Like Galileo, Domingo Gonsales—Godwin's lunar traveler—describes his discoveries of "admirable devices" and "most rare and incredible secrets of

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<sup>39</sup> Robert Hooke, *Micrographia or Some Physiological Descriptions of Minute Bodies Made by Magnifying Glasses with Observations and Inquiries thereupon* (New York: Dover Publications, 1961), 210.

Nature" in the poetic language of wonder.<sup>40</sup> When being flown into the heavens by a flock of "gansa's" (79) or geese, Domingo observes "another Earth" or "that starre which we call the Moone" (96). Unlike the things on Earth that "put on that lurid and deadly colour of blew" when viewed at a distance, the moon "shewed itself in his natural colours" (96). "I perceived also," he continues, to see "that it was covered for the most part with a huge and mighty Sea, those parts only being drie Land, which shew unto us here somewhat darker" (96). Here, the vision of the moon is alive with vivid colour and its seas are animated with strength because of its vast size. These descriptions also address the debate over whether the moons dark spots represent land or sea, a question to which Galileo intimates a potential answer in his *Sidereal Messenger* (43). Domingo even goes so far as to signal his shift into philosophical inquiry by immediately apologizing for the deviation away from his narrative: "But where am I? At first I promised an History, and I fall into disputes before I am aware" (95). The language of natural philosophical debate, Domingo implies, is also language amenable to poetic wonder. Indeed, Domingo describes the ends of natural philosophical discovery in poetic language. Before he relates his marvelous travels to the Isle of St. Hellens, the moon, and China, Domingo prepares his readers for his narrative by prefacing his sights

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<sup>40</sup> Francis Godwin, *The Man in the Moone*, ed. William Poole (Peterborough: Broadview Press, 2009), 73. Hereafter cited parenthetically with page number.

as wonders that, provided the government and Church approves (73), could be harnessed for the benefit of mankind. Of his narrative, Domingo explains:

although since it hath proved a meanes of eternizing my name for ever with all Posteritie, (I verily hope) and to the unspeakable good of all mortall men, that in succeeding ages the world shall have ... to give perfect instructions how those admirable devices, and past all credit of possibilitie, which I have light upon, may be imparted unto publike use.... but that which far surpasseth all the rest, you shall have notice of a new World, of many most rare and incredible secrets of Nature, that all the Philosophers of former ages could never so much as dreame off. (73)

Domingo's argument that wonders could be harnessed for the "unspeakable good of all mortal men" echoes the ends to which Bacon sets his natural philosophical reforms and the reason given for the study of wonders.<sup>41</sup> These ends would also be repeated by Henry Oldenburg, a member of the Royal Society, who championed the communication of natural philosophical knowledge as contributing to the "universal good of mankind" in the latter half of the seventeenth century.<sup>42</sup> Whether for Galileo or Godwin, the language of wonder worked to evaluate claims for the order of the cosmos, persuading an audience of its falsity or veracity. This common use of the poetic language suggests that the discourses of natural philosophy and of fabulous narratives both work together to reveal the implication of wonders for the discovery of knowledge of nature.<sup>43</sup>

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<sup>41</sup> Bacon, *Novum organum*, 11:23; Bacon, *The Advancement of Knowledge*, in Oxford Francis Bacon, ed. Michael Kiernan, vol 4 (Oxford: Oxford University Press, 2000), 63.

<sup>42</sup> Henry Oldenburg, "Introduction to the Philosophical Transactions," *The Philosophical Transactions* 1 (1665) 2.

<sup>43</sup> Ait-Touati, *Fictions of the Cosmos*, 17. Indeed, Ait-Touati argues that "the truth and credibility of the cosmological discourse are not constructed (only) in opposition to but with fiction."

For Galileo, Bacon, and Wilkins, wonder was, in a sense, the goal to which their studies aimed: each sought to advance knowledge into new directions such that the otherwise uncharted areas of nature and the cosmos would be made known. Galileo emphasized the novelty of his discovery of Jupiter's moons, but one of his "very wonderful sights" (title page), to such a point that he proclaims it grounds to seek patronage from Grand Duke Cosimo de Medici. In the *Sidereal Messenger's* dedication, Galileo argues that: "I discovered these stars unknown to all previous astronomers, I decided by highest right to adorn them with the very august name of [the Medici's] family. For since I first discovered them, who will deny me the right if I also assign them a name and call them the Medicean stars" (32).<sup>44</sup> For Galileo, a wonder's novelty was not to be ignored but to be embraced as grounds to proclaim a type of proprietorship over a discovery. Not unlike Galileo, Bacon encouraged the study of wonders, arguing that understanding the "Wonders of Nature, is the nearest Intelligence and passage towards the Wonders of Arte."<sup>45</sup> By studying what he called wonders or the marvels of nature, man could come to understand the underlying causes that eluded the ancients and, with this knowledge, help to restore dominion over nature. But the marvelousness of a

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<sup>44</sup> Van Helden, introduction to *The Sidereal Messenger*, 13n13. Van Helden explains that Galileo's argument that the novelty of his discovery granted him proprietorship over their appellation inaugurated a trend by which a discovery could be named after its discoverer.

<sup>45</sup> Bacon, *The Advancement of Knowledge*, 4:63. Daston and Park, *Wonders*, 222. Daston and Park explain that Bacon's inclusion of marvels as objects of study "serve[s] to correct natural philosophical axioms derived only from [the] commonplace phenomena" that Aristotle demarcated as the only objects from which *scientia* could be discovered.

discovery could also more likely make it subject to criticism. The first proposition (of which there were fourteen) that Willkins lays out in his *Discovery* aims to dispel this very criticism. “[T]he strangeness of [his] opinion,” he contends, “is no Sufficient reason why it should be rejected, because other certain Truths have been formerly esteemed ridiculous, and great Absurdities entertained by common consent” (Epistle). Akin to the outcome Wotton predicted for Galileo’s discoveries, Wilkins makes recourse to the stuff of nature and the stuff of the imagination to support his proposition. Because the “ridiculous” could be shown to be “certain Truths,” what looks to be a flight of fancy, then, may be solid ground for natural philosophical knowledge.<sup>46</sup> “That a new Truth may seem absurd and impossible,” he reiterates, “is not presently to be rejected, but rather to be pry’d into with a diligent enquiry, since there are many things which are yet...reserv’d for future Discovery” (12). To discredit a discovery or a claim because its novelty lends itself to the wonders of fables, Wilkins insists, is to deny the “future” advancement of knowledge. When evaluating a strange claim, Wilkins asks his interlocutors to suspend their disbelief and, in an important sense, to imagine beyond the purview of established knowledge.

Put another way, Wilkins was asking his interlocutors to exercise *ingenium*, a demand both Galileo and Godwin ask of their readers as well. For Wilkins, *ingenium*

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<sup>46</sup> Ait-Touati, *Fictions of the Cosmos*, 61. Indeed, Ait-Touati argues that “In Wilkins’ work, the old fictions are revealed as truthful and are verified by the new philosophy” (61).

would ready the mind to assent to truth, whether in natural philosophy or religion: if to the Enquiries about Religion a man would but bring with him the same Candour and Ingenuity, the same readiness to be Instructed, which he doth to the Study of human Arts and Sciences; that is, a Mind free from violent Prejudices and Desire of contention; it can hardly be imagined, but that he must be convinced and subdued by those clear Evidences which offer themselves to every inquisitive Mind, concerning the truth of *the Principles of Religion* in general, and concerning the *Divine Authority* of the *Holy Scriptures*, and of the *Christian Religion*.<sup>47</sup> As Wilkins intimates, *ingenium* was an essential step in the attainment of knowledge.<sup>48</sup> *Ingenium* resists any single or straightforward definition.<sup>49</sup> As Karen A. Hodges puts it, "*ingenium* unfolds with recursive definitions."<sup>50</sup> Hodges explains that one such definition identifies *ingenium* as "an innovative cognitive power" that "combines sense perceptions with the imagination to open up and reveal the world."<sup>51</sup> Another unfolding of *ingenium*, she continues, is as an "inventive process" by which sense experience gains meaning by crafting similitudes through "fantasy" or

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<sup>47</sup> John Wilkins, *Of the Principles and Duties of Religions: Two Books*, Ninth Edition (London: 1734), 356.

<sup>48</sup> Robert A. Greene, "Whichcote, Wilkins, 'Ingenuity,' and the Reasonableness of Christianity," *Journal of the History of Ideas* 42, no. 2 [Apr. - Jun., 1981]: 245. Although Greene argues that Wilkins' understanding of ingenuity is most developed in Wilkins' later works, *An Essay towards a Real Character and a Philosophical Language* (1668) and his *Of the Principles and Duties of Natural Religion* (1675), I contend that *ingenium* is also important, even if unstated, to Wilkins' cosmological works.

<sup>49</sup> Karen A. Hodges, "Unfolding Sophistic and Humanist Practice through *Ingenium*," *Rhetoric Review* 15, no. 1 (Autumn, 1996):86-92 at 86; Rhodri Lewis, "Francis Bacon and Ingenuity," *Renaissance Quarterly* 67. 1 (Spring 2014): 113-114.

<sup>50</sup> Hodges, "Unfolding," 86.

<sup>51</sup> Hodges, "Unfolding," 86.

the imagination.<sup>52</sup> Here I will refer to *ingenium* in the way I hope to show it was used by Wilkins, Galileo, and Godwin: I focus on *ingenium*'s use of the imagination in celestial exploration and the (possible) discovery of nature's order in the heavens and on Earth. *Ingenium* was also crucial for humanist education because it was regarded as the foundation of all rhetorical prowess:<sup>53</sup> without *ingenium*, a rhetorician could not discover the appropriate materials by which to craft an argument, rendering *inventio* impossible. In the related humanist tradition of poetry, Rhodri Lewis explains that "*ingenium* was the *imaginative talent* through which the poet, painter, or sculptor was able to imitate, and even to surpass, the created world in his works" (emphasis mine).<sup>54</sup> While *ingenium* is most often regarded in relation to rhetorical and poetic arts, *ingenium*—and its related forms, ingenuity and ingenious<sup>55</sup>—is also harnessed by Galileo and his supporters in their endeavors to deduce the implications of what his discoveries meant for the cosmos and the Earth. Galileo, Godwin, and Wilkins all describe wonders and, whether couched in a narrative that identifies itself as fabulous or as a work of astronomy or natural philosophy, new worlds were imagined to account for the wonders discovered in the heavens.

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<sup>52</sup> Hodges, "Unfolding," 86.

<sup>53</sup> Lewis, "Francis Bacon and Ingenuity," 120.

<sup>54</sup> Lewis, "Francis Bacon and Ingenuity," 121.

<sup>55</sup> The terms *ingenium*, ingenious, and ingenuity are considerably slippery. Greene sketches the overlap between ingenious and ingenuity: "Derived from the Latin adjective *ingenuus* (native, indigenous, inborn, innate; hence noble, frank, candid) "ingenuous" was for over a hundred years after its appearance in English generally con-fused with "ingenious" (Latin *ingeniosus*, clever, of good natural talents). Lamented by lexicographers, this failure to distinguish the two words is attributable not only to compositors, to whom many examples can be traced, but to genuine confusion" ("Whichcote, Wilkins, 'Ingenuity,'" 227-228).

In naming Jupiter's satellites after the Medici family, Galileo not only risked princely ridicule but also made *ingenium* central to the legitimation of his discoveries and, through the patronage of the Medicis, his status as a philosopher.<sup>56</sup> Galileo's telescopic discoveries extended beyond the traditional field of astronomy and, in proclaiming its ability to describe the physical reality of the cosmos, he essentially attributed to astronomy what had been the traditional role of natural philosophy. In order to legitimate his discoveries, Galileo needed to legitimate himself as a philosopher proper or, in Mario Biagioli's words, to formulate a new "socioprofessional identity."<sup>57</sup> As Biagioli shows, "the court contributed to the cognitive legitimation of the new science by providing venues for the social legitimation of its practitioners, and this, in turn, boosted the epistemological status of their discipline."<sup>58</sup> By naming Jupiter's moons the Medicean stars, Galileo finally succeeded in being invited to the Medici court—a social promotion that had earlier eluded him.<sup>59</sup> Under the patronage of the Grand Duke, Galileo was granted a sociopolitical rank that lent him and, by extension, his telescopic

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<sup>56</sup> Daston points out that Galileo was skeptical of the imagination, for he "warned that the faculty of imagination is an impoverished source of causal explanations in natural philosophy because nature invents far more causes for the same effect than the human imagination can fathom" ("Galilean Analogies: Imagination at the Bounds of Sense," *Isis* 75. 2 [Jun., 1984]: 303). Nevertheless, Daston argues that "Galileo's vision of a reformed natural philosophy and his distrust of the imagination conspired to all but exclude explanatory analogies from his scientific writings, although he granted wide scope to analogies of both the expository and mathematical type" (302). And as I show, Galileo was less skeptical about the use of *ingenium*, which employed the imagination, in his astronomical writings.

<sup>57</sup> Biagioli, *Galileo, Courtier*, 5.

<sup>58</sup> Biagioli, *Galileo, Courtier*, 2.

<sup>59</sup> Biagioli, *Galileo, Courtier*, 105. Galileo, however, was selected to tutor Cosimo in mathematics years prior but was not invited to court until 1610.

observations a greater legitimacy. Galileo thus successfully fashioned himself as a (natural) philosopher; his astronomical observations predicted the motions of celestial bodies and, more importantly, made claims for the physical existence and structure of the cosmos.

And to court Cosimo II's patronage, Galileo framed his discoveries as the work of (his) ingenuity. In his dedication to Cosimo, Galileo waxes poetic about the motivation behind his nightly observations of the heavens, identifying his gratitude as the cause of his wonderful discoveries: "my soul was so inflamed that day and night it reflected on almost nothing else than how I ... might show how very grateful I am toward you" (32). Here in the language of clientage, he attributes to Cosimo II the true source for the astronomer's discoveries. The prince was as magnificent as a heavenly body, one whose "rays" of "incredible clemency and kindness" (32) could only be reciprocated with a gift of stellar quality. To produce such a gift, Galileo suggests, would require *ingenium*, because to celebrate Cosimo II, Galileo must surpass the "marbles," "metals," and even the "incorruptible monuments of letters" (29). For how could "human ingenuity, content with these [earthly] realms" dare not to "proceed beyond them?" (29-30). "[T]his human ingenuity," Galileo continues, "contrived more incorruptible symbols against which voracious time and envious old age can lay no claim" (30); ingenuity, Galileo writes, turned his gaze toward the heavens to assign "the most brilliant stars the names of those who...were judged worthy to enjoy with the stars

an eternal life" (30). It is for this reason that Galileo deems it necessary to revive this "noble and admirable invention of human sagacity" that was otherwise "out of use" (30). Galileo remarks that Jupiter was the celestial body under which Cosimo was born (30), so it is doubly fitting that Galileo assigns its satellites the name of the Medicean stars. Galileo's *ingenium* expresses his gratitude in a way befitting a client to a royal patron and, in securing patronage in turn, the client hoped to secure greater legitimacy for his celestial discoveries.

Lunar fiction too appeals to the *ingenium* in order to make knowledge claims. Before Godwin's audience turns to his lunar narrative proper, they are met with an address "to the Ingenious Reader." Although this address may have been written by Godwin's son under the pseudonym "E. M.", the choice to describe the reader as "ingenious" is significant because it identifies the common epistemological grounds between works of astronomy or natural philosophy and those of fabulous lunar fiction: both utilized the imagination to discover or invent knowledge of the cosmos and both elicited the imagination of their readers in order to persuade them of the veracity of their descriptions. "E.M." describes Godwin's lunar narrative as an "Essay of *Fancy*, where invention is shewed with *Judgment*" (67). Ait-Touati suggests that the Address to the Reader "stresses" an "ambivalence" between "fiction and learned discourse,

'Judgment'."<sup>60</sup> The reader, E.M. stipulates, cannot expect an exhaustive evaluation of familiar natural philosophical understandings of nature and the heavens, for "[i]t was not the *Authors* [Godwin] intention ... to discourse thee into a beleife of each particular circumstance" (67). Instead, E.M. makes a similar request of the reader that Wilkins asks later that year:<sup>61</sup> "Tis fit thou allow him a liberty of conceite; where thou takest to thy selfe a liberty of judgment" (67). Here, the reader's judgment is allowed an equal freedom to evaluate the natural philosophical claims in the narrative as the "Fancy" has taken to craft its marvelous "conceits" (67). And the reader has ample material upon which to exercise judgment. Among the many natural philosophical claims evaluated in the narrative are the idea of the ether, the reign of fire (98), and the veracity of the Copernican model of the cosmos (92, 94, 97).<sup>62</sup> Godwin's lunar narrative imagines a world where the sense experience trusted to discover and legitimate wonders is made manifest. Although it is a work of "Fancy," Domingo boasts in the narrative the same authority that Galileo uses to legitimate the celestial discoveries for which he risked ridicule. Whether on the wings of geese or through the lens of a powerful telescope, both see the cosmos in a way otherwise thought impossible. *Ingenium*, then, was called upon

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<sup>60</sup> Ait-Touati, *Fictions of the Cosmos*, 52.

<sup>61</sup> Ait-Touati, *Fictions of the Cosmos*, 46. Ait-Touati notes that Wilkins references Godwin's lunar narrative in his *Discovery*, which appeared in print a few months after *The Man in the Moone* (46).

<sup>62</sup> Domingo remarks that he "will not go so farre as *Copernicus*, that maketh the Sunne the Center of the Earth, and unmoveable" (94). But after having a bird's eye view of the Earth, so to speak, he will "allow the Earth his motion (which these eyes of mine can testifie to be his due) and these absurdities are quite taken away, every one having his single and proper Motion onely" (94).

to discover and legitimate the discovery of seventeenth-century wonders in works that today would be differentiated as fact and fiction.

As Galileo would have it, his powerful telescope was a case for optimism in the exploration of nature: the telescope made possible discoveries “unheard of through the ages,” making what was once hidden “manifest to our sight” (35). The discovery of a pockmarked lunar surface provided evidence against the long-held Aristotelian conception of an immaculate lunar sphere composed of quintessence. This discovery of a rough lunar surface was a wonder both because it could not be accounted for by the prevailing theory of the cosmos and because it inspired awe in those who beheld it. In taking wonders as that which made his exploration of nature “great” (35), Galileo risked casting his discoveries as the anomalous objects of study that were rejected by Aristotelian natural philosophy. As we have seen, for the reigning mode of natural philosophical investigation, wonders or marvels were excluded from study because they were not thought to be representative of nature more broadly. Galileo, however, did not frame his “very wonderful sights” (title page) as anomalous phenomena. Instead, Galileo represented these celestial discoveries as similitudinous to the knowledge already known of the Earth and, in so doing, suggested that marvels could be used to understand nature more broadly. Crafting a similarity between the heavens and the Earth called upon *ingenium*, which invented the similitudes through which sense experience became meaningful and intelligible. Galileo, Kepler, Godwin, and Wilkins all

exercised *ingenium* explicitly to prepare for their explorations of the cosmos and implicitly to craft the similitudes between cosmic discoveries and the Earth that made celestial wonders legitimate objects of natural philosophical study.

Although Galileo was reticent to describe the lunar terrain as a “new world” in his *Sidereal Messenger*, the same cannot be said of many of his supporters.<sup>63</sup> Galileo marvels that the “rough and uneven” lunar surface is “just as the face of the Earth itself” (36), using this similitude to draw further conclusions about the lunar terrain. While Galileo does not explicitly claim that the moon is yet another world, he intimates that his discoveries lend credence to such a conclusion: “Thus, if anyone wanted to resuscitate the old opinion of Pythagoras that the Moon is, as it were, another Earth, its brighter part would represent the land surface while its darker part would more appropriately represent the water surface” (43). Galileo’s contemporaries, however, were more intent to claim the moon a “New World.” In the closing lines of “To the Ingenious Reader” that prefaces Godwin’s fanciful lunar narrative, Galileo’s telescopic discoveries of “mountains in the Moon” (67-68) are referenced<sup>64</sup>—a reference that emphasizes the allusion to the *Sidereal Messenger* that Godwin first made in addressing his main character as “The Speedy Messenger” in the narrative’s title. This work, according to the prefatory “To the Ingenious Reader,” relates the “new discovery of a new world” whose

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<sup>63</sup> Ben Jonson wrote a lunar masque performed for James in 1620 entitled, *News from the New World Discover’d in the Moone*.

<sup>64</sup> “To the Ingenious Reader” was signed by “E.M.” or “Edward Mahon.” Poole surmises that Edward Mahon was a pseudonym for one of Godwin’s sons (*Man in the Moone*, 56-58).

readers “perchance may finde little better entertainment in thy opinion, than that that of *Columbus* at first, in the esteeme of all men” (67). Wilkins too uses Galileo’s lunar discoveries, among the discoveries of other astronomers, to ground his argument that there is, as his title makes clear, a “World in the Moone.” At the outset of the *Discovery*, Wilkins fashions himself as comparable to those explorers of an earlier generation who, despite the initial disbelief of their contemporaries, discovered a New World:

[h]ow did the incredulous World gaze at *Columbus* when hee promised to discover another part of the earth, and he could not for a long time by his confidence, or arguments, induce any of the Christian Princes, either to assent unto his opinion, or goe to the charges of an experiment (2).

In both Godwin’s and Wilkins’ lunar narratives, lunar discoveries are described as analogous to Columbus’s discoveries, thereby garnering their readers’ assent to the value of otherworldly exploration for both the advancement of knowledge and the growth of coffers. Godwin makes the link between colonial and lunar discovery literal when Domingo explains that the lunar inhabitants “who are likely to bee of a wicked or imperfect disposition” (113) are sent to the Earth, and most commonly to “the North of America, whose people I can easily believe to be wholly descended from them” (113).<sup>65</sup>

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<sup>65</sup> Domingo further explains that the use of tobacco among the inhabitants of North America and the lunar inhabitants is yet another reason to believe North Americans are descended from the moon (113). Poole also notes the “literal link” between colonial and lunar discoveries in Godwin’s narrative, and contextualizes lunar inhabitants’ tobacco smoking as a reference to an “old piece of moon-lore” in which the man in the moon was thought to smoke tobacco because of the billowing clouds that pass over the moon at night. (*Man in the Moone*, 113n2).

And just as the colonial discoveries were made intelligible (and thus capable of possession) through the discourse of wonder,<sup>66</sup> so too were lunar discoveries.

Unlike the “New World” discovered on Earth, the wonders of the New World in the moon were not as readily marked by difference in the works of those natural philosophers who studied marvels. Instead, the “New World” of the moon is emphatically similar to our own world, and it is upon this similitude that Galileo and Wilkins, among others, explain the significance of these lunar discoveries. For Greenblatt, “[w]onder is ... the central feature in the initial European response to the New World, [and] the decisive emotional and intellectual experience in the presence of radical difference.”<sup>67</sup> The discovery of a new world in the moon, however, is not marked by the “radical difference” that Greenblatt identifies in the encounters with America. Rather, the new world in the moon is marvelous precisely because it so resembles the Earth. And this similarity allowed astronomers and natural philosophers to posit the greater significance of lunar discoveries for both the moon and the Earth. When explaining why the “spots” espied on the moon’s surface led Galileo to “the conclusion” that the moon “be not smooth” (40), Galileo makes recourse to a similitude to the Earth’s terrain. The lunar surface, Galileo argues, “is like the face of the Earth itself, which is

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<sup>66</sup> Greenblatt, *Marvelous Possessions*, 22. Greenblatt argues that the “marvelous is a central feature ... in the whole complex system of representation, verbal and visual, philosophical and aesthetic, intellectual and emotional, through which people in the Middle Ages and Renaissance apprehended, and thence possessed or discarded, the unfamiliar, the alien.”

<sup>67</sup> Greenblatt, *Marvelous Possessions*, 14.

marked here and there with chains of mountains and depths of valleys" (40). In addition to the terminator line which appears "sinuous" (42), Galileo remarks that "what causes even greater wonder" are the "bright spots" that appear in the darkened portion of the moon (42). Galileo accounts for of the lunar "bright spots" with recourse to the way light hits the top of the Earth's mountain peaks throughout the day: "Now, on Earth, before sunrise, aren't the peaks of the highest mountains illuminated by the Sun's rays while shadows still cover the plain?" (42). By drawing a similitude between the moon's surface and the Earth's mountainous chains, Galileo both identifies the significance of, and bulwarks the conclusions he draws from, his lunar discoveries.

Kepler too drew a similitude between celestial bodies and the Earth in order to delineate the significance of telescopic discoveries.<sup>68</sup> Galileo's *Sidereal Messenger* prompted Kepler to speculate:

I cannot help wondering about the meaning of that large circular cavity [on the face of the Moon]... Is it a work of nature, or of a trained hand? Suppose there are living beings on the moon...? It surely stands to reason that the inhabitants express the character of their dwelling place, which has bigger mounts and valleys than our earth has. Consequently, being endowed with very massive bodies, they also construct gigantic projects..." (95).

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<sup>68</sup> When Kepler first read Galileo's *Sidereal Messenger*, he did not have sufficiently powerful telescopes at his disposal to replicate Galileo's observations (Van Helden, conclusion to *The Sidereal Messenger*, 94). Even though Kepler could not see the Medician stars for himself, he trusted Galileo's discovery "[b]ecause [Galileo] loves the truth" and "has no intention of practising deception ... nor does he pretend to have seen what he has not seen" (*Kepler's Conversation* 19-20; Van Helden 94-95).

Galileo's discovery excites Kepler's imagination,<sup>69</sup> inviting similitudes between the Earth and the moon that permit Kepler to suggest that the moon is inhabited and to deduce the inhabitants' probable physical characteristics and social organization. The similitude between the Earth and other celestial bodies emboldens Kepler to conclude that Jupiter must also be inhabited. Kepler reasons that because the purpose of the Earth's moon is to provide aesthetic pleasure for humankind, that the moons discovered to orbit Jupiter do so to provide Jupiter's inhabitants with a "wonderfully varied display" to behold.<sup>70</sup> "The conclusion is quite clear," Kepler contends, "[o]ur moon exists for us on the earth, not for other globes. Those four little moons exist for Jupiter, not for us ... From this line of reason we deduce with the highest degree of probability that Jupiter is inhabited".<sup>71</sup> Kepler's assurance of the "highest degree of probability" that Jupiter is inhabited could not have been made without *ingenium* and its use of the imagination.<sup>72</sup> Far from being excluded from the sciences that study the cosmos, the imagination became the grounds for astronomy's competing claim to knowledge that was once reserved for natural philosophy.

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<sup>69</sup> Van Helden, conclusion to *The Sidereal Messenger*, 96.

<sup>70</sup> Johannes Kepler, *Kepler's Conversation with Galileo's Sidereal Messenger*, Edward Rosen trans., and ed. (New York and London: Johnson Reprint Corporation, 1965), 40; Van Helden, conclusion to *The Sidereal Messenger*, 99.

