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Women's Writing and the Poetics of Scientific Knowledge, 1620-1740

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WOMEN'S WRITING AND THE POETICS OF SCIENTIFIC KNOWLEDGE, 1620-1740

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DEDICATION

To my parents—Mom, Dad, Doug, and Carmen—for all of their love and support.

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ABSTRACT

Women's Writing and the Poetics of Scientific Knowledge, 1620-1740 probes the porous boundary between science and literature, revealing that the methodologies undergirding scientific experimentation were developed communally and through a confluence of interdisciplinary and cultural concerns. Ultimately, it shows that our contemporary understanding of the natural world and the scientific method have a history that is largely one of fragments. Secondly, and more importantly, it demonstrates the value of reading imaginative writing alongside scientific developments of the day. Focusing on women's imaginative writing in particular reveals the power and limits that ostensibly liminal voices have. As such, *Women's Writing and the Poetics of Scientific Knowledge, 1620-1740* continues, in part, the vital project of recovery. Concomitantly, it also suggests that it was women's very marginality that enabled them to create a nexus between types of discourse and the larger scientific and literary milieu. Although barred, institutionally, from practicing experimental science, women remained active participants in contributing to the shape knowledge took. Chapters centered on political, microscopic, epistolary, and anatomical life show how women writers of the period—Margaret Cavendish, Aphra Behn, and Jane Barker, among others—experimented with hybrid narrative forms to account for and illustrate different ways of knowing; critiqued empirical practices and the illusion of objectivity; and used imaginative writing to offer an alternative model for understanding the natural world and one's place within it.

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CHAPTER 1

INTRODUCTION

On February 4, 1645, John Evelyn recounts visiting a "collection of exotic rarities in the Museum of Ferdinando Imperati, a Neapolitan nobleman." In his diary entry Evelyn inventories "the repository of incomparable rarities":

> Amongst the natural herbals most remarkable was the *byssus marina* and *pinna marina*; the male and female chamelion; an *onocrotalus*; an extraordinary great crocodile; some of the Orcades anates, held here for great rarity; likewise, a salamander; the male and female *manucodiata*...papyrus, made of several reeds, and some of silk; tables of the rinds of trees, written with Japonic characters; another of the branches of palm; many Indian fruits; a crystal that had a quantity of uncongealed water within its cavity; a petrified fisher's net; divers sorts of tarantulas . . . (225-226)

In addition to cataloging the museum's contents, Evelyn's description points to the seemingly arbitrary nature that characterized most seventeenth-century collections. From shells to paper, crocodiles to herbs, curio cabinets and *wunderkammerns* contained an eclectic mix that placed the natural alongside the man-made and the exotic alongside the domestic.[1] Evelyn's description, likewise, encapsulates the epistemology that

[1] Frequently, these categories were intertwined in singular objects. Nuts were carved into goblets and crystals into vases; even the natural whorls of wood and veins of agates were frequently incorporated into painted scenes. See Daston and Park 255.

characterized the seventeenth century and the period's approach to natural philosophy. Within it, Evelyn conflates natural and man-made objects, represents knowledge as a collection of discrete, mobile facts, and imposes implicit systems on an otherwise chaotic and unorderly mass of information by way of juxtaposition, analogy, and perspective.

As with Evelyn's, descriptions of all kinds across genres and disciplines represent the world and everything in it as a mosaic; they work associatively rather than contiguitively and reveal a fascination with fragments. For instance, in *Oroonoko* (1688) Aphra Behn describes the titular character as follows:

> He was pretty tall, but of a shape the most exact that can be fancy'd . . . His face was not of the brown rusty black which most of the nation are, but of perfect ebony, or polished jett. His eyes were the most awful that cou'd be seen, and very piercing; the white of 'em being like snow, as were his teeth. His nose was rising and *Roman,* instead of *African* and flat. His mouth the finest shaped that could be seen . . . The whole proportion and air of his face was so nobly and exactly form'd, that bating his color, there could be nothing in nature more agreeable and handsome . . . (20-21)

While Behn's linguistic dismemberment of Oroonoko foreshadows his actual dismemberment at the novel's end, it is not unusual for the period. Like Evelyn, Behn relies on a process of layering singular and minute details by emphasizing smaller and smaller components of individual entities. For instance, Oroonoko's eyes are reduced to the sclera ("the white of 'em"). Consequently, the image of Oroonoko that slowly emerges—eyes, nose, teeth—is reliant on the accumulation of discrete parts, all of which are more clearly delineated than the whole. The period's relentless attention to parts and

conception of knowledge as a process of accretion laid the groundwork for the language of nature to become that of system.[2]

Like Evelyn's and Behn's descriptions, *Women's Writing and the Poetics of Scientific Knowledge, 1620-1740* makes connections between different objects and ideas, teasing out and identifying the relationships between seemingly disparate texts and disciplines. In so doing, it probes the porous boundary between literature and natural philosophy. In the late seventeenth century, science and scientific discoveries were a common literary motif: travel narratives spread knowledge of indigenous peoples, flora, and fauna, poems versified atomic theory, and satires on the Royal Society proliferated. The relationship between science and literature was, however, not unidirectional. Science often borrowed the language of literature. Because there was no default convention for presenting fact, natural philosophers turned to and adapted available literary technologies. Francis Bacon went so far as to assert that poetic expression was part of the process of scientific discovery; as paraphrased by Sprat, Bacon saw simile and metaphor as not just useful but also essential: "the Comparisons which [experiments] may afford will be intelligible to all, because they . . . make the most vigorous Impressions on Mens *Fancie*" (qtd. in Preston 10). The desire to reform the previous century's knowledge of the world based on direct observation heightened the importance of how to express that knowledge. "How to *do* science," according to Claire Preston, "was not just an empirical question but also a rhetorical one: it was a question of how to *say* it" (10). And, as Preston notes "saying and doing in early-modern science are not wholly distinct, that literary

[2] For more on the way system operated as a genre in the late seventeenth and eighteenth centuries, see Siskin.

expressions by scientists are often functional and recapitulate their scientific thinking rather than simply decorate it—that res and verba are of one house" (10). Consequently, contemporary critics generally acknowledge that the two disciplines—literature and science—were once not so far afield. As Jonathan Kramnick argues, while the two disciplines "have grown to seem far flung," they were inextricably intertwined (11). What binds science and literature during the period is not simply content or rhetoric, however, but methodology. Both imaginative writers and natural philosophers represented a fractured and atomized view of the world. As such, the methodologies undergirding scientific experimentation that we accept as *a priori* today were developed communally and through a confluence of interdisciplinary and cultural concerns.

Of these concerns, understanding life—both its origins and operations—predominated. From Bacon to John Locke, philosophers debated whether life was animated by God or was simply the byproduct of carefully arranged cogs or atoms. Experimental scientists, such as Robert Boyle, Richard Lower, and Robert Hooke, suffocated birds, vivisected dogs, and bought, sold, and collected preparations—organs that were preserved and suspended in jars—in their quest for natural knowledge. Simultaneously, imaginative writers populated their works with sentient atoms, metaphorically travelled through the body's circulatory system, and imagined earrings as capable of containing multiple universes. More than anecdotes in the annals of weird science and literature, these experiments, texts, and material artifacts speak to the ethos of the age; following Bacon's call for controlled experiments that constrained and altered nature by the "art and the hand of man," seventeenth-century men and women approached the study of natural phenomena by separating them into their constituent

parts (*Works* IV:29). Consequently, they blurred the boundary between art and nature, living and dead. As Friedrich Engels says of the Baconian method:

> The analysis of Nature into its individual parts, the grouping of the different natural processes and natural objects in definite classes, the study of the internal anatomy of organic bodies in their manifold forms—these were the fundamental conditions of the gigantic strides in our knowledge of Nature which have been made during the last four hundred years. But this method of investigation has also left us as a legacy the habit of observing natural objects and natural processes in their isolation, detached from the whole vast interconnection of things; and therefore not in their motion, but in their repose; not as essentially changing, but as fixed constants; not in their life, but in their death (26-29)

While seventeenth-century writers did distinguish between things that were natural and living and things that were artificial and lifeless, this binary division often breaks down on closer inspection. Hooke, for example, deemed the microscope an "artificial organ" that was instrumental in revealing "the hidden unknown texture of bodies" (204); Thomas Hobbes used a mechanical body—the wooden, clockwork automaton—to represent the social and political body (*Leviathan* 9); and, seventeenth-century anatomists, such as Walter Charleton, injected wax and mercury into various organs so as to preserve and uncover their microsystems.[3]

[3] By the 1650s anatomists turned from air to wax injections, which served the dual purpose of highlighting and preserving the body's hollow structures. In the 1680s mercury injections were used to further delineate fine structures. The practice was eagerly adopted; as William Hunter avowed, "there is no making a good practical anatomist without it" (qt. in Cunningham, *Anatomist Anatomis'd* 237); for a discussion on the use of mercury injections, see Hendriksen 529.

Poets and novelists also explored living systems through artificial means.[4] For Alexander Pope, there was little difference between the two. As he writes in *An Essay on Man* (1733/34), "All Nature is but Art, unknown to thee" (I.X.IX: 52). By theorizing what it is that separates the human from the inhuman imaginative writers were forced to debate matters of existence, motivation, and feeling; as Kramnick notes, they often did so by applying principles from natural philosophy to questions of human action. Like the natural philosophers who parsed nature, erecting artificial systems so as to model its essential elements and laws of operation, imaginative writers mapped living systems onto social systems.

The seemingly dizzying array of disconnected information and objects of fascination that made their way into the philosophical and imaginative texts of the seventeenth century all represented different ways to structure, acquire, and represent knowledge; in turn, the shape knowledge took was central to debates on how to apprehend the natural world. Among the numerous theories meant to describe the natural world, mechanism, vitalism, and atomism dominated during the period. Likening the universe to a clock, mechanism, as portrayed by Thomas Hobbes, Rene Descartes, and Isaac Newton, explains all matter and natural laws in terms of machines; the world and everything in it is designed and created with divine intent. As such, God is considered the master craftsman. Consequently, natural systems begin to look very much like artificial systems; if the world is natural to man but unnatural to God, man-made worlds can, likewise, be simultaneously natural and unnatural. For this reason, mechanistic

[4] For more on the ways imaginative writers challenged the boundaries of the animate and the human, see Deutsch and Terrall.

philosophy underscores the ambiguity of the natural/artificial dichotomy and calls into question its presumed self-evidence.[5] As R. Hooykaas has argued, mechanization includes not simply mathematical formulation but, importantly, "mechanical (nonnatural; artificial) instruments for the investigation of nature, the effacing of any radical distinction between the natural and the artificial, and the introduction of mechanical models of natural things" (40).

Like mechanism, vitalism and atomism also derive their explanatory power from the belief that nature can be comprehended by artificially breaking it into its constituent parts. For instance, atomism argues that the universe is comprised of relatively simple, immutable, minute particles. The multiplicity of visible forms in nature is based upon differences in these particles and in their configurations. As formulated by Pierre Gassendi, atoms, of which God has created a finite number, collide in an empty space, resulting in the constitution of the physical world. In *Philosophiae Epicuri Syntagma* (1649), Gassendi, positing a middle ground between dogmatism and skepticism, argues that while knowledge of the essence of things is impossible, one can acquire probable knowledge of the natural world that is sufficient to explain and predict experience. A mechanistic atomist, Gassendi believed that, because the phenomenal world is related to the atomic world, there is no need to explain events in terms of Aristotelian teleology (Fisher). As with mechanistic philosophy, atomism muddies simple binaries between the natural and the artificial; because atomism is based on invisible particles, it is premised

[5] In its medieval instantiation mechanistic philosophy was imbued with agency; as agents of the church, clockwork automata and other artificial mechanisms were thought to contain vital energy (Riskin *Restless*). For more on Descartes and mechanistic philosophy, see Daniel Garber and Snider.

on manufactured descriptions of natural processes. Consequently, natural and metaphorical explanations of the universe become one and the same for atomists.

Impelled by a different a worldview, vitalistic philosophers, such as Francis Glisson, posited the existence of an aetheral flame to explain life. In *Tractatus de Natura Substantiae Energetica* (1672), Glisson redefines the relationship between the natural operations of the body and forms of sentient perception. Natural perception, according to Glisson, meant an act of vital reactivity embedded in matter, which plays a critical role of coordinating the operations of matter, life, and knowledge within a unified view of nature. For Glisson and other vitalists, living organisms are fundamentally different from non-living entities because they contain some non-physical element, i.e., a vital principle. Vitalism not only makes no distinction between animate and inanimate matter, it also suggests that the invisible can be made visible through artificial means (Cunningham *English Manuscripts*). As a result, the invisible became associated with matter and not merely the metaphysical, lending credence to vitalistic worldviews and explaining, perhaps, the popularity of anatomical theaters and public dissections at a time when sensory perceptions, especially sight, were deemed suspect.

The competing theories proffered to describe and comprehend the natural world were more than just intellectual, however. As critics such as Peter Hans Reill and Michael Hunter have noted, attempts to understand life and the natural world were impelled by a desire to organize the workings of the social order ("Vitalizing"; "Introduction"). Because nature and society were considered interconnected a change in natural philosophy required "an equally strong realignment of social, political, religious and cultural sensibilities" (Reill, "Vitalizing" 369). Given that some of the most

important effects of the scientific revolution and debates on how to comprehend nature were not just cerebral but also social, women had a large stake in defining the discourse of science; views of nature prescribed views of conduct. As such, women weighed in on competing scientific theories, and, most importantly, demarcated the consequences of this new knowledge for society as a whole and for women in particular. Numerous examples abound. Two of which do not fit the scope of this dissertation, but which are nevertheless apt, include Haywood's *Anti-Pamela* (1741) and Frances Burney's *Evelina* (1778). In *Anti-Pamela* Haywood engages with Newton's intromittist theory of optics, which argues that the eye receives impressions that are subsequently imprinted on the mind; that is, the one who sees is the passive object rather than, as we tend to think today, the active gazer. As Rivka Swenson writes, Haywood applies the intromittist theory in *Anti-Pamela* to imagine potential agency for women while simultaneously pushing back against female objectification. Likewise, in *Evelina,* Burney equates femininity with the automaton to detail "the possibility of generating individual affect within the very confines of the mechanized subjectivity that appears to limit the depth of female expression" while critiquing it (Park 23). For Julie Park, the mechanical pineapple, which opens to reveal singing birds and which captivates the novel's Madame Duval but not Evelina, is symbolic of the supposed model of ideal femininity and the mechanical and textual exemplars meant to extoll it: charming on the surface (38-39). For Haywood and Burney, as with many other female authors of the period, imaginative writing provided a forum in which observation and experimentation, both the of the literary and scientific kind, took shape.

Like most historians of science and literary critics, I take as a given the fractured and atomized view of knowledge, or what Bruno Latour calls "immutable mobiles," within the period (7). I also recognize the confluence of literature and natural philosophy. My feminist approach to the history of science adds to these arguments, however, by making explicit the contributions of female, imaginative writers. In so doing, I follow in the footsteps of many feminist critics who, Jennie Batchelor and Gillian Dow assert, are "committed to making visible what was always there but was often, and still is often, obscured: the contribution of eighteenth-century women's writing to all our histories" (14). Although barred, institutionally, from practicing experimental science and natural philosophy, women remained active in molding new forms of knowledge. From creating hybrid narratives in order to account for different ways of knowing to critiquing empirical practices and the illusion of objectivity it necessitated, female, imaginative writers created scientific knowledge and influenced the methodologies undergirding scientific experimentation. As such, *Women's Writing and the Poetics of Scientific Knowledge, 1620-1740* continues, in part, the vital project of recovery. As Hooykaas laments, "Since all of the great figures of the Scientific Revolution were male, women were almost completely absent from the historical narrative" (12). Yet female writers, such as Behn, Margaret Cavendish, Jane Barker, Eliza Haywood, and numerous others, frequently applied, challenged, and explored scientific concepts within their work. In so doing, they did more than just adopt or register scientific ideas; they transformed them. Because the discourse of natural philosophy knew no disciplinary or generic bounds, the plasticity of scientific writing provided women with the opportunity to make their mark. And, as this dissertation shows, they did so in many different ways.

Concomitantly, this dissertation also suggests that it was women's very marginality that enabled their contributions, the value of which should not be underestimated. Their exclusion from the halls of the learned and the esteemed enabled them to create a nexus between types of discourse and the larger scientific and literary milieu. As Catherine Gray has argued in regard to public life, "Women's marginality to traditional institutions of church and state . . . made them crucial figures for imagining an expanded public culture beyond these very institutions" (2-3). It also made them, in a sense, the ideal scientists. Practicing science required space and place free of interruption—a near impossibility for gentlemen virtuosi, such as Boyle. Querulously describing his visitors as "those disturbers of my work," Boyle often bitterly complained of his social obligations and was not alone in doing so (qtd. in Boas 21). As Preston notes, "the dream of some sort of intellectual removal or segregation, the shapely 'fiction of retreat'" proliferated (25). From Bacon's *The New Atlantis* (1627) and Abraham Cowley's plan for a philosophical college to Evelyn's elaborate design for a private laboratory, the fantasy of withdrawal, though rarely realized because financially prohibitive, filled the textual domain.[6] As such, much of what characterized the literary-scientific, according to Preston, "is an essential, constitutive idea of enforced or discretionary withdrawal, both physical and conceptual, a distinct and coherent domain of civil behavior where generic and rhetorical shape based on investigative activity and discovery was indistinguishable from its scientific content" (29). Although not free from numerous obligations of their own, women's relative exclusion from the public sphere is,

[6] For more on these imagined places of retreat, see Preston, pp. 90-157. For more on John Evelyn's designs, which he included in his unpublished manuscript on gardening, *Elysium Britannicum,* see Harris.

paradoxically, what allowed them to enter these conceptual spaces and communities of learning so often written about. Women's status coupled with the fragmented nature of knowledge is, then, precisely what allowed them to write for and imagine a public that, Mihoko Suzuki argues, "did not yet exist" (23). As Isobel Grundy notes, "Women's quest for improvement in, or control over, their own lives has been bound up with the struggle not so much to find a voice as to find an audience" (2). Because facts, now conceived of as separate from overarching theory, could be recombined and reconfigured, they enabled analogical and metaphorical thinking. Consequently, the immutable mobility of these facts allowed people to put them together and disseminate them in a variety of formats and texts; and women, not bound by the same rules as their male counterparts, did just that, using fiction as their canvas.

Women's Writing and the Poetics of Scientific Knowledge, 1620-1740 has two aims. Firstly, it seeks to show that our contemporary understanding of the natural world and the scientific method have a history that is largely one of fragments. Secondly, and more importantly, it demonstrates the value of reading imaginative writing alongside scientific developments of the day. Doing so exposes the fluidity between fields that were intimately connected and recovers the vital contributions that otherwise marginalized texts made to both literature and science. Focusing on women's imaginative writing in particular reveals the power and limits that ostensibly liminal voices have. Consequently, it asks us to recast the narrative of the scientific revolution as one in which women played a central role, thereby taking up Betty Schellenberg's challenge: to imagine women writers "at the center rather than on the margins, as the sought-after literary figure rather than at the periphery of someone else's circle" (84). And indeed, the three female figures

who serve as the primary focus of this study, Margaret Cavendish, Aphra Behn, and Jane Barker, did just that. Endowed with an aristocratic title, the money to back it up, and a supportive husband, Cavendish flouted the rules of propriety. She dressed flamboyantly, used her status to demand an audience with the Royal Society, and self-published philosophical and literary works of all sorts—casting herself at the center of the literary and scientific milieu. Like Cavendish, Behn too paid little mind to the dictates of her gender. She unapologetically wrote for money, frequently played with and questioned gender roles, helped pave the way for the novel, and did not shy away from taking on new science—both satirically as well as seriously. Rather than flouting society, Barker, by contrast, self-consciously opted out in many ways. Eschewing marriage, she desires, instead, her closet where she is able "to serve her God, enjoy her books and her friends" ("Virgin Life" l. 36). As such, Barker is closer to representing the hermetic ideal imagined by Boyle, Evelyn, Cowley, and others. Yet, her isolation, like theirs, is primarily fictional. Although she followed James II into exile, she maintained active correspondence networks throughout her life and, like Cavendish and Behn, created communities in which she could thrive.