<sup>71</sup> Kepler, *Conversation*, 42.

<sup>72</sup> Guy Claessens, "Imagination as Self-knowledge: Kepler on Proclus' *Commentary on the First Book of Euclid's Elements*," *Early Science and Medicine* 16 (2011): 180. Claessens argues that Kepler understands the imagination as a "productive power" that he "transform[s] ... into a tool for cosmic self-knowledge" in *Harmonices Mundi*."

New worlds were imagined by astronomers and natural philosophers to account for the wonders discovered through the telescope. Telescopic discoveries in turn inspired the new worlds imagined by poets. And it is through their shared imagination that the works of the poets and of the astronomers and natural philosophers most explicitly cohere. Galileo, Kepler, and Wilkins imagine a world in the moon to account for the newly discovered wonders on the lunar surface. Godwin too goes to great length to imagine a world in the moon, describing the passage to this “New World” (97), its lunar terrain and environment, and its inhabitants’ physical characteristics, social and political organization, and even their musical language. The fanciful descriptions often addressed and evaluated ancient and contemporary theories about the cosmos. Indeed, Domingo explicitly mentions Galileo and Copernicus (67; 90,92, 94) and alludes to Aristotle, often as a means to critique older conceptions of the cosmos (97, 98). Although many of Godwin’s contemporary readers emphasized the lunar narrative’s picaresque and comedic tones, Wilkins takes its fancy seriously.<sup>73</sup> Wilkins references Godwin’s *Man in the Moone* (as well as Kepler’s *Somnium*) in a number of his works, including *A Discovery a World in the Moon, Mercury, or the Secret and Swift Messenger* (1641), and *Mathematicall Magick* (1648).<sup>74</sup> When discussing the possibility of travel to the moon in *Discovery*, Wilkins relates that he “chanced upon a late fancy ... under the fained Name

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<sup>73</sup> Poole, introduction to *The Man in the Moone*, 47.

<sup>74</sup> Wilkins references Godwin’s cryptography in his *Mercury, or the Secret and Swift Messenger* (1641) and Godwin’s gansas in a chapter entitled “The Art of Flying” in his *Mathematicall Magick* (1648).

of Domingo Gonsales, written by a late Reverend and Learned Bishop ... [wherein] there is delivered a pleasant and well contrived Fancy concerning a Voyage to this other World" (185). Wilkins praises Godwin's narrative and, most importantly, praises it as a work of "fancy" fit to include in his more serious discussion of the world in the moon. The imagination permitted natural philosophers and poets alike to craft new worlds and, given their shared use of the imagination, allowed each other to influence the respective invention of these new worlds.

The *ingenium* was called upon by astronomers and natural philosophers because it helped them understand the significance of their discoveries and to legitimate their discoveries by persuading their audience into assent. "Astronomy," Frédérique Aït-Touati argues, "even when it becomes a science of observation thanks to the telescope, makes deliberate use of the imagination."<sup>75</sup> But if the use of the imagination also made natural philosophers susceptible to criticism, why exercise *ingenium* at all? The imagination, I argue, solved more problems than it created. Galileo and Wilkins, like the Royal Society members that are discussed in Chapter 3, valued sense experience as the criterion for knowledge claims. The wonders they espied, however, were not easily accessible to the larger communities that could legitimate their discovery. The very phenomena that astronomers and natural philosophers used to advance knowledge was, in this way, at odds with the sense experience used to make knowledge claims. In other

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<sup>75</sup> Aït-Touati, *Fictions of the Cosmos*, 10.

words, Galileo and Wilkins, among others, faced a problem of authority because the discoveries by which knowledge was to advance were phenomena not readily accessible to sense experience. When claiming knowledge of a wonder's discovery, the imagination could avoid the issues of authority by advancing astronomy and natural philosophy through probable opinion.

Galileo, Godwin, and Wilkins alike entrusted sense experience as the criterion for certain knowledge, elevating mechanical instruments above the unaided senses. Galileo proclaims the telescope authoritative sight over the naked eye, trusting his spyglass to show "with the certainty of the senses" that the moon "is by no means endowed with a smooth and polished surfaces" (36), among many other discoveries. Sense experience or observation, Galileo suggests, offer firm grounds upon which to make knowledge claims. The disputes over the Milky Way, for instance, were thought to be resolved by the telescope: "with the aid of the spyglass, [the Milky Way] may be observed so well that all the disputes that vexed philosophers are destroyed by visible certainty, and we are liberated from wordy arguments" (62). Rather than a band of glowing light, Galileo's telescope espied countless individual stars. The Milky Way, Galileo observed, was composed of a seemingly innumerable amount of star. The senses are also paramount to claims of knowledge in works of fiction such as Godwin's *Man in the Moone*. "E.M." pairs the audience's "candid censure" with the "faithful relation of the little eye-witness" (68) as the dual criteria by which the readers will assent to the claims about the

cosmos related in the lunar narrative. Indeed, William Poole identifies this reference to the “little eye-witness” — “little” because Domingo is not a very tall Spaniard — as the inaugural instance of the “interplay between sight and seeing that runs through the work” where sight is privileged over sound.<sup>76</sup> The *locus classicus*, Poole adds, is Plautus, *Truculentus*, 490: “qui audiunt audita dicunt, qui vident plane sciunt” (“they who hear, [merely] tell what they hear; they who see, understand clearly”).<sup>77</sup> For Wilkins too sense experience was a top criterion for knowledge and, as we shall see, even sufficient to legitimate the natural philosophical value of fables. Using Galileo’s discoveries as an example, Wilkins envisions sense experience aided by instruments as that which future ages will celebrate as a noteworthy achievement of his age: with the telescope, “those things which others have formerly guest at, are manifested to the Eye, and plainly discovered beyond exception or doubt; of which admirable invention, the latter Ages of the world may justly Boast” (66–67).<sup>78</sup> Wilkins even chides those who do not entrust sense experience to make knowledge claims. Galileo’s telescope, Wilkins argues, “can shew to the Senses a proof beyond Exception; and Certainly that Man must needs be of a most timerous Faith, who dares not believe his own eye” (99). Sense experience could verify a claim without doubt. And the instruments that were thought to enhance the senses, the telescope in particular, were hailed as the hallmark that advanced the

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<sup>76</sup> Poole, *The Man in the Moone*, 68n2.

<sup>77</sup> Poole, *The Man in the Moone*, 68n2.

<sup>78</sup> Indeed, Wilkins “call[s] that physical certainty which doth depend upon the evidence of sense, ... the first and highest kind of evidence of which human nature is capable” in *The Principles and Duties of Religions* (5).

knowledge of nature into the marvellous new realms that demarcated their age of discovery.

The wonders that Galileo, Godwin, and Wilkins used to challenge the accepted model of the cosmos, however, did not lend themselves so easily to sense experience. Before Galileo faced theological criticism for his discoveries, his main interlocutors attacked the reliability of his telescope to offer an authoritative vision of the cosmos. Biagioli argues that the “reliability of the telescope, rather than the philosophical or theological plausibility of the Copernican system, was the main target of Galileo’s adversaries” for nearly a year after the *Sidereal Messenger* was published.<sup>79</sup> Van Helden, however, contends that “Galileo’s visit to Rome [in March 1611] marked the end of the arguments about the new instrument and the reality of the phenomena it revealed.”<sup>80</sup> While many figures relevant to Galileo’s controversial discoveries may have accepted the telescope’s reliability, these concerns persisted at least into the early eighteenth century.

The telescope did not offer a vision of the cosmos free of distortion. Margaret Cavendish’s criticisms of magnifying lenses apply equally to the telescope as it did to the microscope; for neither is “able to discover the interior natural motions of any part

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<sup>79</sup> Biagioli, *Galileo, Courtier*, 95. Biagioli argues that “Copernicanism had begun to emerge as an important issue in the public debates between Galileo and his opponents only at the beginning of 1611” (95).

<sup>80</sup> Van Helden, conclusion to *The Sidereal Messenger*, 113.

or creature of Nature.”<sup>81</sup> And, she continues, “[t]he truth is, the more the figure by art is magnified, the more it appears misshapen from the natural, inasmuch as each joint will appear as a diseased, swelled, and tumid body, ready and ripe for incision.”<sup>82</sup> Jonathan Swift made similar criticisms of magnifying lenses in his *Gulliver’s Travels* (1726) in which Gulliver finds himself immersed in a magnified world where otherwise regular sights are monstrous and deformed. He remarks that his naked vision surpasses that of the “European louse through a microscope” and witnesses the “hateful sight” of “lice” crawling through the garments of the Brobdingagians.<sup>83</sup> He is repulsed by women’s bodies because these sights could not produce “any other emotions than those of horror and disgust” (99). Even the “handsomest” of these maids — “a pleasant frolickesome Girl of sixteen” — is the source of Gulliver’s utter disgust (99). And the images of magnifying lenses were indeed susceptible to various forms of distortion. While telescopes were becoming increasingly common throughout the seventeenth century, not all were sufficiently powerful to verify that telescopic discoveries did not disfigure the image of the heavens. Telescopes were plagued by aberrations and chromatic aberration was not corrected until Newton crafted his reflecting telescope in 1668.<sup>84</sup> For

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<sup>81</sup> Margaret Cavendish, *Observations upon Experimental Philosophy*, ed. Eileen O’Neill (Cambridge: Cambridge University Press, 2001), 50.

<sup>82</sup> Cavendish, *Observations*, 50. Cavendish stipulates, however, that she does not criticise all glasses, just those that grossly magnify the object of vision.

<sup>83</sup> Jonathan Swift, *Gulliver’s Travels*, ed. Albert J. Rivero (New York: W.W. Norton, 2002), 94. Hereafter cited parenthetically by page number(s).

<sup>84</sup> Henry C. King, *The History of the Telescope* (Cambridge: Sky Publishing Corporation, 1955), 71. Henry C. King notes that a number of scientists sought to remedy the chromatic aberration that plagued Galilean

those who insisted on sense experience for the grounds of certain knowledge, their discoveries were only as accepted as their instruments were held reliable.

And even if these technologies were trusted to discover knowledge about nature and its order, communicating marvellous discoveries presented its own issues. Wonders were phenomena that occurred irregularly or that alerted natural philosophers to the limits of their ability to account for natural causes. Because wonders were not frequently accessible to first-hand observation, describing them persuasively in language was essential for their legitimation in larger communities—an important factor in the rise of the experiment that is discussed in Chapter 3. Godwin fictionalizes this issue in his lunar narrative when Domingo's language outright fails him when he attempts to describe the color of the lunar inhabitants' clothing:

neither (which is most strange, of all other) can I devise how to describe the colour of them .... But if you aske me what it was, then I must tell you, it was a colour never seen in our earthly world, and therefore neither to be described unto us by any, nor to be conceived of one that never saw it. (100)

Here, the issues that wonders presented to knowledge discovered by sense experience are cast as issues of language. Indeed, when Kepler is unable to observe Galileo's

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telescopes, including Descartes, Mersenne, and Newton. And in 1663, James Gregory devised a telescope design that used two mirrors to reflect light gathered in the optic tube. King further explains that Gregory's "system, owing to the figures of the mirrors, is ... reasonably free from chromatic aberration." Newton's telescope, modelled off of Gregory's earlier design, operates by using an objective mirror that reflects light to a smaller diagonal mirror which then reflects the light to the eyepiece lens. By reflecting, rather than refracting light, Newton's telescope is able to avoid the color distortions produced by the earlier Galilean telescope, providing a picture of greater magnification and clarity to curious stargazers.

discoveries first-hand, his trust in Galileo is bolstered by Galileo's ability to communicate his authority, an authority crafted by rhetoric no less. "I may perhaps seem rash in accepting [Galileo's] claims so readily," Kepler confesses, "with no support of my own experience" (94). "But why," he continues, "should I not believe a most learned mathematician whose very style attests to the soundness of his judgment?" (94). When wonders could not be observed first-hand, rhetorical style worked especially hard to bolster a reader's assent.

Although wonders often resisted the "certainty of the senses" (Galileo, 36), wonders did not preclude the advancement of natural philosophy. As Wilkins makes explicit, those who discovered wonders that were not easily accessible to first-hand observation could nevertheless make recourse to "probable" opinion. Indeed, the full title of Wilkins' *Discovery* uses the word "probable" or its variant in each sentence: *Discovery of the World in the Moon: Or A Discourse Tending to prove that 'tis Probable there may be another Habitable World in the Moon. With a Discourse Concerning the Probability of Passage thither. Unto which is Added, A Discourse Concerning a New Planet, Tending to Prove, That 'tis Probable Our Earth is one of the Planets.* Probable opinion, I argue, subjected all the possibilities of the imagination to reason, advancing the boundaries of natural philosophy in such a way to account for wonders and what they signified for nature's order. Claims for the larger significance of marvelous discoveries, such as the possibility of lunar seas or lunar inhabitants, could not be readily observed, excluding them from

the certainty attributed to the knowledge discovered directly and repeatedly by the senses. But if grounds could be laid upon which to consider these claims probable, natural philosophy could better account for the wonders that eluded their predecessors and, more importantly, mobilize the resources needed to make them accessible to observation by future ages. As Aït-Touati argues, “[t]he probable is now part of science, which makes it possible to tackle scientifically areas of study that are nondemonstrable mathematically and are beyond the scope of experimentation.”<sup>85</sup> The imagination simultaneously provided the grounds for probable opinion and resolved the problems of authority that astronomers and natural philosophers faced when their marvelous discoveries resisted observation: probable opinion allowed the marvelous possibilities invented by the imagination to count alongside knowledge when certainty could not be had. With the imagination accepted for its service in the advancement of natural philosophy, the new age of discovery envisioned by the likes of Galileo, Godwin, Bacon, and Wilkins could be made manifest.

For many Renaissance thinkers, aligning “probable opinion” and “certain knowledge” would constitute a contradiction in terms. In medieval epistemology, knowledge or *scientia* is the knowledge of necessary universal truths attained by demonstration.<sup>86</sup> Probability, by contrast, was a component of opinion and could not

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<sup>85</sup> Aït-Touati, *Fictions of the Cosmos*, 62.

<sup>86</sup> Ian Hacking, *The Emergence of Probability: A Philosophical Study of Early Ideas about Probability Induction and Statistical Inference*, 2nd ed. (1975; repr., Cambridge: Cambridge University Press, 2009), 20.

constitute knowledge.<sup>87</sup> Where knowledge consisted of demonstrable truths, probable opinion was a claim that was approved of by authority, especially when such a claim is supported by the books of antiquity.<sup>88</sup> Knowledge was certain where opinion was probable. As Ian Hacking argues, this medieval concept of knowledge and opinion that persisted in the Renaissance was transformed in the 1660s. Developing from the empiric “low sciences” such as alchemy and medicine, probability could be conferred on an opinion by treating the signs of nature as testimony writ by the hand of God.<sup>89</sup> This notion of nature conjoined the approval of (divine) authority with the frequency that a natural phenomenon occurred, producing a form of “evidence” from which our modern concept of probability could emerge. As Daston succinctly summarizes the trajectory Hacking delineates, “[t]he result was a way of knowing by degrees, in which rational assent could be proportioned to evidence.”<sup>90</sup> Or as Aït-Touati explains it: “The English *virtuosi*, notably those involved in the Royal Society ... agreed that the natural ... [science was] incapable of a priori demonstrations and that proofs in these domains were of another nature. This realization led them to define and divide kinds of science

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<sup>87</sup> Hacking, *Emergence*, 22.

<sup>88</sup> Hacking, *Emergence*, 30.

<sup>89</sup> Hacking, *Emergence*, 35.

<sup>90</sup> Lorraine Daston, “The History of Emergences Ian Hacking: *The Emergence of Probability: A Philosophical Study of Early Ideas about Probability, Induction, and Statistical Inference*,” *Isis* 98, no.4 (December 2007): 804.

and knowledge to a scale of probability.”<sup>91</sup> Opinion began encroaching upon the traditional territory of knowledge through this new concept of probability.

Hacking usefully plots this trajectory with reference to Galileo and Wilkins. Where probability for the former referred to its older understanding as approval by authorities, it begins to take on its modern understanding of probable evidence across the works of the latter<sup>92</sup>—but neither figure can be firmly slotted into either understandings. Galileo, Hacking concludes, “longs for absolute demonstration” — the domain of knowledge—but he designed his “thought experiments” such that they can “increase probability almost to demonstration.”<sup>93</sup> For Hacking, Wilkins “was concerned only with the probability of opinion” but his *Discovery* “is an essay in the use of probable evidence.”<sup>94</sup> In Wilkins’ posthumous *Principles and Duties of Natural Religion* (1675), Hacking suggests that “probable evidence enters the same league as demonstration.”<sup>95</sup> Wilkins maintains the distinction between knowledge and opinion, allotting evidence that can be held with certainty as knowledge and evidence that is “less plain and less clear” or that is “not so weighty ... as to exclude all reasonable doubt” as “probability”

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<sup>91</sup>Ait-Touati, *Fictions of the Cosmos*, 57. For a discussion of the credible and incredible in Godwin’s *Man in the Moone* and the role of probability in Wilkins’ works on the moon, see Ait-Touati, *Fictions of the Cosmos*, 53-55 and 56-60, respectively.

<sup>92</sup> Hacking, *Emergence*, 26, 82.

<sup>93</sup> Hacking, *Emergence*, 26

<sup>94</sup> Hacking, *Emergence*, 12, 82.

<sup>95</sup> Hacking, *Emergence*, 83.

or “opinion.”<sup>96</sup> In either case, both Galileo and Godwin would legitimate their account of the cosmological order with recourse to probability.

By categorizing an account of a wonder as “probable,” natural philosophy could advance even in the absence of first-hand observation. Dark spots could be seen in the moon with the naked eye. But this vision did not call into question the accepted understanding of the moon as immaculate; they had been explained as varying densities.<sup>97</sup> Galileo’s telescopic observation of these “dark spots,” however, challenged orthodoxy in claiming that these spots due to an Earth-like lunar terrain: “[I]f anyone wanted to resuscitate the old opinion of Pythagoras that the Moon is, as it were, another Earth, its brighter part would represent the land surface while its darker part would more appropriately represent the water surface” (43). Kepler was indeed convinced by Galileo’s suggestion, recanting his original position that the dark spots on the moon represented land, not water. Wilkins too was convinced, and rejected his initial “opinion” that the dark spots represented land (79). Godwin’s Domingo also weighs in on this debate when, during his descent to the moon, he “perceived also, that it was covered for the most part with a huge and mighty Sea, those parts only being drie Land, which shew unto us here somewhat darker then the rest of her body (that I mean) which

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<sup>96</sup> Wilkins, *Principles*, 10-11.

<sup>97</sup> Van Helden, conclusion to *The Sidereal Messenger*, 111–112. Van Helden explains that when Cardinal Bellarmine sent word to four Jesuit mathematicians to evaluate the claims Galileo made in the *Sidereal Messenger*, one of the four denied Galileo’s argument about the dark spots on the moon. Father Clavius adhered to the accepted idea that these spots were a result of varying densities of the moon (Van Helden, conclusion to *The Sidereal Messenger*, 111–112).

the Country people call *el hombre della Luna*, the Man of the Moone" (98).<sup>98</sup> Note, however, that Galileo does not explicitly argue that the lunar spots represented bodies of water, but rather that his observations could be used to support such an "*opinion*" (emphasis mine, 43).<sup>99</sup> Indeed, Galileo offers alternative explanations for these spots in his *Dialogue*.<sup>100</sup> The conclusion that Kepler and Wilkins draw from Galileo's observations were probable. Although Kepler does not identify his new proposition as a matter of probability, Wilkins explains that "it may be probable enough, that those Spots and brighter parts, may shew the distinction between the Sea and Land" (78). And Wilkins defends this "probable" distinction in a ten-page discussion of his proposition that "*The Spots represents the Sea, and the brighter parts the Land*" (79). Galileo's telescopic observations of the moon's dark spots could not constitute certain knowledge. In considering this account of lunar spots "probable," however, natural philosophical understandings of the cosmos could advance at least provisionally, strengthening the similitude between moon and Earth that challenged the accepted model of the heavens.

In order to advance natural philosophy beyond what could be held as certain, the imagination was used to craft a variety of possible accounts for phenomena that

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<sup>98</sup> Poole notes that Domingo's position is opposite that of Plutarch, who had argued that the dark spots on the moon represented land rather than water (*Man in the Moone*, 96n3).

<sup>99</sup> Ewan A Whitaker, *Mapping and Naming the Moon: A History of Lunar Cartography and Nomenclature*, (1999; repr., Cambridge: Cambridge University Press, 2003), 20. Whitaker also pauses on Galileo's word choice, the stipulation "if anyone wanted" (Whitaker uses the translation "wishes" instead of "wanted") in particular, to emphasize Galileo's reticence to identify the moon's dark spots as bodies of water and references other instances in Galileo's writing where the idea of lunar seas is denounced.

<sup>100</sup> Whitaker, *Mapping*, 20.

resisted observation. Once these possibilities had been imagined, those considered to satisfy reason could be considered probable opinion. Near the end of the *Discovery*, Wilkins engages in a more fanciful discussion of lunar inhabitants and proposes “[t]hat ‘Tis Probable there may be Inhabitants in this other World” (142). But because “[t]here hath not yet been any such Discovery Concerning these [inhabitants], upon which we may Build a Certainty, or good Probability ... we can know nothing” (143). The lack of current observation of lunar inhabitants, or Selenites, precludes both certain knowledge and probable opinion, but the similitude between Earth and the moon permits natural philosophers to “Guess in the General that there are some Inhabitants in that Planet: for why else did Providence Furnish that place with all such Conveniences of Habitation?” (144). Based on the observations of a lunar terrain similar to that of the Earth, Wilkins sees fit to “Guess” at the existence of Selenites in natural philosophical discourse. Or put differently, Wilkins encourages imagining different possible accounts of the moon based on limited observation. The similitude between the Earth and the moon lays sufficient grounds upon which the imagination can craft a possible account of lunar inhabitants, even if this type of guessing cannot bear the title “probable” opinion. And this similitude protects these imaginations from being reduced to the flights of fancy alone. Instead, imagined possibilities muster the resolve to pursue knowledge beyond the purview of the known. Wilkins, it would seem, uses the term “Probable” in his proposition because imagining the possibility of lunar inhabitants encourages natural

philosophers to work towards a time when more observations would be sufficient to count the existence of Selenites as probable or as knowledge.

Based on his argument for the possibility of lunar inhabitants, Wilkins' next proposition is "[t]hat 'Tis Possible for some of our Posterity, to find out a Conveyance to this other World, and if there be Inhabitants there, to have Commerce with them" (156). While lunar travel may seem to be a flight of fancy, Wilkins "[a]nswer[s] those Doubts that may make it seem utterly impossible" (159) so as to make such a journey possible. "Questionless," he remarks, "the Invention of some means for our Conveyance to the Moon, cannot seem more Incredible to us" than travel to new lands on earth was to the "first Ages of the World" (158). "Therefore," Wilkins concludes, "we have no just Reason to be Discouraged in our Hopes of the like Success" (158). Wilkins encodes the imagination into the language of "possibility" so as to advance knowledge in stellar leaps and bounds. As Ait-Touati argues, "[b]y shifting the lunar fable from the impossible to the possible, the mechanization of the trip to the moon modifies the very status of fiction. For in describing such a journey as possible, fiction is entrusted with an ontological and cognitive weight."<sup>101</sup> Referencing Godwin's lunar narrative, Wilkins contends that the "new Traffick that might be brought" (187) between Earth and the moon would far surpass the riches accrued in colonizing America: "do but Consider the Pleasure and Profit, of those later Discoveries in America, and we must needs Conclude

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<sup>101</sup> Ait-Touati, *Fictions of the Cosmos*, 71-72.

this [trade with lunar inhabitants] to be Inconceivably beyond it" (187). Even without sufficient sense experience to ascertain probable opinion or certain knowledge, Wilkins uses the imagination to extend the boundaries of natural philosophy and England's colonies, to boot.<sup>102</sup>

Because marvelous phenomena could only be deduced from limited observation, the possibilities of the imagination were subjected to reason and, if shown to satisfy reason, could support the claim of probable opinion. At the outset of the *Discovery*, Wilkins stipulates that the arguments contained therein are "probable" and that "some Astronomicall appearances may possibly be solved otherwise then here they are" (To the Reader). Nevertheless, Wilkins does not look for certain knowledge "[b]ut the thing [he] aime[s] at is this, that probably they may so be solved, as I have here set them downe"(To the Reader). The reader, Wilkins implores, should "assent unto that truth which upon deliberation shall seeme most probable unto thy reason, and then ... either thou wilt agree with mee ... or at least not thinke it to be as farre from truth, as it is from common opinion" (To the Reader). While Wilkins does not describe how to subject the possibilities of the imagination to reason in any great detail, he outlines a means to attain probable opinion before he sets out to show that the dark and light spots on the moon represent the "*Difference between the Sea and the Land*" (71):

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<sup>102</sup> For a discussion of the colonial impulse in Galileo's *Sidereal Messenger*, see Mary Baine Campbell, *Wonder and Science: Imagining Worlds in Early Modern Europe*, (Ithaca and London: Cornell University Press, 1999), 129-131.

For the cleare prooffe of this proposition, I shall first reckon up and refute the opinions of others concerning the matter and forme of those spots, and then shew the greater probability of this present assertion, and how agreeable it is to that truth, which is most commonly received (71).

Based on limited sense experience, in this case those observations made through Galileo's spyglass, a variety of theories about a phenomenon could be evaluated by reason so as to make a claim for probable opinion that was aligned with "truth"(71).

As Wilkins makes clear, the imagination was important to astronomical discovery and to the natural philosophical claims about the order and causal structure of nature. But Wilkins does not often explicitly identify the imagination's role in his natural philosophical pursuits. Indeed, he often differentiates his claims for probable opinion from "fancies." Instead, Wilkins addresses the natural philosophical use of the imagination in the language of the "possible" and the "probable." The imagination crafted possible accounts for marvelous phenomena that, provided these accounts satisfied reason, could then be counted as probable opinion. When the possibilities of the imagination were not based in experience and could not satisfy reason, these wonders were considered a "groundless" (96) imagination and relegated to the fictional world of fables. When discussing different accounts for the wonders espied on the moon, Wilkins discredits particular claims by considering them the works of an imagination unsupported by observation. When Wilkins argues that there is a world in the moon, he bolsters support from ancient and modern thinkers who share his claim so that he "may the better clear it from the Prejudice either of an Upstart Fancie, or an obsolete error"

(60). Here, a false claim is either the product of the imagination or a bald mistake. But Wilkins' description of a false imagination as one that is "Upstart" suggests that only certain types of imagined possibilities fail to discover probable opinion. Those imagined possibilities that lack or contradict observation, he implies, fail to have any truth value. For instance, take Wilkins' refutation of Giulio Cesare la Galla (or Lagalla), a Roman philosopher who had espied the moon through Galileo's telescope and criticised Galileo's account of the moon's dark spots. When Wilkins refutes la Galla's account of lunar spots, Wilkins argues that la Galla contradicts his own sense observation, rendering la Galla's erroneous conclusions a work of fancy. La Galla's account of lunar spots: opposes his own Eye-witness, for he confesses himself, that he saw by this glass ... with an intent of Contradiction [of Galileo's Sidereal Messenger]... which rather betrays an Obstinate, than a Perswaded Will; for otherwise sure he would never have undertook to have destroyed such certain proofs [of Galileo] with so groundless a Fancy (96). The imagination can only be considered to have truth value when it is supported by sense experience and subjected to reason. The imagination, then, was treated as a spectrum with two distinct poles when in the service of natural philosophers: at one extreme the imagination was trusted to discover probable opinion of nature and at the other the imagination failed to make claims to knowledge because it was limited to the possibilities entertained only in fiction.