The fractured and fragmented nature of knowledge that *Women's Writing and the Poetics of Scientific Knowledge, 1620-1740* traces is mirrored within the text itself. Like the epistemology that characterized the late seventeenth and early eighteenth centuries, the discrete parts of this dissertation are made whole through the imposition of analogy and juxtaposition. Each chapter focuses on disparate and ostensibly disconnected texts and contexts and functions as an individual piece of a larger puzzle rather than a step in a

linear and monolithic narrative.[7] Broadly speaking, the second addresses the way in which social and political bodies were organized according to the principles of natural philosophy; the third locates the experimental protocols of natural philosophy within manuscript culture; the fourth demonstrates that the episodic and miscellaneous nature of scientific description is indebted to epistolary culture; and, the fifth shows how the discourse of embodiment in fictional and anatomical texts represents the body as an organizing abstraction that is only ever implied by its parts.

Although I am interested, primarily, in the late seventeenth and early eighteenth centuries, many of the ideas and approaches to natural phenomena were being thought through long before. For this reason, I focus on texts published between 1620 and 1740. While placing works such as Francis Bacon's *Novum Organum* (1620), Hobbes's *Leviathan* (1651), and Hooke's *Micrographia* (1665) alongside Barker's "A Farewell to Poetry with A Long Digression on Anatomy (1688), Cavendish's *Blazing World* (1666), and Behn's *Love-Letters* (1684-87), among others, I note the similar methodologies each employs. Through the synthesis of a wide range of cultural evidence, close reading, and computational analysis I ask questions of these texts that extend beyond the traditional literary purview, show the cross pollination between literature and science, and demonstrate the way in which women actively participated in creating scientific knowledge.

Chapter Two, "Fictional Facts and Artificial Systems: Thomas Hobbes's *Leviathan* and Margaret Cavendish's *Blazing World*," describes in greater detail the

[7] As many historians of science argue, the scientific revolution does not fit a linear narrative of progress. See, for example, Shapin *Scientific*; Dascal and Boantza; Cunningham and Williams; Dear *Revolutionizing*; and Wootton.

implications of approaching the natural world through artificial means, one of which was that philosophical systems operated much like literary texts. In particular, Chapter Two tends to the construction of fictive systems within *Leviathan* and a *Blazing World*, showing how both Hobbes and Cavendish use fiction to model their political and social worlds. As Mary Morgan writes, narratives, even those of the scientific cast, create order among materials and derive their explanatory power from their ability to answer how and why questions. In essence, narratives are simultaneously acts of world creation and reflections of the world as it is. By using narrative to put forth their respective theories of government, Cavendish and Hobbes erect artificial systems. Consequently, examining Hobbes's and Cavendish's use of fiction provides insight into what they deem to be the essential elements and laws of operation governing the natural world.

In contrast to Hobbes, Cavendish overtly recognized the way in which fiction was integral to both her and Hobbes's respective theories of government. Importing much of her natural and political philosophy into her pseudo-science-fiction text, Cavendish uses fiction to both dramatize and enact the tenets she lays out in her non-fiction treatises—tenets that Hobbes addressed nearly ten years earlier in *Leviathan*. In so doing, Cavendish throws into relief the way in which Hobbes's theory of government is premised on the subjunctive while simultaneously engaging with and amending theories of the mind. Cavendish's use of fiction is in line with her pantheistic, vitalistic natural philosophy. Because Cavendish does not believe that nature can be broken down or understood in relation to is parts, she emulates rather than parses nature, turning to fictional rather than actual examples in *Blazing World*. As such, Cavendish's fantastical, labyrinthine narrative parallels her description of "Nature's Works": "so various and wonderful, that

no particular Creature is able to trace her ways" (51). By depicting the natural world as "self-moving," comprised of "inanimate, sensitive and rational Matter," Cavendish further plugs her theory of pantheistic vitalism and alludes to what she could only see as irreconcilable problems in *Leviathan* (80; 81); namely that matter, like nature, is self-moving and that it is through fiction rather than "chopt logick" that one can offer an expanded vision of the natural world (58). Though they be fictional, Cavendish's worlds are "composed onley of the Rational, which is the subtilest and purest degree of Matter" (100). Consequently, her political theory parallels her natural philosophy and presents a view of reality that, for her, is closer to reality.

Chapter Three, "Jane Barker, Manuscript Culture, and Epistemology of the Microscope," examines scientific diagrams and scientific poetry through the figures of Robert Hooke, curator to the Royal Society and author of *Micrographia*, and Jane Barker, a gentlewoman whose work was both circulated in manuscripts and appeared in print. The experimental scientist's practice of approaching nature through artificial means led to the acceptance of studying its constituent parts. This in turn, led to an understanding of knowledge as a collection of discrete, observable phenomena, which had to be corroborated before being considered fact. Microscopes, in particular, exemplified the need to verify findings through multiple witnesses and replication. Reliably unreliable, microscopes magnified the fraught nature of the senses and the vastness of the unknown. While seventeenth-century microscopes opened up a tiny world previously unseen, they were not only difficult to operate but also varied significantly; what one saw underneath its lens could, therefore, differ drastically from one microscopist to the next. In perhaps what is the earliest version of crowdsourcing, experimental scientists accounted for this

instability by diffusing authority—deliberately seeking out and amalgamating multiple perspectives. While scholars such as Walter Ong have traced the conception of facts to print culture, I offer a different analogy, arguing that experimental science and manuscript culture share a similar bias and social logic (308). In the same way that poets created knowledge communally by passing around and emending manuscripts, so too did scientists.

In Chapter Three I show, in particular, how Jane Barker's "A Farewell to Poetry with a Long Digression on Anatomy"—a manuscript poem in which Barker describes the circulation of the blood—and Robert Hooke's *Micrographia* represent the acquisition of knowledge as a social process of accumulation. Like Hooke's scientific diagrams, Barker's poem enlarges the body beyond its normal point of recognition, thereby decentering the authority of human perspective. Barker does not reject sensory perception entirely, however; instead, she embraces multiple perspectives and experiences so as to circumvent the problems associated with the senses; namely, that they are an inaccurate measure of reality at best. For Barker it is only through the combination of multiple, inevitably flawed perspectives that we can arrive at anything resembling truth. Consequently, Barker creates new knowledge by synthesizing old and often contradictory anatomical views with contemporary theories, especially William Harvey's. In so doing, she anticipates and preemptively solves the problem of the nature and limits of human understanding that writers such as Locke would later grapple with. In embracing the multiple Barker embraces the belief that parts of a whole lead to greater knowledge.

Chapter Four, "Promiscuous Experiments: Aphra Behn's *Love-Letters,* Epistolarity, and the Problem of Description," reads Behn's epistolary romance alongside

the Royal Society's project of presenting information via "the Scheme of Heads of Inquiry." The Society's scheme itemized natural phenomena, provided an agenda for further experiments, and codified a set of conventions for representing individual experience and observation. The form of writing that emerged consisted, primarily, of organizing experimental tracts by way of a list of topics that were meant to both proliferate an olio of observations centered on a wide array of subjects as well as a multitude centered on singular items. In addition to providing suggestions for further research, however, the Society's scheme, which is most often associated with Boyle, frequently prescribed what and how experimentalists were meant to see, giving them precise instructions on what to look for. As such, the written descriptions the scheme elicited did not represent individual experience or detached observation but, instead, a mastery of genre.

The strictures that guided scientific writing and its miscellaneous nature have an obvious corollary in seventeenth-century epistolarity. As Roger Iliffe says, "To an overwhelming extent, the Society *was* its correspondence" (173). *Philosophical Transactions* was filled with printed epistles and natural philosophers relied on correspondence to share and acquire information across the continent.[8] Boyle's *The Christian Virtuoso* (1690), which Karen Bloom Gevirtz describes as a "declaration of the experimenter's self," opened with a letter and continues to address a correspondent throughout the text (31). Moreover, and as with scientific writing, letter-writing guides of the period established vocabularies and provided exemplars for how to represent

[8] According to Atkinson, the letter represented the "single most common generic form" of articles published in *Philosophical Transactions* between 1675 and 1875 (81).

individual, and subjective experience. In so doing, letter-writing guides, much like the Society's scheme, fashioned subjectivity into a recognizable and conventional form. Consequently, the portrait of the author that emerges in letters, both public and private, was deeply influenced and shaped by generic conventions that governed the form.

Recognizing the impact of genre on descriptions of individual experience, Behn uses *Love-Letters* to probe the limits of human knowledge but comes to a radically different conclusion than Jane Baker. Whereas Barker suggests that the instability of experience can be mitigated by the amalgamation of multiple perspectives, leading to a more accurate picture of reality and account of knowledge, Behn questions the project of empiricism and the methodologies underlying it. For Behn, the act of observing and experiencing are intimately connected to and influenced by the act of communicating. By adhering to the form of epistolary romance—in which generic conventions and formulaic descriptions are particularly salient—Behn illustrates the tension between subjectivity and representation. Ultimately, Behn argues that because genre influences perception, fictional and scientific descriptions can never offer unadulterated access to nature or the world.

Chapter Five, "Distant Reading the Body, 1640-1699," further parses descriptive practices, tracing linguistic representations of embodiment across fictional and anatomical discourse. The turn to systematicity and the fragmentation of knowledge, which I sketched in the previous chapters, led to a profound reorientation in the way that the corporeal body was theorized and discussed. In this chapter, I show how the body, once seen as a unified whole, became a physiological object defined by its parts and processes. This new understanding of the body is apparent in the period's anatomical

descriptions as well as in its imaginative and philosophical writing. Armed with pens rather than scalpels, novelists committed to new notions of realism are largely silent about corporeality. Seventeenth-century authors tend to write more about the clothes people wore than about their bodies, omitting basic information such as the color of eyes and hair or the contours of faces. Even when their descriptions are evocatively physical and tactile, as with Behn's description of Oroonoko, they are so focused on the body's parts that the body as a whole ceases to come into focus.

Curiously, the body's illegibility came about at the exact moment that the body began to be known. Advances in anatomy promised access to the body's interior recesses and the field flourished in the seventeenth century. Because the body of general knowledge was thought to be shaped and formed through the fragmentation of the physical body, anatomy had broad philosophical and political implications. The anatomical imperative *nosce te ipsum*—know thyself—permeated all aspects of seventeenth- and eighteenth-century life, leading Johann Veslingus to assert that "he that knows himselfe aright cannot but know all the world, because he is an Epitome of it" (qtd. in Sawday, *Body Emblazoned* 34). To know the body was to know one's own place in the world. Nevertheless, within fictional and anatomical discourse, the body is always only implied. Like much in the seventeenth century, the body becomes subservient to the smaller and smaller parts that comprise it, both at the level of description and practice.

In order to unearth conceptions of the seventeenth-century body not visible at the level of close reading, this chapter applies computational semantics to two subsets of the publicly available EEBO-TCP corpus: one anatomical, one fictional. Parsing each document into smaller and smaller sections, as the anatomist does the body, reveals

word-use at the paragraph level allowing me to track precise patterns not otherwise apparent. Modeled computationally, the word *body* is a conceptual object with many semantic parts, only some of which are shared across the two sub-collections. What signifies the body is not physicality. As a referential figure that points to something other than its own corporeality, the fictional and anatomical body becomes an always-in-motion vehicle of meaning and an organizing abstraction that can be inferred but never seems to be materialized on the space of a page.

Katherine Binhammer has, somewhat polemically, announced the "death of women's writing" (61). Arguments about it, once radical, are now well-worn: "this woman writer found her voice by claiming maternal authority or this woman writer claimed authority by refusing the maternal voice or this woman writer was constrained by a misogynist reception of her work or this woman writer was a savvy and active agent in print culture" (62). *Women's Writing and the Poetics of Scientific Knowledge, 1620-1740* seeks to do more than elucidate the particulars of women who fit that pattern, however. Instead, it suggests that studying female, imaginative writers through the lens of the history of science can illustrate what Preston has described as "a co-dependent, mutually influential relationship between literary and scientific expression," which, with a few exceptions, has been inadequately recognized (8-9). When read outside the narrow strictures of marriage plots, domesticity, and attempts to subvert the patriarchy we can begin to see that much of women's imaginative writing responds to, challenges, and modifies philosophical ideas that dominate the history of science, including those of Hobbes, Hooke, and Boyle. As such, women's writing exemplifies, and thereby makes

visible to us, the role literature played in instantiating and normalizing the epistemological turn that governed new science.

CHAPTER 2

FICTIONAL FACTS AND ARTIFICIAL SYSTEMS: MARGARET CAVENDISH'S *BLAZING WORLD* AND THOMAS HOBBES'S *LEVIATHAN*

Fact and fiction in the early modern period were notoriously difficult to distinguish. Along with numerous others, John Richetti, Catherine Gallagher, Adrian Johns, and Michael McKeon have all shown how early novelists often relied on claims to historicity and facticity.[9] In this chapter I address how writers modeled their natural, social, and political environments by using the tropes and modalities of fiction. Locating an experimental modality in fictive discourse, John Bender writes: "fictions, be they hypotheses or novels, yield a provisional reality, an 'as if,' that possesses an explanatory power lacking in ordinary experiences" (*Ends* 22). This quality of fiction allows us to look at it as a kind of artificial system, which mirrors real systems by putting into play

[9] Looking at Charlotte Lennox's *The Female Quixote*, Bender examines "the new novel as a mode of fiction that dwells in fact" (*Ends* 24). Gallagher contends that it was as late as the midcentury that discourses of fictionality finally began to develop ("The Rise"). McKeon, examining a 1672 print catalog of books, too, notes "the absence of any will to distinguish 'history' and 'literature,' between 'fact' and 'fiction'" (*Origins* 26). Calling the novel a convenient label that represents twenty-first century assumptions about imaginative fiction, Richetti argues that the eighteenth-century novel played with the "still blurry" division of fact and fiction, "often presenting fiction as fact and dramatizing fact in ways we would find more appropriate to fiction" ("Introduction" 2). Similarly, Scholar and Tadie argue that fiction in early-modern parlance was not identified solely with the novel as we are wont to believe and that the term was polyvalent. This is not to suggest that the theorization of fiction and its relation to the world in which one lived were not on the minds of many long before the seventeenth century, as Aristotle's *Poetics* and Sidney's response testifies. It is to say, however, that fiction as an epistemological category was only loosely defined; consequently, fiction often encompassed history, natural philosophy, and political theory.

their essential elements and laws of operation. In particular, this essay tends to the construction of artificial systems in Thomas Hobbes's *Leviathan* (1651) and Margaret Cavendish's *The Description of a New World, Called the Blazing World* (1666). Because fiction organizes the workings of the social world and the natural order it provides a way to investigate what is essential to life. Consequently, examining the ways Hobbes and Cavendish use fictional modalities to create artificial systems enables one to examine what Hobbes and Cavendish identified as the most essential elements of life. For Hobbes the essential can be found in the state of nature and for Cavendish in "the most pure, that is, the rational parts of Matter" (*Blazing* "Epilogue").

Leviathan, which represents a systematic account of civil science according to Hobbes, is indisputably a work of non-fiction; it depicts a demonstrative and causal account of society that, Hobbes, believes, all knowledge should be premised on.[10] And yet, as Quentin Skinner writes, *Leviathan*'s effects are strikingly different from the "self-consciously scientific austerities" of the earlier work it borrows from: most notably Hobbes's *The Elements of Law* (1640) and *De Cive* (1642) (4). Within it, Hobbes employs metaphor, analogy, and simile—hallmarks of the humanist rhetoric he had previously rejected—to a much greater degree than before. Victoria Kahn too notes the differences, writing that the first contract of *Leviathan* is not a political but a literary contract, thereby emphasizing "the fictional dimension of contract to a greater degree than before" (*Wayward* 6). Likewise, Patricia Springborg notes that "between the *Elements* and *Leviathan*, Hobbes had refined his theory [of psychological empiricism] to

[10] As Hobbes describes in *The Elements* and *De* Cive, scientific demonstrations follow three basic steps: 1. ensuring that definitions and names are consistent; 2. creating syllogisms; and, 3. linking propositions (qtd. in Skinner 295-296).

provide a role for outrageous fictions" (276). Not surprisingly, then, within the text Hobbes also reevaluates the roles that fancy and judgement play in scientific demonstrations; rather than merely oppose them, he describes them as mutually constitutive. For Hobbes, fancy and imagination represent the residue of sensory information that can be combined and recombined in several ways to create similitudes. Hobbes therefore upholds the empiricist view that "there is no conception in a man's mind, which hath not at first, totally, or by part, been begotten upon the organs of sense. The rest are derived from that original" (*Leviathan* 13). To that, however, Hobbes adds the element of language: arguing that understanding is "nothing else but a conception caused by speech" (*Leviathan* 30).[11] While recognizing that words and the reality they represent are fully human constructions, Hobbes also recognizes that they shape the way we live, act in, and perceive the world.[12] As Kahn explains, "the displacement of the object by the subject's imagination or fancy means that nature itself is the product of our imaginative construction" (*Wayward* 144). In contrast, to have sound judgement or reason is to observe differences rather than similitudes, "which is called *Distinguishing*, and *Discerning*, and *Judging* between thing and thing" (Hobbes, *Leviathan* 51). For Hobbes, judgement is the faculty that enables scientific demonstration. In *Leviathan*, however, Hobbes upholds the use of fancy, writing: "In demonstration . . . Judgement does all; except sometimes the understanding have need to be opened by some apt

[11] For more on Hobbes's conception of sense and imagination, see Gert.
[12] Engells argues that for Hobbes, the imagination is a faculty that "actively forms our conceptions of the world, and, compounded and regulated to form an end or design governing its function, it becomes the process of artistic creation" (15). For more on Hobbes's distinction between language, marks, and natural and artificial signs, see Nerney.

similitude; and then there is so much use of Fancy" (52). While many scholars have begun to point to the literary and rhetorical facets of *Leviathan*, fewer have explored how Hobbes bolsters his conception of artificiality, which is integral to his civil philosophy, through fictional modalities.[13] Even fewer have addressed the implications of it on Hobbes's conception of life. Hobbes not only creates a space for fancy within scientific treatises but relies on it to erect what is essentially a system of artificial life: the commonwealth.

Like Hobbes, Cavendish, too, does not believe that nature can ever be fully known. However, for Cavendish nature is incomprehensible because man "himself is part of her" (*Observations* II.7: 24). As such, she too relies on fancy, turning her attention "from a Natural World, to an Artificial" one in *Blazing World* (96). Within the text Cavendish narrativizes the philosophical views that she laid out in her companion piece, *Observations upon Experimental Philosophy,* through the tale of shipwrecked woman who becomes Empress of a previously unknown world. In perhaps the narrative's most fantastic twist, the Empress is later joined by the Duchess of Newcastle who, under the guidance of immaterial spirits, learns how to create her own worlds. Although Cavendish, like Hobbes, indemnifies much of her argument through similar claims to pure rationality, her philosophy's fictional modalities are premised on pantheistic and vitalist, rather than mechanistic, assumptions. Because "Nature is but one Infinite Self-moving Body" it is in a state of constant flux and therefore cannot be understood through rigorous demonstration (*Blazing* 48). Instead, Cavendish forwards her discussion through overtly

[13] Recent work on Hobbes and artifice include Prokhovnik;, the 2015 special issue of *Hobbes Studies* 28, no.1, which features articles on Hobbes, nature, and artifice; Epstein; and Cooper.

and purposefully constructed fictional tropes. Unlike Hobbes, who attempts to distance himself from this philosophical-fictional quagmire, Cavendish embraces it. As Diana Barnes has argued, Cavendish sees imagination and reason as "two different elements in a unified system" (161). Consequently, Cavendish sees fiction is an alternative model for understanding the natural world not because of its persuasive power but because it emulates rather than parses nature.