This division of the imagination into two poles, however, is not drawn by natural philosophers alone. Godwin also maligns the fancy to discredit accounts of the moon and uses his fanciful lunar narrative to advance alternative theories in their stead. By calling a particular astronomical or natural philosophical account a fancy, Godwin was able to cast his fictional discoveries of the moon as credible, if not probable by contradistinction. During his flight to the moon, Domingo criticises the Peripatetic natural philosophers who argued that the air was hot and wet (as opposed to the other elements of fire, water, and earth, which were believed to combine hot and cold with moist and dry in different pairings)<sup>103</sup> based on his sense experience. Finding that the air was “exceeding temperate, neither hot nor cold,” Domingo concludes that “as for that imagination of the Philosophers, attributing heat together with moystnesse unto the ayre, I never esteemed it otherwise then a fancy” (91). And Domingo’s passage to the moon unscorched also discredits the Aristotelian region of fire.<sup>104</sup> “As for that region of fire our philosophers talk of,” Domingo exclaims, “mine eyes have sufficiently informed me that there can be no such thing” (98). Without burnt skin or cooked birds and with no sight of fire, Domingo’s sense experience shows Aristotle’s notion of the region of fire to be so false that he is compelled to exclaim “O Vanities, fansies, Dreames!” (97). Because of his experience, Domingo makes claims to knowledge, not probable opinion.

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<sup>103</sup> Poole, *Man in the Moone*, 91n5.

<sup>104</sup> Poole, *Man in the Moone*, 39-40; Ait-Touati, *Fictions of the Cosmos*, 62.

For the contemporary reader, however, Domingo's accounts can be held as probable at best because no one has ever travelled to the moon to corroborate Domingo's account. As in Wilkins' *Discovery*, probable opinion and certain knowledge are aligned to evaluate and support natural philosophical theories of the cosmos.

Because those who wrote astronomical or natural philosophical works and those who crafted fabulous narratives equally appealed to the fancy to criticise orthodox understandings of the cosmos, what is at stake is not the "fancy" *per se*. The derisive use of the term "fancy" does not attack the use of the imagination in natural philosophical discovery, but strikes more deeply at what constitutes a claim to probable opinion, to certain knowledge, and the relation between them. Just as Galileo and Wilkins entrust sense experience as a criterion for knowledge, so too does Godwin's Domingo make recourse to first-hand observation (even if it is only imagined by Godwin) to discover knowledge. The term "fancy" was used to discredit particular theories or accounts of nature and the heavens that could not corroborate sense experience, regardless of whether that sense experience described the telescopic images or imagined flights to the moon. What Galileo, Wilkins, and Domingo all criticise when they discredit a natural philosophical account a "fancy" is not its use of the imagination, but rather the imagination's (supposed) failure to corroborate sense experience.

But the role of the imagination in astronomical and natural philosophical discovery was not always made explicit by those who championed its use. For Galileo

and Godwin, the imagination is often addressed under the blanket of *ingenium* or the “ingenious.” For Kepler and Wilkins, it is discussed in terms of “possible” or “probable” accounts for nature’s wonders. By encoding the imagination in the language of probability, natural philosophers countered criticism that their discoveries, especially the ones made with instruments such as the telescope, were “ridiculous” (Wotton) or were the stuff of a “fable” (Horky). Both natural philosophers and their critics understood that the imagination, especially as it was used by *ingenium*, was essential to the discovery of wonders, their legitimation in broader circles of natural philosophers, and to claim probable accounts for their broader implications. Critics targeted the imagination’s role in astronomy and natural philosophy by calling discoveries a “fable,” discrediting the discovery as a fiction that failed to attain knowledge of nature. This was also the tactic of astronomers and natural philosophers who likewise called competing accounts of wonders or of the cosmos a “groundless ... fancy” (Wilkins 96). The imagination’s role in natural philosophical discovery, then, could not be talked about in the same way poets understood the role of the imagination in their art: where the poet could discover the divine signatures that marked nature, the natural philosopher discovered the things of nature that bore those marks. Instead, the imagination was described in terms of “possible” accounts for a given phenomenon that, if it satisfied reason, could be considered “probable” opinion. In considering the products of the imagination “possible” accounts for, or “probable” opinion of, a phenomenon,

astronomers and natural philosophers could better protect their discoveries from being discredited as a ridiculous fable. Once considered “probable” opinion, the work of the imagination was endowed with the authority to make knowledge claims in astronomy and natural philosophy.

Did, as Wotton predict, Galileo prove “exceeding ridiculous” or “exceeding famous”? I wager “yes” to both, even if in ways unexpected by Galileo’s contemporaries and by those who still study his works today. Galileo’s discoveries and methods have secured him centuries of fame, though they equally secured his infamy in the Church and, as a result, no good fortune. And Galileo did indeed prove ridiculous in so far as his discoveries both relied on and worked to legitimate the *ingenium* and its use of the imagination. Both in the means by which he made these discoveries and the language with which he described these wonders, the poetic imagination was not only welcome in his study of nature but more importantly helped his astronomy lay claim to the traditional domain of Aristotelian natural philosophy. New worlds were imagined so as to account for celestial wonders, in this way aligning the work of the astronomer and natural philosophy with the work of fanciful fiction. Galileo, Kepler, Wilkins and Godwin all crafted new worlds to render intelligible marvellous telescopic discoveries and their implications for the grander order of the cosmos. The similitude between the earth and the moon was essential to make claims about the lunar terrain that, in turn, shattered Aristotle’s reigning model of the immaculate heavenly spheres. These new

worlds, however, often resisted repeatable sense experience, undercutting the experiential criterion for certain knowledge advocated by Galileo, Godwin, and Wilkins. In categorizing the account of new worlds as probable, the imagined possibilities vetted by reason could stand alongside knowledge when certainty could not yet be attained. "Possible" or "Probable" theories of wonders encoded the imagination into the means of discovery such that the imagination's use in astronomy and natural philosophy could be distinguished from its use in fabulous narratives, safeguarding these discoveries from being accused as flights of fancy. The imagination's role in natural philosophy would be sustained in the burgeoning experimental philosophy of the Royal Society, of which Wilkins was a founding fellow, though its use would become even less explicit in the language used by the experimental philosophers to champion their science. Poetic language would also remain a prominent feature in experimental philosophy, but these experimental philosophers would begin to distinguish themselves from the poets as these philosophers claimed the poetic imagination as their own.

### 3. “Naked” Prose and its Body of Poetry

“Eloquence ought to be banished out of all civil societies,” declares Thomas Sprat, and by extension poetry ought to be relegated to a marginal role, its privileged position as a science would be assumed by experimental philosophy. In defense of the Royal Society’s experimental philosophy, Sprat rejected the poet’s “swellings of style” for a “close, naked, natural way of speaking,”<sup>1</sup> lest both the pursuit of knowledge and the operation of the commonwealth grind to a halt in idle dispute. But if elevated language was indeed deleterious to experimental philosophy, why do so many Royal Society members consistently use tropes and figures, the very practice Sprat denigrates? Since the early twentieth century, the Royal Society’s elevated language has received considerable scholarly attention. Some have argued that the Royal Society was hostile to elevated language, some have denied this antagonism by explaining it as a blanket posture against those who criticized the Royal Society, still others have claimed that the Royal Society rejected only particular types of tropes or figures and not poetic language as a whole. This scholarship has primarily worked to categorize Royal Society fellows as either pro or anti-poetic language, even if scholars introduce caveats for certain tropes or figures so as to account for the Royal Society members’ use of elevated language. These categories, however, presuppose the very opposition between poetry and experimental

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<sup>1</sup> Thomas Sprat, *The History of the Royal-Society for the Improving of Natural Knowledge*, (London: Printed by T.R., 1667), 113. Hereafter cited as *H* with page number(s).

philosophy that was in the process of being established in the mid-seventeenth-century debates over language. In so doing, this scholarship retrofits the Royal Society with oppositions that better characterize our modern concerns. Although twentieth-century scholarship has seized upon the Royal Society's use of elevated language as though it was of great significance to its fellows and its critics, such a use of tropes and figures does not seem to be of great concern to their seventeenth-century contemporaries.

If Sprat's *History of the Royal Society* is any indication, the attacks launched at the Royal Society were sufficient to occasion a lengthy apology to debunk criticisms just a few years after the Society was granted its Royal Charter. Despite its sheer number of critics, however, very few attacked the Royal Society for its use of elevated language. We can then plausibly conclude that modern scholarship's preoccupation with the Royal Society's use of elevated language more accurately represents our own preoccupations with the disparity between the so-called "two cultures"<sup>2</sup> of science and literature than it does with any such opposition in the seventeenth century. As a result, our focus on the Royal Society's elevated language has tended to make us lose sight of the larger debate that motivated Sprat's rejection of poetic and rhetorical language in the first place. The Royal Society's concerns over language reform were a constitutive component of the larger argument over which arts can produce *scientia*.<sup>3</sup>

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<sup>2</sup> C.P. Snow, *The Two Cultures and the Scientific Revolution* (New York: Cambridge University Press, 1961).

<sup>3</sup> While many thinkers defined *scientia* differently, it more commonly meant teleological knowledge. See Chapter 1.

This chapter spells out the larger stakes in the Royal Society's language reform.<sup>4</sup> The rejection of elevated language was a constitutive part of the redefined conceptions of "nature" and "art" intended to ground and defend experimental philosophy as an emergent means of attaining *scientia*. Earlier in the century Francis Bacon sought to restore, at least to some degree, an Adamic sovereignty over the natural world by applying man's art to nature. This was an anti-Aristotelian means of invention or discovery that privileged the use of mechanical devices over the means of invention used by other arts, most notably of poetry. The Royal Society largely adopted Bacon's utopian goals and use of machines, and abandoned older conceptions of "nature" and "art" to legitimate their claims as a means to arrive at *scientia*. Just as Bacon adopted the poetic imagination into his natural philosophy, the Royal Society seized the poet's *inventio* and modified it such that they claimed the primacy of experimental philosophy's invention. The task of the poet and the experimental philosopher is to use "art," be it language or machinery, to perfect an image of "nature," be it human nature or the material world, such that it is made to reveal knowledge. And it is this task to "perfect" nature that allowed poetry and experimental philosophy both to lay claim to

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<sup>4</sup> The Royal Society, of course, was a corporate body whose fellows differed greatly on many matters. While considering only a few voices as representative of the general stance of the Royal Society as a whole can be problematic, this chapter deals mostly with those members who explicitly sought to serve as mouthpieces or popularizers for the broader aims, maxims, and methodologies of the Royal Society. And language reform was prime among the concerns expressed when these members, notably Sprat, Henry Oldenburg, Abraham Cowley, Robert Hooke, Joseph Glanvill, introduced or advertised the aims of the Royal Society at large.

the title of a “science.”<sup>5</sup> Where the poet describes a perfected world invented or revealed by the imagination, experimental philosophers describe a perfected material world invented or discovered with machines that were not thought subject to the fallibility of the human mind and senses. Having appropriated the imagination for their own form of invention, after mid-century natural philosophers could disavow this relationship by condemning poetry as an idle pursuit and poetic language as frivolous ornament. Our understanding of Sprat’s “naked” prose, then, cannot be reduced to the rejection of poetic and rhetorical devices. Sprat’s use of the term “naked” prose itself, of course, is metaphorical. Rather, what Sprat and other Royal Society members advocated was a language that can describe the world with the same precision as the machines that invented or uncovered knowledge of the heavens and the earth. By understanding the Royal Society’s call for language reform as a claim for what more broadly constitutes a science, we can avoid the starkly opposed categories scholarship applies to the Royal Society members and thereby bypass the confusion that arises when Royal Society fellows use elevated language because we recognize that Sprat’s call for a “naked” prose works to replicate the mechanical means of invention rather than advocates a language stripped of poetic ornament. Far from a source of hypocrisy or inconsistency, the Royal Society uses elevated language because it is the most apt means to describe the promise

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<sup>5</sup> George Puttenham called poetry a “noble, profitable, ancient, and divine ... science” (*The Art of English Poesy: A Critical Edition*, ed. Frank Whigham and Wayne Rebhorn (Ithaca: Cornell University Press, 2007), 99. Hereafter cited parenthetically as *A* with page number(s).

of the experiment and the utopian goals to which experimental philosophy aimed.

Granted its Royal Charter from Charles II in 1662, the informal clubs of natural philosophers that met most notably at Gresham College formed the *Royal Society for the Improving of Natural Knowledge*. Although the Royal Society owes its vision, method, and aims to a number of natural philosophers, its fellows praised Francis Bacon as their Society's most formative influence.<sup>6</sup> In his "Ode to the Royal Society," Abraham Cowley champions Bacon as the "mighty Man" who cast off the authority of the ancients, ushered natural philosophy from its "Nonage" into a golden age of productive knowledge which, "like Moses," he "led [the Royal Society] forth at last."<sup>7</sup> Earlier in the century, Bacon set about restoring the Adamic sovereignty over nature lost in the Fall, working to "increase the empire of humanity itself over the whole universe of things" (O, 11:195). Thomas Sprat and his fellow Royal Society members took up Bacon's labors and through experimental philosophy, they argued, "Mankind may obtain a Dominion over Things" (H, 62). The Royal Society would further the natural philosophy sketched by Bacon, importantly adopting his anti-Aristotelian preference for machines to discover

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<sup>6</sup> Francis Bacon's influence on the methods and aspirations of the Royal Society was pervasive. The *Longman Anthology of British Literature: The Restoration and the Eighteenth Century* goes so far as to claim that the "works of Francis Bacon ... served for [the Royal Society members] as something akin to scripture" ([Pearson Longman, 2006], 2174); Andrew Black specifies that Bacon's *The New Atlantis* "came to be read as the spiritual foundation for the Royal Society" (4) (The Orator in the Laboratory: Rhetoric and Experimentation in Thomas Shadwell's *The Virtuoso*, "Restoration: Studies in English Literary Culture, 1660-1700" 37.1 [Spring 2013], 4).

<sup>7</sup> Abraham Cowley, "Ode to the Royal Society," in *The History of the Royal Society of London for the Improving of Natural Knowledge* by Thomas Sprat ([London] 1667), II.19, I.8, V.5. Hereafter cited parenthetically as *Ode* with canto and line number(s).

knowledge of the material world. Where Bacon worked tirelessly to correct the “subtle error” that led men to believe that art is “merely an assistant to nature” rather than a force to “fundamentally alter nature” (*W*, 8:410), the Royal Society reaped the benefits of his labors. By the time Sprat was writing his *History of the Royal Society* in 1667, the idea that man’s art can transmute the material world had been figured as sanctioned by God:

what greater *Privilege* have men to boast of than this; that they have the pow'r of using, directing, changing, or advancing all the rest of the Creatures? This is the *Dominion* which *God* has given us over the *Works* of his hands (*H*, 395-396).

To achieve dominion over the material world, however, first required a command over language. Only then could experimental philosophy attain the utopian aims set by Bacon decades before.

Bacon’s and the Royal Society’s goals are founded on the assumption that language is inextricably linked with the process of creation and knowledge of the material world. Under this assumption, knowledge of God’s creations and God Himself are intimately bound with the Word and language. In naming Eden’s creatures, innocent Adam distinguished one from another according to their essences, revealing the divine order of nature through language. Language had the power to make worlds and reveal the divine hand that ordered them. As we saw in Chapter 1, the poet was considered a homologue for God in his ability to make imaginary worlds through word. Akin to Adam before the Fall, the poet made a world with language that discovered the divine imprints that marked the material world and rendered them intelligible to mankind. For

George Puttenham, Sir Philip Sidney, and Bacon, the poet's *inventio* crafted an imaginary world that revealed God's order and illuminated virtuous courses of action. Poetry discovered knowledge of God's order in His material creations and man's place among them, and this knowledge, to use Puttenham's words, thereby legitimated poetry as a "divine ... science" (A, 99). Because poetry moved men to virtuous action, poetry's function to reveal knowledge could not be disarticulated from its political function; knowledge of the divine order promoted the political order that political hierarchy aimed to emulate. But poetry would be rejected in favor of an experimental philosophy that Royal Society fellows worked to legitimate as a means to attain *scientia* throughout the latter half of the seventeenth century.<sup>8</sup> Experimental philosophers modeled their science after innocent Adam's work in Eden,<sup>9</sup> an *imitatio Adami* that bound the Royal Society's attempts to proclaim the primacy of their experimental philosophy to language and its reform.

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<sup>8</sup> The work necessary to legitimate experimental philosophy as a means to obtain knowledge of nature should not be understated. The particular understanding of nature, the criteria for what constituted knowledge of nature, and the method(s) by which to gain this knowledge (not to mention the attendant assumptions about man and his relationship to nature and knowledge) advocated by experimental philosophers like Sprat comes to largely found our current conception of "science." But these conceptions, tenets, and values were hard won throughout the seventeenth century and beyond. The Royal Society faced staunch criticism, not the least from Thomas Hobbes who argued that experimental philosophy itself failed to obtain *scientia*—the goal of natural philosophy—because it largely concerned itself with matters of fact instead of causal laws. Throughout the mid-to-late seventeenth century, experimental philosophy continuously argued for its legitimacy as a means to investigate and attain knowledge of nature.

<sup>9</sup> Joanna Picciotto, *Labors of Innocence in Early Modern England* (Cambridge: Harvard University Press, 2010), 3-4.

Why then did Sprat declare that experimental philosophy and all other professions were obstructed by their “most profest enemy” (*H*, 113), the elevated language of poetry and rhetoric? When discussing the role of “Schoole-men,” many of whom “busie themselves chiefly about *Eloquence*” and “*Poetry*” (*H*, 19), in the pursuit of knowledge, Sprat elegantly concludes that:

if they would be content, with any thing less then an Empire in Learning, we would grant them very much.... We would commend them, as we are wont to do *Chaucer*; .... And, as Sir *Philip Sidney* of him, we would say of them; that it is to be wonder'd, how they could see so cleerly then, and we can see no cleerer now: But that they should still be set before us, as the great Oracles of all Wit, we can never allow. ... Let them still prevail in the *Scholes*, and let them govern in disputations: But let them not overspread all sorts of knowledge. That would be as ridiculous, as if, because we see, that Thorns, and Briers, by reason of their sharpness, are fit to stop a gap, and keep out wild Beasts; we should therefore think, they deserv'd to be planted all over every Field (*H*, 21).

Sprat describes experimental philosophy as an emergent means by which to gain knowledge of nature. And if we follow the simile that closes his argument, experimental philosophers needed to grow their science in an open field of knowledge, unbothered by the pricks of poetry. Experimental philosophy, Sprat suggests, needs to be demarcated from the work of the scholastics and, by extension, their use of poetry and rhetoric. The distinction that Sprat aimed to establish between “School-men” and their linguistic arts and experimental philosophers and their experimental art seems to help corroborate the notion that “modern science” emerged by claiming literary fiction, poetry included, as

its binary opposite.<sup>10</sup> Given the passage above, it is clear that Sprat considered “Schoolmen” and poets in particular, as rival claimants over the province of knowledge. But as we shall see, it is more convincing to view the relationship between poetry and experimental philosophy as one of distinction or difference rather than one of opposition and antagonism.

As Puttenham and Sidney suggest near the end of the sixteenth century, poetry was a “science,”<sup>11</sup> one that could reveal the divine imprints that marked the material world and could convey moral knowledge. Sprat clearly recognizes poetry as an art that can attain knowledge when he admits that the poet could “describe *Goodness, Honesty, Obedience*; in larger, fairer, and more moving Images[,] ... represent *Truth*, cloth'd with Bodies; and ... bring *Knowledg* back again to our very senses, from whence it was at first deriv'd to our understandings” (*H*, 112). Sprat stipulates, however, that poetry was only an “admirable Instrument in the hands of *Wise Men*” and has since “chang'd to worse uses” (*H*, 112). For Sprat, elevated language now primarily served to inflame the passions, incapacitating men’s reason (*H*, 112) to the detriment of the pursuit of knowledge and the operation of the commonwealth. Echoing Bacon’s warning over the

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<sup>10</sup> While Denise Albanese does not make use of Sprat to construct her argument, she does contend that “as a consequence of the culturally productive mechanisms of opposition—particularly those mobilized by Renaissance colonialism—the emergence of modern scientific ideology in the seventeenth century resulted in the positing of fiction, of literary representation, as its binary (and prospectively devalued opposite)” (*New Science, New World* [Durham: Duke University Press, 1996]: 3).

<sup>11</sup> Puttenham, *The Art of English Poesy*, 99. Sir Philip Sidney, *Defence of Poesie, Astrophil and Stella and Other Writings*, ed. Elizabeth Porges Watson (London: Everyman Paperbacks, 1997), 101.

Idols of the Market, Sprat argues that poetic and rhetorical language was ill-defined and inflammatory, transforming the poet's knowledge into idle disputes. To this end, the Royal Society's argument about language reform in experimental philosophy was also an argument about how to maintain the stability of the political order. Just as Gosson claimed that poetry, among other arts, could threaten the body politic, experimental philosophers argued that poetic language could produce civil unrest, or worse, civil war. As a result, Sprat concludes that "*eloquence* ought to be banish'd out of all *civil Societies*, as a thing fatal to Peace and good Manners" (H, 111). Whether for Gosson, Bacon, or Sprat, poetic language had the potential to threaten the pursuit of knowledge and the political order. And having lived through the Civil War that cleft the head of both the King and the body politic, language reforms seemed all the more urgent during the Interregnum and Restoration: language needed to be stripped of its ornaments lest the political order collapse once again. If the Royal Society was to help restore the Adamic dominion over nature, experimental philosophy required its own style of language.

To that end, Sprat rejects the "swellings of style" in favor of "a close, naked, natural way of speaking" (H, 113)—seemingly a denigration of poetry that has led many modern scholars to assume some staunch opposition between literary language and scientific language. The *Oxford English Dictionary's* definitions most applicable to Sprat's use of "naked" are "Lacking or defective in some quality, skill, etc.; *esp.* lacking in rhetorical art" and "Of words, language, etc.: free from concealment or reserve; plain,

straightforward; outspoken.”<sup>12</sup> On the face of it, Sprat’s “naked” prose signifies a style of language that lacks rhetorical art and poetic ornament. The term “naked,” however, also functions metaphorically: language can be clothed or laid bare only in a figurative sense. Adam labored naked in Eden and, by his unaided eye, named all the things in the garden in a way true to their essence. It is Adam’s “naked” relationship to nature that seventeenth-century natural and experimental philosophy sought to achieve often, if not ironically, by the use of the machines that could help repair their fallen senses.<sup>13</sup> As we shall see, Sprat’s advocacy of a “naked” prose was a call to restore fallen language to its prelapsarian use and precision. To achieve the Royal Society’s utopian goal, Sprat argues that these experimental philosophers “have endeavor’d, to separate the knowledge of *Nature*, from the colours of *Rhetorick*, the devices of *Fancy*, or the delightful deceit of *Fable*” (H, 62). He differentiates experimental philosophy from poetry, pitting each science against the other by redefining the kind of “nature” that the poets imitated and discovered. Over the course of the seventeenth century, the once complementary sciences of poetry and natural philosophy were becoming too distinct to function together. Although much modern scholarship understands Sprat’s “naked” prose as an outright rejection of most poetic and rhetorical language, the tropes and figures Sprat

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<sup>12</sup> Oxford English Dictionary, 3<sup>rd</sup> ed. s.v. “naked” [online] (Oxford: Oxford University Press, 2003) <http://www.oed.com.proxy.lib.duke.edu/view/Entry/124890?rskey=7ItRXo&result=2&isAdvanced=false#eid>

<sup>13</sup> Peter Harrison, *The Fall of Man and the Foundations of Science* (Cambridge: Cambridge University Press, 2007), 96.

used throughout work invite us to look more closely at what he means by a “naked” prose.

Like Gosson’s *Schoole of Abuse*, Sprat’s *History* is ripe with the florid language he opposes. If poetic language was deleterious to the political order and hindered the advancement of knowledge—if the Royal Society did indeed “reject all the amplifications, digressions, and swellings of style” (*H*, 113)—why are experimental philosophical treatises written so eloquently? The question concerning the experimental philosopher’s simultaneous use and denunciation of elevated language became a prominent matter of concern for literary scholars and historians of science in the early twentieth century and has persisted until today. In a number of works written between the early and mid-decades of the twentieth century, Richard Foster Jones argued that Bacon and the Royal Society were hostile to poetic and rhetorical language.<sup>14</sup> Jones’s argument largely persisted until Brian Vickers offered his influential counterargument in the 1980s in which he places Sprat’s *History* in the historical and political context of this debate: the Royal Society’s criticisms of poetic language belonged in a larger rebuttal to the criticisms waged against experimental philosophy in a time when the power of rhetoric was held responsible for fomenting civil strife.<sup>15</sup> “The New Scientists,”

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<sup>14</sup> Richard Foster Jones, *The Seventeenth Century: Studies in the History of English Thought from Bacon to Pope*, (Stanford: Stanford University Press, 1965).

<sup>15</sup> Brian Vickers, “The Royal Society and English Prose Style: A Reassessment,” in *Rhetoric and the Pursuit of Truth: Language Change in the Seventeenth and Eighteenth Century*, eds., Brian Vickers and Nancy Streuver (Los Angeles: University of California, 1985): 62.

Vickers explains, “were not against language, or rhetoric, or the imagination. They were against their opponents’ misuse of them—or perhaps more simply, they were against their opponents.”<sup>16</sup> For Vickers, Sprat never “contradicted himself, since he never disclaimed all use of rhetoric or of appeals to the imagination, but merely the specific situations in which the exercises of these faculties was permissible.”<sup>17</sup> Other scholars have similarly argued that Royal Society fellows did not advocate the complete rejection of elevated language, but simply those tropes or figures that did not announce themselves as such<sup>18</sup> or that relied on alchemy or occultism for their significance,<sup>19</sup> or that promoted a new rhetorical style that focused on images of nature rather than on traditional *exempla*.<sup>20</sup> By the same token, Katharine Park has shown, analogies and similitudes were even regarded as necessary for the communication of the knowledge discovered by natural philosophy.<sup>21</sup> As Park points out, Bacon argues in c. 1603 *Valerius terminus* that “there is no proceeding in invention of knowledge but by similitude.”<sup>22</sup> Rather than categorize Sprat and his fellow experimental philosophers as either pro or anti-poetic language, it would be more useful to identify the emergence of the division between experimental philosophy and poetry that these categories presuppose. As we

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<sup>16</sup> Vickers, “The Royal Society,” 62.