In the first section I explore the concept of artificiality through the figures of Francis Bacon and Hobbes. As has been well documented, Hobbes not only served briefly as an amanuensis for Bacon but was influenced by much of his thinking.[14] Although Bacon and Hobbes frequently place "artificial" in opposition to "natural," they regularly complicated the relationship between the two, mapping artificial experience onto natural phenomena to isolate and examine them. As I argue in the second section, Hobbes's use of metaphor, which elides, or, at the very least, evades the differences between natural beings and automata reflects his revision of the natural/artificial dichotomy. As he moves from theorizing the commonwealth as an artificial body to theorizing the social body and legal persona, artifice and fiction merge; the covenant he relies on to make his case for government is simultaneously both. Although Hobbes uses fictional tropes to imbue *Leviathan* with explanatory power, he continues to insist that the text represents a purely systematic and scientific approach consistent with his mechanist philosophy. Cavendish, on the other hand, embraces fancy, repackaging *Observations upon Experimental Philosophy* in its fictional form. In the final section I argue that

[14] In *The Cambridge Companion* alone Tuck, Sorrell, and Malcolm "A Summary Biography" all make mention of Hobbes's relationship with Bacon. For a more detailed account of Hobbes and Bacon, see Bunce.

Cavendish employs fiction in much the same manner as Hobbes. Because her understanding of the natural world was premised on a version of pantheistic vitalism, however, she does so to a greatly different effect. Ultimately, this chapter aims to shows how, despite their different world views, both Hobbes and Cavendish offer extended inquisitions on theories of life and fiction that are based on the belief that living systems are best comprehended in their artificial forms.

2.1 CONCEPTIONS OF ARTIFICIALITY: FRANCIS BACON AND THOMAS HOBBES

In *Novum Organum* (1620) Bacon highlights an Aristotelian understanding of the dichotomy between art and nature.[15] Writing that "the secrets of nature reveal themselves more clearly under the vexations of art than when they go their own way," Bacon retains a distinction between the two that is premised on polarization (*Works* IV.1: 95). While art can help to reveal nature, it is separate from it. Within the same sentence, however, Bacon begins to blur the divide by aligning artificiality—the purposeful manipulation of natural phenomena as well as the creation of man-made systems that mimic nature—with experimental practice. Because artificiality provided a way to tease out properties that are otherwise intangible, it was instrumental to his reform; as Bacon writes, "things which strike the sense outweigh things which do not immediately strike it, though they be more

[15] As laid out by Aristotle's *Physics*: plants, animals, and simple bodies ("earth, fire, air, water") are natural because "each of them has *within itself* a principle of motion and of stationariness." By contrast, "a bed, and a coat and anything else of that sort, *qua* receiving these designations—i.e. in so far as they are products of art—have no innate impulse to change" (II.9: 236). As such, art could imitate nature but never surpass her because it did not possess internal principles of change and reproduction. However, as practices of grafting and other forms of fusing art and nature became more widely accepted, even if only under the auspices of wonder, alternative views became possible. See Daston and Park, especially pp. 255-301.

important" (*Works* IV.1: 58). For Bacon, there are several acceptable means of "conveyance"—bringing things to the senses—including adding or substituting something to an object if it cannot be seen ("as in communication by beacons, bells, and the like"); bringing to the surface things that are otherwise emerged ("thus the condition of the human body is known by the state of the pulse, the urine, and the like"); or, more commonly, investigating complex phenomena by breaking them into their constituent parts (*Works* IV.2: 194-195). Using milk as an example of a complex body, Bacon writes that the separate elements comprising it, "butter, curd, whey, &c.," "are made manifest to the sense by artificial and skillful separations" (*Works* IV.2: 194-195). Although Bacon advocates throughout *Novum Organum* the principles of induction, he here emphasizes the integral role of artificiality to inductive processes. In its early-modern instantiation, artificial is not simply used in opposition to nature but also points to invention and system, which is why Bacon is able to assert that "by art and the hand of man [nature] is forced out of her natural state, and squeezed and moulded" (*Works* IV: 33).[16] By squeezing and molding nature Bacon is essentially modeling it, breaking down complex, natural bodies, such as milk, so as to identify and study the operations of their particulars. In so doing, Bacon fuses the artificial with the natural, creating and studying artificial systems in order to better understand their natural counterparts.

Describing experimentation, Bacon further argues that it is only such "nice tests of bodies whether natural or artificial . . . [that can] make manifest to the sense things not

[16]As Prokhovnik explains, in the seventeenth century "artificial" retained its positive classical and medieval association with "imitation" and had begun, by mid-century, to refer positively to systems and classifications as well as mechanical construction and manufacture (79).

directly perceptible, by means of those which are" (*Works* IV.2: 200). Asserting that experimentation is the only way to isolate and thereby understand natural phenomena, Bacon directly links experimentation to artificiality. In so doing, Bacon propounds studying a man-made version of nature, infusing that which is artificial into his observations of the natural world. As Richard Bauman and Charles Briggs write: "Bacon played a key role in the invention of nature, in the carving out of a domain that excluded humans and simultaneously seemed to be made just for them—to harness and control for their own mental and material progress" (19). Consequently, Bacon sees art as a "species of natural history": although "it is the fashion to talk as if art were something different from nature . . . things artificial differ from things natural not in form or essence, but only in the efficient" (*Works* V: 506). Therefore, to omit "the experiments of the mechanical arts" from the history of animals and plants is to commit an egregious error (*Works* V: 506). While Bacon uses the term "artificial" straightforwardly as an antithesis to "natural," he implicitly subverts that distinction through his experimental philosophy.

Bacon's philosophical thought encompasses all sorts of artificiality broadly constructed. In *The New Atlantis* (1627), for example, Bacon turns to imaginative writing to create an artificial environment, peppering it with objects that represent natural and artificial phenomena as well as objects in which the two are conjoined. The House of Solomon contains caves used for "the imitation of natural mines; and the producing, also of new artificial metals" (29), "a number of artificial wells and fountains, made in imitation of the natural sources" (30), orchards in which trees are made "by art . . .to come earlier or later than their seasons" (30), "birds and beasts which we use not only for

view or rareness, but likewise for dissections and trials" (31), and so forth. In Bacon's utopian vision, nature is perfected by and best studied through artificial means.

Just as artificiality is critical to Bacon's research institute, it is also key to his narrative development, explaining, perhaps, why Bacon turned to fiction to illustrate his scientific ideal. As Erin Kathleen Kelly has recently argued, narrative functions much like Bacon's inductive process which "moves constantly between the paratactic mode of the list and the hypotactic mode of narrative" (149). Bacon's lists, aphorisms, and "tables of discovery" organize information, or "particulars," but do not lead to conclusions (*Works* IV.I: 96).[17] Instead, they point to the incomplete, communal, and provisional nature of knowledge. In contrast, narratives, like lists and aphorisms, represent experience by illustrating relationships between phenomena but can further illustrate how such relationships develop over time. For Laura Dassow Walls, fiction, like science, gathers together "heterogeneous elements into a chimerical gestalt," thereby "knitting together matter and meaning" (591-92). That is, narrative relies on and deploys particulars but contextualizes them in a broader, more generalizable scheme. Consequently, narrative works similarly to scientific practices as well as to artificial systems. And because it does, narrative, especially utopian narrative, is an ideal vehicle for imagining and constructing commonwealths.[18] Narrative deploys discrete and ostensibly known phenomena in order to model possible futures.

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[17] See also Zittel et al.

[18]As Kelly writes, utopias are both "no-where and no-*when*" (163). As such, utopia is capacious enough to represent a host of possibilities not easily refuted. In Rees's words, utopian fiction "concentrates on what might be made of this world" thereby "reassess[ing] the basic definition of what it is to be human" (6). Consequently, utopian fiction throws into relief one's understanding of the world and the living systems that constitute it. For more on utopian fiction in general, see Holstun.

Like Bacon, Hobbes too seems to retain the distinction between nature and artificiality. For example, he uses it as the basis for separating philosophy into two branches—"Consequences from the Accidents of Bodies Naturall" and "Consequences from the Accidents of *Politique* Bodies"—and explicitly calls attention to the commonwealth as an artificial construction (*Leviathan* 61). Moreover, Hobbes's science, as with Bacon's, has much in common with the doctrine of resolution and composition that was developed by the Paduan school of philosophy in the sixteenth century (Jesseph 95). According to this theory, true knowledge is derived by first breaking complex phenomena into their constituent parts (which is necessarily an artificial act) and then reconstituting the whole from said parts, thereby leading to an understanding of the first causes and principles. Taken together, Hobbes's conception of analytic reasoning—which involved imaginatively breaking down (resolving) something into its component parts and common properties—and synthetic reasoning—adding the parts together (composing) to recreate the whole, usually by way of starting from right definitions—is notably similar. As Douglas Jesseph notes, Hobbes's method was not new; what was, was the way he phrased the difference between the two modes in terms of cause and effect: analysis "proceed[s] from effects to (possible) causes, whereas the synthetic mode of reasoning follows the natural causal order and moves from causes to effects" (93). For Hobbes, demonstration is synthetic and hence the proper method of teaching; however, because analysis allows one to arrive at universal principles from which synthetic reasoning begins, it is the necessary starting point.

Unlike Bacon, however, Hobbes elevates artificiality, seeing it as a valid system in and of itself rather than a technology that aids in experimentation. For Raia

Prokhovnik, "the concept of artifice is central, as a constituent part of his theorizing" (75). Likewise, Gary Browning writes that Hobbes, as a political theorist, "stressed the role of artifice in developing a political association" (14). Indeed, artifice is not simply a critical component to the theory Hobbes lays out in *Leviathan* but is crucial to his overall philosophical endeavor, as his embrace of Euclidean geometry demonstrates. Euclidean geometry represented, for Hobbes, the height of demonstrative knowledge; it proceeds from carefully defined terms, the causes of which are fully known, because "the lines and figures from which reason are drawn and described by ourselves" (*Six* A2r) to "Conclusions [that] have hereby been made indisputable" (*Leviathan* 34). By contrast, the causes of natural phenomena are based on hypotheses because our knowledge of the natural world is gleaned through fancy, the causes of which, because they are representations in the mind, are internal. As Victoria Silver has noted, Hobbes embraced Euclidean geometry because "it constituted its own artificial truth. That is, once one enters the system of proof, its sheer internal coherence fashions the sense of a proposition's demonstrativeness" ("Hobbes" 332-333). Hobbes applied the insights he gleaned from geometry to his philosophical position writ large: one need only start from the right definitions in order to determine a phenomenon's properties and causes. Hobbes believed that his civil philosophy qualified as a demonstrative science because, as Jesseph writes, the commonwealth, like geometry, "is created by man, [therefore], its causes are fully knowable by men" (88). For Hobbes, artificiality leads to sound science and true knowledge.

Consequently, by describing the commonwealth as an "Artificiall Man" Hobbes is able to put forth what he considers an airtight theory and scientific demonstration of how

states come into being (*Leviathan* 9). The point Hobbes makes in his famous introduction, argues Noel Malcolm, is not that the commonwealth resembles a man but that it is artificial. Like the watch Hobbes compares it to, the commonwealth he imagines is a human artifact (*Aspects* 150-152).[19] As Hobbes was well aware, to imagine such a government, perhaps any form of government, is to knowingly engage in an act of creation. After all, Hobbes wrote *Leviathan* while attending the exiled court of Charles II and the outcome of the Civil Wars in both England and France were uncertain. *Leviathan* therefore catalogs with great precision a society that did not exist. As Tom Sorrell writes, *Leviathan* was meant to show "how a state *ought* to be constructed to last, and not how a short-lived actual state is in fact constructed" (58). In order to do so Hobbes, like Bacon, relies on an opposition between nature and artifice.

However, Hobbes's commonwealth is premised on what only *seems* to be a binary between the natural and the artificial. Within the opening pages of *Leviathan* Hobbes effaces the dichotomy between the two in ways that align with his mechanistic conception of life. Conflating nature and art, Hobbes writes:

> Nature (the Art whereby God hath made and governes the World) is by the *Art* of man, as in many other things, so in this also imitated, that it can make an Artificial Animal. For seeing life is but a motion of Limbs, the beginning whereof is in some principall part within; why may we not say, that all *Automata* (Engines

[19] According to Malcolm, artifacts require "not just a different level of description but a different kind of description [than natural bodies]: description in terms of intentions" (*Aspects* 150). Malcolm's point in this particular chapter is not to address the commonwealth as an artifact but, rather, Sorrell's argument that Hobbes does not present a deductive scheme of the sciences.

> that move themselves by springs and wheeles as doth a watch) have an artificiall life? (9)

Because nature is God's "Art," the world is natural to man and unnatural to God. Through this association Hobbes both obscures and lays bare the etymological relation of art as a skill and practice that transforms what is natural to something unnatural. By doing so, Hobbes is able to assert that "the Pacts and Covenants, which the parts of this Body Politique were at first made, set together, and united, resemble that Fiat, or the Let Us Make Man, pronounced by God in the Creation" (*Leviathan* 9). With this pronouncement Hobbes creates, as Jeffery Epstein argues, a system that is "both greater than and an exact replica of the natural human body," thereby muddling the divide between nature and artifice that his very theory relies upon, in effect naturalizing sovereignty (133). Hobbes reinforces the simultaneously natural and artificial nature of the commonwealth through a similar analogy. Writing of the "*Infirmities*" that can infect commonwealths, Hobbes turns from the natural body to the "diseases of a natural body, which proceed from a Defectuous Procreation" and "vicious conception" (*Leviathan* 29-30). Read in conjunction with Hobbes's earlier analogy, a weak sovereignty can, Epstein explains, be seen as "the offspring of sickly parents" (137). Whether weak or strong, Hobbes's sovereign is therefore "*conceived* of as an artificial thing that is posited and simultaneously *conceived*, naturally, as is the child in the womb" (Epstein 137). In both cases, the mechanism of life underscores the ambiguity of the natural/artificial dichotomy and calls into question its presumed self-evidence.

Further, Hobbes's understanding of nature as God's art enables him to describe nature in mechanistic terms: everything is reducible to completely mechanical principles

of motion and collision of matter. All phenomena can be explained in terms of mechanical laws. Hobbes was influenced by this view early on. In his description of a trip taken to Italy with the earl of Devonshire in 1635, Hobbes writes that he:

> began to think about the nature of things all the time, whether I was on a ship, in a coach, or travelling on horseback . . . I came to the conclusion that there is only one thing in the whole world which is real [motion], although it is undoubtedly falsified in many ways . . . which is why anyone who wishes to understand physics must first of all make a study of the laws of motion. (qtd. in Skinner 253)

Not surprisingly, then, Hobbes claims that life is nothing more or less than "a motion of limbs," which, in turn, enables him to equate man-made objects, like automata, with biological objects, like men (*Leviathan* 9). God's creations are different from man's creations only in degree, not in kind.[20] Consequently, Hobbes suggests that the "*Art* of man" is as natural as the art of God (*Leviathan* 9).

With this assertion Hobbes effaces the practical distinction between automata and men, artificial and biological bodies. In so doing, he echoes and amends Descartes who, in a 1649 letter to Henry More, writes: "since art copies nature, and people make various automatons which move without thought, it seems reasonable that nature should even produce its own automatons, which are more splendid than artificial ones—namely the animals" (Cottingham 366). Although using a similar line of reasoning, Hobbes diverges from Descartes by flipping the script. If men are "Engines that move themselves by springs and wheeles as doth a watch," then both man and machine can be understood as

[20] Hobbes rejects the Aristotelian separation between nature and art and, as Dear notes, sets up "situations in which nature will produce a desired result—so that art is the human exploitation of nature rather than an activity outside of nature" (*Discipline* 155).

forms of life (*Leviathan* 9). That Hobbes's man-machine metaphor is multidirectional reinforces and highlights this somewhat outré claim. As Terrel Carver points out, it works both ways—the commonwealth is comparable to a man and the heart to a spring (126-127).

Hobbes's equation of man and machine hearkens back to an earlier variant of mechanist philosophy. Fictional and actual automatons were by no means a seventeenth-century invention. Immensely popular in medieval churches and cathedrals, automatons dotted the landscape, becoming attractions for tourists across the continent. As Jessica Riskin writes, medieval automata were primarily religious in nature, ranging from mechanical devils and angels to the especially popular mechanical Christ. Given their close association with the Catholic church, mechanical beings were not considered artificial mechanisms devoid of spirit. Instead, automatons were thought to exhibit a vital and divine agency (*Restless Clock*). In its earliest instantiation, then, mechanistic philosophy was imbued with agency that it would come to lack in the seventeenth century. Hobbes's formulation thereby opens up a space in which to investigate life and the workings of the inaccessible but ever-present natural world.

The automaton was not merely an apt metaphor for Hobbes. It was the material and readily accessible product of a set of theoretical suppositions that Hobbes put into play in *Leviathan.* Automata were objects of curiosity and esteem precisely because they were more than just fabrications; by simulating living organisms they provided a way to comprehend natural systems of life. As Risken notes in her explication of Jacques Voucaonsone's digesting duck, automata should not be understood as just simply representations. "Powered by a weight wrapped around a lower cylinder, which drove a

larger cylinder above it," Voucaonsone's mechanical bird simulated the motions of a duck and, most notably, ate bits of corn and grain that it later expelled ("Defecating" 605).[21] His flute player was likewise designed to model biological processes. More than a musical box encased in the hollow facade of a man, Voucaonsone's flute player was an experiment in the theory of acoustics as well as the potential of mechanical simulation; as such, it "played a real flute, blowing air from its lungs and exercising soft, flexible fingers, lips, and tongue" (Riskin, "Defecating" 613). Simply put, what Voucaonsone did with mechanical parts Hobbes attempted to do with words: he created an artificial system that parallels the processes of natural systems.

As the above discussion has shown, the divide between the artificial and the natural was evoked in traditional ways only to be simultaneously complicated. While Bacon upheld the notion that what is natural is that created by God, he simultaneously forwarded a program of scientific study that allowed one to parse nature. In essence, Bacon overlaid the necessarily artificial experience of natural phenomena onto them in order to bring them to the senses. For Hobbes, on the other hand, what is natural and what is artificial are two sides of the same coin. Because nature and the life forms it

[21] Although the swallowing mechanism of Vaucanson's duck was later revealed to be fraudulent—the grain did not travel into the stomach but stayed at the base of the mouth—it was otherwise a genuine imitation: "all the Duck's movements (except the one just mentioned) were modeled upon exhaustive studies of natural ducks" (Riskin, "Defecating" 609). In attempting to model the processes behind life rather than merely representing them, Voucaonsone practices an early version of what we would today call the science of artificial life (Alife). In its simplest conception, Alife is concerned with constructing life in an artificial medium, thereby understanding the general principles that govern the living state. In the words of Christopher Langton, one of the principal founders of Alife, "you used computers to model basic biological mechanisms of evolution and life itself"—a process that requires abstracting life's essential laws of operation (qtd. in Waldrop 201).

encompasses are nothing more than God's art, man-made objects can also be forms of life. This insight enables Hobbes to view social relations as artificial and to thereby understand our experience of everything as unnatural.

2.2 RHETORIC AS REALITY IN *LEVIATHAN*

In the section above I discussed the way in which artificiality was constructed and complicated in the early modern period. This section explores how Hobbes uses fictional modalities to forward his theory of government. As Hobbes turns from artificial to social bodies, he moves from artifice to fiction. Although careful to distance himself from what he describes as the pernicious effects of language, Hobbes simultaneously employs affective language.[22] As he argues, "there are few things, that are uncapable of being represented by Fiction," including the commonwealth (*Leviathan* 113). The way in which he does so, however, is consistent with his larger thinking about poesis and imagination, which, Skinner asserts, is most clearly theorized in his "Answer" to Davenant's poem (333). In "The Answer," Hobbes argues that fancy "consisteth not so much in motion, as in copious Imagery discreetly ordered, and perfectly registered in the memory," yet he situates it alongside judgement (131). Likewise, in *Leviathan* Hobbes writes: "Judgement begets the strength and structure, and Fancy begets the ornaments of a poem" (483). When guided by "the Preceps of true Philosophy," however, fancy serves as more than mere "ornament"; it can produce "very marvellous effects to the benefit of mankind" so long as it does not exceed "no other than such as an imitation of human life requireth" ("The Answer" 131-132). Consequently, fancy can be part of a philosophical enterprise

[22] For a thorough account of Hobbes's use of rhetoric, see Skinner.

and in *Leviathan* Hobbes uses it accordingly, creating a fictional reality—an imitation of human life—in order to critique his contemporary reality and model an alternate future.

As such, the commonwealth Hobbes creates is not only represented by but dependent upon a fiction. As he writes in his appended letter to Francis Godolphin, "I speak not of the men, but (in the Abstract) of the Seat of Power" (*Leviathan* 3). His notion of a sovereign representative is therefore based on an "artificial man," which, in turn, enables him to elaborate on his definition of what constitutes a person:

> he, whose words or actions are considered, either as his own, or as representing the words of actions of an other man, or of anything to whom they are attributed, whether Truly or by Fiction. When they are considered as his owne, then is he called a *Naturall Person:* And when they are considered as representing the words and actions of an other, then is he a *Feigned* or *Artificiall person*. (*Leviathan* 111)

In his explication of Hobbes's theory of authorization, David Gauthier rightly points out that Hobbes's "artficiall person" is not "a non-human entity given in law the status or partial status of a man, but rather a real man or group of men, considered as representing some other man, group, or thing" (121). Nevertheless, in Hobbes's definition of the natural and the artificial person, Hobbes conflates fiction with artificiality. The artificial man that emerges through the covenant is reliant upon a conceptual transfer of rights, an authorization that occurs through an imaginative act and exists in words rather than material exchange. And it is this conflation that strengthens his discourse of a legal persona.[23] The commonwealth becomes, in Hobbes's description, an automaton; it is a

[23] As Skinner notes, Hobbes's addition of artificial persons is an important refinement to his concept of the legal persona he had already introduced in *The Elements* and *De Cive*. According to Skinner, it enabled Hobbes to "insist even more firmly that any attempt to

single body who "maintains his resemblance with the Naturall; whose Veins receiving the Bloud from the severall Parts of the Body, carry it to the Heart; where being made Vitall, the Heart by the Arteries sends it out again, to enlive and enable for motion all the Members of the same" (*Leviathan* 175). Through metaphor, Hobbes highlights the man-made nature of the commonwealth and, in so doing, the way in which the commonwealth represents both artificial and fictional constructs.

This artificiality is indicated most strikingly in the book's famous frontispiece (see Figure 2.1). Prominently featuring a crowned man, the body of whom is comprised almost entirely of other people, *Leviathan*'s title page is monstrous in its representation, not only abnormal in size, but also impossible in nature. Connecting the monstrous blazon to the Gallic Hercules—the mythical rhetorician who, as described by Lucian, "drags after him a great crowd of men who are all tethered by the ears"— Springborg calls the frontispiece "artful in the double sense of being constructed by art and using the art of rhetoric as his medium" (281). By contrast, Malcolm and Skinner posit the "perspective glass"—a tube with a faceted lens that reveals fragments of a scene—as Hobbes's inspiration (Skinner 288; Malcolm "The Title Page").[24] Their assertion is corroborated by Hobbes's "Answer," which, Skinner writes, "strangely foreshadows" the frontispiece (388): "I believe (Sir) you have seen a curious kind of perspective, where, he that looks through a short hollow pipe, upon a picture containing diverse figures, sees none of those that are painted, but some one person made up of their parts, conveyed to the eye by the artificial cutting of a glass" ("Answer" 144). In either case, the engraving,

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questions his inferences will lead to self-contradiction, and will thus give rise not merely to error but to absurdity" (337-338).

[24] For more on the perspective glass, see Terpak.

which was produced by Hobbes's printer, Andrew Crooke, suggests that Hobbes's explanation of the commonwealth could not be represented nor recognized in anything other than artificial and mythic, i.e., fictional, terms.

Hobbes signals the social body's fictionality in subtler ways as well, systematically employing the art of *elocutio* throughout *Leviathan.* With his frequent use of the subjunctive clause "as if," Hobbes carefully marks his fictions as fiction while ensuring that what precedes or follows the "as if" can only be accepted as truth.[25] For instance, in writing "Of the Causes, Generation and Definition of a Common-Wealth" (117) Hobbes says: "This is more than Consent, or Concord; it is a reall Unitie of them all, in one and the same Person, made by Covenant of every man with every man, in such manner, *as if* every man should say to every man, '*I Authorise and give up my Right of Governing my selfe*'" (120; first emphasis mine) In so doing, Hobbes echoes Sir Phillip Sidney who, Judith Dundas writes, uses the phrase "as it were" to separate "the logic of his argument from his metaphorical illustrations in the *Apology*; or, in the *Arcadia*, to separate his verisimilar narrative from his metaphorical excursus" (271). While Hobbes distinguishes his metaphorical and fictional truths from an independent reality, he does so in order to guarantee that the notion of a commonwealth as a "reall Unitie of them all" is indisputable in definition. As Peter Dear asserts, when people treat them as such "metaphors . . . tend to turn into practical identities," and the fictional and artificial body become one and the same (*Discipline* 159).

Not without precedent, Hobbes's coercive argumentation follows the advice of ancient rhetoricians. Just as Quintilian argues for the use of phrasing such as "that I may

[25] A key-word search of *Leviathan* yields 66 occurrences of the phrase "as if."

express myself" to excuse "expressions which are too daringly metaphorical," Cicero asserts that metaphor, especially when deployed in prose, "ought to be introduced with *diffidence*" (qtd. in Dundas 272). Following Aristotle, who argued that "it conferres also to perswasion very much to use these ordinary forms of speaking, *All men know; Tis confessed by all; No man will deny* and the like," Hobbes likewise variously describes his propositions as "universally agreed upon" or that "all men agree on this" (qtd. in Skinner 381-382).[26] As such, Hobbes's writing resembles the writing of those he admonishes: those "Greek, and Latine Authors, [from whom] men from their childhood have gotten a habit (under a false shew of Liberty,) of favouring tumults, and of licentious controlling the actions of their Soveraigns" (*Leviathan* 150). Naming Cicero, Aristotle, and others by name, Hobbes demonstrates, in his admonition, more than a passing familiarity with their work. And indeed, Hobbes had more than a passing familiarity with the rules governing classical rhetoric.[27]

Enacting his theory on verbal constructs that can only impersonate truth, Hobbes "invents," as Silver argues, "a comprehensive, systematic account of human society and

[26] Hobbes's technique did not go unnoticed among his contemporaries. John Wallis, for example, scathingly noted that Hobbes can "by a *Manifestum est*, save him the trouble of attempting a Demonstration" (qtd. in Skinner 381-382). Likewise, in 1672 John Eachard characterized Hobbes's work as being "tailed together by far fetched contrivances" (qtd. in Sommerville 247).

[27] In addition to receiving a traditional humanist education, Hobbes published a translation of Thuycides's *History* in 1629 and, as tutor to the earl of Devonshire, published the earl's *A Briefe of the Art of* [Aristotle's] *Rhetoric* in 1637. Further, Hobbes closely echoes Cicero at various points in *Leviathan*, especially in his presentation of *oratio* and *ratio*. For more on Hobbes and Cicero, see Skinner, 351-353 and Silver, "Hobbes"; for Hobbes, history, and his translation of Thuycides, see Borot; for Hobbes and Aristotle's *Rhetoric*, see Rayner.

government," that is, "a science of words, not of facts" ("The Fiction" 356).[28] While Hobbes's theory masquerades as truth, it is nothing more than, in Silver's words, "rhetoric realized" ("The Fiction" 356). Arguing that a man who locks his doors and chests "accuse[s] mankind by his actions, as I do by my words," Hobbes equates rhetoric and reality because their implications are so similar (*Leviathan* 89). For Hobbes language constructs reality as we live it; consequently, reality as we experience it is an artificial system that simply mirrors living, natural systems.

Describing "Law" as that which makes "Sin[ful]" the "Desires, and other Passions of Man," Hobbes argues that words create legal constructs which are then codified in practice (*Leviathan* 89). As relative, artificial constructs disconnected from an independent reality, legal sanctions shape the actions of man and the way in which man perceives the world. Although not denying the existence of an independent reality, Hobbes hereby argues that we have no access to it: what is natural to man is unnatural to God. This is why he advises his "Counsellour" to "propound his advise, in such forme of speech, as may make the truth most evidently appear": that is, "with as firm ratiocination, as significant and proper language, and as briefly, as the evidence will permit" (*Leviathan* 179). While alluding to the existence of truth, Hobbes simultaneously suggests that it is a facet of language and reasoning—reinforcing his earlier point, "that truth consisteth in the right ordering of names in our affirmations" (*Leviathan* 28).[29] In emphasizing the "forme" that speech takes, Hobbes throws into relief the way in which language is a

[28] Citing *De Cive*, Hequembourg likewise notes that Hobbes's political systems relies upon the transference of power by a figure of speech (101).
[29] For more on Hobbes and truth, see Duke; De Jong; and Duncan.

conduit that shapes perceptions of reality, suggesting that reality can be manipulated through speech, for example, through the use of law.

Although arguing that "The force of Words" is "too weak to hold men to the performance of their Covenants" and thus must be backed by the sword, Hobbes nevertheless renders words powerful enough to create commonwealths (*Leviathan* 99). Additionally, Hobbes cautions against the way in which words incite war and lead to the dissolution of commonwealths, naming "the Reading of the books of Policy" as "one of the most frequent causes" of "Rebellion in particular against Monarchy" (*Leviathan* 225). Hobbes would have been all too aware of this given the time in which he was writing. As Joad Raymond has argued, the pamphlet culture of the 1640s inflamed political instability between the King and parliament. An easily printed and disseminated form, pamphlets brought together previously disconnected material, allowing for an amalgamation of information that was used in the service of partisan politics and fomenting rebellion.[30] Hobbes, himself, fled to the Continent fearing reprisal for his royalist tract, *The Elements of Law*, which had been circulating in manuscript form. Further, Hobbes attributes his decision to publish *De Cive* (1642), which was intended to be the third section of his conceived *Elements of Philosophy*, before the first two: *De Corpore* (1655) and *De Homine* (1658) to the same unrest.[31] Clearly Hobbes understood that words divorced from the sword are powerful in their own right.

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[30] See also Zaret; Zwicker; and Nigel Smith.

[31] In the Epistle Dedicatory to *De Cive*, Hobbes writes: "Whilst I contrive, order, pensively and slowly compose these matters (for I only do reason, I dispute not), it so happened in the interim, that my country some few years before the civil wars did rage, was boiling hot with questions concerning the rights of dominion, and the obedience due from subjects, the true forerunners of an approaching war; and was the cause which (all other matters deferred) ripened, and plucked from me this third part" (qtd. in Herbert 6).

In brief, Hobbes adopts fictional modalities and rhetorical principles to manipulate a reality that is feigned but that, nonetheless, has profound political consequences. By writing of the state of nature as if it were self-evident in a philosophical treatise whose form aspires to an impersonality equated with objectivity, Hobbes constructs an artificial system while masking that it is a construction.

2.3 RETHINKING *LEVIATHAN*: FICTION AS REALITY IN *BLAZING WORLD*

Despite their personal differences, Cavendish's natural and political philosophy belies a closer alliance with Hobbes's view of nature than either were wont to admit.[32] For Anna Battigelli, "the figure of Thomas Hobbes looms behind Cavendish's work" (63).[33] Despite her rejection of mechanism, Cavendish, like Hobbes, is thoroughly materialist and believes that true knowledge is based in reason rather than in sensory information. However, her theory of motion, which is fundamental to her theory of nature, marks a stark divergence from Hobbes's mechanistic philosophy. Whereas mechanism ascribes change to external force, Cavendish sees it as the internal

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Sorrell, in particular, questions Hobbes's assertion that his three parts were meant to be connected, suggesting that Hobbes's political science and natural science should be considered independently.

[32] In a 1662 letter to Cavendish Hobbes expresses surprise that she would consider him a friend, suggesting a frosty relationship between the two. However, Hobbes "was an intimate though unofficial member of [the Cavendish] household, having been for years a deeply valued friend of her husband, William Cavendish" (Battigelli 64-65). Reese, too, notes their connection, writing that during the years of exile Cavendish made many intellectual contacts through her brother-in-law, Charles Cavendish, including that of Hobbes and Descartes. More than just intellectual acquaintances, Hobbes and William Cavendish were, as members of the Virginia Company, business partners. For an extended discussion on Hobbes's work as secretary to William Cavendish, see Malcolm "Hobbes, Sandys."

[33] For Hutton, Cavendish's criticism of Hobbes and mechanistic philosophy points not necessarily to a difference between their thinking but rather to a close familiarity and that at its base, Cavendish's pantheistic vitalism is materialist.

reconfiguration of the three degrees of matter (rational, sensitive, and inanimate). As Anne Thell explains, for Cavendish everything in nature is composed of rational and sensitive matter (the combination of which makes up animate matter) as well as inanimate matter. Rational matter thinks, that is, it "conveys to the parts general knowledge of the whole" while sensitive matter works, that is, "it follows the instructions of the rational and carries or moves the entire tri-partite apparatus" (9). Because the three degrees of matter are commingled and interdependent all of nature operates as a unified, self-knowing, and self-moving whole—or, as Thell writes, "something like a living cell network" (9). As such, Cavendish understands everything in nature to be intelligent and self-perceptive, whether it is the imagination or a stone. This enables Cavendish to assert that fancies take a material form: they are "not No-things, but as perfectly imbodied as any other Creatures; but by reason, they are not so grosly imbodied, as those creatures that are composed of more sensitive and inanimate matter, man thinks or believes them to be no bodies" (*Philosophical* 448). While recent scholars have begun to recognize the link between the natural and political philosophies of Hobbes and Cavendish, few, with the exception of Thell, have examined the way in which fiction and artificiality is integral to both authors' theories of government.

Whereas Bacon mapped artificial experience onto natural phenomena and Hobbes conflated the distinction between nature and artificiality, Cavendish staunchly upholds the dichotomy. For her, artificiality is, in its most insidious form, "chopt Logick," which she contrasts to reason or, in her terms, "natural wit" (*Blazing* 58). In her conference with the Blazing World's orators and logicians, the Magpie-, Parrot- and Jackdaw-men, the Empress emphatically declares that:

> Art does not make Reason, but Reason makes Art; and therefore as much as Reason is above Art, so much is a natural rational discourse to be preferred before an artificial: for Art is, for the most part irregular, and disorders Men's understandings more then it rectifies them, and leads them into a Labyrinth where they'l never get out, and makes them dull and unfit for useful employments. (58-59)

Voicing her assertion through the Empress, Cavendish excoriates artificiality in its form as rhetoric, going as far as to say that when employed in an attempt to comprehend nature, as Bacon and Hobbes advocate, "tis but a folly to think that Art should be able to regulate them [motions in Nature], since Art it self is, for the most part, irregular" (59). For that reason, Cavendish dismisses the mechanistic belief that mathematical descriptions of the natural world can provide certain knowledge.[34] Although the Empress holds her "Mathematicians" in "great esteem," she describes their "Imaginary points, lines and figures as Non-beings" (56). And, as the worm-men previously averred: "If it be no substance, it cannot have a being, and if no being, it is nothing" (73). For Cavendish, mathematical descriptions and Hobbesian rhetoric are of a kind because both conjure something from nothing, thereby *seeming* to represent the natural world but actually distorting it.

Instead, Cavendish offers an overtly fictional account of the world, which, because "framed and composed of the most pure, that is, the Rational parts of Matter,

[34] As Riell writes, the overarching goal of mechanism was to transform knowledge into a form that resembled mathematical principles. Pointing to Galileo, who says "the book of nature is written in the language of mathematics," Reill argues that mechanists were inspired to reduce things to "fixed, logically coherent principles" (*Vitalizing* 35).

which are the parts of [her] mind," is not only more real but, because a part of nature, more natural (*Blazing* "Epilogue"). Although often presenting herself as singular in mind, Cavendish is not alone in propping her philosophical beliefs on the ballast of fiction. Likening Cavendish's position to that of Aristotle's, Oddvar Holmesland argues that Cavendish's "'poetical description' is a means of transcending the limitations of empirical observation" (464). Gabrielle Starr too argues that fancy is, for Cavendish, an "epistemic tool, because the frontiers of knowledge are subject to imaginative vision alone" (298). Yet Cavendish's understanding of fiction is more sophisticated than Starr and Holmesland acknowledge. Fiction is not simply a tool for Cavendish; it represents, as she writes in *Nature's Pictures* (1656), "copies of nature, or natural copies" (103). As the latter phrasing suggests, fiction does not just mimic nature; it simulates and is a part of nature. Simultaneously, fiction has the capacity to extend beyond nature: "though Nature hath not only made this World, but may be thought, in reason, to have made many others, and so a world of Worlds; yet Wit creates, in its imaginations, not only Worlds, but Heavens and Hells, Gods and Devils" (*Olio* 6). As Melanie Holm writes, Cavendish's depiction of wit as a "process of natural (re)production" parallels her "vitalist portrayal of nature as a continual activity of creation, movement, and quickening" (14). Consequently, the fantastical, labyrinthine narrative that is *Blazing World* mirrors Cavendish's description of "Nature's Works": "so various and wonderful, that no particular Creature is able to trace her ways" (*Blazing* 51). For Cavendish fiction does not render an artificial depiction of nature but rather nature as it is and as it operates.

In the same way that Cavendish rethinks theories of fiction, she provides a more nuanced understanding of the concept of artificiality. Although Cavendish repeatedly

refers to the artificiality of the Blazing World, writing of "Pillars, so artificially placed, that a stranger would lose himself" (12) and of diamonds "so artificially [colored], as it seemed but of one piece" (12), as well as of "Artificial Glasses" (28) and "Artificial delusions" (28), she is careful to distinguish between types of artifice. In the latter two examples, "artificial" takes on an explicitly negative connotation. Art leads men from the "Sense and Reason" nature endowed upon them while also creating strife (49). The glasses to which Cavendish refers, telescopes and microscopes, are rendered "meer deeluders, [that] will never lead you to the knowledge of Truth" (27-28). They cause difference in opinion so unbearable to the Empress that she commands the bear-men to destroy them. This vignette has been read as an attack on the Royal Society and the emerging science of optics, in particular, as an attack on Robert Hooke's *Micrographia* (1665).[35] It is likewise an attack on Bacon's experimental approach to nature. In contrast to Bacon, Cavendish understood nature to be comprised of universal, self-moving matter. As the Empress tells her chemists, the Ape-men: "Nature is but one Infinite Self-moving Body, which by the vertue of its self-motion, is divided into Infinite parts, which parts being restless, undergo perpetual changes and transmutations by their infinite compositions and divisions" (48). For this reason, Cavendish rejects telescopes, microscopes, and other experimental devices designed to isolate and dissect various components of natural substances. In an almost direct response to Bacon, the Empress declares it "vain to look for primary Ingredients, or constitutive principles of Natural

[35] According to Spiller, Cavendish catalogs her ongoing disputes with the Royal Society in her *Observations upon Experimental Philosophy*. Using Hooke's *Micrographia* as a guide, Cavendish systematically disproves his arguments while simultaneously attacking, albeit indirectly, members of the Society (*Science* 152). See also Clairhout and Jung.

Bodies, since there is not more but one Universal Principle of Nature, to wit, self-moving Matter, which is the only cause of all natural effects" (7).

However, Cavendish does not condemn artificiality wholesale. Writing of nature as organic, material, in constant motion, and, above all, unifying, she sanctions artificial devices when their effects parallel nature's effect. When first describing the denizens of Blazing World, the Empress marvels over the construction of their ships' engines, calling it "an extraordinary Art, much to be taken notice of by Experimental Philosophers" (7). A machine that "would draw in a great quantity of Air, and shoot forth Wind with a great force," the engine is meant to simulate rather than dissect nature (7). Consequently,

> the artificial wind had the better of the natural; for, it had a greater advantage of the waves, then the natural of the Ships: the natural being above the face of the Water, could not without a down right motion enter or press into the Ships; whereas the artificial with a sideward-motion, did pierce into the bowels of the waves. (7-8)

Likewise, and for the same reason, Cavendish lauds the design of the ships themselves, which "were so ingeniously contrived, that they could fasten them together as close as a Honey-comb" (8). For Cavendish, artificial designs ought only to emulate nature; they cannot stand in for nature nor serve as a vehicle through which to understand nature. As she makes clear throughout *Blazing World*, any device that pretends to do otherwise is useless. Upon seeing the magnified images of a flea and a louse, for example, the Empress asks "Whether their Microscopes could hinder their biting, or at least shew some means how to avoid them? To which they answered, That such Arts were mechanical and below the noble study of Microscopical observations" (31-32). Although she stops short

of overtly saying so, Cavendish groups telescopes and microscopes among the "useless work" (52), "useless Inspections" (53), and "useless Fancies" (74) that she highlights throughout her text.