<sup>17</sup> Vickers, “The Royal Society,” 23.

<sup>18</sup> Picciotto, *Labours of Innocence*, 17.

<sup>19</sup> Ryan J. Stark, *Rhetoric, Science & Magic in Seventeenth-Century England* (Washington: The Catholic University Press, 2009), 2–3.

<sup>20</sup> Frédérique Aït-Touati, *Fictions of the Cosmos: Science and Literature in the Seventeenth Century*, trans. Susan Emanuel (Chicago: University of Chicago Press, 2011), 170.

<sup>21</sup> Katharine Park, “Bacon’s ‘Enchanted Glass,’” *Isis* 75, no. 2 (1984): 292, 294, 299–300.

<sup>22</sup> Park, “Enchanted Glass,” 294.

shall see, experimental philosophy seized the faculty of the imagination that made poetry a science, thereby appropriating for this philosophy the poet's role in both the discovery of knowledge and in securing the political order in the mid-seventeenth century. When Sprat "rejects" the "swellings of style" (*H*, 113), he is not rejecting poetic language *per se*. Rather, he was challenging the long-held view of poetry, in Puttenham and Sidney's words, as a "science," stripping it of its claim to discover knowledge and restricting the status of science to experimental philosophy.

Although twentieth-century scholars have taken up the supposed contradictions in the Royal Society's language reforms, the Royal Society's use of poetic language was not widely commented on by those in the seventeenth.<sup>23</sup> Samuel Butler is one of the few to fault the Royal Society for their contradictory views on language: "The historian of Gresham College endeavours to cry down oratory and declamation while he uses nothing else."<sup>24</sup> Much of the attacks on the Royal Society focus on their use of machinery in the pursuit of knowledge of the material world. Many critics, such as Margaret Cavendish, either argue that mechanical aids distorted, not perfected, the image of the material world or, like Thomas Hobbes, contend that the machinery failed to evince the conclusions drawn by experimental philosophers. The paucity of contemporary

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<sup>23</sup> "Vickers, "The Royal Society," (4). Vickers suggests that few of the Royal Society's contemporaries commented upon their use of eloquent language, though Butler's criticism is missing from Vickers's references.

<sup>24</sup>Samuel Butler, "Unclassified Prose Observations," in *Prose Observations* ed. Hugh de Quehen (Oxford: Oxford University Press, 1979), 155.

complaints suggest that the recent preoccupation with the Royal Society's language reform more readily reflects our current understanding of literature and science than it does seventeenth-century poetry and experimental philosophy. Our current conception of literature and science places each in stark opposition: the assumptions, goals, and methods of either are self-contained, their respective domains bridged only in the interdisciplinary studies that presuppose their division. When traced through the Royal Society's language reforms, the divergence between poetry and experimental philosophy after the mid-seventeenth is better described as a process by which the means of scientific invention becomes increasingly restrictive.

In Bacon's works in the first decades of the seventeenth century poetry was considered a science, one that was complementary with natural philosophy. As Chapter 1 has shown, Bacon's natural philosophical reforms could not achieve the dominion he sought over nature without the poetic imagination—the faculty necessary to make manifest the utopianism of the Adamic restoration that made his scientific reforms profoundly political. But Bacon's anti-Aristotelian use of machines in the discovery of natural knowledge greatly contributed to the division between poetry and experimental philosophy that emerged as the debate over language was taken up by fellows of the nascent Royal Society. The use of machines in the discovery of knowledge of the material world, along with the larger movement toward knowledge discovered through sense experience in Bacon and many others, redefined the ideas of “nature,” “art,” and

the relation between them. Thus while the stakes of the Royal Society's language reform mirrored those of the language debates that occurred at the turn of the seventeenth century, by mid-century the terms of this contention had greatly changed. Where what "nature" meant for the early seventeenth-century poet ranged from human nature, to the material world, to the divine imprints with which God marks his creations, "nature" had become more narrowly defined as the material world for the poet in the latter half of the century. As inheritors of Baconianism, experimental philosophers largely believed that "nature's" divine causes could be admired but not discerned in the way they were for the poet. As a result, the experimental philosopher relegated "nature" to the material phenomena that could be empirically observed or produced by machinery. As the understanding of nature and art shifted throughout the seventeenth century, so did their concomitant implications in the political sphere. Very much like the work of the poet and natural philosopher in Bacon and Shakespeare, the work of the experimental philosopher was also profoundly political. What constituted an authoritative knowledge claim was also a claim for political authority and assent. The epistemological and political role of the poet and experimental philosopher changed as experimental philosophers, Sprat in particular, vied to validate his science above poetry.

To set about his "grand instauration," Bacon advocates the use of "art," by which he means mechanical aids or equipment, in natural philosophy. "Neither bare hand nor unaided intellect counts for much," Bacon argues, "for the business is done with

instruments and aids, which are no less necessary to the intellect than to the hand (O, 11:65). Reforming natural philosophy involved employing instruments to aid one's senses and to one's reason. For the "hand," this involved the use of machines thought to compensate for the limitations of the human senses. Indeed, the role of the machine in Bacon's reforms should not be understated; Bacon identifies his reformed natural philosophy itself as a "machine" that must be supplied with "the facts of nature" (W, 8:24), highlighting the marriage between man's art and the knowledge of the material world that differentiated his natural philosophy from that of Aristotle. Aristotle distinguishes *poiesis*, or man's art, from *scientia*, the teleological knowledge of nature. Bacon rejects this distinction, contending that knowledge of nature is more readily discovered under the "vexations of art" than when material phenomena occur "in their usual course" (O, 11:157). Given that Bacon was skeptical of some forms of the experiment and did not himself perform many experiments, what is most significant about Bacon's "vexations of art" is his inclusion of mechanical aids in the pursuit of natural knowledge. Rather than offer any reductive definition of what Bacon meant, what is most important is to understand these vexations as the applications of machines to material phenomena. This broader understanding of Bacon's "vexations of art" includes the use of mechanical aids in the observation of nature, as Robert Hooke later made famous with his microscope, and in the production of material phenomena, as Robert Boyle made (in)famous with his air pump experiments. In Bacon's reformed

natural philosophy, mechanical devices would be applied to nature to extract knowledge that would otherwise remain hidden. Man's art, Bacon further argued, could "fundamentally alter nature" (W, 8:410–11), granting man control over nature by use of such machines. Manipulating nature in this way was not just a valid epistemological means to gain knowledge of the material world, but could also further advance the development of man's art. Since studying the "Wonders of Nature" would lay the "passage towards the Wonders of Arte" (O, 4:63), Bacon suggests that the use of machines in natural philosophy could set in motion a cycle of progress where the knowledge of nature refines the machines used in large part to discover this knowledge in the first place.

Sprat and his Royal Society fellows also believed that knowledge of nature could be gained from the manipulation and simulation of material phenomena in an experiment. Once practiced primarily by artisans, midwives, and alchemists, the *experimentum*, a test or trial,<sup>25</sup> became the hallmark of the Royal Society's science. The Royal Society's experimental philosophy, however, importantly conjoined the *experimentum* and *observationes*, the detailed recording of a material phenomenon, that had in prior centuries been two distinctly different procedures. The Royal Society's experimental philosophy conjoined both: it manipulated nature under the application of

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<sup>25</sup>Lorraine Daston and Elizabeth Lunbeck eds., *Histories of Scientific Observation* (Chicago: University of Chicago Press, 2011), 16-17.

machines and recorded its results with detailed observations. Because of the “dependance amongst all the orders of creatures,” Sprat explains that, whether “natural” or “artificial,” the “apprehension of one of them is a good step towards the understanding of the rest” (*H*, 110). Counter to Aristotle, man’s art could indeed produce knowledge of nature. As Bacon suggested, the use of machines did discover knowledge of nature that would have remained hidden from the purview of an Aristotelian natural philosophy. The telescope, the microscope, and the air pump, just to name a few of the most famous examples, discovered phenomena that could not be accounted for by Aristotle. When Galileo lifted the telescope to the night sky, moons were seen to orbit Jupiter, providing empirical evidence for a model of the cosmos where heavenly bodies did not circle exclusively around the Earth. When Hooke looked through the microscope, new microworlds were exposed to view that challenged the sense experience of the macroworld. Even the sharp point of a needle metamorphosed into a “*broad, blunt*” instrument when magnified.<sup>26</sup> Boyle’s air pump, he contended, removed all of the air from the pump’s chamber, sparking a debate with Thomas Hobbes over the existence of a vacuum.

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<sup>26</sup> Robert Hooke, *Micrographia or Some Physiological Descriptions of Minute Bodies Made by Magnifying Glasses with Observations and Inquiries thereupon* (New York: Dover Publications, 1961), 1-2. This edition is a facsimile of Hooke’s *Micrographia*. Since there are no page numbers given for the Preface, I have enumerated in Roman numerals to help the reader identify where it was taken from this work. Hereafter cited as *M* with page number (given in Roman numerals if from Preface).

The Baconian “restoration” of the sciences adopted by the Royal Society established the primacy of experimental philosophy among older sciences—Sprat’s *History* is but one of the more notable pieces of propaganda.<sup>27</sup> Sprat states boldly that experimental philosophy will alter the older “*Systeme of Natural Philosophy*,” a science he compares with the demise of poetic art as a source of knowledge:

[the] change [to natural philosophy] will be so advantageous, that I have no reason to dissemble it.... But to what sum will the damage amount? What can we lose, but only some few *definitions*, and idle *questions*, and empty *disputations*? Of which I may say as one did of *Metaphors*, *Poterimus vivere sine illis*. (*H*, 327)

The presence of poetry and rhetoric in an argument about the primacy of experimental philosophy over natural philosophy attests to the earlier complementarity between poetry and natural philosophy—a complementarity that would not be as readily entertained by experimental philosophers. Sprat’s defense of experimental philosophy frames the older sciences, poetry and Aristotelian natural philosophy, as unnecessary adornments that can be lost without any detriment to the pursuit of knowledge.

Similarly for Cowley, poetry was like “desserts,” not “solid meats,” that should be stripped from Philosophy’s diet. Defenses of experimental philosophy, then, are also demarcations of this particular science from older ones. More than a predilection for a particular writing style, language reform was central to the Royal Society’s defense of experimental philosophy because poetry was itself a science that offered a means of

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<sup>27</sup> Joseph Glanvill’s *Vanity of Dogmatizing* is another example.

invention that vied for primacy with experimental philosophy. And as experimental philosophers worked to legitimate their science, the older notions of “nature” and “art” were called into question, redefining what pursuits of knowledge constituted a science.

As the relation between art and nature in natural philosophy changed throughout the seventeenth century with the use of machines in the pursuit of knowledge of the material world, so did the conception of “nature” and “art.” The understanding of “nature” was important to both the poet’s and natural philosopher’s labors throughout the seventeenth century. But what “nature” signified for poets and natural philosophers at the beginning of the century was different for the poets and experimental philosophers after mid-century. Referencing Aristotle’s *Poetics*, that had been recovered by the mid-sixteenth century,<sup>28</sup> Puttenham and Sidney both identify the poet as a “maker (*D*, 87) and an “imitator” (*A*, 93): mimesis was central to what the poet made. What they imitated, however, greatly varied. The “nature” they imitated signified differently among poets<sup>29</sup> and at times, even within a given poet’s oeuvre. Because the poet “can express the true and lively of everything is set before him” (*A*, 93), Puttenham argues that the poet is an imitator capable of crafting lifelike images of the material world. For Sidney, the poet would at times imitate human nature,<sup>30</sup> but this imitation would take the material or “brassen” (Sidney *D*, 88) world as its primary model and, in so

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<sup>28</sup> S.K. Heninger, Jr., *Sidney and Spenser: The Poet as Maker* (University Park: Pennsylvania State University Press, 1989), 71.

<sup>29</sup> Heninger, *Sidney and Spenser*, 18.

<sup>30</sup> Heninger, *Sidney and Spenser*, 281.

doing, would reveal the divine imprints that marked God's material creations. The poet, for Sidney, "goeth hand in hand with *Nature*" while at the same time "freely ranging onely within the Zodiack of his owne wit" (*D*, 88) so as to transmute the "brasen" material world into a "golden" one where the lineaments of an ideal order are more visible. What the poet made, then, was a perfected image of "nature," be it human nature or the material world. And his "art" was the language used to describe this perfected image. The poet described nature such that its perfected image revealed knowledge. By way of comparison, Sprat claims the poet's task for the experimental philosopher whose mechanical devices better perfected the image of nature so as to reveal knowledge to the attentive observer.

Because the poet and the experimental philosopher understood nature differently, they each presuppose different assumptions about how "nature" could be made to reveal knowledge. If each is to approach nature so as to attain knowledge, should this approach focus on the material world or on the perfected image that revealed the divine imprints on the material world? At the turn of the seventeenth century both the poet and the natural philosopher set out to transmute material phenomena from a "brasen" world to a perfected, "golden" one. Experimental philosophers turned to mechanical devices to examine material phenomena so as to perfect their vision of nature such that it revealed the "golden" world that was otherwise revealed by the poet's language.

The poet was guided by his imagination, crafting perfected images of nature that were more beautiful than the material world itself. For the poet, knowledge was not found in the material world, but invented in nature's perfected image. Nevertheless, "nature" was central to Sidney's conception of poetry. Nature was the object in relation to which he thought the poet gained knowledge. For Sidney, the poet surpassed the knowledge of the natural philosopher (among other professions) precisely because the poet need not describe the material world as it existed. Instead, nature was a "brazen" (*D*, 88) world capable of being transmuted into a "golden" world by the poet alone. Like Sidney, Bacon also uses an alchemical metaphor to describe the relationship between art and nature. For Bacon, the fallen world could be "transmute[d]" (*W*, 8:410) through man's art into one where man's relation to nature is, at least to a certain degree, "restored to its perfect and original condition" (*W*, 8:17). Bacon dedicates his reforms to the restoration of an Adamic dominion over nature. This restoration could not be achieved unless natural philosophers focused exclusively on material phenomena. Bacon locates the source of knowledge in nature (*W*, 8:24) and the material phenomena simulated by man's art. Where knowledge was discovered in the imagined world for the science of poetry, knowledge was discovered in the material world, largely with mechanical devices, for the science of Bacon's natural philosophy.

After mid-century, poets were more constrained to represent nature, be it human nature or the natural world, than their predecessors and experimental philosophers

discovered knowledge in a perfect image of the material world accessible only through the mechanical arts. As it was for Puttenham, Sidney, and Gosson, the abuse of language persisted as a concern for poets in the latter half of the seventeenth century. John Dryden's 1668 *Essay of Dramatick Poesie* expresses four different views on poetry, couching larger debates over poetry's relation to the world of nature and the limits of the imagination in smaller concerns, the merits of verse as opposed to blank verse in particular. Crites, Dryden's mouthpiece for Sir Robert Howard, argues that the best poetic work is one that closely imitates or comes "nearest" to human "nature" because "no man was ever deceived but with a probability of truth."<sup>31</sup> For this reason, Crites concludes that poetic works should not be written in verse because verse would not accurately imitate how men actually talk. Crites, however, begins to elide human "nature" with the natural world when he argues that a play's "scenes" or backdrops should be painted to closely resemble the material world: "we sufficiently understand that the scenes which represent cities and countries to us are not really such, but only painted on boards and canvas:

but shall that excuse the ill painture or designment of them? Nay, rather ought they not to be laboured with so much the more diligence and exactness, to help the imagination? [S]ince the mind ... seek[s] after truth; and therefore the nearer anything comes to the imitation of it, the more it pleases (*E*, 80).

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<sup>31</sup> John Dryden, *Of Dramatic Poesy and Other Critical Essays*, ed. George Watson, vol. 1 (London: Camelot Press, 1962), 79. Hereafter cited parenthetically as *E* and page number.

Whether an imitation of man's passions or the countryside, Crites claims that poetry (inclusive of drama) is most pleasing when it accurately resembles what is being imitated because the imagination is better able to entertain the poetic work as a source of "truth." Crites, then, aligns "truth" with a close resemblance to nature, be it human nature or the material world.

Neander, Dryden's own mouthpiece, rejects Crites argument by differentiating between comedic and tragic works. In tragedy, Neander contends that the best relation between the material world and the poet is not one that aims to represent nature with the greatest degree of accuracy. Instead, the poetic work is the "representation of nature, but nature wrought up to a higher pitch" (*E*, 87). The poet's imagination importantly perfects the image of the world he crafts, but even for Neander poetry must not deviate too far from a close imitation of (human) nature. The poetic work can reach "as high as the imagination of the Poet can carry," but Neander stipulates, "with proportion to versimilitude" (*E*, 87). As it was for Crites, here the issue underlying Neander's argument is the boundaries of the imagination, which for both debaters, should be kept in check. But where Crites argued that verse should be eliminated from poetic works because it impedes the imagination, Neander argues that verse helps to rein in an unruly fancy. "[V]erse," Neander affirms, is but one means to keep a poet's "building compact and even, which otherwise lawless imagination would raise either irregularly or loosely" (*E*, 91). Despite their disagreement, both Crites and Neander argue that the poetic

imagination must be fettered. Where Sidney celebrated the “Zodiack of [the poet’s] owne wit” (*D*, 88) in the late sixteenth century, after mid-seventeenth century the poet was increasingly expected to confine the imagination under tighter constraints such that it maintains a greater degree of verisimilitude.

In contrast, experimental philosophers began discovering knowledge in the perfect image of the material world. They believed that the fallibility of human sense and the limitations of the mind were corrected by mechanical devices that revealed a perfected image of material phenomena. Just as a poet invents or reveals a perfected image of the material world, the experimental philosopher’s mechanical equipment revealed in nature the “rich tapistry” (Sidney *D*, 88) once thought possible only in poetry—a world so revealed was as magnificent as the worlds described in poetry. For Sprat, the experimental philosopher differs from the poet because “he invents what he does not out of himself, but gathers it from the footsteps of nature” (*H*, 334). Knowledge was discovered in the material world, not out of the mind. To defend against criticisms that the experimental philosopher’s materialism led to atheism, Sprat frames the material world not as a fallen world, but one in which the magnificence of God’s creations is made most visible through the use of such mechanical devices such as the telescope and microscope. He argues that while the experimental philosopher attends solely to “material things” (*H*, 348), the experimental philosopher knows that in “every work of nature he handles ... there is not only a gross substance which presents itself to

all mens eies; but an infinit subtilty of parts which come not into the sharpest sense" (*H*, 348). Because the experimental philosopher's senses are "assisted by the instruments of art" (*H*, 348), however, gross nature more readily reveals the hidden hand of God (*H*, 348–9). If "the invisible things of God are manifested by the visible," Sprat contends, "then how much stronger arguments has [the experimental philosopher] for his belief ... in the *Godhead*, from the vast number of *Creatures*, that are invisible to others, but are exposed to his view by the help of his Experiments?" (*H*, 349). Machines revealed a perfected image that secures before the experimental philosopher's "eyes the *beauty*, *contrivance*, and *order of God's works*" (*H*, 349). In order to counter claims that experimental philosophy leads to atheism, Sprat affirms his science's reverence by emphasizing its ability to make visible God's otherwise hidden hand.

Like the poet whose imagination could craft similitudes of God's work, Hooke suggests that the experimental philosopher renders visible a vast universe within a speck of its matter:

By this the Earth it self, which lyes so neer us, under our feet, shews quite a new thing to us, and in every *little particle* of its matter, we now behold almost as great a variety of *Creatures*, as we were able before to reckon up in the whole *Universe* it self" (*M*, Preface, iv).

Mechanical instruments make visible the grandeur of the macocosm within a microcosm that lies beneath man's feet. Even the basest pest, the flea, was revealed to

don a “polish'd suit of *sable* Armour” (*M*, 210) under the microscope’s lens.<sup>32</sup> After mid-century, the poetic and natural philosophical understanding of “nature” had in some senses changed positions. Unlike their earlier counterparts, mid-century poets describe the material world to discover knowledge and mid-century experimental philosophers used art to describe the gross material world into a perfected world.

How knowledge of nature was to be read also changed from the turn of the seventeenth century to mid-century. Poets, natural philosophers, and experimental philosophers all use the metaphor of the book of nature whether at the outset or the end of the seventeenth century:<sup>33</sup> nature was marked or imprinted with the signature or stamp of God’s hand. How divine signatures were to be read, however, differed for poets, natural philosophers, and experimental philosophers across the seventeenth century. At the turn of the seventeenth century, poets saw nature’s divine signatures as symbols that pointed beyond their appearance in the material world to the lineaments of the ideal order. While Bacon also believed that the material world bore the “authentic

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<sup>32</sup> When observing the book-worm, the bane of anyone involved in preserving or trading books (including the scholars who today search for salvageable copies of ancient texts), Hooke notes that “the whole Animal appear of a perfect Pearl-Colour” (*M*, 208), its head “furnish’d on either side of it with a cluster of eyes”, a series of “fring’d Girdle[s]” of “smaller hairs” on sections of its “long horns” (*M*, 209), and a mouth so deleterious to book pages that it can be dubbed “one of the teeth of Time” (*M*, 210). Despite the danger the book-worm’s hunger presented to the preservation of books, Hooke’s microscopic image compels him to “remember and admire the excellent contrivance of Nature” (*M*, 210). For a brief discussion of the threat book-worms posed to book preservation, see Stephen Greenblatt, *The Swerve: How the World Became Modern* (New York and London: Norton & Company, 2011), 82–84.

<sup>33</sup> Catherine Wilson notes that this metaphor persisted well into the eighteenth century with George Berkeley and Immanuel Kant, even if they read it differently than their predecessors in earlier centuries (*The Invisible World: Early Modern Philosophy and the Invention of the Microscope* third printing, [Princeton: Princeton University Press, 1997], 63).

seals that the Creator has stamped upon his creatures" (O, 11:187), he argues that nature does "not portray the image of the Maker" but only reveals God's "omnipotency and wisdom" (W, 8:477). All that can be gleaned from nature about its divine creator was an adoration of his work, not any knowledge of His will.

Following Bacon, Royal Society members hesitated to extrapolate any significance beyond how nature appeared other than to inspire worship of God; material phenomena could not point to final causes. Boyle argued that God could effect a given natural phenomenon through any number of causes, warning experimental philosophers to refrain from asserting knowledge of final causes: "an Artificer can set all the Wheels of a Clock a going, as well with Springs as with Weights ... So the same Effects may be produc'd by divers Causes."<sup>34</sup> Knowledge of recorded material effects, not claims that posited their causes, could be held as certain. Rather than read the divine imprints as symbols, nature was to be read as one reads the hands of a clock. Steven Shapin and Simon Schaffer summarize this position nicely when they unpack the metaphor of nature as resembling a clock: "man could be certain of the hours shown by its hands, of natural effects, but the mechanism by which those effects were really produced, the clockwork, might be various."<sup>35</sup> Extrapolating causes beyond natural phenomena could not produce certain knowledge. For Bacon and the experimental

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<sup>34</sup> Robert Boyle, *Some considerations touching the usefulness of experimental natural philosophy* (Oxford: Printed by Hen. Hall for Ric. Davis, 1663), 81.

<sup>35</sup> Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (New Jersey: Princeton University Press, 1985), 24. Hereafter cited parenthetically as *L* with page number.

philosophers who adopted his tenets, nature's marks could not be read as symbols as they were read by the poets. Although God's creatures bore His signature, these marks were to produce awe of God. Experimental philosophers concerned themselves with the immediate appearance of material phenomena. When Cowley praises Bacon for having "learn'd to Read [nature's] smallest Hand" (*Ode*, VII.20), then, he is not referring to nature as a book.<sup>36</sup> Instead, it is to be read as the hands of the clock that point only to natural effects and not their animating cause.

Because causal knowledge was not thought to be held with any great certainty, Boyle and other experimental philosophers focused what they believed they could provide more probabilistic assurance or what they called a "matter of fact." As Shapin and Schaffer explain, matters of fact were communally agreed upon records of the results of art's application to nature:

In Boyle's view assent was to be secured through the production of experimental findings, mobilized into matters of fact through collective witness. The individual agreed with other individuals about what he had witnessed and believed. The programme was, therefore, founded upon collectivized individual sensory experience (*L*, 152).

In addition to the "material technology" of the mechanical instruments, matters of fact involved two other technologies, "literary" and "social," in order to stand as a legitimate knowledge claim, demonstrating the mutually constitutive emergence of

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<sup>36</sup> Wilson reads this line as a reference to the book of nature which, she argues, was a trope that persisted sporadically until the eighteenth century even though "nature [as] a system of signs meant for us to read [was] no longer a tenable view" around the mid seventeenth century (*The Invisible World*, 63).

epistemological and political criteria for authority (*L*, 25). The literary technology consisted of a set of discursive practices that garnered communal assent necessary to consider the record of man's manipulation of nature as "fact." Because not everyone could observe these events first hand, the language used to communicate these facts was thought to replace direct observation, producing what Shapin and Schaffer call "virtual witnesses." The social technology produced criteria to achieve communal assent, demonstrating that the epistemological criteria for what constituted knowledge could not be disarticulated from issues of assent in the political order. As Shapin and Schaffer argue, "solutions to the problem of knowledge are embedded within practical solutions to the problem of social order, and that different practical solutions to the problem of social order encapsulate contrasting practical solutions to the problem of knowledge" (*L*, 15). The production of matters of fact, then, were also understood as a means to promote the political order, at once redefining man's relation to the material world and his relation to the commonwealth.

Central to the labors of the poet, Bacon's natural philosopher, and experimental philosopher, the notion of "art" underwent a transformation along with a similar revision in the conception of "nature." At the outset of the century, *poesis* and *techne* were inextricably linked. In the early seventeenth century, terms associated with art such as "contrivance," "device," and "invention," were all applied equally to the labors of the poet, the Baconian philosopher, and the experimental philosopher. "Art" was a

term that included the materiality of language and the assemblage of machines.

Jonathan Sawday notes that “the language of machines and Renaissance poetic theory seem to slide seamlessly into one another.”<sup>37</sup> Rayna Kalas makes a similar point, arguing that a “predominant strain of poetic theory in the English Renaissance recognized poesy as *techne* rather than aesthetics.”<sup>38</sup> But as instruments became the primary means by which to investigate nature, poetic art and natural philosophical and experimental philosophical art began to diverge.

Where the poet’s art was thought to be a unique product of his imagination alone, the product of an instrument was thought to be regular and reproducible. Bacon’s argument that man’s art is the best means by which to discover knowledge of the physical world implicitly fostered a distrust of the human senses. Mechanical “aids” (*O*,11:165) were thought necessary to correct the senses and to reveal nature without the taint of human bias—an argument Hooke makes in his popular *Micrographia* when he seeks to remedy the “*infirmities*” of the senses with mechanical “*Instruments*” (*M*, iii).<sup>39</sup> As new mechanical instruments were introduced for the study of nature, the regularity and reproducibility of their products became associated with experimental philosophy’s

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<sup>37</sup> Jonathan Sawday, *Engines of the Imagination: Renaissance Culture and the Rise of the Machine* (London and New York: Routledge, 2007), 174.

<sup>38</sup> Rayna Kalas, *Frame, Glass, Verse: The Technology of Poetic Invention in the English Renaissance* (Ithaca: Cornell University Press, 2007), xi.

<sup>39</sup> Bacon believed that both the senses and the intellect required instrumental “aids” to assist in the discovery of natural knowledge: “Neither bare hand nor unaided intellect counts for much; for the business is done with instruments and aids, which are no less necessary to the intellect than to the hand. And just as instruments of the hand stimulate or guide its motion, so the instruments of the mind prompt or look out for the intellect” (*O*, 11:65).

criteria for knowledge—and these mechanical values were made most visible when contrasted with the poet’s art. Where the poet’s art was specific to his own mind, the natural and experimental philosopher’s art produced or observed natural phenomena that was thought to be accessible to any witness or reproducible by any hand. Matters of fact were, in an important sense, “fact” because they represented the communal assent of witnesses that a particular finding would indeed occur in the same way to anyone, whether first hand or virtually.<sup>40</sup> Cowley refers to the distinction between the poet’s and the experimental philosopher’s products when he imagines the trajectory of “Philosophy[’s]” (*Ode*, I.1) fruition under Bacon and his philosophical heirs:

From words, which are but pictures of the thought, /  
 Though we our thoughts from them perversely drew /  
 To things, the mind's right object, he [Bacon] it brought, /  
 .....  
 No, not from Rubens or Vandyke; /  
 Much less content himself to make it like /  
 Th' ideas and the images which lie /  
 In his own fancy, or his memory. /  
 No, he before his sight must place /  
 The natural and living face; /  
 The real object must command /  
 judgment of his eye, and motion of his hand./ (*Ode*, IV. 1-3, IV.13-20)

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<sup>40</sup> These “matters of fact,” however, were often difficult to reproduce. Boyle’s air pump experiments were seldom repeated—a failure that Hobbes used to criticize Boyle’s notion of the vacuum and his experimental philosophy more broadly. For an extensive discussion of the dispute between Hobbes and Boyle, see Shapin and Schaffer, *Leviathan and the Air-Pump*. Even the discoveries made under a microscope were very difficult to reproduce. When Hooke attempted to reproduce Antony van Leeuwenhoek’s surprise discovery of “small animals of divers kinds” in a solution of pepper-water, it took over a year before Hooke could also see the “little eels” in the mixture (Lisa Jardine, *Ingenious Pursuits: Building the Scientific Revolution* [New York: Nan A. Talese, 1999], 93).

Cowley conflates the poet's and the painter's art as he reduces them both to the particularity of one's fancy or memory. The uniqueness of the poet's art is trivialized because it is thought to be singular to that poet alone. The "real object" of science is the physical world that, when observed or manipulated by mechanical equipment, discovered knowledge thought to be more reliable because it lacked human bias. Once held as a virtue, the uniqueness of poetic art is here mapped onto the fallibility of the mind and senses. Since experimental philosophers argued that mechanical instruments could correct the fallibility of the mind and senses, the qualities of the instrument were thought to stand opposed to the uniqueness of poetic art. As experimental philosophers worked to legitimate the role of mechanical equipment in the pursuit of knowledge, *poiesis* and *techne* diverged, the former becoming increasingly assigned to poetry and the latter to experimental philosophy. With the rise of experimental philosophy, poetry was not as readily considered a "science." The unique product of the poet and the (supposedly) repeatable and observable facts of the experimental philosopher's machine became the respective hallmark characteristic of each profession. The longstanding connection between *poiesis* and *techne* was severed whereby terms associated with uniqueness migrated to the category of "art" and terms associated with regularity assembled under the title of "techne." Far from ridding science of its poetic trappings, experimental philosophers adopted the poet's role in the invention of a perfected image

of the world from which to ascertain knowledge. The art the experimental philosopher employed, however, was considered *techne* rather than *poiesis*.

However paradoxical it may seem to trace the divergence of the sciences through the experimental philosophers' adoption of the poet's role, the Royal Society would not have defended its science against the very criticisms it lodged against poetry if experimental philosophy were void of poetic invention. Despite their efforts to arrest the deleterious effects they ascribed to poetic language, the Royal Society was accused of the very same charges they laid against poetry. Sprat explains that his History is also an "apology" (To the Reader) against all of the criticisms levied at this newly chartered Society. "Experimental Philosophy," Sprat complains, has "undergone the imputation of those very faults, which it endeavors to correct in the *Verbal*" (H, 26). Just as experimental philosophers worry that poetry would make men's minds idle and render them incapable of rational, moral action, the Royal Society was likewise considered "meerly as an idle matter of Fancy, and as that which disables us, from taking right measures in humane affairs" (H, 27).<sup>41</sup> According to its critics, the Royal Society is subject to the whims of a luxurious imagination—the faculty responsible for poetry. "They farther object," Sprat relates, that experimental philosophy makes men's "minds too lofty and *Romantic*, and inclines them to form more perfect imaginations of the

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<sup>41</sup> Sprat repeats the criticism that experimental philosophy precludes rational action, for the Royal Society is accused of "inclin[ing] men to be unsettled, and *contentious*" (H, 331).

matters we are to practise, than the matters themselves will bear" (*H*, 334).<sup>42</sup> When a flea is described as sporting "a curiously polished suit of sable armor" (Hooke *M*, 210), one that is "neatly jointed, and beset with multitudes of sharp pins" (Hooke *M*, 210) to boot, it is easy to criticise the Royal Society for addressing nature with all the adornments they descry in poetic and rhetorical language.<sup>43</sup> If experimental philosophy perfects an image of nature that does not bear a close resemblance to the material world, experimental philosophy is unable to distinguish its science from that of poetry. It is for this reason, this chapter argues, that experimental philosophy is configured as a poetic science that is steeped in nature.

Once experimental philosophy assumed the poet's role in inventing a perfected image of the material world, the Royal Society attempts to redefine the poet's art and its relation to nature. Poetic ornament, Sprat contends, wearies the material world it is set

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<sup>42</sup> Sprat repeats this accusation elsewhere in the *History* when he relates the criticism that experimental philosophy makes men "*Romantic*, and subject to frame more perfect images of things, than the things themselves will bear" (331).

<sup>43</sup> Because Hooke's *Micrographia* uses exquisite images to show the reader the magnified specimen, images that ensured the text's popularity no less, in addition to descriptive and metaphorical prose, it may be objected that Hooke's figurative language was held inferior or supplemental to his detailed engravings. Frédérique Aït-Touati argues that "Hooke made himself the herald of an experimental method whose aim was to replace text with image .... Fictions, visions, and credible conjectures are banished in favor of a visualization enabled by scientific instruments that explores the efficacy of a new type of scientific authority" (*Fictions of the Cosmos* 12). Hooke's figurative language, I argue, helps make the images signify in ways that the image alone could not. By crafting the flea as an armoured knight, Hooke's figurative prose works to explain the resilience of the pest that would not have been so easily conveyed by the pictorial representation of its body under the microscope. Hooke's descriptions, and his figurative descriptions in particular, elucidate characteristics about the specimen's function and one's relation to that specimen that the image itself could not signify. While the engravings for which *Micrographia* is most famous show its readers a vision of a flea otherwise inaccessible to view, it is his metaphorical description that explains why it is so difficult to purple one's nail with such a specimen.

to invent and reveal. In a swooping criticism against the ancients and poetry, Sprat argues that elevated language not only fails to ascertain knowledge of nature but even burdened nature with the weight of ornate language:

The sweetness of Flowers, and Fruits, and Herbs, [ancient poets] had quite devour'd: They had tir'd out the *Sun*, and *Moon*, and *Stars* with their Similitudes, more than they fancy them to be wearied by their daily journeys round the *Hevens* (H, 416).

In Sprat's estimation, the order presented by the poet does not discover the divine order of the material world. Rather than invent or discover the order with which the "Sun, and Moon, and Stars" move about the cosmos, the "Hevens" are worn out by the "Similitudes" of poets. And rather than mediated by language, Sprat contends that the experiment affects "all mens Senses" directly, making the "*most vigorous impressions on mens Fancies*" (H, 416); the wearied world of the poet's imagination would be invigorated by the experiment. Poetry was useful in an earlier time, but experimental philosophy is now primed to take its place. Sprat argues that:

It is now therefore seasonable for *Natural Knowledge* to come forth, and to give us the *understanding* of new *Virtues* and *Qualities* of things; which may relieve their fellow-creatures, that have long born the burden alone, and have long bin vex'd by the imaginations of *Poets* (H, 416).

Poetry "vexes" nature, but does not produce the fruit of knowledge or arts of Bacon's vexations. Experimental philosophy, Sprat intimates, better perfects the poet's science. What, then, is the place of poetry if experimental philosophy takes up its role and its form of invention?

The poet still held a place in experimental philosophy's purview, but his relation to nature was to be mediated by the experimental philosopher. Unlike the poet, Sprat explains that the experimental philosopher "invents not what he does out of himself; but gathers it from the footsteps and progress of Nature" (H, 334). Sprat proclaims that the "works of nature" are home to an "inexhaustible Treasure of Fancy" (H, 413) and could be discovered and transformed into technology. By tapping into nature's "treasure of Fancy," experimental philosophy will furnish language "with very many *new things*, to be nam'd, and adorn'd, and describ'd in their discourse" (H, 324). The "vigorous impressions" with which the experiment marks men's imagination will be nearly "infinite" and "may be always new and unsullied, seing there is such a vast number of *Natural and Mechanical things*, not yet fully known or improv'd" (H, 416). The experiment's ability to stir the imagination helps ensure the growth of natural knowledge. And Sprat links the imagination's role in the experiment to Bacon:

The use of *Experiments* to this purpose is evident, by the wonderful advantage that my Lord *Bacon* receiv'd from them. This excellent Writer was abundantly recompenc'd for his Noble Labors in that *Philosophy*, by a vast Treasure of admirable *Imaginations* which it afforded him, wherewith to express and adorn his thoughts about other matters (H, 416).

As shown in Chapter 1, Bacon appropriates the poetic imagination into his vexations of art, without which his natural philosophy could neither gain knowledge of the material world nor obtain Adamic sovereignty over nature. As Rhodri Lewis makes clear, *ingenium*—the "imaginative talent through which the poet...was able to imitate, and

even surpass, the created world in his works” — was an essential component of Bacon’s art of discovery.<sup>44</sup> And this component, Lewis argues, was emphasized by many of those philosophers who claimed to be Bacon’s intellectual heirs, Robert Boyle included.<sup>45</sup> Sprat’s laudatory remarks on Bacon confirm the imagination’s central importance to Bacon’s natural philosophy and, by extension, that of the Royal Society. In this laudatory passage, Sprat does not applaud Bacon for the characteristics we would today associate with a scientist. Instead, Sprat frames Bacon as a poet, one whose “Noble Labors” in natural philosophy were “afforded” by a “vast Treasure of admirable *Imaginations*.” And these imaginations allowed Bacon to “adorn” other aspects of science, no less.<sup>46</sup> Bacon, Sprat proclaims, “was a Man of strong· cleer, and powerful Imaginations: his Genius was searching, and inimitable: and of this I need give no other proof, then his Style it self; which as, for the most part, it describes mens minds, as well as Pictures do their Bodies” (*H*, 36). In using Bacon’s writing style as evidence of his

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<sup>44</sup> Rhodri Lewis, “Francis Bacon and Ingenuity,” *Renaissance Quarterly* 67, no. 1 (2014): 121, 143-144. Lewis argues that “Bacon presents an art of discovery consisting of two complementary, but hierarchically arranged, parts: *experientia literata* and *novum organum*,” (137), the former relied on *ingenium* and performed essential preparative work for the latter but did not itself arrive at *scientia*. For more on Bacon’s art of discovery and the role of the *ingenium*, see Chapter 1 and Chapter 2.

<sup>45</sup> Lewis argues that “[i]ngenuity provided a flag of the utmost convenience under which to sail the ship of Baconian reform, and one finds repeated references to it throughout the natural-philosophical writing of the 1640s, ‘50s, and ‘60s” (148). Lewis continues, however, to point out the irony of Bacon’s reception: many philosophers who adopted Bacon’s art of discovery claimed only *experientia literata* and its relation to the *ingenium* while neglecting the *novum organum*, which Bacon himself had privileged in the pursuit of natural knowledge (145-151). Lewis lists only Robert Hooke and Thomas Hobbes as those who did not give short shrift to the component of Bacon’s art of discovery thought to attain *scientia*, the *novum organum* (151-154).

<sup>46</sup> Sprat elsewhere uses the term “adorn” to describe Bacon’s work, casting Bacon yet again as a poet: “In whose Books there are every where scattered the best arguments, that can be produc’d for the defence of Experimenta Philosophy; and the best directions, that are needful to promote it. All which he has already adorn’d with so much Art” (*H*, 35).

“powerful Imaginations,” Sprat again crafts Bacon as a poet. Indeed, Bacon’s natural philosophical writings were ripe with tropes and figures, not the least his call to “penetrate” nature’s “inner sanctum” (*O*, 11:59) through the “vexations” of art (*O*, 11:157). The Royal Society’s experiment not only provided fodder for the poets but, if we take Sprat’s description of Bacon seriously, was indebted to one. The experiment focused the imagination on material phenomena, using machines to perfect the image of the material world that the poet invented with his language. In this way, the experiment assumes the role of the poem; the experiment transmutes the brazen world into a golden one where God’s hand is best adored.

Given the importance of the poetic imagination in the experiment, the Royal Society’s rejection of poetic language was not envisioned as a way to eliminate the poet from the purview of experimental philosophy. Rather, it cleared the grounds for experimental philosophy to appropriate and adapt the poet’s science under an epistemology focused solely on the physical world. Experimental philosophy did not render poetry obsolete, but moved the poet’s role onto grounds that would not challenge the primacy of experimental philosophy and its understanding of nature, art, and political authority. “Whatever discoveries,” Sprat assures the poets and rhetors, “the same words, and the same waies of Expression will remain” (*H*, 324). Poetry will not suffer any “ill effects” (*H*, 324) at the hands of experimental philosophers. And, he slyly adds, “if perhaps by this means, any change shall be made herein; it can be only for the

better" (*H*, 324). Experimental philosophy could then be touted as having perfected the poet's work since the experimental philosopher was, at least in theory, better able to impress men's fancies with knowledge that leads to the reverent adoration of God. In Sprat's mind, the work of the poet would not cease altogether, but his labors would be secondary to the experimental philosopher who provided him with the material of his poems. Sprat's "naked" prose, then, does not exclude poetic language, for if it did, it would not be described as "naked." Rather, experimental philosophy's language aimed to describe "nature" — the perfected image of the material world — with words that mirrored [matched] the precision and regularity of the machinery used to discover it. Following Bacon, Sprat seizes the scientific value of poetry as that of experimental philosophy, rejecting poetic language not for its tropes and figures but as what was seen as a rival science.

In perhaps the most extreme example of the experimental philosophy's language reform, John Wilkins devised a language that he thought accorded perfectly with the material world. Part of the universal language movement, Wilkins devised an ideographic language that, by its very design, is set to preclude poetic language. For both Sprat and Wilkins, eloquent language would have "eaten out" the knowledge discovered by "all professions" if it was not immediately eliminated from discourse.<sup>47</sup> In

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<sup>47</sup> John Wilkins, *Essay Towards a Real Character and a Philosophical Language*, ([London] 1668), 18. Hereafter cited parenthetically as *RC* with page number(s). Sprat also argues that natural philosophical knowledge would be "eaten out" by eloquent language (*H*, 111).

his 1668 *An Essay towards a Real Character and a Philosophical Language*, Wilkins attempts to reduce the material world into a series of hierarchical categories, or “Tables” of “Natural bodies” (Epistle). Each of the material phenomena enumerated is assigned a mark or character “according to their respective natures” (RC, 10). “Every word,” Wilkins explains, is “a description of the thing signified by it; Every *Letter* being significant, either as to the *Nature* of the *Thing*, or the *Grammatical Variations* of the *Word*” (RC, 440). Although Wilkins’ language aimed to “signifie things, not words” (RC, 21), the “things” his characters signified represented universalized material phenomena. Wilkins’ characters were not bound to the particularities of any given material phenomenon, but instead signified a perfected representation of the material world. In using language to offer a perfected, universalized image of the material world, Wilkins’ experimental language, then, is akin to that of the poet. If only in theory, Wilkins’ language made the material world accessible to any reader with all the precision and regularity of a machine. Because each mark was believed to correspond perfectly to the material phenomena it represented, reading Wilkins’ words would produce as much knowledge as experiencing the material phenomena first hand. The word and the material world were in a fixed relation, making literal the trope of the book of nature: man could read a word and come to know the material world it represented. Reading Wilkins’ universal and philosophical character would transform any reader into a virtual witness. Wilkins’ universal language, then, was Sprat’s “naked” prose taken to

its most logical extreme. This ideographic language seizes the poet's relation to nature and his discovery of knowledge but with a language that importantly mirrors the machine upon which experimental philosophers' rested both their hands and their claims as a science.

Sprat and Wilkins posited a new relationship between words and the material they discussed, producing a different conceptualization of language.<sup>48</sup> The relationship between *res et verba*, "words and things" or "words and matter," was important to the work of poets, rhetoricians, and natural philosophers alike.<sup>49</sup> The pairing of *res et verba* can be found from the classical rhetoric books of Cicero and Quintilian to the Renaissance work of Erasmus, all of which were influential in sixteenth-century England.<sup>50</sup> A.C. Howell argues that where the relationship between *res et verba* was understood as the "subject matter" of writing or an oration and "words" in the sixteenth century, *res* "seems to become confused with *res* meaning things" in the seventeenth.<sup>51</sup> Informed by Howell's account, Magaret de Grazia similarly explains that "in the

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<sup>48</sup> Sawday links this new conception of language in England to the increasing influence of mechanical philosophy within the Royal Society: "the reform of language and the promotion of mechanical philosophy were seen as allied endeavours. If machines had no need of rhetoric in their operation, then why should language, which was a token presence of the 'universal instrument' of human reason (to recall Descartes), deploy such strategies?" (257).

<sup>49</sup> Kalas points out that "[f]or a great man English writers of the sixteenth century, the principal question was not how words relate to things, but how the crafting of language related to the crafting of things" (xvi). The emphasis on *invenio*—a discovery of divine signatures that could be made visible through language—in rhetoric books and poetry manuals, however, suggests that these English writers did indeed take seriously the relationship between words and the world.

<sup>50</sup> For a succinct discussion of *res et verba* in Cicero and Quintilian, see A. C. Howell. "Res et Verba: Words and Things," *ELH* 13, no. 2 (Jun., 1946): 131-142

<sup>51</sup> A.C. Howell, "Res et Verba," 131.

seventeenth century [*res*] things or matter come to lose their rhetorical sense of things to be discussed or subject matter; they refer instead to empirical things or physical matter."<sup>52</sup> She suggests that when natural philosophers begin to require that words "serve as transparent representations of things, their own thinglike or sensible properties must be overlooked. Or else remade in the image of what they represent."<sup>53</sup> Concerned with baldly representing "things," many English experimental philosophers ignored the sensible material of language and, with it, disregarded its eloquent crafting in poetry and rhetoric as trifles at best and abuses of language at worse. The poet, rhetorician, and natural philosopher each discovered in nature the materials of their professions, but the matter of the poet and rhetorician was "subject matter" where for the natural philosopher it was "physical matter."

Because they have seized what made poetry a science as its own, the Royal Society could then disavow its relation to poetry. The imagination was essential to the continued growth of natural and experimental philosophy because it opened up new avenues in knowledge and art that were otherwise unknown or thought impossible. By

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<sup>52</sup> Margaret de Grazia reduces the difference between the poet's or rhetor's and the natural philosopher's use of language to the goal to persuade and represent, respectively ("Words as Things," *Shakespeare Studies* 28 (2000): 231-235, at 233). While natural philosophers certainly motioned for the elimination of language's persuasive ornaments, they did not and could not reject the idea of persuasive language altogether. Steven Shapin and Simon Schaffer's influential *Leviathan and the Airpump* aptly demonstrates how much of the Royal Society's experimental proceedings relied upon forms of persuasion to be considered to have produced knowledge (see in particular the second chapter, "Seeing and Believing: the Experimental Production of Pneumatic Facts"). Bacon, too, did not wholly reject persuasive language; as Katherine Park has argued in her article "Bacon's Enchanted Glass," and as I emphasize below, persuasive language was central to the wide dissemination that Bacon envisioned for his new natural philosophical program.

<sup>53</sup> de Grazia, "Words as Things," 231.

directing men's imagination from the poet's perfected image of the material world to the perfected image of the material world revealed through the use of instruments, experimental philosophy was claimed to better perfect the poet's science. In promoting a "naked" prose, the Royal Society could distance itself from the potential dangers that they and others ascribed to poetic language. "What can we lose," Sprat argues, "but only some few *definitions*, and idle *questions*, and empty *disputations*?" (H, 327). By whetting the imagination with the "works of nature," experimental philosophers would "cure our minds of *Romantic swelling*, by shewing all things familiarly to them, just as large as they are" (H, 341). Rejecting elevated language in favor of a supposedly "naked" prose, then, permits Royal Society fellows to proclaim the primacy of experimental philosophy as a science all the more potent than poetry because it is all the more verisimilar to God's material creations. Cowley closes his "Ode" by praising Sprat's "candid" and "clean" (*Ode*, IX. 11) writing style, clinching his argument for the primacy of experimental philosophy by his very rejection of poetic language. Sprat's "Fancy" illuminated his style just as the "sun" glistens on a flowing stream. This brilliant relation between the imagination and nature is made possible through language that matches the precision of machines, for as Cowley concludes, the experimental philosophy's style of writing "has all the beauties Nature can impart, / And all the comely dress without the paint of art" (*Ode*, IX. 18-19). Once the Royal Society claims that experimental philosophy perfected poetry's aims, they could disavow poetry by labelling it a frivolous pursuit and poetic

language as idle ornament without challenging the important role of the imagination in experimental philosophy.

Distracted by “empty” disputes (Bacon *W*, 8:78; Sprat *H*, 327), natural and experimental philosophers claim, nature was shrouded by the idle language of those who would wish to bring nature’s secrets to light. By using language that mirrored the mechanical equipment used to discover knowledge of the material world, however, the experimental philosopher was believed to enter the “Garden” of nature and sate himself on the bounty of its “Fruits” rather than resigning himself to “Idle talking, and wandring, under its fruitless shadows” (*H*, 327). And, Sprat proclaims, experimental philosophy will help mankind reach the “highest pitch of *humane reason*”: an understanding of nature that can be harnessed into the conveniences of man’s art (*H*, 110). This, he argues:

is truly to command the world; to rank all the *varieties*, and *degrees* of things, ... that standing on the top of them, we may perfectly behold all that are below, and make them all serviceable to the quiet, and peace, and plenty of Man's life. (*H*, 110)

Restored is man’s divine dominion over nature, bringing the political sphere to order in turn. Indeed, a restored commonwealth is the metaphor that Oldenburg uses to unify the multiple results claimed to be effected by experimental philosophy and its dissemination. Like Gosson’s healthy laboring body politic, Oldenburg claims that once experimental philosophy’s “productions” are “clearly and truly communicated,” men will be “encouraged” to “find out new things, impart their knowledge, and contribute”

to the “grand design” of the improvement of knowledge and mankind’s estate.<sup>54</sup> And all these labors will serve the “glory” of God, the “universal good of mankind” and, in a phrase that lays bare the passage’s driving metaphor, “the honor and advantage of these kingdoms.”<sup>55</sup> What Sprat, Oldenburg, and others craft is a vision of a utopia where man’s dominion over nature ensures peace and plenty for mankind. Living in a fallen world, the experimental philosopher adopts the role of the poet, perfecting an image of nature that would otherwise remain hidden. When read in light of the experimental philosophy’s utopian promise, the Royal Society members’ florid language is a style best suited to their aims.

While Royal Society members attempted to fetter the imagination that made poetic language deleterious to the political order and to the growth of knowledge, their writing style was touted to accentuate the powers of the fancy. Cowley opens his ode with praise of Bacon as the Royal Society’s founder and of the coming of a utopian future that, if experimental philosophy is allowed to flourish, would surely follow. Cowley closes the poem with praise of Sprat’s call for a “naked” prose (Sprat *H*, 113). He lauds Sprat for his “candid Stile [that] like a clean Stream does slide/ And his bright Fancy all the way/ Does like the Sun-shine in it play” (*Ode*, IX. 11-13). Sprat’s “Fancy” is not hindered by a “candid” or “clean” writing style, but rather this type of language

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<sup>54</sup> Henry Oldenburg, “Introduction to The Philosophical Transactions,” *The Philosophical Transactions* 1 (January 1665): 1-2 at 2.

<sup>55</sup> Oldenburg, “Introduction,” 2.

only brightens the light afforded by his imagination. The imagination, once the tool of the poet, is wielded by the natural and experimental philosopher to greater effect—at least according to Royal Society fellows. Just as Bacon appropriates the poetic imagination in the opening decades of the seventeenth century, Royal Society fellows' adoption of the imagination crafts experimental philosophy as a form of poetry, but one that importantly surpasses the poet's invention of knowledge. As Cowley puts it, Sprat has "from all modern Follies .../ Has vindicated Eloquence and Wit" (*Ode*, IX, 9-10). The experimental philosophers' use of poetry and rhetoric's tropes and figures, then, are better regarded as an example of Sprat's "naked" prose because this elevated language best illuminates the perfected world they discovered with machines and the utopian ends to which they aimed.

Having appropriated the poetic imagination, the elevated tropes and figures that saturate the experimental philosophical writings of the Royal Society fellows are not inconsistent with their denunciation of the abuse of poetic and rhetorical language. Instead, elevated language is an apt means by which to communicate the experimental philosopher's labors and the utopian promise of his work. By grounding the poetic imagination in the material world rather than the mind, experimental philosophy was thought to reveal a perfected image of the material world. In this way, poetic language was the most apt to illuminate the riches of knowledge and art that would make manifest the utopian promise of natural and experimental philosophy. Far from a source

of inconsistency or hypocrisy, the Royal Society's use of elevated language was appropriate in experimental philosophy because it was the language that best exemplified the utopian promise of their science. The idea of restoration saturates many of the works of Sprat, Oldenburg, and Hooke so thoroughly that it becomes a reigning trope of experimental philosophy. Following Bacon's goal to restore an Adamic sovereignty over the material world, the Royal Society fellows craft their experimental philosophy as the means to illuminate a peaceful kingdom of man unified by knowledge and art. Elevated language was an important component of experimental philosophy if this new science was to advance knowledge and restore mankind's dominion over nature as the Royal Society fellows had advertised in many of their works. The Royal Society's use of tropes and figures is not a point of contradiction but an appropriate use of poetic language.