While Cavendish rejects artificiality as Hobbes and Bacon define it, she does not deny its utility altogether. Adopting many of the components of artificiality as developed by Hobbes, most importantly his conception of the legal persona, Cavendish, like Hobbes, creates a theory of artificiality that hinges upon her conception of life—a conception grounded in pantheistic vitalism. Using the worm-men to voice her views on natural philosophy, Cavendish writes that "Nature is Eternal and Infinite, and her particulars are subject to infinite changes and transmutations by vertue of their own Corporeal, figurative self-motions; so that there's nothing new in Nature, nor properly a beginning of any thing" (45). Although, as Holmesland explains, "turning to nature in search of a rational or moral principle was by no means a new notion" in the seventeenth century, Cavendish's view of self-moving matter is in direct contrast to Hobbes's view of matter as externally motivated (312). This departure is further amplified in her rejection of Cartesian dualism, which she underscores when she attempts to create a world according to Aristotelian thought: "remembering that her mind, as most of the Learned hold it, was Immaterial, and that, according to Aristotle's Principle, out of Nothing, Nothing could be made; she was forced also to desist from that work" (100). However, because Cavendish understands all natural entities as material she sees little difference between mind and matter. For Cavendish, productions of the mind *are* material, one instance of which is the text of *Blazing World*, itself. By this means, Cavendish is able to assert that her "natural wit" is both a product and a part of nature.

As such, Cavendish takes up Hobbes's insight that the legal persona functions, in the body politic, as a natural body to argue against him. Echoing and then amending Hobbes, who says a "Proper Name bringeth to mind one thing only; Universals recall any one of those many" (*Leviathan* 26), Cavendish writes that "the Title of a Prince is more a Title of Honour, then of sovereignty; for, as I said before, it belongs to all that are adopted to the Crown" (94). Consequently, the commonwealth, a feigned body headed by a feigned prince, and hence a Universal name, is no more real than an imagined empress. If all life is artificial, as Hobbes suggests, writing a utopian narrative to understand the world is only logical. Cavendish, rethinking what it means to be a living thing in the world, offers an alternative mode to artificiality, something more akin to what we now call "fictionality." Whereas Gallagher locates this epistemological shift in the mid eighteenth century, Cavendish, more than a hundred years earlier, adopts what Gallagher has described as the use of "a nonreferentiality that could be seen as a greater referentiality" ("The Rise" 372). In Cavendish's hands, fictionality no longer turns on its explicit connection to examples in the world but, in Gallagher's terms, "inheres in the *creation* of instances" ("The Rise" 372). Whereas Hobbes only implies that the relationship between subject and ruler is imagined, Cavendish does so overtly, writing: "if any should like the world I have made, and be willing to be my Subjects, they may imagine themselves as such, and they are as such" (*Blazing* "Epilogue"). In so doing, Cavendish offers readers a view of the social body that parallels her understanding of nature and fiction.

For Cavendish, change and creation are the result of internal action—the apotheosis of which occurs when the Duchess creates a world for and within herself. Using the Immaterial Spirits to forward her fictional model, Cavendish writes:

> every human Creature can create an Immaterial World fully inhabited by Immaterial Creatures, and populous of Immaterial subjects, such as we are, and all this within the compass of the head or scull; nay, not onely so, but he may create a World of what fashion and Government he will, and give the Creatures thereof such motions, figures, forms, colours, perceptions, &c. as he pleases, and make Whirl-pools, Lights, Pressures, and Reactions, &c. as he thinks best; nay, he may make a World full of Veins, Muscles, and Nerves, and all these to move by one jolt or stroke: also he may alter that World as often as he pleases, or change it from a Natural World, to an Artificial; he may make a World of Ideas, a World of Atoms, a World of Lights, or whatsoever his Fancy leads him to. (96)

Simultaneously, Cavendish engages with and argues against Hobbes; the Immaterial spirits' reference to "Veins, Muscles, and Nerves" hearkens back to Hobbes's description of life and, by his own extrapolation, to the commonwealth: "For what is the *Heart*, but a *Spring*; and the *Nerves*, but so many *Strings*; and the *Joynts*, but so many *Wheeles*, giving motion to the whole Body, such as was intended by the Artificer?" (*Leviathan* 9). In aligning *Blazing World* with Hobbes's *Leviathan*, Cavendish uses a variant of Hobbes's "as if." She thereby makes Hobbes's use of fiction explicit, while also maligning and mocking it.

As the Duchess's subsequent description of her experience in creating an imagined world evidences, Hobbes's theory of government and the simulation it enables

is distorted and disgusting. “The parts of this Imaginary World,” when made according to “Hobb’s Opinion”:

> came to press and drive each other, they seemed like a company of Wolves that worry sheep, or like so many Dogs that hunt after Hares; and when she found a re-action equal to those pressures, her mind was so squeezed together, that her thoughts could neither move forward nor backward, which caused such an horrible pain in her head, that although she had dissolved that World, yet she could not, without much difficulty, settle her mind, and free it from that pain which those pressures and reactions had caused in it. (100)

Finally settling on creating a world composed “of sensitive and rational self moving Matter” Cavendish simultaneously plugs her theory of pantheistic vitalism and alludes to what she could only see as irreconcilable problems in *Leviathan* (101)*;* namely, that matter, like nature, is self-moving, that “Fear, though it makes people obey, yet does it not last so long” and, finally, that it is through imagination rather than rhetoric that one can offer an expanded vision of the natural world (63).

Appending *Blazing World* to *Observations upon Experimental Philosophy*, Cavendish physically, although not contextually, separates her philosophical from her fictional work.[36] Calling *Blazing World* “meerly Fancy” and depicting herself the “*Happy Creatoress*,” Cavendish openly admits to its status as fiction (A4r). So too does her most avid and open supporter, William Cavendish, Duke of Newcastle. In his panegyric of

[36] Keller and Spiller (“Reading”) argue that *Observations* and *Blazing World* represent a complete argument and should be considered as a singular text. For a concise survey of scholarship on the interaction between Cavendish’s fictional and philosophical texts, see Thell, n. 6.

her—which Cavendish includes in the paratextual material to *Blazing World*—Newcastle compares her to Columbus: whereas Columbus "Onely discovered" (l. 6) "this new World" (l. 5), i.e., America, Cavendish "thought it fit / To make [her] World of Nothing, but pure Wit" (ll. 9-10) and in so doing "Enlightens all" (l. 12). Echoing Abraham Cowley's 1656 praise of Hobbes in which Hobbes is said to surpass "*Columbus"*(l. 56) for not only finding new lands but for having "planted, peopl'd, built, and civiliz'd it," Newcastle registers their connection ("To Mr. Hobbes" l. 62). In so doing, Newcastle simultaneously points to the genre in which Cavendish's tract is written, romance, while suggesting that Hobbes's *Leviathan* is as equally fanciful.[37]

At the same time, however, Newcastle fits *Blazing World* neatly into the early modern scientific paradigm. In describing Cavendish's world as one that was made, in fact, privileging it because it was made, Newcastle points to contemporary beliefs about knowledge formation. As Elizabeth Spiller has argued, "a belief in the *made* rather than the found character of early modern knowledge unites poets and natural scientists" (*Science* 2; emphasis mine). Spiller further asserts that both early modern science and imaginative literature saw small worlds as "artificial representations that made it possible to create knowledge" (*Science* 16). Although Spiller falls short of calling it such, what she is here pointing to is the nascent specter of artificial life.

Though they be fictional, Cavendish's worlds are "composed onely of the Rational, which is the subtilest and purest degree of Matter" (*Blazing* 100). Her political theory thereby parallels her natural philosophy, and, as she writes it, presents a view of

[37] For Kahn, *Leviathan* is in dialogue with romance; however, Kahn argues that Hobbes's primary purpose is to demystify the fictions of the imagination ("Hobbes").

reality that, because fictional, is closer to reality: "Art does not make Reason, but Reason makes Art" (*Blazing* 58). By opposing her work to that of *Leviathan*, Cavendish suggests that her art, *Blazing World,* is based on reason and can therefore depict herself a "plain and rational Writer" in a text that is seemingly anything but (89). As Cavendish writes in her address, *Blazing World*, though fanciful, is a record and reconfiguration of her "Contemplations" (A4r).

Repackaging *Observations upon Experimental Philosophy* in a more palatable form, because "most Ladies take no delight in Philosophical Arguments," enables Cavendish to offer her readers an entree into the world she herself was often barred from (A4r). While many critics have pointed to the proto-feminist tenor at work in *Blazing World*, such an emphasis obscures what I believe to be the more interesting aspects of the text and the way in which Cavendish implicitly theorizes fiction within it.[38] Cavendish argues fiction is able to propound a provisional reality and possesses an explanatory power beyond that of reality itself. Cavendish thereby offers her readers a view of society that will not delude, as do telescopes, microscopes, and Hobbesian rhetoric, but enrich society.

Although history has written Cavendish as "mad Madge" and Hobbes as a preeminent thinker, Cavendish, substituting fiction for rhetoric, writes of a world that is

[38] Salzman, for example, sees the Empress as a "figure who fulfills Cavendish's dreams of entry into the male world of science" and the character of the Duchess as representative of Cavendish's desire to be taken seriously as an author (308); Jonathan Goldberg views the Empress as "a figure readers may well have assumed to be a fantasy projection of the author's" (433); Gallagher reads Cavendish's conflation of Duchess and Empress as the "metaphorical equivalence of sovereign monarch and sovereign private person" ("Embracing" 140); Spiller reads *Blazing World* as an attempt to develop a theory of reading that allows for "a more active reader who is able to destroy as well as create knowledge" (*Science* 23).

all the more attainable because not premised on the subjunctive—Hobbes's "as if."[39] As she writes in *Blazing World,* the "Art of Logick . . . consists onely in contradicting each other, in making Sophismes, and obscuring Truth" (101-102). Whether Cavendish was consciously thinking of Hobbes, the statement is easily applicable as he was a man who, according to Springborg, took it upon himself to persuade Newcastle "of the power of rhetoric in politics" (276).

What was and continues to be at stake, however, is not just the proper way to render the natural world but in deciding what comprises it. Although Hobbes and Cavendish ultimately disagree on the basic elements of life and the ways in which nature functions, both use fictional modalities to explore reality. Just as theories of "'vital energies,' . . . rewrote the understanding of the human subject, and opened up ways for subconscious or unconscious acts to be contemplated or imagined," fiction rewrote the way in which one approached reality (Packham 8). Whereas Steven Shapin, asking where and what constituted the laboratory in seventeenth-century England, turns to physical spaces, especially the gentleman's home, this essay turns to fiction and contends that the laboratory may also be found within early imaginative writing ("The House"). Fiction represented an alternative method to organize and understand the workings of the natural world, and, as Hobbes and Cavendish suggest, the best way by which to do so.

[39] Within the past two decades Cavendish's work has gained traction among literary and science scholars; nevertheless, surprisingly few take seriously her philosophical thinking (Thell 6).

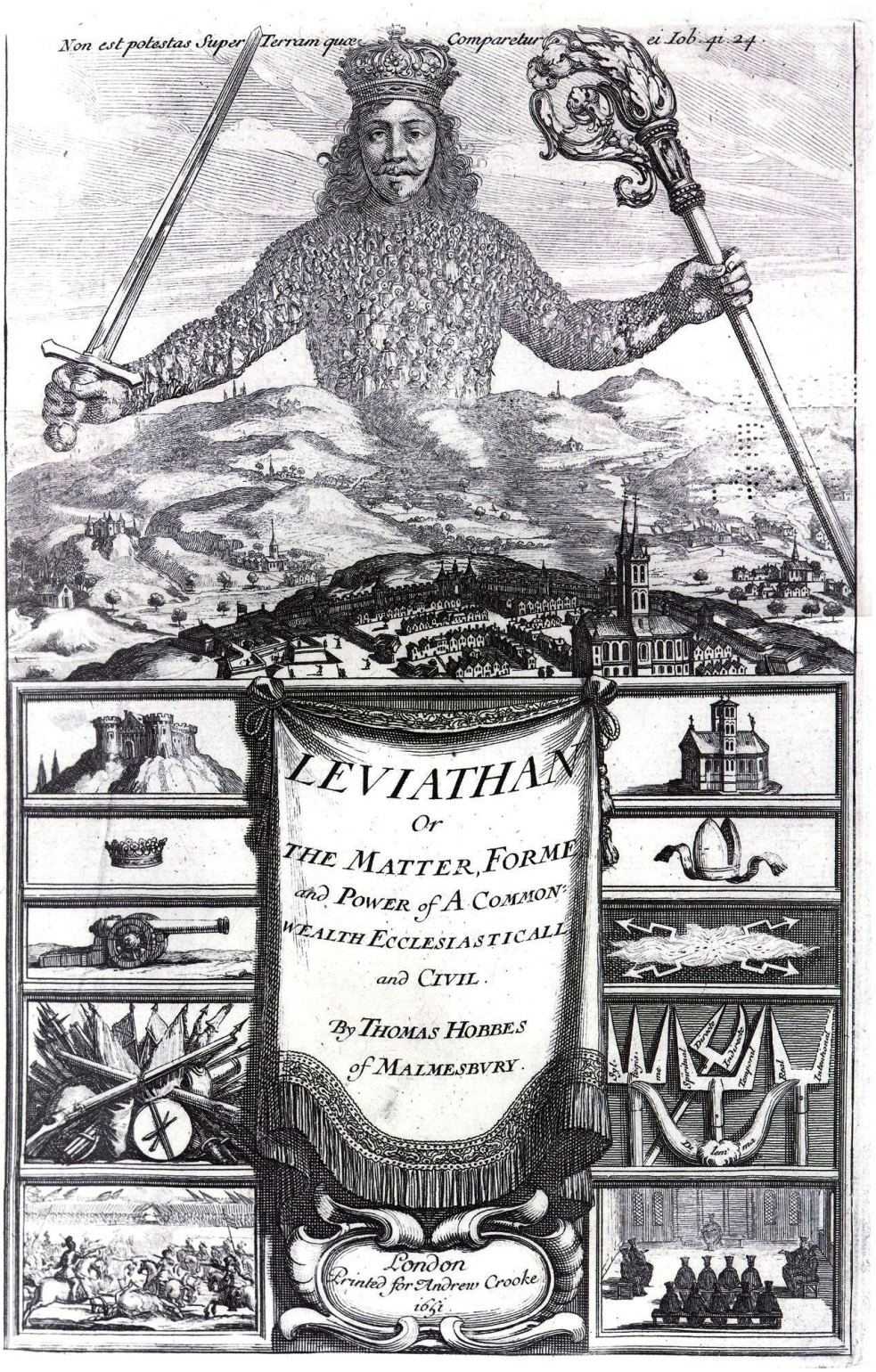

Figure 2.1 Frontispiece, *Leviathan*[40]

[40] Public Domain, via *Wikimedia Commons*.

CHAPTER 3

JANE BARKER, MANUSCRIPT CULTURE, AND THE EPISTEMOLOGY OF THE MICROSCOPE[41]

In the seventeenth century, the microscope revealed worlds unseen and unknown while exposing the limits of the human eye. Once rudimentary magnifying glasses, microscopes evolved into powerful scientific instruments that enabled natural philosophers, such as Robert Hooke, Nehemiah Grew, Marcello Malpighi, Jan Swammerdam, and Antonie van Leeuwenhoek, to discover nature's hidden structures and the basic units of life.[42] Simultaneously, the protocols governing natural philosophy shifted from a reliance on geometrical proofs and logic to a collectivist epistemology in which facts—isolated particulars whose referents are empirical—were created through a process of agreement.[43] Details of new discoveries filled the pages of print and

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[41] Mann, Rachel. "Jane Barker, Manuscript Culture, and the Epistemology of the Microscope." *Eighteenth-Century Life*, vol. 43, no. 1, 2019, pp. 50-75.

[42] For a history of the microscope and leading seventeenth-century microscopists, see Fournier.

[43] By the mid seventeenth century, experimental scientists increasingly held that physical knowledge was, at best, probable. Scientific hypotheses were considered "provisional and revisable" and were, therefore, no longer rigidly distinct from opinion and individual experience (Shapin, "Pump" 483). In lieu of a systematic, overarching schema, exemplified by geometry and logic, experimentalists offered "matters of fact." The matter of fact that emerged largely under Robert Boyle came to be understood as an epistemological unit that represented, simultaneously, "the complete separation of observed particulars from theories, and the elevation of particulars to the status of *evidence* capable of proving or disproving theories" (Poovey 92). See also Dear, *Discipline* 21-25.

manuscript, sharing a methodology that recognized the existence of multiple perspectives and the splitting of knowledge into facts. This essay explores that logic through the figure of Jane Barker, a gentlewoman who lived from 1652 to 1732, and whose work was both circulated in manuscripts and appeared in print. Like the microscopists who sought natural knowledge through shifts in scale and layering of perspectives, Barker accounts for the instability of human experience and the articulation of it by proliferating multiple points of view. In particular, in "A Farewell to Poetry with a Long Digression on Anatomy" she views the acquisition of natural knowledge as a multifaceted social process that relies upon correlating and combining dissimilar data.[44]

First published in *Poetical Recreations* (1688), "A Farewell to Poetry" presents a veritable cosmopoesis via magnification and metaphorical vivisection.[45] Within it, Barker narrates a fantastical tour of the body. Joined by William Harvey, Johannes Walaeus, and Richard Lower, she follows the circulation of the blood through the mansion of the human form. Throughout the journey, Barker rehearses existing models of medical knowledge, putting into conversation the mythical alongside the medical and metaphorical. Rather than endorsing a singular theory to help understand the body's mysteries, however, Barker embraces all. In so doing, she not only advocates a collectivist methodology that acquires and represents knowledge from a fragmented base, but also performs this process in her poem. As such, "A Farewell to Poetry" is not about

[44] Unless specified otherwise, I refer here and throughout to the 1688 version of "A Farewell to Poetry with a Long Digression on Anatomy," from *Poetical Recreations.*
[45] Although the title bears 1688 as its publication date, the volume hit the bookstalls by December 1687. See King, "Jane Barker" 551-70, especially 551.

anatomy per se; "A Farewell to Poetry" is about *how* one arrives at a modern understanding of anatomy and approximates scientific certainty.

Perhaps more than any other other scientific instrument of the time, the microscope exemplified the necessity of the collectivist epistemology that "A Farewell to Poetry" exhibits. Although not universally championed as an instrument of scientific discovery, the microscope became ubiquitous in scientific experimentation and in larger discussions about knowledge during the period.[46] Due to the nature of microscopic study and the varying types, sizes, and magnifications of microscopes, specimens often looked different from one microscopist to the next.[47] Consequently, an individual's empirical findings were deemed valid only if corroborated by others; in short, experiments were performed in front of others, were repeated by others, and were written about with so

[46] Those who opposed the use of the microscope in scientific study did so on grounds that can be loosely categorized as epistemological; the apprehension of the physical world, and, by extension, the structure and acquisition of knowledge, was at stake. Alexander Pope, for example, believed that knowledge could not and ought not be comprehended piecemeal because everything was connected in a "Vast chain of being" (I.VIII.4: 51). John Locke, in *An Essay Concerning Human Understanding* (1690), saw microscopy as a distraction that was irrelevant to understanding the nature of human life: "Were our senses altered, and made much quicker and acuter, the appearance and outward Scheme of things would have quite another face to us" (II.XXIII.12: 302). Margaret Cavendish, in *The Description of a New World, Called the Blazing World* (1666), raises a similar objection: After the empress is shown magnified images of a flea and a louse, she queries whether "microscopes could hinder their biting, or at least shew some means how to avoid them" (31-32). For Locke, Pope, Cavendish, and others, studying the minute compositions of nature and breaking down the universe into discrete parts does not lead to a greater understanding because knowledge cannot be built upon a foundation of small artifacts.

[47] Ratcliff argues that stable, microscopical knowledge was by necessity created communally because "using a microscope is essentially looking at an object that *no one* can see at the same time in the same way" (7). Reproducing experiments was one way to circumvent this particular problem. And yet, as Ratcliff further notes, because microscopes were made by individual artisans, it was "never certain that the reproduction of an observation would yield the same result" (7).

much detail and circumstantial language as to create virtual witnesses.[48] The microscope thereby disrupted the notion that knowledge could be built upon a uniform perspective and demanded a form of representation that proliferated different views.

The overt protocols that shaped microscopic study are akin to the tacit expectations of manuscript culture. Literary as well as scientific writing was passed among coterie members whose personal judgments, shared through private letters, became communal as they were exchanged, altered, and added to a text.[49] Likewise, as Steven Shapin, Simon Schaffer, Mary Poovey, and others have shown, scientific advancement relied on a communal process of emendation and repetition. Because facts were not based on fixed texts but on social protocols that managed textual and empirical multiplicity, the information ecology of science looks rather like manuscript culture: both create forms of data—facts in the former, texts in the latter—through social negotiation.[50] Reading "A Farewell to Poetry" alongside scientific developments of Barker's day, especially the turn to microscopic study, reveals a latent homology between putatively different forms of communication, such as scientific diagrams, like those in Robert Hooke's *Micrographia*, and scientific poems, like "A Farewell to Poetry."

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[48] See Shapin "Pump"; Shapiro; Bazermann; and Shapin and Schaffer.
[49] See Ezell; Love *Culture and Commerce* and Love "Oral and Scribal. For more on the way coteries "vouched" for texts, see Trolander and Tenger, especially 371-372.
[50] In her recent study of John Aubrey's *Naturall Historie of Wiltshire* (1691), Yale demonstrates that scientific knowledge was grounded in "the material and social realities of communication" (19). Riddled with annotations, cut and pasted leaves, and notes written over decades, Aubrey's *Historie* provides a material example of the relationship between knowledge as a conglomeration of facts and manuscript as a conglomeration of texts; as Yale notes, Aubrey's text "mirrored the social organism, Aubrey's correspondence, that produced it" (117).

3.1 THE MICROSCOPE AS EMBLEMATIC OF SEVETEENTH-CENTURY EPISTEMOLOGY

In his 1676 letter to the Royal Society, Antonie van Leeuwenhoek reported peering through a microscope and seeing "an incredible number of very small animals of divers kinds" (qtd. in Jardine *Ingenious* 94). Members of the society tried to replicate his experiment several times but failed, leading Daniel Whistler, physician and fellow of the society, to dismiss them as "imagined creatures"(qtd. in Birch 349, vol. 3). One year later, Robert Hooke reported success: Leeuwenhoek's small animals "were seen by Mr Henshaw, Sir Christopher Wren, Sir John Hoskyns, Sir Jonas Moore, Dr. Mapletoft, Mr. Hill, Dr. Croune, Dr. Grew, Mr. Aubrey, and divers others" (qtd. in Birch 352, vol. 3). As a result, Hooke concludes that "there was no longer any doubt of Mr. Leewenhoeck's discovery" (qtd. in Birch 352, vol. 3). In revealing nature as a complex system of invisible as well as visible components, the microscope exposed the instability of human knowledge. Thus, it served as an impetus for thinking through issues of how knowledge is acquired and recorded.

Because microscopic technology was not yet standardized, differing drastically from one artisan to the next, and microscopes, in general, were difficult to use, observations could not always be verified or reproduced. As Leeuwenhoek comments:

> it doth happen often to me, that People looking through a Magnifying-glass, do say now I see this, and then that, and when I give them better Instructions, they saw themselves mistaken in their opinion, and what is more, even he that is very well used to looking through Magnifying-glasses may be misled by giving too sudden a Judgment, of what he doth see. (306)

Samuel Pepys experienced this frustration firsthand. Excited by *Micrographia*, Pepys purchased a microscope, which included plated specimens, from Richard Reeve's London shop.[51] As he records in his diary, it was only "with great difficulty" that he and his wife "could come to find the matter of seeing anything" (240, vol. 5). Even with later improvements to the microscope, users lamented the difficulty of discerning specimens. As late at 1771, George Adams comments on how challenging it was to see "animalcula," even though they are "exceeding numerous" (qtd. in Frey 380). As a result, an individual's findings lacked authority and status. So much so that even when John Wilkins, founding member of the Royal Society and Hooke's early patron, described a deer hair as quill-like, Hooke was asked to replicate the findings. Hooke saw something different and subsequently demonstrated the hair's sponge-like qualities. Importantly, it was not Hooke's status that convinced the fellows, but, rather, his detailed drawings and textual explication, both of which served as a form of virtual witnessing that enabled others to corroborate his findings (Doherty 211-212).[52] The visual microscopic fact and the textual account merge, each as suspect as the other until socially verified.

Microscopes not only led to an increase of viewings across individuals, but also magnified the ways in which an individual could view the same object differently or, sometimes, not at all. Consequently, microscopists often viewed specimens many times before committing their specs to paper. Hooke was no exception:

[51] According to Pepys, Reeve's instruments were among "the best in the world" (IV:241).
[52] Visualizations were of special import to experimentalists because the skill required to replicate experiments was rare, and the equipment prohibitively expensive. Detailed drawings alleviated the need. See Matthew Hunter 5.

> In making [draughts], . . . I indeavoured (as far as I was able) first to discover the true appearance, and next to make a plain representation of it. This I mention the rather, because of these kind of Objects there is much more difficulty to discover the true shape, then of those visible to the naked eye, the same Object seeming quite differing, in one position to the Light, from what it really is, and may be discover'd in another. And therefore I never began to make any draughts before by many examinations in several lights, and in several positions to those lights, I had discover'd the true form. (sig. f2v.)

As Meghan Doherty notes, looking is not a neutral act; Hooke was required to make "a series of decisions," based off of a series of observations, "about what exactly it was that he was seeing while preparing his drawings," and he turned to others to validate his observations (219). Earlier iterations of Hooke's observations can be found in John Covel's *Natural History and Commonplace Notebook* (ca. 1660), and, as Ian Lawson points out, drafts to *Micrographia* include initials in addition to Hooke's, such as "R.G. being present," "D.C. being present," and, "E.T. Ocul. Testis," that is, eye witness (20).[53] While the others appear to have been silent witnesses, E.T. Ocul. Testis colored the insect, adding information to the sketch (Lawson 20). Hooke's illustrations are, then, both contrived and composite images rather than drawings by a "*sincere Hand,* and a *faithful eye*"; they combine information acquired from different sources and disciplines (Hooke sig.b1r).[54] Created by Hooke with input from his fellow experimentalists and approved

[53] For more on Covel and Hooke, see Matthew Hunter 125-131.
[54] Lawson notes that Hooke's drawings are composites that combine information from Hooke's own observations and from an "abstract knowledge gathered from books and communications" (20). Doherty argues that Hooke's engravings captivated viewers because he "saw differently" rather than because of their subject matter (211). For

under the seal of the Royal Society, *Micrographia* is, in essence, a coterie publication that demonstrates the logic of microscopic knowledge.

In relying on multiple observations as well as on isolated particulars, Hooke undermines the notion of a singular, monolithic worldview. Through the microscope, Hooke was able to see and therefore break down natural phenomena into their constituent parts. As a result, Hooke called into question the doctrine of correspondence. In the traditional scheme of correspondence, the microcosm was defined by its relationship to the macrocosm in what Michael McKeon calls a "hierarchical continuum of tacit distinction" (*Secret History* 403). *Micrographia* ruptures this relationship by systematically focusing on the smaller parts that constitute a greater whole. According to Hooke, microscopy was "of no inconsiderable use towards the invention of the *Latent Scheme*, (as the Noble *Verulam* calls it) or the hidden, unknown Texture of Bodies" (204). In Hooke's optimistic formulation, studying the patterns of the microworld would unveil nature's processes. In *Micrographia,* Hooke thereby tends to describe his specimens by their parts rather than their whole; observations center on "the Sting of a *Bee*" (163), the "Wings of *Flies*" (172), the "Teeth of a *Snail*" (180), the "Scales of a *Soal*" (163), and so forth. Even when Hooke renders a specimen in toto, he does so by parsing its discrete components. As a result, Hooke's illustrations provide readers with a

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Doherty, Hooke combined the skills of the portrait engraver with those of the experimental scientist. The formal visual techniques he learned at an early age while apprenticed to Dutch painter Peter Lely, alongside those garnered through books and an interest in print later in life, enabled Hooke to imbue his observations with a depth and texture unlike that of his predecessors (216-28). Hooke's draughtsmanship explains, perhaps, why *Micrographia* was so much more popular than Henry Powers's book of microscopic observations, *Experimental Philosophy.* Hooke's success in generating new, microscopic knowledge can, then, be attributed to the way he accrued and combined different skills from different disciplines.

disjointed view of his specimens and depict them as systems of working parts, each of which needs to be considered separately (see Figures 3.1 and 3.2).

Through his diagrams, Hooke dissects and artificially magnifies information. Hooke's louse (Figure 3.2) is blown up almost beyond recognition and is described textually as a collection of letters rather than as a common pest:

> It has a head shap'd like that exprest in 35. *Scheme* marked with A . . . on either side behind the head . . . are placed its two black shining goggle eyes, BB . . . It has two horns that grow before it . . . each of these CC hath four joynts . . . from which to the tip of its snout D, the head seems very round and tapering . . . it seems in several Positions to have a resemblance of chaps, or jaws, as is represented in the Figure by EE . . . by having the lesser claw (a) set so much short of the bigger (b) when it walks on the skin the shorter touches not. (211-12)

Hooke was not the first to turn to diagrams; early anatomists, too, populated their textbooks with diagrammatic drawings. Those in Andreas Vesalius's *De humani corporis fabrica libri septum* (1543), a 663-page folio volume filled with stunning imagery, provide an important point of comparison, especially since they are considered representative of "the renaissance in science" (Harcourt 28). Many images populating Vesalius's book, such as his muscle men (see Figures 3.3 and 3.4), tend to be contextualized: they are reconstructed coherently, situated in vaguely pastoral settings, and poised for action. The objects they represent are, in a word, recognizable. In placing the body against a familiar backdrop rather than against the white space of the page, Vesalius's diagrams contextualize and familiarize the body, recalling something more

akin to still lifes.[55] Other Vesalian diagrams, however, feature body parts disconnected from the whole. Like Hooke's diagrams, they denaturalize and defamiliarize the objects they represent. In both books, then, the tension between fragmentation and wholeness that governs manuscript culture operates at the level of the diagram.

One can approach these images from more than one direction. For example, the illustration of Hooke's microscopes (Figure 3.1) lacks fidelity to both scale and hierarchy and does not impose a logical order. Rather, it demands the study of the microscope's parts, which, in turn, generates new understanding through the correlation of sensory data. Hooke's diagrams thereby restructure the relationship between subjects and the physical world. The white background on which the microscopes are set is integral to this process. As John Bender and Michael Marrinan argue, a diagram's white backdrop creates "an arena of potentiality that fosters connections without fixing them or foreclosing thought experiments. It provides support for the composite play of imagery and cognition that is the motor-energy of diagram" (43). In displacing the self as the center of knowledge, Hooke's diagrams surpass the limits of ordinary vision, proliferating images and closing off singular interpretations. Hooke's diagrams rely on a spatialized conception of a world in which knowledge is a constellation of many parts rather than a monolithic whole. Hooke's diagrams require readers to employ the same methodology Hooke used to approach his microscopic studies: they needed to look at the same specimen multiple times in multiple ways.

[55] In his analysis of seventeenth-century natural history, David Freeberg traces the rise of the diagram in place of the picture, noting that the latter was no longer able to "yield the principles of order; these could only be achieved by penetrating beneath the surface, by counting and by reducing the fullness of pictorial description to their essential geometrical abstractions" (qtd. in Matthew Hunter 15).

Micrographia exemplified an understanding of knowledge that was based on repeated observations and ushered in a view of the natural world as a phenomenon that could be understood through attention to its discrete components. *Micrographia*'s visual and verbal anatomizations troubled notions of a unified understanding by parsing rather than imitating nature.[56] Hooke's diagrams were small epistemological units rather than wholes, units that encourage the reader to reassemble, and thereby re-see, natural phenomena. This view of the world relied on accepting the premise that knowledge was created by collecting small observations that, once socially verified, became small facts.[57]

Jane Barker makes a similar epistemological argument. Like Hooke, she too regards the acquisition of knowledge as a social process that synoptically gathers, accounts for, and juxtaposes different perspectives. In "A Farewell to Poetry," Barker, in particular, offers a synthetic take on two issues: (1) the multiplicity of perception, now imaginatively disjointed by microscopy, and (2) the fragmentation of scientific

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[56] To explain the structure of *Micrographia* as well as to justify the purpose of observing minute objects, Hooke writes: "We must first endevour to make *letters*, and draw *single* strokes true, before we venture to write whole *Sentences*, or to draw large *Pictures*" (sig.b1r—pagination begins on the next page, 2).

[57] This new understanding of socially negotiated, atomized knowledge and its connection to the microscope seeped into the larger cultural imagination, influencing imaginative as well as scientific writing. In "Of Many Worlds in This World" (1664), for example, Margaret Cavendish suggests that small objects have the capacity to be quite large. In describing earrings as capable of containing a world, Cavendish implies that size, and by extension, knowledge, are relevant and dependent upon perspective. Three years later, Abraham Cowley explicitly celebrates the connection between microscopic study and knowledge in his 1667 ode "To the Royal Society," which is really an ode to the microscope. As Cowley explains, the microscope trained the human eye; it "taught the curious Sight to press" into Nature's innermost crevices (l. 143). Cowley's form of knowledge is, like Hooke's diagrams, neither linear, fixed, nor apparent. To understand nature, one must understand the parts constituting nature; consequently, to create a body of knowledge about the physical world, one must first build a dataset made up of nature's "imperceptible Littleness" (l. 145). For scholarly criticism on the intersection of microscopic study and literature, see Nicolson; Catherine Wilson; and Goodman.

knowledge through putatively social but unreliable and unrepeatable experiments, exemplified by the microscope and compensated for by the sociality of manuscript verse.

3.2 EMBRACING THE MINUTE AND MULTIPLE: JANE BARKER AND HER EPISTEMOLOGY

Jane Barker's "A Farewell to Poetry" is a seemingly quirky poem in which she bids adieu to poetry so as to immerse herself in anatomy. Her goodbye is accomplished in six swift lines, after which she turns her attention to the body and the body of knowledge on which her understanding is based. Barker begins by glossing the ancients, among them Aesculapius, Hippocrates, Galen, and Aristotle, and is then taken under the wing of the renowned anatomist Bartholin—either Thomas or Casper. He proceeds to give the poem's speaker a superficial tour of the body, showing her the bones, skin, muscles, and eyes. Shortly thereafter, William Harvey and Johannes Walaeus take over the tour. Under their guidance, the speaker enters the body, walking through the abdomen, heart, and brain. Upon returning to the heart, the trio is met by Richard Lower, who reflects that knowledge of the heart is not enough to prevent its failing. What follows is a three-part address to Barker's deceased brother, Edward, and a reflection on human ignorance in light of God's knowledge.

Although Barker's poem appears to end on a resigned note, it offers a methodology for approximating knowledge. Within it, Barker rehearses various, and sometimes competing, philosophies of life. She includes in the catalog of philosophical greats "with whom [she] must Acquaintance make" the mythical, metaphysical, and experimental (l.11). Barker puts into play the metaphorical white space against which Hooke's diagrams operate. Rather than embracing a singular theory to comprehend nature and the body, she synthesizes old and often contradictory views. As Hooke does in

Micrographia, Barker privileges multiple viewings over uniform authority and magnifies individual parts of a system, such as the arteries, to describe the much larger circulatory system.

Barker's embrace of multiple perspectives may reflect her own experience in acquiring knowledge. As is commensurate with her time and station as a member of the minor gentry, Barker was likely instructed in "Physick" but denied a formal education (King, *Exile* 68-76). And yet, she was well versed in academic medicine, possessing knowledge that was not only rather unusual for a woman of her time, but that also took her into what her biographer, Kathryn King, calls "male-only intellectual territories" (*Exile* 70). Barker most likely came to this through her brother, Edward Barker. Supposedly a medical student, Edward served as her tutor, providing her with a seemingly erudite medical education and a sound grasp of Latin. Barker's knowledge of Latin and her basic medical education enabled her to read and study Edward's texts. In the 1680s, she appears to have turned her knowledge to practice, going so far as to prescribe medications to her London patients.[58] While sound, Barker's medical knowledge and expertise would have been gained haphazardly; given her circumstances, she had to scrape it together from a variety of sources and people. Through social

[58] In *A Patch-Work Screen for the Ladies* (1723), Barker's alter ego, Galesia, reports that "Dressing, Visiting, and other Entertainments, befitting a young Gentlewoman" did not get in the way of her "Study, in which [her] Brother continued to oblige." Accordingly, Edward assisted her in "Anatomy and Simpling" to the point that she was able "to understand *Harvey*'s Circulation of the Blood and *Lower*'s motion of the heart" (82-83). Later in the novel, Galesia reports receiving "several People [who] came to me for Advice in divers sorts of Maladies," and having "got to such a Pitch of helping the Sick, that I wrote my *Bills* in *Latin*, . . . as Doctors do; which Bills and Recipes the Apothecaries fil'd amongst those of the Doctors" (116). King, in *Exile*, contextualizes Barker's fictions against common seventeenth-century practices and has found evidence suggesting Barker advertised and sold gout plaster (72-77).

interaction and textual accretion, she acquired knowledge bit by bit—each bit of which was as important as the sum total.

The material history of "A Farewell to Poetry" and its numerous iterations illustrates the way Barker proliferates and repurposes, rather than dismisses, existing forms of knowledge. "A Farewell to Poetry" was first published by Benjamin Crayle in *Poetical Recreations,* a two-part volume containing more than fifty items, which were "Occasionally Written by Mrs. Jane Baker," and a verse miscellany written by "several Gentlemen of the Universities, and Others." While there are no known manuscripts of *Poetical Recreations,* scholars believe that many of the poems in the volume were likely written for a coterie.[59] As King has argued, "writing and exchange of verse was a vital part of Barker's social existence," and her early work was primarily social, "composed for a small but sympathetic circle (or circles) of fellow amateur poets" (*Exile* 29). [60] And indeed, nearly half of Barker's poems in the volume are occasional and familiar verses, addressed to friends. Like King, Carol Shiner Wilson asserts that Barker exchanged verse with her companions, among them a group of Cambridge students whose verse makes up the second part of *Poetical Recreations* (xxii). Barker's later assertion that the volume

[59] King, in "Jane Barker," for example, notes that the poems in *Poetical Recreations* "bear traces of their coterie origins" in their titles and believes Barker to have been "engaged in literary exchange with a number of fellow poets, including at least three Cambridge students and (probably) a London bookseller" (552-53, and 564).

[60] Even in Barker's later, published work, she frequently aligned herself with coterie writers, especially Katherine Philips. For example, *Love Intrigues* opens with a request from Galesia's friend, Lucasia, the well-known literary pseudonym for Anne Owens, Philips's friend and fellow coterie member. Pages later, Galesia versifies her aspiration to "*reach fair* Orinda's *Height*" (7 and 14). Likewise, in *A Patch-Work Screen,* Galesia scornfully dismisses Aphra Behn, "reply[ing], with a blunt Indignation, That *they* [Philips and Behn] *ought not to be nam'd together*" (108). In Barker's final novel, *The Lining of the Patch-Work Screen* (1726), Galesia dreams of being led atop Parnassus so as to see "the Annual Coronation of *Orinda*" (174).

had been printed "without her consent" further supports King's conclusion that the body of poetry may have been ushered into print through "a group of St John's College men with whom she evidently exchanged poetry for many years" (*Exile* 34).[61] Barker's protestation is likely more than a claim to modesty; unlike her later print publications, *Poetical Recreations* contains no front matter or prefatory material, which suggests that she had no part in preparing it for the press. (King, *Exile* 32).