As experimental philosophers vied for the primacy of their science by seizing that which allowed the poet ground to stake the same claim, the once complementary work they performed in the political sphere began to diverge. Poetry, of course, never ceased to be political—indeed many poets sharpened their wit through political criticism—but its political work was no longer thought complementary to that of natural and experimental philosophy. John Dryden and William Davenant's adaptation of Shakespeare's *The Tempest* offers an instructive example of this shift, elucidating the political functions attributed to poetry and natural philosophy that were discussed in

Chapter 1. Although Dryden and Davenant's play, *The Tempest; or The Enchanted Island* (henceforth *The Enchanted Island*) evaluates various models of sovereignty, the magical art by which Prospero restores political hierarchy has changed. Where Prospero's art shared the domains of the poet and natural philosopher at the outset of the century, his magic is relegated to the former after mid-century.

First performed in the year Sprat's *History* was published, Dryden and Davenant's adaptation of Shakespeare's *Tempest* does not share the same cultural assumptions that grounded the original play. Instead, Dryden and Davenant's island adheres to a new set of values that experimental philosophers worked to legitimate—values that Dryden would have been exposed to during his four year fellowship in the Royal Society from 1662 until he was expelled for non-payment of dues in 1666.<sup>56</sup> In keeping with the issues of sovereign power exemplified in Shakespeare's *The Tempest* (c.1610), Dryden and William Davenant's 1667<sup>57</sup> *Enchanted Island* addresses numerous claims for legitimate rule. In both plays, the chaos caused by the usurpation of legitimate rule is brought to order through Prospero's art.<sup>58</sup> But where Shakespeare's

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<sup>56</sup> John Shanahan, "The Dryden-Davenant *Tempest*, Wonder Production, and the State of Natural Philosophy in 1667," *The Eighteenth Century* 54.1, [Spring 2013]: 95.

<sup>57</sup> George Robert Guffey notes that the play was first entered into the Stationers Register in January of 1670 and an "operatic" version came out in 1674 (*After The Tempest: "The Tempest, or The Enchanted Island" (1670); "The Tempest, or the Enchanted Island" (1674); "The Mock-Tempest: or The Enchanted Castle" (1675); "The Tempest. An Opera" (1756)*, introduction by George Robert Guffey (Los Angeles: University of California, Los Angeles, 1969),xx, ix.

<sup>58</sup> Jack M. Armistead argues that the restoration of political order cannot be attributed to Prospero's magical art in Dryden and Davenant's play: "That Prospero can bury "All past crimes ... in the joy of this / Blessed day" (5.2.151-52) is owing not to his magical "art" but to the Providential operation of human passion in

Prospero works his art over the imagination, a domain he shares with the poets, and nature, a domain he shares with the natural philosopher, Dryden and Davenant's Prospero works his art only over the former. The Restoration Prospero exerts dominion over his enemies' imaginations, situating his art squarely with the poet. The work of this Prospero's art is to enchant, and *The Enchanted Island* did indeed enchant its seventeenth-century audience.<sup>59</sup> The complementarity between poetry and natural philosophy in Shakespeare's drama, then, no longer operates in Dryden and Davenant's play. Poetic art is considered less a science and more a means to enchant. In laying bare the tropes that made intelligible the claims to legitimate rule in Shakespeare's *Tempest*, *The Enchanted Island* demonstrates that the tropes and model of sovereign power they exemplify have become ossified.

Dryden and Davenant's popular *Enchanted Island*<sup>60</sup> opens with a prologue, written by Dryden, that declares that Shakespeare's "Monarch-like" command of the stage enchanted his audiences with a "Magick [that] could not copy'd be."<sup>61</sup> Dryden's

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conjunction with an empirical interpretation of natural phenomena" ("Dryden's Prospero and His Predecessors," *South Atlantic Review* 50. 1 [1985]:30).

<sup>59</sup> [Shanahan](#) notes that the "revised *Tempest* was an immediate hit, and apparently because it did in fact have (stage) magic" ("The Dryden-Davenant *Tempest*," 91).

<sup>60</sup> Shanahan relates that the "adapted *Tempest* was the most performed play of the Restoration, and constituted a tenth of all live performances on both stages in its first season" ("The Dryden-Davenant *Tempest*," 91).

<sup>61</sup> John Dryden and William Davenant, *The Tempest, Or the Enchanted Island*, in *After the Tempest* ed. Guffey. Prologue, line 7, 19. Because no page number or line number were given for the Prologue, I have here included the line number. Because no line numbers demarcate the play's scenes and acts, I have referenced

modesty topos makes explicit the political work performed by poetic art and situates Dryden and Davenant's own roles as dramatic poets in their own play. Shakespeare is said to have given "those his subjects law,/ And is that Nature which they paint and draw" (*El*, Prologue 7–8). Shakespeare's poetic "pow'r", Dryden adds, "is sacred as a King's" (*El*, Prologue 24). Here Shakespeare's sovereign "pow'r" is limited to a form of "Magick" (*El*, Prologue 19, 23), importantly paralleling Shakespeare's art and Prospero's art. Shakespeare's Prospero is indeed a magician figure, but not exclusively so. He uses his art to orchestrate the restoration of the legitimate sovereign and ducal line, exerting control over nature, the domain of the natural philosopher, and the imagination, the domain of the poet, to achieve this goal. After Ariel's important counsel, however, Prospero recognizes that his tight grasp over his enemies' imaginations debases his art. As a result, Prospero opts for the "rarer action" of mercy and "drown[s] [his] book" so as to prevent his "so potent art" from degrading entirely into a "rough magic."<sup>62</sup> Magic, then, is the debased remnant when Prospero's art deviates from its noble course to restore harmony to the body politic. In Shakespeare's original play, Prospero's art works both in nature and over the imagination to restore a legitimate model of

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the page number instead. Hereafter cited parenthetically as *El Prologue* with line number for the Prologue and *El* with page number for the play proper.

<sup>62</sup> William Shakespeare, *The Tempest*, ed. Peter Hulme and William H. Sherman (New York: Norton and Company, 2004), 5.1.27, 5.1.57, 5.1.50. Hereafter cited parenthetically as *T* with act, scene, and line number(s).

sovereignty, identifying the complementary political work natural philosophy and poetry both performed. But where the art of Shakespeare's original Prospero arguably exerts control over the imagination and nature, the art of Dryden and Davenant's Prospero arguably exerts control over the imagination alone.

If Shakespeare's *Tempest* dramatizes the complementary political work of the poet and the natural philosopher by extending Prospero's magic art over the imagination and nature, then Dryden and Davenant's *Enchanted Island* attests to the growing disparity between the poet and natural philosopher by relegating Prospero's art to the imagination only. In Shakespeare's play, Prospero's art throws the natural order into disorder so as to reveal the legitimate political order in which he is sovereign. In Dryden and Davenant's adaptation, however, there is no need for Prospero's art to reveal the legitimate political order because his enemies identify their shipwreck as a magical retribution for their treachery the moment they find themselves ashore. When Alonzo, the Duke of Savoy,<sup>63</sup> laments over his son Ferdinand's assumed death, Antonio asks how the tempest could have been avoided, identifying the wreck as some terrible misfortune. Alonzo, however, disagrees and blames the storm and his son's supposed death on his treachery: "we should have helpt it, when thou betrayedst thy Brother *Prospero*, and *Mantua's* Infant, Sovereign to my power: And when I, too ambitious, took by force anothers right; then lost we *Ferdinand*, then forfeited our Navy to this

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<sup>63</sup> In Shakespeare's play, he is the King of Naples.

Tempest" (*EL*, 14).<sup>64</sup> Antonio concedes, squaring his lot on "this desert Isle" as a form of retribution for having "broke [the] truce with Heav'n" when he "usurp[ed] my Borthers' fertile lands" (*EL*, 14). Prospero's art, then, need not solicit his enemies' repentance in the Restoration drama, limiting the ends to which Prospero's art can be effected.<sup>65</sup> The important scenes where Prospero restages some of the events of his usurpation in Shakespeare's play can be safely excluded from the adaptation.<sup>66</sup> Shakespeare's Gonzalo need not fall into a slumber to have Alonso's brother attempt to usurp him in the way Prospero's brother usurped Milan. The significance of Shakespeare's restaging of Prospero's betrayal with Alonso is lost because Dryden and Davenant's Prospero need not reveal the legitimate order because his art works exclusively to enchant.

Restoration Prospero no longer shares the domains of the poet and the natural philosopher because his art no longer needs to reveal the legitimacy of his rule as it is already acknowledged by his enemies Prospero's enemies know immediately that their treachery is not met by the misfortune of tempestuous weather, but rather by magic. Gonzalo pleads "sure we are shipwrackt on the Dominions of some merry Devil" (*EL*, 15) to which Antonio agrees, exclaiming that the "Isle's enchanted ground" (*EL*, 15).

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<sup>64</sup> As there are no line numbers given in the facsimile, I provide the original page numbers as they appear in the 1670 version of the play in the Stationers register.

<sup>65</sup> Armistead goes even further to suggest that the power of Prospero's magical art is moot, for "[w]ithout lifting his wand, Dryden's Prospero has witnessed the righting of all the wrongs, old and new, with which he has been confronted" (30).

<sup>66</sup> Guffey notes that "only about 31 per cent of Shakespeare's play was actually used (by direct quotation or very close paraphrase) in the Davenant-Dryden version" (*After The Tempest*, viii).

Unlike Shakespeare's *Tempest*, there is no confusion over whether Prospero's art affects the imagination, or nature, or both, because the Restoration Prospero's art is exclusively poetic—its enchantment commands the imagination alone. The complementarity between poetry and natural philosophy exemplified in Shakespeare's drama has been severed, situating poetic art as one that enchants, not as one that reveals the order that the political hierarchy is meant to emulate. The poet's labor to discover the lineaments of an ideal order are moot in Dryden and Davenant's play. By the time they wrote *The Enchanted Island*, and perhaps given Dryden's exposure to the Royal Society, poetic art was no longer celebrated as an art that discovers teleological knowledge.

Both the original *Tempest* and its adaption address the grounds for the claim to legitimate sovereignty. But because Prospero's art is no longer an art that reveals knowledge of the ideal or perfected order, *The Enchanted Island* can address models of sovereignty without the tropes and figures of poetic language that rendered these models intelligible to Shakespeare's audience in the early seventeenth century. Instead, *The Enchanted Island* lays bare the implicit assumptions for legitimate political sovereignty through the squabbles of the sailors and Prospero's machinations for his daughters' marriages. Indeed, Katharine Eisaman Maus argues that the "play redefines the limits and uses of sovereignty."<sup>67</sup> Dryden and Davenant's play has been read as a

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<sup>67</sup> Katharine Eisaman Maus, "Arcadia Lost: Politics and Revision in the Restoration *Tempest*," *Renaissance Drama* 13 (1982): 190. Other scholars, such as Gavin Foster, argue that "[i]n Dryden and Davenant's rewriting, the conflicts of Shakespeare's *Tempest*—legitimacy and usurpation, royal will against corrupt and

Hobbesian exploration of man in the state of nature (a sparsely populated island a most befitting setting),<sup>68</sup> Prospero as a father-king model of patriarchalism,<sup>69</sup> and Stephano's and Trinculo's vies for power as parodies of interregnum parliamentarians.<sup>70</sup> Candy B.K. Schille summarizes late twentieth-century criticism, explaining that "most critics have accounted for these revisions by placing the play in the context of the embattled status of several contemporary ideologies: faith in patriarchalism...; faith in the more fundamental idea of any wholly stable model of civil government; and, finally, along with faith in magic, faith in an active, sentient, and mystical Providence."<sup>71</sup> Clearly, Dryden and Davenant's *Enchanted Island* implicates itself in considerable political work.

Many of the conceptions of sovereignty related and ridiculed in the Restoration adaption signal changes in the early modern model of legitimate sovereignty that Shakespeare dramatized in his play. The sailors spout claims to legitimate authority based on popular support and claims to rule through the inheritance of marriage,

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chaotic forces—are not, however, resolved through invocation of the redemptive power of majesty" ("Ignoring "The Tempest": Pepys, Dryden, and the Politics of Spectating in 1667," *Huntington Library Quarterly* 63, no. 1/2, John Dryden: A Tercentenary Miscellany [2000]: 10). Foster's line of argument intimates that the reach of sovereign power in Dryden and Davenant's adaptation is especially circumscribed.

<sup>68</sup> Derek Hughes argues that "[i]n examining humanity in the state of nature, the Restoration *Tempest* (obviously) portrays not the regenerative nature of Shakespeare but the nature of Hobbes" (*English Drama 1660–1700* [Oxford: Oxford University Press, 1996], 52).

<sup>69</sup> Maus argues, however, that the figure of the father-king was becoming "anachronistic" by the time of the Restoration *Tempest* (202).

<sup>70</sup> David Francis Taylor, "The Disenchanted Island: A Political History of The Tempest, 1760-1830," *Shakespeare Quarterly* 63, no. 4 (2012): 487.

<sup>71</sup> Candy B. K. Schille, "'Man Hungry': Reconsidering Threats to Colonial and Patriarchal Order in Dryden and Davenant's *The Tempest*," *Texas Studies in Literature and Language* 48, no. 4 (2006): 274.

parodying each with the threat of cannibalism or incest. Prospero and Miranda make explicit the patriarchalism at work in the play, the latter wishing to limit sovereign power to save her beloved. In a Hobbesian state-of-nature scenario, Stephano, Mustacho, Ventoso, and Trincalo vie for power having thought themselves as the only inhabitants of an otherwise “empty” (Mustacho *EI*, 21) island and, therefore, as the founding members of a new society. Stephano attempts to assume rule given his “Master” rank on the ship, warning that “Whoever eats any of my subjects, [he’ll] break out his Teeth with [his] Scepter” (*EI*, 20). Stephano, however, cannot muster the Hobbesian “consent” (*EI*, 20) necessary to take his place as sovereign, for without a social contract, he has no legitimate claim to authority. Trincalo refuses Stephano’s rule and instead tries to establish himself as sovereign by marrying Caliban’s incestuous sister, Sycorax.<sup>72</sup> When faced with the ridicule of Stephano who denounces Sycorax for having “ma[d]e love in her own Tribe” (*EI*, 63), Trincalo declares that “’tis no matter” as he “marry’d her to be a great man” (*EI*, 63); for Trincalo, his move to elevate his rank by marrying into the hierarchy of the island’s original inhabitants will trump the rank sexual misdeeds of his bride. These schemes for power fail of course, and not just because their marooning on the island is but a piece in Prospero’s plot to regain his rank as legitimate sovereign. The all-powerful figure of Hobbes’s Leviathan is reduced to four drunken sailors who rehash

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<sup>72</sup> Dryden and Davenant double many of the characters in Shakespeare’s original play, inventing Dorinda as a sister for Miranda, Hippolito as a counterpart to Ferdinand, and Sycorax as a sister to Caliban.

competing political claims for sovereignty, and all for the laughter of the play's audience.

While this type of political parody can be expected of *The Tempest's* butler and jester, *The Enchanted Island* opens the patriarchalism of those fit for rule to scrutiny as well. Unlike the original play, the Restoration Prospero's plan is jeopardized when Hippolito, the right heir of Mantua and Dorinda's lusty husband-to-be, is murdered by Ferdinand in an altercation over Miranda's hand.<sup>73</sup> When Prospero fears his plan to wed Dorinda and Hippolito, and Miranda and Ferdinand have failed because of Ferdinand's bloodied blade, he sentences Ferdinand to death: "Blood calls for blood" (*EI*, 69). While Shakespeare's Prospero shows mercy to his enemies, Dryden and Davenant's Prospero must "execute Heav'n's Laws, [for] Here [he is] plac'd by Heav'n, here [he is] Prince" (*EI*, 69), for a sovereign's "Acts of grace To Criminals are Treason to Heavens prerogative" (*EI*, 73). When Miranda points out that Prospero should be "condemnd'd for shedding" (*EI*, 73) Ferdinand's blood, Prospero counters the claims of his hypocrisy by arguing that no man of rank will execute punishment for Ferdinand's crime, but that the deed will be tasked to "the Monster *Caliban*" (*EI*, 73). Prospero and Miranda's dispute over Ferdinand's fate makes explicit the founding assumptions that order the political hierarchy under patriarchalism. The literalness by which these political ideologies are

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<sup>73</sup> Hippolito is also played by a woman, a feature of the play so unique that Dryden remarks that "One of our Women to present a Boy./ And that's a transformation you will say/ Exceeding all the Magick in the Play" (*EI*, Prologue, 30-32).

addressed in *The Enchanted Island* suggests that these models were becoming ossified because they could be divorced from the tropes and figures that set these models to work. And more importantly, because they could be transformed into explicit language capable of being investigated, criticised, and rejected. While it would exceed the scope of this chapter to argue for what claim to sovereignty the *Enchanted Island* most convincingly makes, it is important to stress that the shared political work performed by poetry and natural philosophy that is dramatized in the original *Tempest* is not present in its Restoration adaptation. The work of the poet and the natural philosopher was no longer complementary.

The debate over language waged by experimental philosophers after mid-century was more a means to demarcate what arts could properly be claimed to produce knowledge of nature than it was a rejection of poetic and rhetorical language. Poetic language persisted in the writings of experimental philosophers (and in their arguments against elevated language, no less), and this type of language performed considerable work. Just as the poet's art perfected the image of nature through language, experimental philosophers' carefully chosen tropes and devices mirrored the perfected image of nature they claimed to reveal through the experiment and mechanical equipment, notably the microscope. And whether for the poet or the experimental philosopher, this perfected image of nature revealed the otherwise hidden hand of God in the material world. In this way, experimental philosophy seized the poetic

imagination as a means to obtain knowledge of nature, just as Bacon had done decades earlier. Indeed, if the Royal Society did not appropriate the poetic imagination into their experimental philosophy, Sprat would have no cause to protect the Royal Society's means of improving natural knowledge from the very criticisms he launched against poetic and rhetorical language. As the Royal Society claimed the poetic imagination for their own science, they could then bolster the primacy of experimental philosophy by disavowing poetry as an idle and frivolous play with language. In the process of claiming proprietorship over the means by which art could attain knowledge of nature, the notions of "nature" and "art" with which the debate over language was waged were also changing. "Nature" came more exclusively to mean the material world for both poets and experimental philosophers while the conceptualization of the "arts" capable of discovering knowledge of nature came to diverge. Where *poesis* and *techne* were nearly synonymous at the outset of the seventeenth century,<sup>74</sup> poetry continued to be considered a form of *poesis* while the experimental philosophers' art would come to be understood as a form of *techne*. Knowledge of nature became more exclusively the domain of the experimental philosopher after mid-century where this province had once been shared with the poet. Just as Prospero's art becomes circumscribed to a means of enchantment in its Restoration adaptation, poetry was thought less to reveal the divine signs that marked nature and more as a means to compel the imagination in the latter

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<sup>74</sup> Kalas, *Frame, Glass, Verse*, 1. See Chapter 1.

half of the seventeenth century. The once complementary arts of poetry and natural philosophy were importantly diverging by the Restoration. While poetry certainly provided an important foil for the development of experimental philosophy, this new science established itself not by claiming poetry as its binary opposite but by adopting the function that granted poetry the means to reveal knowledge in the first place.

## 4. To be “Lowly Wise” at the Height of Discovery

Throughout the first half of the seventeenth century, poets and natural philosophers alike acknowledged the importance of the imagination in their pursuit of knowledge of nature. In the first decades of the seventeenth century, they once agreed on the role of the imagination. During the Restoration, however, they divided on precisely this point. Royal Society fellows appropriated the imagination in an effort to disallow its use in poetry. Poets attempted to reclaim the imagination by criticizing its use in natural and experimental philosophy. Milton argued that the natural philosopher put the imagination to “less assured” work.<sup>1</sup> Or as Margaret Cavendish argues, the experimental philosopher’s microscope is akin to a disorderly imagination, transforming nature into a “misshapen” image.<sup>2</sup> The utopianism and *imitatio Adami* that were central features of the complementarity between poetry and natural philosophy in the opening decades of the seventeenth century persist in the poetic works of Cavendish and Milton. But they become the poet’s lines of attack on the emerging experimental philosophy and ultimately contribute to the growing division between these once compatible arts.

As poets and natural philosophers in the late sixteenth and early seventeenth century agreed, the imagination could transmute, in Sidney’s words, the “brazen” world

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<sup>1</sup> John Milton, *Paradise Lost*, ed. Scott Elledge, 2<sup>nd</sup> edition (New York: Norton, 1993), 5.262. Hereafter cited as *PL* with book and line number(s).

<sup>2</sup> Margaret Cavendish, *Observations upon Experimental Philosophy*, ed. Eileen O’Neill (Cambridge: Cambridge University Press, 2001), 50. Hereafter cited parenthetically as *Obs* with page number.

of nature into a “golden” one. And as Bacon intimated, it was a faculty that encouraged natural philosophers to search beyond the pale of accepted knowledge and to “fundamentally alter” nature for the benefit of the humankind. But the imagination could also produce “chimeras” and monstrous creatures that overwhelmed the mind and subordinated reason to baser passions. After the Restoration, these were the dangers that Royal Society fellows used to bolster their rejection of the poet’s ornate “swellings” of language and that poets drew upon to criticize the Royal Society’s methods, equipment, and aims. Natural philosophers concealed their use of the imagination by describing its role as the search for nature’s most secret wonders—a pursuit of marvels, such as a shooting star, that exceeded the scope of unaided human sense but could be justified as “possible” and “probable” knowledge. Once their use of the imagination was concealed, natural philosophers could then disavow its role in poetry; natural philosophers claimed to have put the imagination to more important work, rendering the poet obsolete in the search for knowledge of nature. Poets, however, were not convinced that the natural philosopher had successfully trumped the poet at his own game. Such poets as Samuel Butler, Cavendish, and Milton charged natural philosophy with the attempt to conceal its reliance on the poetic imagination. Across all manner of poetic forms, poets after the Restoration argued that natural philosophical inventions and methods debased the imagination’s powers and produced false images of nature. Poets, then, rejected the Royal Society’s authority by casting natural philosophers as

failed poets, undercutting the natural philosophical use of the imagination. Stripped of its claim on the poet's imagination, poets concluded that the Royal Society's philosophy mistook true knowledge for impossible fancies or, put differently, fiction for fact.

In Samuel Butler's satirical poem "The Elephant in the Moon," the Royal Society lets its collective imagination run wild, making a moon elephant out of an earthly field mouse.<sup>3</sup> In the poem, a "Learn'd Society" (1) looks to the heavens with a telescope, discovering an elephant on the moon's surface. The discovery of an elephant in the moon, Butler's Royal Society fellow proclaims, is "enough/ To take all former scandals off" (224-225) and to establish experimental philosophy as an authority on knowledge. But when the society members convene to produce a narrative of this discovery, their assistants discover that this elephant is nothing but a common field mouse stuck in the telescope. The Royal Society takes a lowly mouse to be a cosmic elephant. For Butler, the Royal Society's errors can be traced back to their unruly imaginations. Butler argues that the "foot-boys" (325) are able to discover the truth behind the wondrous elephant in the moon because they had not allowed their imaginations to overwhelm their reason: "[the assistant] was not so far overgrown/ In any speculation,/ to judge with mere imagination" (242-244). The imagination has "overgrown" any capacity for reasonable judgment, making the Royal Society fellows susceptible to mistake fable for lunar fact.

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<sup>3</sup> Samuel Butler, "The Elephant in the Moon," in *The Poetical Works of Samuel Butler*, Vol II. London: William Pickering, 1835. 123- 138. Hereafter cited parenthetically by line number(s) of the short version of this poem. <<https://archive.org/stream/poeticalbutler02butluoft#page/122/mode/2up/search/elephant>

Where Butler takes issue with the way that Royal Society members put magnifying glasses to use, Cavendish is critical of the glass itself. In her *Observations upon Experimental Philosophy*, Cavendish rejects the microscope in a thinly veiled critique of Hooke's *Micrographia* and its popularity among experimental philosophers. Cavendish takes it as given that magnifying glasses, especially the microscope, are "not able to discover the interior natural motions of any part or creature of nature" (*Obs*, 50), repeating a concern shared by other natural philosophers.<sup>4</sup> The thrust of her argument stems from her criticism that the magnifying glass fails to represent its object accurately: "nay, the question is, whether it can represent ... the exterior shapes and motions so exactly, as naturally they are" (*Obs*, 50). This latter criticism attests to the imagination's role in the Royal Society's equipment and expands Cavendish's argument to encompass the social threat caused by an idle fancy (*Obs*, 52): the microscope crafts the very chimeras that Royal Society members thought threatened the social order. Cavendish contends that the microscope presents its object in "a monstrous shape" (*Obs*, 50), reproducing the chimeras of an unruly imagination. Just as a poet can imagine a cat as a ferocious lion, a louse can come to look like a "lobster" by "the help of a magnifying glass" (*Obs*, 50). Hooke also revealed common objects to have surfaces that did not

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<sup>4</sup> Catherine Wilson summarizes the criticism of the microscope shared among Locke, Bernard de Fontenelle, and Hume, all whom argue that "[w]e see only surfaces, whatever we see is the effect of hidden machinery; therefore whatever we see is scenery and not truth" (*The Invisible World: Early Modern Philosophy and the Invention of the Microscope* [Princeton: Princeton University Press, 1997], 255).

correspond to their sense experience nor the common ends of their uses: a needle tip, sharp to the touch and capable of piercing thick material, was blunt when viewed under the magnifying lens. Cavendish argues that the microscope distorts the image of the needle point because a “blunt globe” could not “pierce” another physical body in the way a needle does so effortlessly in common experience. “If... the point of a needle were naturally and really so as the microscope presents them,” Cavendish concludes, “they would never been so useful as they are” (*Obs*, 51). The microscope crafts an image of the needle that requires the observer to imagine it in ways that do not correspond with the demonstrable knowledge of its sharp, pointed tip. The microscope, then, debases the fancy, producing misshapen images of objects that do not correspond to sense experience of their physical properties or common experience of their demonstrable uses. The microscope, Cavendish implies, is an idle use of the fancy.

Drawing upon the threat that an idle fancy posed to the body politic, Cavendish rejects the microscope because its images do not produce knowledge that can be channeled for the betterment of humankind. Rather, the microscope’s images “have intoxicated so many men’s brains” (*Obs*, 51) and compelled them to “lay aside” (*Obs*, 51) those arts or studies that support the commonwealth (*Obs*, 51-52). Should a painter “draw a louse as big as a crab,” Cavendish argues, surely he would be charged of producing an idle fancy because this image “neither instruct[s] [its viewer] how to avoid breeding them, or how to catch them, or how to hinder them from biting” (*Obs*, 52).