More than a decade later, Barker copied the verse into the Magdalen Manuscript (ca. 1701), a three-part, eighty-poem collection she prepared while in exile at St. Germain. As King has written extensively, the manuscript offers considerable insight into Barker's poetic activities, including manuscript exchange across different communitites, such as "a Cambridge poetic-exchange coterie of the 1680s (part 3) and an exiled Jacobite community in France in the 1690s (parts one and two)" ("Introduction" 3). In 1723, Barker included "A Farewell to Poetry" in *A Patch-Work Screen for the Ladies*. In the novel, Galesia, a character many critics read as Barker's alter ego, recounts the circumstances that impelled her to write the poem.[62] Sounding much like Barker, Galesia explains that, devastated by the loss of her brother Edward, she pored over "those Books he had most studied" and "resolv'd" to put into verse the portions "on which I had seen my Brother most intent" (*Patch-work Screen* 84, 85). "A Farewell to Poetry," then, exists

[61] In *The Magdalen Manuscript*, Barker asserts that many of the poems from part 3, including "A Farewell to Poetry," were "taken out of a book of Miscellany poems, . . . but without her consent, [and] were printed in 1688: now corrected by her own hand" (qtd. in King, *Exile* 34).
[62] See, for example, King, *Exile* 7; Carol Shiner Wilson, "Introduction" xvi; and Doody 221.

on a least three different levels: as part of a printed copy of miscellaneous poems, as part of a handwritten manuscript volume, and as part of a novel.

As it is recontextualized, Barker's verse takes on different meanings. In *Poetical Recreations*, "A Farewell to Poetry" was one among many verses whose purpose appeared to be social and intimate. Its epistemological nature reflects that purpose. Barker suggests that knowledge is created by multiplying perspectives rather than by adopting a uniform view. The 1723 version, on the other hand, was enfolded into the larger narrative of *A Patch-Work Screen for the Ladies*. The poem is broken into two pieces and retitled "An Invocation to the Muses" and "Anatomy." The final section of the poem, addressed to Barker's brother, is further separated by a chunk of narrative in which Galesia reflects on "the Happiness he [Edward] enjoys by Divine Vision" (*Patch-work Screen* 90). Through the narrative enveloping the poem, Barker emphasizes the emotional toll of losing her brother; as a result, the poem becomes a homage to Edward rather than a commentary on acquiring knowledge. The narrative surrounding the poem becomes one of many in the novel, each one treated as a patch for a gentlewoman's screen. Although the poem has changed from the 1688 to 1723 version, the overarching argument Barker makes has not.[63] As she explains in her introduction to *A Patch-Work Screen*: "*whenever one sees a Set of Ladies together, their* Sentiments *are as differently mix'd as the* Patches *in their Work. . . . This puts me in mind of what I have heard some* Philosophers *assert,*

[63] "An Invocation of her Muse" includes lines 1-14 of the original poem; "Anatomy" begins at line 15 of the original. As early as the Magdalen manuscript, Barker replaced the character of Johannes Walaeus with that of Thomas Willis. King, in *Exile*, suggests that Willis's neurocentric model had special implications for women: "To install the sexless brain at the center . . . was to put in place a physiological paradigm that allowed for the possibility of less reductive models for comprehending female nature" (94-95).

about the Clashing *of* Atoms*, which at last* united *to compose this glorious Fabrick of the* Universe" (52). Barker's nested narratives operate in a manner similar to her 1688 poem. Barker's novel, according to Karen Bloom Gevirtz, "advocates a collectivist epistemology for maximizing knowledge" (74). Barker need not use the poem to forward her epistemological stance in 1723, because the novel that includes the poem already does so.

The content of "A Farewell to Poetry" likewise parallels the logic of manuscript culture and its communal process of acquiring and organizing knowledge. The poem is informed by and rehearses different interpretations of existing anatomical knowledge: Barker's own knowledge, Edward's knowledge, and knowledge Barker acquired from the textbook she studied while writing the poem, Caspar Bartholin's *Anatomicae instituions corporis humani* (*Patch-work Screen* 84). Written in 1611, Bartholin's textbook was used widely by university students across Europe. In 1641, Thomas, Bartholin's son, revised the manual to take into account recent findings, such as Harvey's circulation of the blood, and in 1662, Nicholas Culpeper and Abdiah Cole released an English translation.[64] Retitled *Bartholinus anatomy: made from the precepts of his father, and from the observations of all modern anatomists,* the English translation emphasizes the collaborative nature of the work, which, as I will discuss at greater length below, Barker reflects in her poem. The textbook is subdived into four books: "Of the Lower Belly," "Of the Middle Venter or Cavity," "Of the uppermost Cavities, *Viz* The Head," and "Of the Limbs"—in modern parlance: the abdomen, the heart, the brain, and the bones. The textbook follows the sequence adopted by anatomists who, working without means for

[64] King, *Exile* 86-88; Hill; Bartholin *The Anatomy House.*

preserving cadavers, began with parts of the body most susceptible to decay rather than the ideal sequence, which would have ordered the body as a structure analogous to a building.[65] In *De humani corporis fabrica* (1543), Vesalius argues that anatomists should approach and describe the body as they would a building: "First he describes the scaffold—the bony skeleton—then the muscles, the vascular system, the nervous system, the organs of nutrition and other abdominal viscera and lastly the brain" (qtd. in Sawday, *Bodies by Art* 65). The analogy of body-as-building and its explanatory power held steadfast throughout the sixteenth century and can be found in popular works such as Pierre La Primaudaye's *L'Academie française* (1584 onwards), which went through several editions and was translated into English (Sawday, *Bodies by Art* 88-97). Notably, Barker incorporates both ways of organizing anatomical knowledge into her poem. She begins by rendering the body "Nature's *Architecture*" ("A Farewell" l. 16), and, following a compressed version of Vesalius's body, writes:

> How Pillars of strong *Bones* are made;
> How th' Walls consist of *carneous* parts within,
> The out-side *pinguid*, over-laid with Skin;
> The Fretwork, Muscles, Arteries, and Veins,
> With their *Implexures*, and how from the Brains
> The Nerves descend; and how they do dispence
> To ev'ry Member, Motive Pow'r and Sence. (ll. 18-24)

[65] Anatomical demonstrations were typically held over a period of three days with two lectures per day; each day was dedicated to a separate system: visceral, muscular, and osteological. See Cunningham, *Anatomist Anatomis'd* especially 26, 47, and 59; Cregan 14-15; and Sawday *Body Emblazoned*.

Despite following Vesalius's recommended order, Barker's language echoes Bartholin's. Early chapters of his first book are titled "Of Skin" (2), "Of Fat" (4), "Of Membranes in General" (7), and "Of the Muscles in General" (8). Her ordering of information and her analogy of the body-as-building hearkens back to a much older and well-worn conceit. Upon entering the interior of the body, Barker's journey more closely follows that of Bartholin's text; she moves from abdomen, to chest, to brain. By incorporating both models of organizing anatomical knowledge, Barker leaves open possibilities of interpretation. Like Hooke's diagrams, Barker's poem has various entry points and plays with perspective. "A Farewell to Poetry" thereby exemplifies her epistemological stance: that natural phenomena can only be understood by combining many observations, and that knowledge, in turn, represents a collection of discrete views rather that a monolithic body of information.

By representing knowledge as a combination of discrete observations, Barker mitigates the problems she associated with sensory knowledge that relies upon one overview; as she notes in "A Farewell to Poetry," one's senses can mislead and delude. Reconfiguring the story of original sin, Barker describes the eyes as "tribly Glaz'd" with "Curtains drawn betwixt / Them and Earths objects" (ll. 26-27). For Barker, individual sensory knowledge can lead one astray as it did Eve:

> For 'twas the Eye that first discern'd the food,
> As pleasing to it self, then thought it good
> To *eat*, as b'ing inform'd it wou'd refine
> The half-wise *Soul*, and make it all Divine.
> But ah, how dearly *Wisdom*'s bought with Sin,

Which shuts out Grace, lets Death and Darkness in! (ll. 29-34)

Although sight ostensibly promises knowledge, it is inaccurate at best and forbidden at worst. Notably, Barker describes one's inability to take in the natural world as a biological inevitability. The "Glaze" she refers to corresponds to the vitreous, aqueous, and crystalline humors. Traditionally, these humors, the crystalline humor in particular, were thought to be the seat of vision.[66] Barker, however, writes of them as partitions, obstructing access to "Earths objects." For Barker, we can approximate knowledge only by combining several, inevitably flawed observations because we are not biologically equipped to do otherwise.

Consequently, Barker not only turns to a multitude of people to construct "A Farewell to Poetry," but also demonstrates the process within her poem. Just as she includes both methods of ordering anatomical knowledge, she rehearses various philosophies of life without endorsing one over the other. Immersing herself in anatomy requires acquaintance with:

Wise *Aristotle* and *Hippocrates*,
Galen, and the most Wise *Socrates*;
AEsculapius, whom first I should have nam'd
And all *Apollo*'s younger brood so fam'd. (ll. 7-10)

As her litany suggests, Barker is not willing to adopt a single philosophical viewpoint governing natural systems in general and anatomy in particular. Instead, she chooses to become acquainted with all, despite their contradictions. Hippocrates focused on the humors to explain physiological causes; Aristotle believed that the heart was central to

[66] See Lindberg *Theories of Vision*; Stuart Clark; Gal and Chen-Morris; and Lennox.

vitality and that the nerves originated in the heart; and Galen argued that the heart was secondary to the liver, which he identified as the source of blood.[67] Galen serves an especially important function in Barker's list; his views generally predominated until the mid seventeenth century and, more importantly, he was among the first to integrate Hippocrates's, Aristotle's, and Plato's ideas into a unified theory of the tripartite soul. In order to do so, Galen merged medical and philosophical knowledge. He assigned Plato's division of the soul to localized areas of the body; the rational soul is located in the brain, the spiritual soul in the heart, and the appetitive soul in the liver. These three points correspond with the location of Hippocrates's humors: head (phlegm), heart (blood), liver (black bile), and gall bladder (yellow bile). In uniting Hippocrates's theories with Plato's, Galen connected the health of the soul to the health of the body.[68] What Galen did in *On the Doctrines of Hippocrates and Plato*—combine existing theories—is akin to Barker's own epistemological viewpoint and understanding of the way knowledge is created. For Barker, Galen exemplifies the way knowledge is derived by combining perspectives, which is inherently a social process.

Barker brings the social nature of her epistemological model to the fore when, midway through the poem, William Harvey and Johannes Walaeus take over the tour—joined later by Richard Lower. King argues that this moment indicates a paradigm shift between ancient and modern models of medicine (*Exile* 88). Prior to Harvey, blood circulation was attributed to the venous and arterial systems. Thought to originate in the liver, blood passed through the venous system into the heart where it was purified. Once

[67] See Mattern, especially 139-86, and Jouanna.
[68] See Schiefsky; Mahdihassan; Gill et al.; and Lindberg *The Beginnings.*

refined, blood moved from veins into arteries by way of invisible pores, which were located in the septum, and continued its progress to the brain.[69] In *De Motu Cordis* (1628), Harvey theorized that the blood originated in the heart and moved in a circular pattern. He dispensed with Galen's two-system model and conceived of the heart as a pump rather than as a furnace. While Harvey's findings came to be revolutionary, they were neither immediately nor automatically accepted. Those skeptical of Harvey's discovery, such as John Riolan, jeered that they would "rather err with Galen than proclaim the truth with Harvey" (qtd. in Churchland 15). Walaeus, Harvey's co-guide in "A Farewell to Poetry," played a crucial role in transforming Harvey's discovery from observation to fact. In his capacity as professor at the University of Leiden, Walaeus had his English student, Roger Drake, publicly defend Harvey's theory. After James Primrose attacked Drake's thesis, Walaeus penned a number of letters to Thomas Bartholin detailing experiments that confirmed Harvey's theory. The letters were appended to Bartholin's updated anatomical textbook in 1641, added to a new edition of *De Motu Cordis* in 1643, and published in a stand-alone volume in 1645. Through Walaeus, Harvey's truth spread throughout Leiden and beyond (Schouten). Like Walaeus, Richard Lower also built upon Harvey's discoveries. Lower's major work, *Tractatus de Corde* (1669), summarizes a series of experiments he undertook with Hooke and details the workings of the heart and lungs, taking as its foundation the circulatory physiology established by Harvey (Felts). Harvey's, Walaeus's, and Lower's appearances throughout "A Farewell to Poetry" illustrate the way modern science was a product of textual and social interplay.

[69] See Windelspecht 22-23; Krebs 20-27; Furley and Wilkie; and Fuchs.

Barker reinforces the notion that knowledge is derived through a process of accretion by continuing to infuse her discussion on modern anatomy with Galenic science. Despite Harvey's and Walaeus's presence, for example, she uses a multitude of voices to describe the brain in distinctly Galenic terms:

> Here's *Cavities,* says one; and here, says he,
> Is th' Seat of Fancy, Iudgment, Memory:
> Here, says another, is the *fertile* Womb,
> From whence the Spirits *Animal* do come,
> Which are mysteriously *ingender'd* here,
> Of *Spirits* from *Arterious* Blood and Air:
> Here, said a third, *Life* made her first approach,
> Moving the Wheels of her Triumphant Coach. (ll. 77-84)

As she does with Vesalius's theory of the body, Barker compresses theories of life and the brain. Per Galen's physiological system, chyle is brought to the liver where it is transformed into blood and imbued with natural spirits. It is then transported via the veins to the right chambers of the heart where impurities are exhaled through the lungs. The blood then passes through the heart's septum into the left chambers where, through inhalation of the lungs, it is further purified and imbued with vital spirits. The blood then travels to the brain (the "fertile womb") via the arterial system; upon entering the brain, it is infused with animal spirits. These spirits pass through the brain via ventricles (the "Cavities") and then to the nerves.[70] In the poem, Harvey's only response to this Galenic

[70] For a concise survey of the medical and philosophical backdrop of pre-Galenic cerebral anatomy as well as a comprehensive look at Galen's anatomical and theoretical work on the brain, see Rocca.

model of the brain is in relation to the origin of "*Life.*" Because Harvey believed that blood originated in the heart rather than the liver he tells Galen's followers that "Life made her first approach" in the right atrium of the heart, that is, in the "deaf Ear on the *dexter* side" (l. 86). Resituating the heart as the origin of life is a major emendation to Galen's theory. And yet Barker narrates it as a passing moment, writing: "Then there arose a trivial small dispute, / Which he [Harvey] by Fact and Reason did confute" (ll. 87-88). In describing the dispute as "trivial," Barker implies that Harvey has merely refined existing knowledge as facts are accrued and layered.

Galen's division of the body parallels Barker's organization of knowledge. Under Galen, each of the body's organs has an important role to play and contributes to a larger physiological process. The structure of Barker's poem works similarly; she devotes one stanza to poetry, five stanzas to bodily processes, and three to her deceased brother and muse, Edward Barker. The final stanzas are labeled "I.," "II.," and "III.," which further reveals that the poem consists of distinct parts. However, when they are taken together, the poem presents a larger, systematic argument: one can approximate knowledge by combining discrete particulars and several accounts. Barker's poem, like Hooke's diagrams or Galen's body, thereby illustrates the smaller components of working systems. It does so, in part, by emphasizing shifts in scale. In the same way that Hooke's microscope visually expands the louse beyond its normal point of human recognition, in the same way that Jonathan Swift describes Gulliver as miniscule in comparison to the Brobdingnagians, Barker enlarges the body. In the first shift, the body is blown up to the size of a building. In the second, the interior of the body becomes a physiological object capacious enough to hold the poem's speaker and guides. Veins become "*Labyrinths*"

through which "winding streams wou'd sport" (l. 71 and l. 74), the pyloric section of the stomach becomes a "Kitchin" (l. 49), and the intestines become a "Dining-Room" (l. 51).

Barker's metaphors are more than acts of poesy. Although she enlarges the body beyond its point of recognition, she does so in order to make its parts all the more recognizable. By likening veins to "labyrinths," for instance, she renders them visible while simultaneously making their function immediately knowable: veins are serpentine channels through which liquid flows. Likewise, the liver is both a "Court" and a "*Port*"—two places familiar to seventeenth-century men and women—from which

> All necessaries are brought from far,
> For sustentation in both Peace and War:
> For *War* this Common-wealth do's oft infest,
> Which pillages this part, and storms the rest. (ll. 43-48)

Barker's description of the liver-turned-clearing house connects the lived experience of the not-so-distant civil wars with the lived, but unnoticed, function of the liver.
By rewriting parts of the body in accord with human experience, Barker relativizes our relationship to physical objects. Her blueprint of the body, like Hooke's diagrams, renders physiological processes knowable through correlation and amalgamation. As Bender and Marrinan note, "Diagrams incite a correlation of sensory data with the mental schema of lived experience that emulates the way we explore objects in the world" (42). By emphasizing the civil wars that reshaped her world, Barker shows how individual parts of a system can be variously comprehended while always remaining codependent on other parts.

The final three stanzas of Barker's poem shift again. She zooms back out, reflecting upon what her anatomical journey has taught her, namely, that we cannot decipher God's works in any great measure. She writes:

> Should'st thou, my Dear, look down on us below,
> To see how busie we
> Are in *Anatomie,*
> Thoud'st laugh to see our Ignorance;
> Who some things miss, & some things hit by chance,
> For we, at best, do but in twilight go,
> Whilst thou see'st all by th' most *Transcendent* light,
> Compar'd to which the *Sun*'s bright *Rays* are night. (ll. 124-31)

Taken in isolation, this stanza seems resigned to human ignorance. The preceding stanzas suggest otherwise, however, and when the poem is read in its entirety, the message is quite different. While we may never have a comprehensive understanding of the natural world according to God's plan, we can approximate it by mitigating what "things [we] miss, & some things hit by chance." Under Barker's model, knowledge is, as Gevirtz argues, comparable to a fly's eye: "Like the eye of the fly, each narrative provides one lens, one view, of an object or idea; a sense of that object or idea is only possible when the views through all the lenses are combined" (75). By recapitulating and putting into conversation different anatomical theories and perspectives, Barker's poem provides and performs a collectivist method to organize and thus approximate knowledge. In so doing, Barker's poem demands that readers do so as well.