Because experimental philosophy equally sets the imagination to idle work, these “unprofitable arts” (*Obs*, 52) should likewise be considered a threat to the political order. Cavendish’s comparison between the microscopist and the painter faults the experimental philosopher for putting the imagination to use in ways that a painter would never dare.

Akin to Butler and Cavendish, Milton too faults natural philosophy for its use of the imagination. Milton takes Satan’s flight to Earth as an opportunity to criticize natural philosophy. Milton writes of Galileo, the only named contemporary in the epic, that “by night the glass/ Of Galileo, less assured, observes/ *Imagined* lands and regions in the moon” (*PL*, 5.261-263; emphasis added). Here, Milton is referring to the “mountains” and “valleys”<sup>5</sup> that Galileo argues mark the moon’s face with light and dark regions in *Sidereal Messenger*. Astronomers, natural philosophers, and poets alike had offered many explanations for the lunar spots,<sup>6</sup> but Milton’s explanation rejects the very means by which Galileo made his observations. As Galileo lifts his spyglass to the heavens in the epic, Satan soars across the moon’s face, marking the lunar surface with his shadow. The lunar peaks and valleys that Galileo espied through his telescope are but “Imagined [lunar] lands and regions” — a fabulous vision that mistakes Satan’s shadow for knowledge of the cosmos. Milton’s “Tuscan artist” (*PL*, 1.288) has put the imagination to

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<sup>5</sup> Galileo, *Sidereal Messenger*, 40.

<sup>6</sup> See Chapter 2. Many natural philosophers argued that the dark spots on the moon were vapors that clouded the lunar face.

“less assured” (*PL*, 5.262) use, producing false images of nature.<sup>7</sup> Where the poet’s imagination illuminates the divine hand that marks nature, Milton suggests that the natural philosopher imagines only Satan’s shadows.

Butler, Cavendish, and Milton all suggest that the natural philosopher’s abuse of the imagination reduces him to the profession he works so resolutely to disavow: the natural philosopher is but a bad poet. Traditionally, the poet’s imagination crafted language in such a way to discover the ideal order of the natural world and to celebrate God’s creations. The wonders of nature, such as a rainbow or other infrequent natural occurrences, were the province of the poet—a province that Aristotle had excluded from the purview of the natural philosopher because these marvels were not thought to be representative of nature at large. Poets often populated their poems with the wonders of nature. Marjorie Hope Nicolson even argues that Galileo’s discovery of cosmic wonders greatly affected seventeenth-century poetry, proclaiming that his *Sidereal Messenger* was the “most important single publication...so far as its effect upon the imagination is concerned.”<sup>8</sup> Many seventeenth century natural philosophers, Bacon, Galileo, and Sprat among them, rejected this aspect of Aristotle and worked to incorporate the study of wonders into natural philosophy. And this preoccupation with wonders did not go

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<sup>7</sup> When Galileo is said to have “Imagined lands and regions in the moon” (5.263), Harinder Singh Marjara contends that “Milton probably signifies not so much that Galileo imagined these [lunar] features, as that he ‘conjectured’ them” (*Contemplation of Created Things: Science in Paradise Lost* [Toronto: University of Toronto Press, 1992], 63). I argue, however, that Milton, like Cavendish and Butler, astutely acknowledges the imagination’s role in natural philosophy. Milton’s reference to “Imagined” lunar lands was a literal one.

<sup>8</sup> Marjorie Hope Nicolson, *Science and the Imagination* (Ithaca: Great Seal Books, 1956), 4.

unnoticed by poets. Rather than revealing a “golden” world as Sidney’s poet does through tropes and figures, Butler and Cavendish argue that the natural philosopher’s elevated language serves only to swell and disfigure the image of nature. Such an image of nature, Milton points out, fails to celebrate God’s handiwork. For Butler, Cavendish, and Milton, the natural philosopher is unfit for the poet’s work.

Butler and Cavendish both warn that the Royal Society pursues wonders at the expense of knowledge. Bacon, Galileo, and Sprat, among others, had worked to include wonders into natural philosophical study. Sprat even goes so far to hail the “almost infinite Curiosities” of nature as the grounds “on which the true Philosophy must be founded.”<sup>9</sup> As “infinite” as these “Curiosities” may be, natural philosophers who took them as objects of study recorded them carefully because they infrequently occurred or because they were observable only with equipment accessible to a privileged few. One of Butler’s members of the “Learn’d society” admits that they must “cautiously contrive/ To draw an exact narrative” (235-336) of the curiosities they espy because “it is uncertain when/ Such wonders will occur again” (233-234). The virtuosi then begin to record this “strange memoir o’ th’ telescope” (246), leaving the telescope open for a footboy to discover that this elephant is but a mouse trapped in the telescope’s tube. Once the virtuosi finally resolve to open the glass and find a mouse, the society is left with one

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<sup>9</sup> Thomas Sprat, *The History of the Royal-Society for the Improving of Natural Knowledge*, (London: Printed by T.R., 1667), 8. Hereafter cited parenthetically by page number(s).

“discovery alone:” “those who greedily pursue/ Things wonderful instead of true .../.../  
[reduce] nat’ral history into a Gazette/ of tales stupendous and far-fet” (509-514). The  
penchant for wonders, Butler demonstrates, trivializes the pursuit for knowledge that  
the Royal Society so adamantly aims to legitimize in works like Sprat’s *History*.  
Cavendish shares this criticism, arguing that the “numerous books written on the  
wonders of [magnifying] glasses” – Hooke’s *Micrographia* in particular – peddle nothing  
but “superficial wonders” (*Obs*, 51). By attacking the wonders by which natural  
philosophers proclaimed to surpass an Aristotelian understanding of nature, Butler and  
Cavendish suggest that the Royal Society peddles the idle fancies that the fellows  
proclaim to reject. The poet’s golden wonders, then, should be his province alone.

Although relatively few criticized the Royal Society for using elevated language  
in the seventeenth century, Butler links their pursuit of wonders with the “swellings of  
style” (113) that Sprat disavows in poetry. For Butler, the virtuosi’s “exact narrative”  
(236) is itself a “stupendous and far-fet” fable because natural philosophy takes nature’s  
“strange” (417) wonders as a primary object of study. The Royal Society, Butler  
intimates, crafts a “wonderful Narration” (364)<sup>10</sup> that swells with elevated language  
because their natural philosophy “swell’d” (356) an earth-bound mouse into a lunar

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<sup>10</sup> Butler opts to use “miraculous” (370) instead of “wonderful” narration in the long form version, suggesting that the Royal Society frames their natural philosophical accounts with the same religious fervor with which miracles and revelations are recounted.

elephant.<sup>11</sup> And this swollen rhetoric is met in measure with the swollen importance with which the Royal Society frames its discoveries. Upon discovering an elephant in the moon, a society fellow known for his “excellence/ In height’ning words.../ And [for] magnifying all he writ” (168-169) declares that this “great discovery” will “stretch our victories beyond/ Th’extent of planetary ground” (187-88). This “great discovery,” of course, proves to be but an embarrassing mistake, deflating the rhetoric and the importance that the Royal Society invests in their natural philosophy. The poet’s skillful use of tropes and figures are mishandled by the Royal Society whose “naked prose” is, at least for Butler, but a form of bombast.

Natural philosophers were not just considered bad poets because their pursuit of wonders and their swollen rhetoric were the products of an idle fancy. Milton attacks natural philosophers, Galileo in particular, because natural philosophical observations fail to perform the work by which poets discovered the divine signatures in nature. From the Latin verb *invenio*, “to come upon,” the poet’s *inventio* discovered or “invented” the marks that God impresses upon the natural world.<sup>12</sup> In bringing these divine signatures to light, the poet celebrated God and His creations. Galileo and his “Imagined lands,” Milton argues, not only fail to discover knowledge of God’s creations

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<sup>11</sup> Butler shares Cavendish’s argument that the Royal Society’s reliance on magnifying lens serves to “swell” an image of nature into a “deformed shape” (*Obs*, 52) rather than enlarge it in an accurate relation to the object’s natural proportions.

<sup>12</sup> Jonathan Sawday, *Engines of the Imagination: Renaissance Culture and the Rise of the Machine* (London and New York: Routledge, 2007), 174.

but more importantly mistake God's handiwork for Satan's shadow. Milton's first allusion to Galileo latches Galilean discoveries squarely to Satan's shoulder blades. As Satan turns from Beezlebub and moves across the "lake of fire" the reader espies his "ponderous shield .... / Hung on his shoulders like the Moon, whose Orb/ Through Optic Glass the Tuscan Artist views/ to descry new Lands, Rivers or Mountains in her Spotty Globe" (*PL*, 1.284-290). Satan's shield, the reader knows, has endured the blows of the angelic battle that cast him and his rebels out of Heaven, marking the shield with his fall from grace. These dents and depressions are akin to the moon's "mountains" and "valleys" that Milton will reference once more when he returns to Galileo's lunar observations in Book V.

With each allusion to Galileo, Milton extends the reach of his criticism of natural philosophy. In 1609, Galileo reported his telescopic observation that the sun was pocked with "spots." These sun spots challenged the reigning Aristotelian notion that the sun, like all supralunary bodies, were immaculate. Milton, however, proposes another explanation for these sun spots in Book III: "There lands the Fiend, a spot like which perhaps/Astronomer in the Sun's lucent Orbe/ Through his glaz'd Optic Tube yet never saw" (*PL*, 3.588-90). Galileo's discovery of sun spots threatened the Aristotelian understanding of the cosmos that was used to corroborate Scripture. In failing to recognize Satan as the cause of a sun spot, Milton suggests that Galileo misses entirely the theological implications of these telescopic discoveries. Galileo looks to discover

knowledge of the heavens but finds only Satan. For Milton, Galileo cannot perform the poet's work because these "imagined lands" take Satan's shadows as knowledge of God's creations. Rather than celebrate God's divine signatures, Milton suggests that Galileo's observations are complicit in Satan's plot to bring about the fall of man.

Butler, Cavendish, and Milton all cast the new natural philosophers as failed poets, challenging their claim on the imagination with the same arguments that these natural philosophers used to disavow poetry. Where the shared use of the imagination once united poetry and natural philosophy as complementary arts in the opening decades of the seventeenth century, it became a point of contradiction that was resolved only by separating these arts into distinct (and hierarchically arranged) disciplines. Cavendish, for instance, defines the work of the fancy and of reason in poetry and natural philosophy, separating each into distinct arts that are complementary. But where Sidney exalted the poet above the natural philosopher, Cavendish subordinates poetry to the more "serious" studies of natural philosophy.<sup>13</sup> Like Butler and Milton, Cavendish reveals the role of the imagination in natural philosophy that the new philosophers attempted to conceal.

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<sup>13</sup> Cavendish, Margaret. *The Blazing World and Other Writings*. Edited by Kate Lilley. England: Penguin Books, 2004), 124. Hereafter cited as *BW* with page number(s).

Cavendish argued that natural philosophy could not achieve knowledge of nature without the imagination.<sup>14</sup> She contended that nature consisted of an “infinite” amount of “eternal” matter in motion.<sup>15</sup> The mind and all its faculties are also composed of matter in motion. As matter in motion, a mind’s workings could be described as a “dance,” which is “measur’d Motion” (*PF*, 31), that produces a type of mental “Figure” (*PF*, 31) when an object is presented to the senses. The mind’s mental faculties all have different relationships to or types of dances that distinguish them as “*Thoughts*, as *Memory*, *Understanding*, *Imagination*, or *Fancy*, and *Remembrance*, and *Will*” (*PF*, 30). Cavendish defines the Memory as the process when an object is presented to the senses and mental matter “straight dance themselves into that Figure” (*PF*, 31): the figure presented to the memory is identical to the object presented to the senses. By contrast, Cavendish defines the imagination as the faculty in which the matters of the mind “dance figures of their own invention” (*PF*, 31). The fancy is distinguished from reason, but both are produced by “rational matter” (*BW*, 124).<sup>16</sup> Cavendish explains that “by

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<sup>14</sup>Scholars have acknowledged the imagination’s role in natural philosophy. Ryan J Stark points out that Cavendish’s florid writing style is a means for her to criticize the gendered implications of the Royal Society’s rejection of poetic language (“Margaret Cavendish and Composition Style,” *Rhetoric Review*, Vol. 17, No. 2 (Spring, 1999): 264-281). G. Gabrielle Starr has further shown that the imagination is central to Cavendish’s Epicureanism and her natural philosophy more broadly (“Cavendish, Aesthetics, and the Anti-Platonic Line,” *Eighteenth-Century Studies*, Vol. 39, No. 3, New Feminist Work in Epistemology and Aesthetics [Spring, 2006]: 295-308). DC because pxxvi Observations

<sup>15</sup> Margaret Cavendish, *Philosophicall fancies. Written by the Right Honourable, the Lady Newcastle*, Printed by Tho: Roycroft, for J. Martin, and J. Allestrye, at the Bell in St. Pauls Church-yard ([London], 1653), 1. Hereafter cited parenthetically as *PF* with page number.

<sup>16</sup> Margaret Cavendish, *The Blazing World and Other Writing*, ed. by Kate Lilley (England: Penguin Books, 2004), 124. Hereafter cited parenthetically as *BW* with page number(s).

reason I understand a rational search and enquiry into the causes of natural effects; and by fancy a voluntary creation or production of the mind, both being effects or rather actions of the rational parts of matter" (BW, 123-124). The imagination and reason were not opposed for Cavendish. In her *Blazing World*, Cavendish aligns natural philosophy with reason, which searches for "the true causes of natural effects" (124). Poetry is aligned with the imagination, the "voluntary creation[s] or productions of the mind" (BW, 123), which crafts "fiction" (BW, 123). Because reason and fancy "are actions of the rational parts of matter" (BW, 124), each complement each other: the delightful work of the fancy "recreate[s]" and reenergizes the mind for the "serious contemplations" of natural philosophy (BW, 124). Natural philosophy and poetry work together for Cavendish. Indeed, she uses poetic language to express the unique tenets of her natural philosophy in her *Philosophical Fancies* (1653). She also appends a fantastical utopian travel narrative to her serious *Observations upon Experimental Philosophy* because they are "two worlds at the ends of their poles" (BW, 124). Composed of "the rational parts of matter," both reason and fancy are inextricably connected, even if they operate within separate "worlds," so to speak.

Where the Royal Society reframed the imagination for natural philosophy and disavowed the imagination's use in poetry, Cavendish argues that the imagination's role

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in both natural philosophy and poetry works to discover knowledge of nature. While Cavendish criticizes the Royal Society for their use of the imagination, she does not exclude the imagination from the natural philosophical pursuit for knowledge of nature. Instead, the fancy discovered knowledge of the inner workings of nature. The tiny matters that compose all things are for Cavendish imperceptible by the senses. The imagination, however, allows the mind to invent an image of this matter, giving it a form or shape from which one can discover knowledge. G. Gabrielle Starr puts it this way:

we cannot see such tiny bits of matter, but imaginative vision (Epicurean phantasia, our "Fancies") brings them to light, enabling us to perceive the dance of fitness and agreement.... For Cavendish, fancy is an epistemic tool, because the frontiers of knowledge are subject to imaginative vision alone (298).<sup>17</sup>

Cavendish rejects the microscopist and experimental philosopher because their focus on external appearances cannot provide knowledge of the invisible matters of which natural bodies are composed; the imagination, not the senses, is necessary to obtain this type of knowledge. As Ryan J. Stark contends, "For Cavendish ... even the scientist (and scientific style) "fashioned nature" to a certain extent in that the scientist's imagination and fancy could not be dissociated from scientific observation."<sup>18</sup> But the Royal Society and their magnifying lenses apply the imagination to an object's appearance alone, failing to discover knowledge of its inner workings. Where the Royal Society had

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<sup>17</sup> Starr, "Cavendish, Aesthetics, and the Anti-Platonic Line," 298.

<sup>18</sup> Stark, "Margaret Cavendish and Composition Style," 277.

relegated the poet to the work of entertainment, the function of the imagination for Cavendish is the same in poetry as it is in natural philosophy. Akin to the poet who uses the imagination to reveal that which is hidden in nature, Cavendish's natural philosopher is to use the fancy to reveal that which is imperceptible to the senses. The Royal Society's work to reframe the imagination for natural philosophy, then, fails precisely because it has divested itself from its function in poetry.

Cavendish reclaims the epistemological function of the poet by criticizing how the Royal Society appropriated the imagination into its natural philosophical practices. Fellows, namely Sprat, Wilkins, and Hooke, recast the imagination in the language of the ingenious and distanced the fancy from its association with the poet by rejecting the ornate "swellings" of language.<sup>19</sup> Like Bacon, the Royal Society claimed that their new experimental philosophy would benefit all mankind, framing their pursuits as utopian endeavors. Many scholars have read *The Blazing World* as a utopian fiction, but Cavendish's use of utopian tropes works more to satirize the utopianism of the Royal Society than to establish an euutopia in its own right. *The Blazing World's* utopianism addresses the limits of female authority, especially within natural philosophy, to underscore the exclusions implicit in the new experimental philosophy: Cavendish

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<sup>19</sup> As I show in Chapter 3, the Royal Society did not consider their use of poetic tropes and figures as the "swellings" of language. Rather, the elevated language used to describe their new discoveries was thought to accurately describe the wonders they revealed in nature.

“make[s] a world of [her] own” because it is the only place where her authority on natural philosophy would merit the title “Margaret the *First*” (BW,124).

Bacon wrote an unfinished utopian narrative, *The New Atlantis*, that was bound to his work on natural history, *Sylva Sylvarum*. *The New Atlantis* exemplified the reformed natural philosophy he had developed in his *Magna Instauratio*. In it, Bacon described the discovery of an ancient island called Bensalem, a Christian paradise that recovered the lost Ark of the Covenant.<sup>20</sup> Bensalem is a technologically advanced and peaceful society led by a hermetic group of natural philosophers. Here, the various natural and experimental philosophical methods and aims delineated in Bacon’s *Magna Instauratio* are taken up as discrete professions or “employment[s]” (NA, 153). Salomon’s House, the seat of Bacon’s scientific oligarchy, consists of a number of discrete natural philosophical duties, including the “depredators” who “collect the experiments which are in all books,” the “pioneers” who “try new experiments,” and the “merchants of light” who sail the world to appropriate the knowledge and new technologies of other lands (NA, 153), among others. Akin to the metaphor of the body politic, Bensalem’s natural philosophy is a communal project where each specialized employment works to manifest an eutopian society. Royal Society members largely hailed Bacon as their forefather, adopting many of the utopian tenets to which his natural philosophical

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<sup>20</sup> Francis Bacon, “The New Atlantis,” in *Four Island Utopias*, Ed Albert Keith Whitaker (Newburyport: Focus Publishing, 1999), 129-130. Hereafter cited as NA with page number(s).

reforms aimed.<sup>21</sup> Sprat argued that experimental philosophy would restore an Adamic dominion over nature and its creatures, “mak[ing] them all serviceable to the quiet, and peace, and plenty of Man's life” (*H*, 110). Cavendish's *Blazing World*, I argue, turns Bacon's and the Royal Society's utopianism on its head to assert female authority in matters of knowledge.

Cavendish's *Blazing World* shares many of the same utopian tropes as Bacon's *New Atlantis*, but she uses them to satirize the relationship between experimental philosophers and poets. Like *The New Atlantis*, Cavendish binds her fantastical narrative with a work of natural philosophy.<sup>22</sup> Cavendish's main character finds herself in a (supposedly) utopian island, called the Blazing World, whose strange, animal-like inhabitants are “ingenious and witty in the invention of profitable and useful arts” (134). In the imperial city, “named Paradise” (*BW*, 131) no less, the new Empress establishes “schools” and “societies” to further their technological and natural philosophical advances:<sup>23</sup> “The bear-men were to be her experimental philosophers, the bird-men her astronomers, [the] worm- and fish- men her natural philosophers” (*BW*, 134), among others. But where Saloman's House discovers nature's most hidden secrets for the

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<sup>21</sup> Andrew Black specifies that Bacon's *The New Atlantis* “came to be read as the spiritual foundation for the Royal Society” (“The Orator in the Laboratory: Rhetoric and Experimentation in Thomas Shadwell's *The Virtuoso*,” *Restoration: Studies in English Literary Culture, 1660-1700* 37.1 [Spring 2013], 3-17 at 4).

<sup>22</sup> Marina Leslie, “Gender, Genre and the Utopian Body in Margaret Cavendish's *Blazing World*,” *Utopian Studies*, Vol. 7, No. 1 (1996): 6-24 at 9.

<sup>23</sup> Marina Leslie points out another “echo” between the blazon that describes the dress and accoutrements worn by the Empress in *The Blazing World* and the description of the technological and natural philosophical accomplishments in Bacon's *New Atlantis* (“Gender, Genre and the Utopian Body”), 16-17.

betterment of humankind, Cavendish's society busies themselves in endless disputes. Cavendish's "ingenious" virtuosos fail to reach a consensus on the causes of the "wind" (*BW*, 138-9), on the causes of "thunder and lightening" (140), and on the accuracy of their telescopes and microscopes (*BW*, 142-5). The bear-men's advocacy of magnifying lenses occasions the Empress's lengthy critique, one that repeats the same arguments Cavendish offers in her *Observations* (50-53). The magnifying glasses are "false informers" (*BW*, 141) or "deluding arts" (*Obs*, 53) that "will never lead ... to the knowledge of truth" (*BW*, 142) and must be rejected in favor of the "natural eye" (*Obs*, 53), which the Empress commands her bird-men to "trust" (*BW*, 141) as their guides in the pursuit of knowledge. At the threat of a royal decree to destroy the telescopes, the bear-men plead to save their spyglasses, satirizing the Royal Society's use of their experimental instruments. The bear-men beg:

We take more delight in artificial delusions, than in natural truths. Besides, we shall want employment for our senses, and subjects for our arguments; for were there nothing but truth, and no falsehood ... we should want the aim and pleasure of our endeavours in confuting and contradicting each other" (142)<sup>24</sup>

The bear-men's candid response undercuts the utopian claims that the Royal Society used to bolster support for their experimental philosophy. Hooke and other Fellows

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<sup>24</sup>Oddvar Holmesland emphasizes the connection between the social order and Cavendish's argument that natural philosophers must trust their reason and the naked eye. He argues that for Cavendish, "Individuals who shed their 'artificial glasses' that produce but 'artificial delusions' will be freed to respond to their natural self-motions, and this, in turn, induces more natural communal relations among individuals" ("Margaret Cavendish's 'The Blazing World': Natural Art and the Body Politic," *Studies in Philology* 96. 4 [Autumn, 1999]: 465).

claimed that their instruments repaired man's eyesight to the perspicacity of Adam, restoring the Adamic utopia prior to the fall. In the *Blazing World*, however, these instruments only delude the senses and foster social discord, rejecting the Royal Society's utopian claims.

Cavendish's utopianism does not serve as a model for an advanced, peaceful society in the way that Bacon narrativizes a scientific oligarchy that later became the model for Royal Society aims. Rather, *The Blazing World* displays the Royal Society's utopian goals as failed poetic fancies. Cavendish suggests that the Royal Society fails to make manifest an Adamic utopianism because their mechanisms fail to perform the work of the poet. The bear-men's various magnifying glasses prove to be idle pursuits for the same reasons that Cavendish enumerates in her *Observations*. But *The Blazing World's* critique of the microscope is perhaps the most powerful. Cavendish's utopian narrative lifts passages from Hooke's description of the drone fly in his *Micrographia*. When voiced by the bear-men, Hooke's popular *Micrographia* is as idle a pastime as Royal Society members held poetry to be. When espied under the microscope, both Hooke and Cavendish describe the fly's "14000" "Pearls or Hemispheres" in its eyes (*BW*, 142-143; Hooke, 176). Hooke and the bear-men argue that the fly's eye is composed of thousand small hemispheres, each one "a perfect eye" (*BW*, 143; Hooke, 178). Hooke explains that each of these eyes may be able to see what is in its direct line of sight, "so there may be multitudes of Pictures made of an Object in the several Pearls" (179).

Hooke stipulates that “though there be a distinct Image made in every eye, yet 'tis very likely, that the observing faculty is only employ'd about some one object for which they have most concern” (179). Were this an accurate description of the eye, the fly would see thousands of perspectives of a given object, but only the most appropriate image would be distinct. Just as Hooke’s copper plate engravings of microscopic specimens are a form of rhetorical *enargeia*,<sup>25</sup> the fly’s eye embodies the rhetorician or poet’s *copia*. A poet is trained to fashion a given idea in a variety of different ways such that he can select the one most appropriate to his aims (and indeed, Erasmus offers hundreds of ways to craft the phrase “your letter pleased me greatly”).<sup>26</sup> The fly’s eye performs an analogous function: only the hemisphere that can see the object most appropriate to the fly’s concern is selected by the observing faculty from among a multitude of different perspectives. When describing the fly’s eye, then, the experimental philosopher reveals a world that was traditionally discovered through the poet’s tropes and figures.

This form of *copia*, however, only produces idle fancies. The Empress quickly rejects the bear-men’s and, by extension, Hooke’s conclusion that each hemisphere is an individual eye. “They might be glass pearls, and yet not eyes,” the Empress replies to the bear-men, “and that perhaps their microscopes did not truly inform them” (*BW*, 143). Nevertheless, the bear-men continue to show the Empress countless other

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<sup>25</sup> John T Harwood, “Rhetoric and Graphics in *Micrographia*,” in *Robert Hooke: New Studies*, eds. Michael Hunter and Simon Schaffer (Woodbridge, UK: Boydell Press, 1989), 135.

<sup>26</sup> See Margaret de Grazia, “Words as Things,” *Shakespeare Studies* 28 (2000): 231-235.

microscopic observations. So many, in fact, that the Empress informs the reader that she will omit such copious descriptions because “all of their parts would be too tedious to relate” (*BW*, 144)—a courtesy that she holds yet a second time, for these innumerable descriptions would “tire even the most patient reader” (*BW*, 145). Experimental philosophers, Cavendish suggests, would do better to omit their multitude of microscopic descriptions altogether than to render the vision of natural world an idle fancy.

Cavendish also uses the figure of *copia* to critique the gendered implications of the Royal Society’s experimental philosophy. When used well by the poet or rhetorician, *copia* persuaded or produced assent to a given idea or argument. In *The Blazing World* Cavendish refuses, to borrow a term from Shapin and Schaffer, to act as a “virtual witness,” denying the reader an account of the bear-men’s microscopic findings—she prevents the microscopic images from counting as “matters of facts.”<sup>27</sup> Because the microscope (among other experimental equipment) was not widely available, virtual witnesses were an essential means by which Royal Society members legitimated their work in wider social circles. Virtual witnesses, however, could not be of any social ilk. As Shapin and Schaffer point out, only one from the appropriate rank and gender could produce a matter of fact: only the male virtuoso could be considered a reliable source to record experimental proceedings of technological observations. As a female ruler, the

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<sup>27</sup> See Shapin and Schaffer, *Leviathan and the Air Pump*, 22-80.

Empress's repeated refusal to relate the details of the bear-men's account challenges the Royal Society's exclusion of women from their social circles, rejecting the very means by which they produced knowledge.

Female exclusion from early modern experimental practices need not be detailed here at any great length. Suffice it to say that Cavendish's writings and single visit with the fellows of the Royal Society occasioned a number of snide comments: Samuel Pepys writes that she is a "mad, conceited ridiculous woman"; John Evelyn argues that she is a "mighty pretender to Learning, Poetrie, and Philosophy;" and Dorothy Osborne concluded "that there [were] many soberer People in Bedlam" after having read *Philosophical Fancies*.<sup>28</sup> Cavendish herself calls attention to her exclusion from positions of authority, opting to "ma[k]e a world of [her] own" because she has "neither power, time nor occasion to conquer the world" (*BW*, 124). Cavendish makes this point clear when she rejects all of the worlds her imagination has crafted "according to Pythagoras's doctrine" or "according to" Aristotle's, Descartes', or Hobbes' "opinion" (*BW*, 187-188) in favor of a world crafted of her mind only. Cavendish's *Blazing World* is not an eutopia, a good place, like the one the Royal Society aims to restore. Rather, it is a utopia, a no place crafted in poetry, because the empress's authority over knowledge is

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<sup>28</sup> Anna Battigelli, *Margaret Cavendish and the Exiles of the Mind* (Kentucky: University Press of Kentucky, 1998), 4. Samuel Pepys, "18 March 1668" in *Everybody's Pepys: The Diary of Samuel Pepys 1660-1669*, ed. O.F. Moreshead (New York, Harcourt, Brace & company, 1926, 514; .Dorothy Osborne, *Letters from Dorothy Osborne to Sir William Temple (1652-54)*, ed. Edward Abott Parry (London J. M. Dent & Sons ltd. 1888): 79; John Evelyn, "30<sup>th</sup> May, 1667," in *The Diary of John Evelyn*, ed. William Bray (New York and London: M. Walter Dunne, 1901): 2:33.

acknowledged only in a fantastical world. For Cavendish, the imagination is necessary to both discover knowledge and to claim authority over this knowledge. The flights of poetic fancy that the Royal Society rejected in order to establish their own authority over knowledge become the means by which Cavendish crowns herself “Margaret the First” (BW, 124).

A variety of scholars note the centrality of gender to Cavendish’s natural philosophy and her utopian narrative. Rachel Trubowitz argues that Cavendish revises the utopian genre such that it “uniquely accommodates her construction of female subjectivity in imperial terms” (230).<sup>29</sup> Marnie Leslie qualifies this line of argumentation, stipulating that “although Cavendish clearly challenges and revises generic boundaries, she also seeks inclusion in male literary and philosophical canons, and in order to gain recognition she must also be to some degree recognizable within such canons” (7).<sup>30</sup> Angus Fletcher, however problematically, contends that *The Blazing World’s* “aesthetic irregularity” should not be “traced to a desire to reject hierarchy but rather to [Cavendish’s] place in a feminist tradition that sought to redefine authority by associating it with women’s inconstant dispositions” (142).<sup>31</sup> In all of these accounts, the

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<sup>29</sup> Rachel Trubowitz, “The Reenchantment of Utopia and the Female Monarchical Self: Margaret Cavendish’s *Blazing World*,” *Tulsa Studies in Women’s Literature* 11, No. 2 (Autumn, 1992): 229-245 at 230.

<sup>30</sup> Marina Leslie, “Gender, Genre and the Utopian Body in Margaret Cavendish’s *Blazing World*,” *Utopian Studies* 7, No. 1 (1996): 6-24 at 7.

<sup>31</sup> Angus Fletcher, “The Irregular Aesthetic of “The Blazing-World,”” *Studies in English Literature, 1500-1900* 47, No. 1, The English Renaissance (Winter, 2007): 123-141 at 142.

utopian genre itself facilitates Cavendish's arguments about gender and its relationship to political and epistemological authority. I argue that Cavendish underscores the utopian genre as one that is explicitly the work of a poet, reclaiming poetry as a means to discover knowledge. Put differently, as a genre that attests to its status as fiction, Cavendish's utopia demonstrates that the experimental philosopher's appropriation of the imagination cannot be divested from poetry.

Cavendish revels in the poetic imagination, populating *The Blazing World* with strange anthropomorphized animals, the spirits of Classical and seventeenth-century philosophers, and even a single body with three souls. Nevertheless, her utopia is also a mouthpiece for the serious criticisms she wages against the Royal Society in her *Observations*. Cavendish's use of the utopian genre links her flights of the imagination with serious philosophical critique in the same way she connects "fancy" with "reason" (*BW*, 123): they are "two worlds" joined "at the ends of their poles" (*BW*, 124). Poetry and natural philosophy are connected, even if they operate in different spheres. As we saw in Chapter three, however, Royal Society members tried to sever their ties to the poet. Experimental philosophers appropriated the poetic imagination and, in the process, divested itself from the realm of the poet: fiction was said to have no place in matters of fact. *The Blazing World* demonstrates how the Royal Society's disavowal of poetry delegitimizes the power of the fiction upon which their production of knowledge relies. Elizabeth Spiller argues that both Galileo's *Sidereal Messenger* and Cavendish's

*Blazing World* turn to fiction to overcome the limits that human senses impose on the discovery of knowledge:

Like Galileo, Cavendish depicts for readers something that they cannot see – something not visible to the naked eye. That something is fiction not science.... [Scholars must] take Margaret Cavendish seriously and recognize that the fiction itself is the philosophy. Both in argument and form, *The Blazing World* offers one solution to Galileo's philosophical problem about the limits of observation. When we look at Cavendish looking, in effect, through Galileo's telescope, we see that she has redefined that which exceeds the natural limitations of human vision as the realm of fiction.<sup>32</sup>

Cavendish points out that the new natural philosopher's knowledge must be counted as fiction because it cannot be verified without recourse to the very technology by which it was first discovered. Until discoveries made with technology are corroborated through independent means, these discoveries can only be counted as fiction. For her, Galileo's serious astronomical observations are equally as imagined as the bear-men's accounts of microscopic images. In this way, the production of virtual witnesses is itself the craft of fiction.

Experimental philosopher's recourse to the imagination, especially in its microscopic and telescopic discoveries, become the primary target of the poet's scorn in the latter half of the seventeenth century. For Cavendish, experimental philosophy could not appropriate the poetic imagination without also accepting that their technological discoveries were also forms of fiction. The poetic imagination could not be divested

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<sup>32</sup> Elizabeth A. Spiller, "Reading through Galileo's Telescope: Margaret Cavendish and the Experience of Reading," *Renaissance Quarterly* 53, No. 1 (Spring, 2000): 210.

from the sphere of poetry without also losing its power to produce the *scientia* to which the poet had also traditionally laid claim. By rejecting poetry as a means to discover knowledge of nature, experimental philosophers were consequentially delegitimizing their claims over knowledge. As Cavendish argues, the Royal Society must align themselves once more with poetry if their fictions are to reveal facts. Milton too works to reclaim poetry as a means to produce knowledge. The poet had a place within natural philosophical debates and, as I turn to next, could reconcile natural philosophy with theology.

Before *Paradise Lost* was published, the vision of the cosmos had changed. The geocentric Ptolemaic model could not account for a number of seventeenth-century telescopic discoveries: an earth-like terrain and dark spots became visible on the immaculate lunar and solar faces in 1610 and 1612 respectively, the Galilean moons were seen to orbit around Jupiter 1610, and the discovery that Venus waxed and waned could only be explained if it danced round the sun. These celestial observations prompted over a century of incendiary debates — debates that are played out in the pages of Milton's epic. Galileo's advocacy of the heliocentric model challenged the authority of theology. Theologians argued for a geocentric cosmos that they thought corroborated multiple passages in the Bible. Galileo appealed to the "true demonstrations" of his astronomy to argue that some Scripture was best read in light of evidence accrued through natural philosophy. The knowledge gleaned from the book of nature, Galileo contends, took

precedence over certain passages in the book of Scripture. Milton's epic stages the vexed relationship between natural philosophy and theology through a man who, at first glance, is unfit for knowledge of any world but his own: Adam asks Raphael why Earth should be the center of the cosmos—a question that prompts Raphael's caution to be "lowly wise" (*PL*, 8.173). Milton's suspicion of Galileo's "less assured" discoveries and their implication in the larger debate between natural philosophy and theology, however, stems from the importance that Galileo invests in natural philosophy rather than a rejection of heliocentrism. Milton offers a way to reconcile natural philosophy and theology and, along with it, the sun-centered and earth-centered models of the cosmos. Milton makes commensurate Ptolemaic and Galilean cosmologies by explaining that the geocentric model accurately describes the cosmos as it appears to Adam and humankind on Earth, and thereby leaves open the possibility that heliocentric model may accurately describe the cosmic order as it appears to those not bound by the limits of unaided human sense. Both cosmological models, *Paradise Lost* suggests, are able to produce accurate knowledge—a reconciliation that Newton later proposed when faced with a similar debate between the book of nature and the book of Scripture. By reconciling natural philosophy and theology through the poet's pen, Milton's epic works to reclaim poetry's place as a means to discover knowledge of nature.

A lot of scholarly ink has been spilled in attempts to decipher the cosmology described in *Paradise Lost*, in part because Milton provides a number of passages

compatible with both Ptolemaic and Copernican models. Take for instance Raphael's discussion of "how and wherefore this world was first created" in Book VII. Within the span of a couple lines, Raphael suggests a cosmos that is characteristic of geocentrism and heliocentrism. Beginning at line 371, Raphael describes the sun as the "Regent of the day, and all th' horizon round Invested with bright rays, jocund to run/ His longitude through heav'n's high road" (*PL*, 7.371-373), attesting to the movement of the sun, its "jocund run," in the Ptolemaic model. But beginning at line 364, just seven lines earlier, Raphael describes Venus in a way compatible with the Copernican model alone: Raphael says "Hither as to their fountain other stars/ Repairing, in their golden urns draw light,/ And hence the morning planet gilds her horns" (*PL*, 7.364-366).<sup>33</sup> Espied through his telescope, Galileo discovered in 1609 that Venus has phases and, much like the moon, only looks like a set of "horns" at given points during its cycle of waxing and waning. In other positions in the sky, Galileo observes that Venus is replete with light. In the Ptolemaic model, Venus should consistently be seen as a crescent, a hypothesis shown untenable with the observation of Venus's other visible phases. The discovery of Venus's phases provided evidence in support of the Copernican model since Venus could only be entirely cast into golden light—its "horns" could only be "gilded"—if it orbited the Sun.

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<sup>33</sup> See Marjara, *Contemplation of Created Things*, 63-67.

Galileo's celestial observations were not the only cause of the Church's concern. In his "Letter to the Grand Duchess Christina of Tuscany" (1615), Galileo attempts to reconcile his celestial evidence for the Copernican model with the Bible by arguing that Scripture should be read in light of "truly demonstrated" observations. Scripture, to quote Galileo, "is often very abstruse, and may say things which are quite different from what its bare words signify. Hence in expounding the Bible if one were always to confine oneself to the unadorned grammatical meaning, one might fall into error."<sup>34</sup> The Biblical passages that support a sedentary earth and geocentric cosmos, Galileo argues, should not be taken at face value. Instead, Galileo proposes that to avoid "error," the observations of astronomy, and natural philosophy more broadly, should guide the interpretation of the Bible. He writes: "having arrived at any certainties in physics, we ought to utilize these as the most appropriate aids in the true exposition of the Bible and in the investigation of those meanings which are necessarily contained therein, for these must be concordant with demonstrated truths" (183). More than just advocating a cosmological model at odds with the one suggested in the Bible, Galileo here argues for the primacy of natural philosophy over theology. Galileo writes that "in discussions of physical problems we ought to begin not from the authority of scriptural passages but from sense experiences and necessary demonstrations" (182). Natural philosophy,

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<sup>34</sup> Stillman Drake, trans. *Discoveries and Opinions of Galileo* (New York First Anchor Books, 1957), 181.

Galileo contends, is a more reliable source for knowledge of nature than the theological interpretations of the Bible.

Like Galileo who is concerned with the Bible's "abstruse" passages, Milton is also concerned with how God's "almighty works" (PL, 7.112) can be conveyed clearly and accurately to humankind. Raphael asks Adam: "What words or tongue of Seraph can suffice,/ Or heart of man suffice to comprehend" (PL, 7.113-114) the magnificence of God's cosmic handiwork? Where Galileo argues that sense demonstrations of natural philosophy can guide the interpretation of certain Biblical passages, Milton contends that the Bible should stand alone.<sup>35</sup> In *The Christian Doctrine*, Milton writes: "no inferences from the text are to be admitted, but such as follow necessarily and plainly from the words themselves; lest we should be constrained to receive what is not written for what is written, the shadow for the substance, the fallacies of human reasoning for the doctrines of God."<sup>36</sup> While Galileo trusts the careful observations of natural philosophers to infer Biblical meaning beyond the literal word of Scripture, one of the reasons Milton may make recourse to "the words themselves" is because the Bible, so Milton intimates, is accessible for any and all to understand. He writes, "the use of the Scriptures is prohibited to no one; but that, on the contrary, they are adapted for the

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<sup>35</sup> See Barbara Lewalski *The Life of John Milton: A Critical Biography*. 2000 Reprinted (Oxford: Blackwell, 2003), 130.

<sup>36</sup> John Milton, *A Treatise on Christian Doctrine Complied by Scripture Alone*, trans. Charles R. Sumner (Cambridge University Press, 1825), 471-472.

daily hearing or reading of all classes and orders of men.<sup>37</sup> Raphael takes up this task and adapts knowledge of the heavens and the earth such that Adam can understand it. In the process, Milton demonstrates how the geocentrism and heliocentrism can be reconciled as compatible models of the heavens.

In Book VIII, Adam worries that the Earth is but a meagre speck unworthy of its cosmic privileges, a concern that prompts Raphael to make intelligible God's heavenly organization. To do so, Raphael uses the sense experiences with which Adam is already familiar. As Bacon had earlier argued, "things in themselves new will yet be apprehended with reference to what is old" (*W*, 7:75). Raphael uses terms and notions that are accessible to "all classes and orders of men", not just Adam alone, by appealing to how the heavens appears to the sense experience from man's earth-bound perspective. Adam asks Raphael to "resolve" (*PL*, 8. 14) him of the "doubt" (*PL*, 8.13) that shakes his faith in the divine order: Why does the earth, "but a spot, a grain/ An atom" (*PL*, 8.17-18) merit the coveted position at the center of the heavens? Raphael's answer, I argue, satisfies both natural philosophical and theological convictions.

Given the grandeur of the heavens, Adam cannot understand why the Earth should lay at the center of a magnificent cosmic dance. "How [could] nature, wise and frugal," Adam asks, "commit such disproportions" by situating the Earth at the heart of

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<sup>37</sup> Milton, *Christian Doctrine*, 467.

“so many nobler bodies” (*PL*, 8. 25-28)? Adam’s query about the divine reasoning behind Earth’s position also poses a natural philosophical question:

For aught appears, and on their orbs impose/  
Such restless revolution day by day/  
Repeated, while the sedentary earth/  
That better might with far less compass move,/  
Served by more noble than herself, attains/  
Her end without least motion, and receives/  
As tribute such a sumless journey brought/ ...  
warmth and light" (*PL*, 8.30-37).

Here Adam describes the earth-centered Ptolemaic model, arguing that the Earth’s sedentary position does not merit the “tribute” of “warmth and light” it receives from the dance of the more brilliant celestial bodies. Adam’s doubt challenges the geocentric model of the heavens advocated in Scripture, suggesting that natural philosophical questions about the heavenly structure cannot be divorced from its theological implications. Raphael thus responds to these questions by trumping Adam’s natural philosophical question with the promise of knowledge of greater importance: “whether heav’n move or earth/ Import not, if thou reckon right” (*PL*, 8.70-71). Raphael assures Adam that the Earth’s privileged position cannot be challenged by the luster of bigger celestial bodies, for “the great/ Or bright infers not excellence” (*PL*, 90-91). Rather, he continues, “the earth may of solid good contain/ more plenty than the sun barren shines” (*PL*, 8.93-94). With the Earth secured in its privileged position, Raphael advises Adam not to concern himself with further natural philosophical questions: “Heaven is too high for thee/ To know what passes there. Be lowly wise” (*PL*, 8. 172-173).

“Contented” with knowledge “Not of earth only but of highest heav’n” (*PL*, 8.177-178), Raphael concludes that knowledge of God’s divine favor should quench any desires to engage in natural philosophical debates.

Nevertheless, Raphael’s response to Adam’s question about the structure of the cosmos leaves open the possibility that both the sedentary earth of Ptolemy and the Bible, and the travelling earth of Galileo are accurate descriptions of the cosmos. Adam’s concern that the sedentary earth receives undue light and warmth from superior celestial bodies stems from the belief in a Biblical earth-centered cosmos. But Adam importantly stipulates that he’s deduced this based on how the cosmos appears to him from earth: “For aught [it] appears” to be a “sedentary earth.” Raphael responds in kind, affirming nothing but that the earth appears sedentary from the vantage point of the earth itself: “But this I urge/ Admitting motion in the heav’ns, to show/ Invalid that which thee to doubt it moved;/ Not that I so affirm, though so it seem /to thee who has dwelling here on earth” (*PL*, 8. 114-18). Although Raphael establishes that he need not admit motion to the heavens because his answer about Earth’s privileged position satisfies a higher theological question, his reference to the way the heavens “seem” to an earthly perspective also answers Adam’s natural philosophical question.

Adam and Raphael’s recourse to “appearances” to account for the geocentric model directly answers “whether the sun/ ... rise on the earth or earth rise on the sun” (*PL*, 8.160-161). The experience of how the heavens “appear” or “seem” to those who

have “dwelling here on earth” suggests a commensurability between the two supposedly conflicting cosmological models. Where Galileo argues that the Bible can, and in some circumstances, must be interpreted through the lens of natural philosophy, Milton reconciles the geocentrism of the Bible and heliocentrism of Galileo by validating each as accurate and truthful in their own right. Both the heliocentric model corroborated by the Bible's depiction of the cosmos and the heliocentric model can be accurate in so far as the former describes what "seems" or "appears" to humankind from a position on earth, where the latter can accurately represent what appears to one unbound by the limits of human senses. Put differently, the heliocentric model may be accurate for those whose can see beyond ordinary human senses, say with the help of a telescope. Scripture can stand at face value because, as a sacred text intelligible to anyone and everyone, it accurately describes how the cosmos appears to be organized given humankind's position on earth. And Galileo's telescopic evidence for the Copernican model can equally stand as accurate and truthful because it describes the cosmos as it appears to a scope of vision that far surpasses the naked eye. Milton's recourse to appearance, then, makes commensurable geocentrism and heliocentrism.

Milton's appeal to the “appearance” of the cosmos from an earthly standpoint in some ways anticipates Isaac Newton's reconciliation between Biblical passages and his firm conviction in empirical evidence amassed through natural philosophy. In a letter written in January of 1680, Newton responds to Thomas Burnet's queries over a

philosophical account the formation of the oceans by reconciling Moses's account with the one demonstrated through natural philosophy. Newton explains that he does not think Moses's "description of the creation [of the oceans] either Philosophical or feigned, but that he described realities in a language adapted to the sense of the vulgar."<sup>38</sup> Newton continues, "Moses here sets down their creation as if he had then lived and were now describing what he saw... To describe them distinctly as they were in themselves would have made the narration tedious and confused."<sup>39</sup> Unlike Galileo who made natural philosophy primary to Scripture, Newton's notion that the Bible describes how the Earth and the cosmos's workings appear to the senses of the common people places the Bible and natural philosophy on equal footings. The Bible and the conclusions of natural philosophy diverge not along the lines of truth and falsity, but among the cosmic appearance and the cosmos as it is "in themselves." Newton is regarded as the first person to reconcile the Bible and natural philosophy by epistemologically validating vulgar appearances. But *Paradise Lost* may have used the same line of argumentation over a decade earlier. While Milton does not go so far to explicitly pronounce astronomical findings as those which are absolute, both Milton and Newton insist on the epistemological validity of how the cosmos appears from the perspective of Earth.

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<sup>38</sup> Isaac Newton, "Newton to Thomas Burnet, January 1681," in *Memoirs of the Life, Writings, and discoveries of Sir Isaac Newton*, Vol. 2 Sir David Brewster [Edinburgh, 1855], 452. See Andrew Janiak, *Newton as Philosopher* (Cambridge: Cambridge University, 2008), 159-161.

<sup>39</sup> Newton, "Newton to Thomas Burnet," 452.

The invisible exploits of God's cosmos can be made intelligible through vulgar appearances for Milton and, later, Newton. Adam and Raphael's insistence on appearance when discussing the organization of the cosmos allows us to reread Galileo's place in Milton's epic and, importantly, the limits Milton exacted on man's knowledge. Raphael does not sidestep the natural philosophical question that Adam raises when he asks about the cosmic order. Raphael's assurance that the earth is privileged regardless of its cosmic position does not relegate Adam to "think only what concerns thee and thy being". Instead, Milton's ability to reconcile the geocentric model characterised by the Bible with the astronomical evidence for a heliocentric model extends the epistemological boundaries within which mankind can be "lowly wise." Raphael assures Adam that to be "lowly wise" includes knowledge of the divine order. When Raphael chides Adam to "Dream not of other worlds, what creatures there/ Live" (*PL*, 8.175-176), he the angel does not circumscribe the reach of man's knowledge. Indeed, knowledge of "highest heav'n" (*PL*, 8. 78) has been "revealed" (*PL*, 8.177) to Adam. Instead, Raphael asks Adam to trust that his "lowly" position is sufficient to reach the heights of knowledge. The Bible, Milton and Newton imply, explains the order of nature and the heavens in ways that are accessible to all mankind, grounding its knowledge in an earth-bound perspective. To imagine the cosmos from the perspective of "other worlds" is to discredit man's favored position on Earth and to disavow the knowledge revealed in Scripture. Milton's contribution to the cosmological debate, then,

does not limit human knowledge but, like the chiasmic structure of the epic itself, what can be counted as “lowly” knowledge is expanded.

Aiming to “justify the ways of God to men (*PL*, 1.26), Milton’s epic poet exemplifies how humankind can be “lowly wise” even at the height of discovery. Milton’s expressed purpose is to provide an imagined account of man’s fall from grace such that he may come to understand that God’s ways are just by the end of his epic. Only the poet, Milton suggests, is capable of attaining such a feat. Though novel in its use of blank verse, Milton firmly establishes *Paradise Lost* in the lineage of epic poems before him. Directly translating a line from Ariosto’s *Orlando Furioso*, Milton also proposes to do “things unattempted yet in prose and rhyme” (*PL*, 1.16).<sup>40</sup> With the promise to “assert Eternal Providence” (*PL*, 1.25), Milton makes clear that the epic poem is the best means to achieve the “hight of this great argument” (*PL*, 1.24.). The poet’s imaginative art, as it had long since been trusted, is poised to reclaim its task to discover knowledge of nature and its divine order in Milton’s epic. By reconciling the debate over the geocentric and heliocentric models and its implications for the rivalry between natural philosophy and theology, Milton works to reclaim the heights of knowledge for the poet.

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<sup>40</sup> Ludovico Ariosto, *Orlando Furioso*, trans. Guido Waldman (Oxford: Oxford University Press, 2008), 1. Waldman translates this line as “what has never before been recounted in prose or rhyme”

Many poets were not persuaded by the Royal Society's rhetoric. Butler, Cavendish, and Milton all build upon a common criticism: experimental philosophers could not discover knowledge of nature because their appropriation of the poetic imagination failed to perform the poet's work. Experimental philosophy, especially its use of magnifying lenses, produced a misshapen vision of nature that could neither accurately represent the natural world nor discover knowledge of its inner workings. The ideal, "golden" world to be revealed by Sidney's poet becomes deformed and monstrous in the hands of the experimental philosopher. Indeed, a quick glance through the microscope nearly sends Cavendish's Empress into a "swoon" (*BW*, 144)—a sentiment Swift repeats when Gulliver is repulsed by his magnified vision of a Brobdinagian maid's giant bosom)<sup>41</sup>. Experimental philosophy, these poets argued, could not produce useful knowledge of nature. Instead, experimental philosophy was claimed to content itself in meaningless disputes, be it over Butler's lunar elephant or among Cavendish's bear-men. This experimental philosophical vision of nature rendered the imagination idle: if the mind was not bogged down with the minutia of inconsequential details, it was halted all together while the body managed a volatile stomach. The imagination that allowed experimental philosophers to pursue knowledge of nature ultimately precluded that knowledge. The poet, however, had already mastered the use of the imagination. As Cavendish and Milton work to show, the poet's

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<sup>41</sup> Jonathan Swift, *Gulliver's Travels*, ed. Albert J. Rivero (New York: Norton, 2002), 98-99.

pursuit of knowledge would not be reduced to the minutiae of philosophical debate and would reach the height of cosmic knowledge.

While today we are accustomed to understanding science and literature as distinct, even antagonistic disciplines, this was not the case for natural or experimental philosophy and poetry throughout the seventeenth century. For Bacon, Galileo, and fellows of the Royal Society, the poetic imagination revealed material explanations of nature's order that other orthodox models and methods could not. Natural or experimental philosophy and its mechanical inventions, such as the microscope and telescope, were thought to reveal natural wonders that otherwise inaccessible to the naked eye or unaided sense. Butler, Cavendish, and Milton all wage a version of the same base criticism because experimental philosophy could not divest itself from poetry without also losing its ability to discover knowledge. Poetry and natural philosophy were inextricably linked, whether or not natural philosophers would acknowledge this connection. When modern scientists and science popularizers, such as Dawkins, proclaim science to be a form of poetry, then, they are revealing the vexed relationship between poetry and natural philosophy that has informed the rise of "science" since the seventeenth century.

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## Biography

Jacqueline L. Cowan was born in 1985 in Mississauga, Ontario, Canada. In 2009, she received her Honours Bachelor of Arts with *High Distinction* from the University of Toronto, Mississauga. During her time at Duke University, she published “Francis Bacon’s New Atlantis and the Alterity of the New World” in *Literature and Theology* (2011) and “The Imagination’s Arts: Poetry and Natural Philosophy in Bacon and Shakespeare” in *Studies in Philology* (forthcoming in 2015). Jacqueline has also received generous support for the research and writing of her dissertation from the Social Sciences and Humanities Research Council of Canada (2012-2013) and the Myra and William Waldo Boone Fellowship (2014).