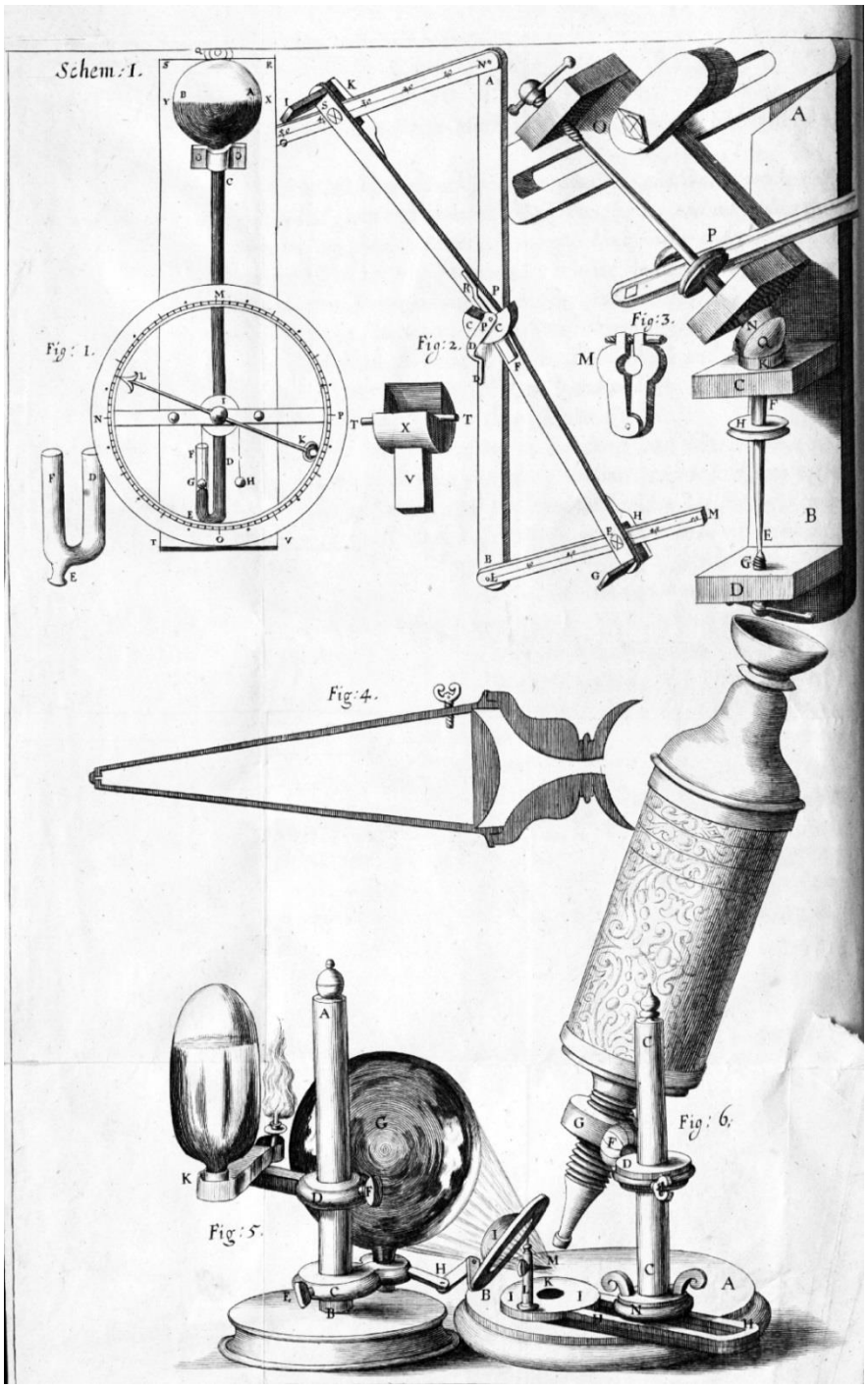

Figure 3.1 *Micrographia*, scheme 1, opposite p. 1[71]

[71] Within the illustration, figures 4 and 5 are different instruments: a waterscope and a scotoscope. For a description of each, see Lawson, 27-31. Courtesy US National Library of Medicine.

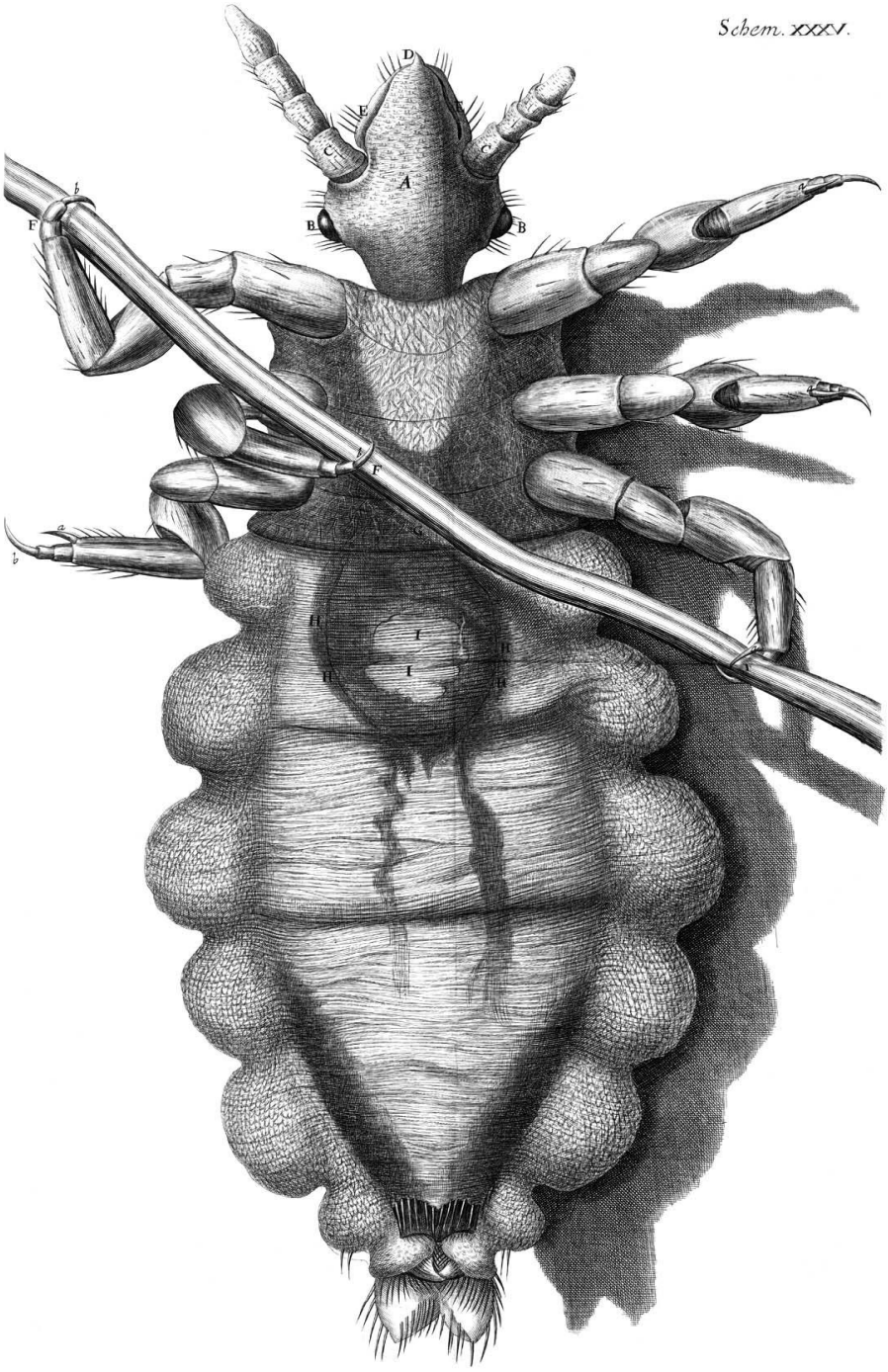

Figure 3.2 *Micrographia*, scheme 35, opposite p. 211[72]

[72] Courtesy US National Library of Medicine.

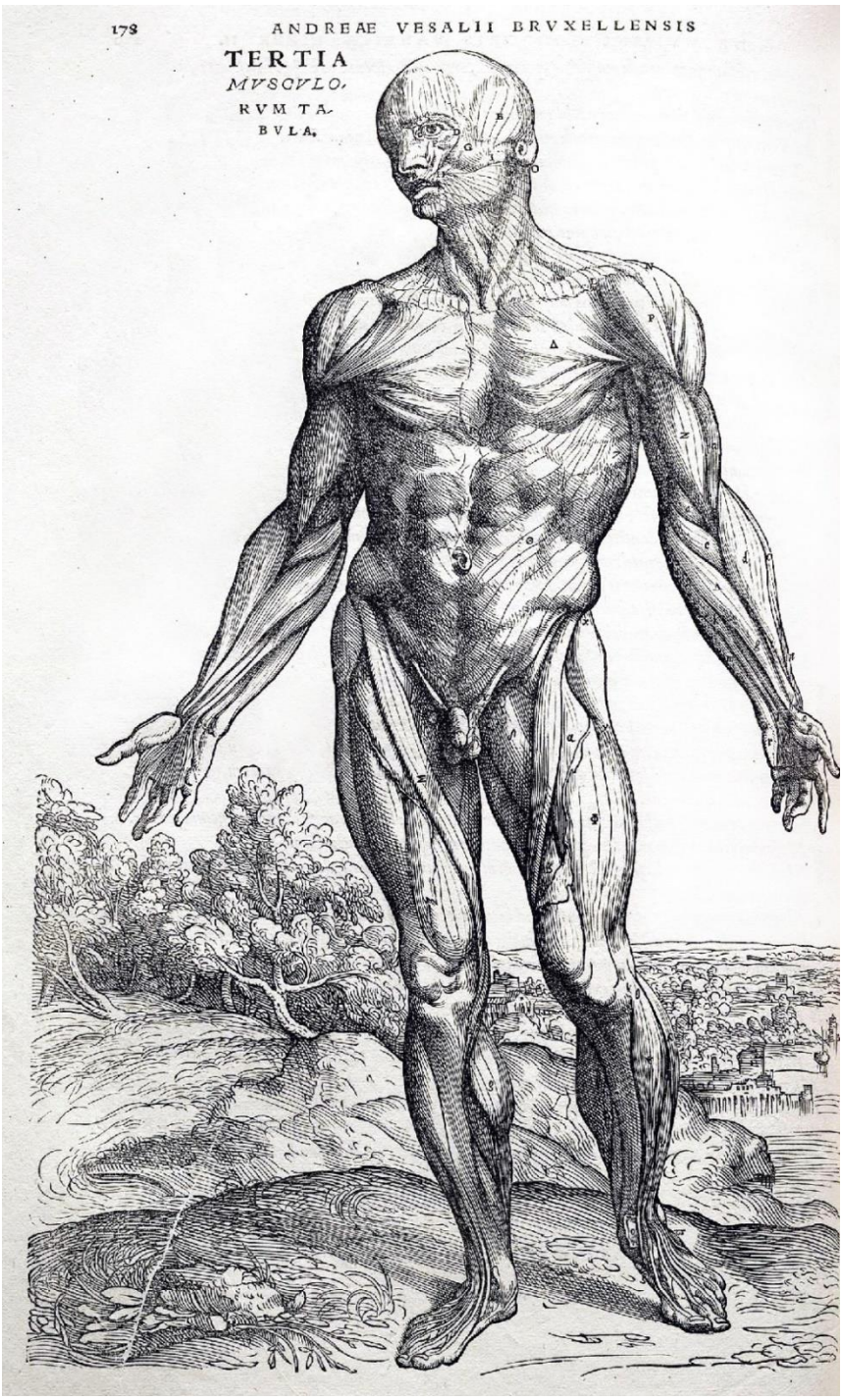

Figure 3.3 *De humani corporis fabrica libri septum*, 2.178[73]

[73] Courtesy US National Library of Medicine.

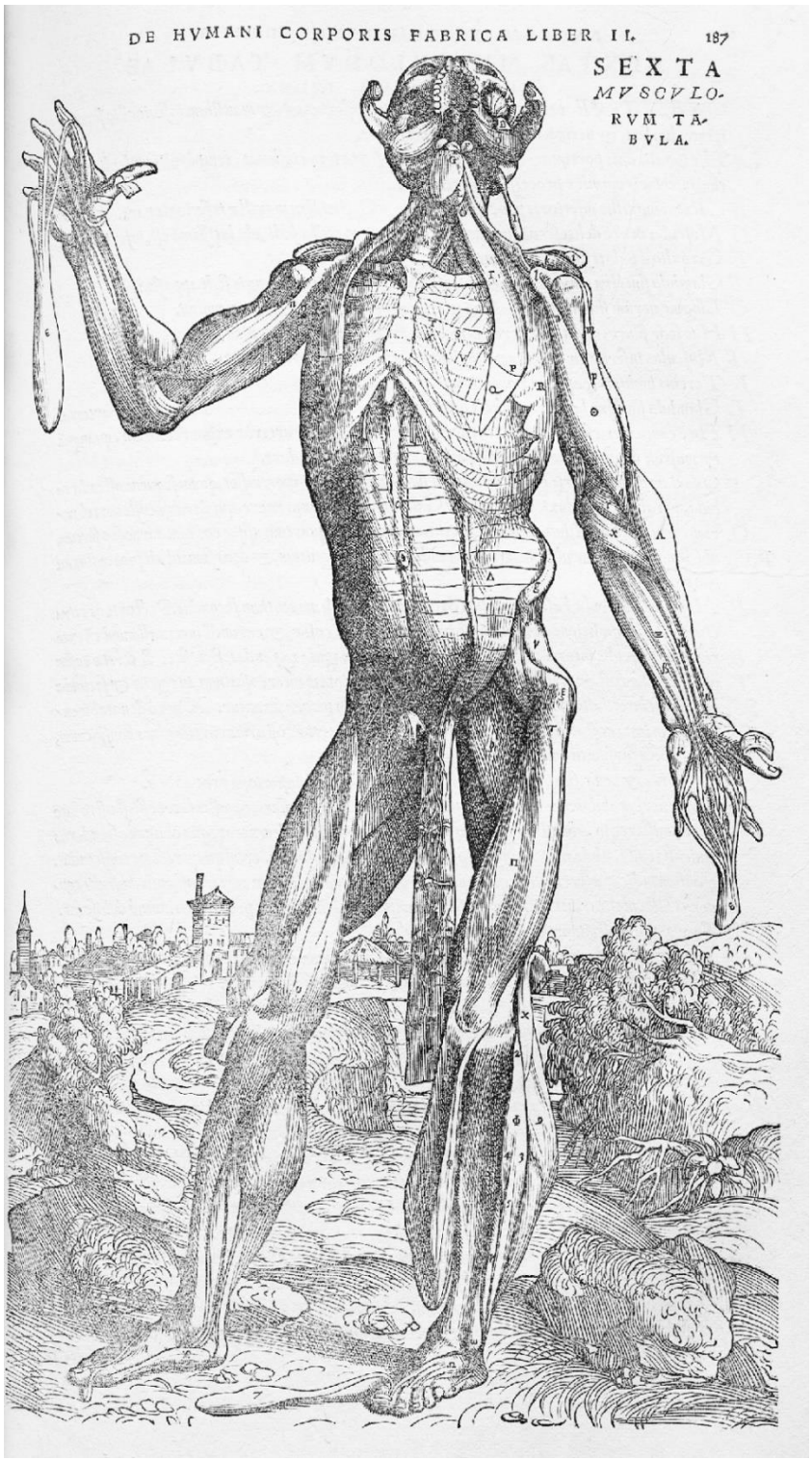

Figure 3.4 *De humani corporis fabrica libri septum*, 2.187[74]

[74] Courtesy US National Library of Medicine.

CHAPTER 4

PROMISCUOUS EXPERIMENTS: APHRA BEHN'S *LOVE-LETTERS*, EPISTOLARITY, AND THE PROBLEM OF DESCRIPTION

This chapter examines the impact and influence of description on empiricism, ultimately revealing an interdependent relationship between observation and formal, stylistic conventions. In so doing, this chapter argues that the objective, direct observation and experiential investigation that new science was premised on was far more prescriptive than descriptive. Scholars tend to agree that seventeenth-century natural philosophers experimented with form as much as they did with their objects of inquiry. As Claire Preston observes, there was "no default convention or format for presenting matters of fact" (12). Consequently, natural philosophers turned to and modified existing literary forms, such as the letter and the essay, to meet their needs. Simultaneously, the changing nature of knowledge from theory to the directly observable meant that practicing science and expressing it were akin; in Preston's words, "the res and verba are of one house" (10). Natural philosophers developed new, technical vocabularies and styles of writing to accommodate this new way of knowing as well as to mitigate the representational nature of language. Few scholars, however, have explored the way in which these vocabularies and protocols undercut the Society's project of empirical research and reliance on individual experience as evidence. What one observed or experienced was largely indebted to the features one was expected to emphasize in their subsequent descriptions.

The Royal Society's massive data-gathering campaign, that is, the "Scheme of Heads of Inquiry," and the stylistic conventions it codified neatly illustrate the prescriptive nature of empirical science. The scheme, which provided an organizational structure for numerous scientific treatises, consisted of compiling and subdividing experimental tracts by way of a list of topics, or heads. These lists not only itemized natural phenomena but, importantly, also set and structured the agenda for further inquiries. In so doing, the scheme of inquiries trained an army of amateur scientists, especially, but not only, travelers and travel writers, in the art of observation. Such prescribed observation, though ostensibly detached and impartial, created a situation in which experiencing and representing experience were inextricable because tied to a pre-established set of expectations and procedures.

Whether intentionally so, the Society's scheme borrows from and operates, methodologically, much like seventeenth-century letter-writing manuals and the products they shaped: letters. From prescribing rules of style to providing examples that functioned much like templates, letter-writing manuals dictated epistolary description, ushering in what become readily available and acceptable forms of expression. As such, and like scientific description, letters embody the tension between individual subjectivity and the strictures of form. Given the nature of letters and letter-writing manuals, it should not be terribly surprising that the seventeenth-century letter served as a model for organizing new knowledge; after all, much of new science was practiced via letters. In addition to creating and connecting an international community of observers, letters—like dialogs and encyclopedias—offered a fragmented and pluralistic view of the world. Consequently, they were an apt form for a period that, Thomas Beebee writes, was

preoccupied "with the creation of meaning and with questioning the received order" (6). Additionally, the rigidly discursive protocols of letter writing ensured that "each letter of reply rewords the tropes of the letter to which it responds" (Barnes 84). As such, the fragmented and pluralist form of seventeenth-century letters speaks to the Society's fragmented and pluralist approach to studying nature and their practice of prescribing how it should be described.

By looking at the highly formulaic and readily recognizable genre of epistolary romance that Aphra Behn employs in *Love-Letters Between a Nobleman and his Sister* (1684-1687), we can see that amatory intrigue operates by a set of protocols that organize experience in way that is similar to those that organize natural description. In particular, *Love-Letters* exposes the influence that stylistic conventions have on shaping and describing one's experience. Like Jane Barker, Behn uses imaginative writing to probe the limits of human knowledge but comes to a radically different conclusion. Whereas Barker suggests that the instability of experience can be mitigated by the amalgamation of multiple perspectives, leading to a more accurate picture of reality and account of knowledge, Behn questions the project of empiricism and the methodologies underlying it. Because the act of observing and experiencing cannot be separated from the act of communication and because communication was dictated by stylistic conventions, what one sees and what one therefore knows is entirely unreliable no matter the plurality of perspective. Consequently, in *Love-Letters* the characters are never certain of their own, much less another's feelings, and the reader, faced with an edited collection of letters and an unreliable narrator in Book III, is not either. For Behn, dictating what one should

observe and how to report it led to insights that were akin to and as unstable as fiction, itself.

4.1 PRESCRIBED OBSERVATION: THE SCHEME OF HEADS AND INQUIRIES

The Royal Society's adherence to detached observation and the creation of fact based on experience were undermined by the necessity of accounting for and ascribing meaning to individual sensory impressions. That representation was a concern is evidenced in the numerous discussions during the period centered on the slippery nature of language. In *Two Treatises* (1645) Kenelm Digby neatly encapsulates the problem: "It is true, wordes serve to expresse thinges: but if you observe the matter well; you will perceive they do so, onely according to the pictures we make of them in our owne thoughts, and not according as the things are in the proper natures" (2). The imprecision of language and its role as a mediating force between objects observed and the observer continued to trouble natural philosophers as the century progressed. Sounding much like Digby, John Locke writes in 1689 that "*Words* in their primary or immediate *Signification*, *stand for* nothing, but the *Ideas in the Mind* of him that uses them" (III.II.2: 405). Locke's and Digby's assertions go beyond issues of rhetoric and were epistemological in nature; given that language represents one's perceptions of events and only imperfectly so, description and epistemology form a kind of ouroboros.

Concerns over language's instability brought to the fore problems of representation and verisimilitude, but they also point to a related issue: the performative nature of scientific description. While seventeenth-century natural philosophers did not characterize their writing as such, preferring, instead, to see it as a representing "a close, naked, natural way of speaking" modern scholars argue otherwise (Sprat 113). For Peter Dear and Richard Scroll, performance is an inextricable aspect of seventeenth-century

science writing. As Dear notes, "an account of an experiment is an essential part of its performance" ("Narratives" 135). That is, an experiment cannot and does not take place without the act of ascribing meaning to it. Therefore, Galileo's practice of rolling balls down a plane is not an experiment until contextualized as such. Because, for Dear, "language is not simply a transparent medium of communication, but a shaper (perhaps a realizer) of thought," to do an experiment is always to engage in a discursive activity ("Introduction" 4). Richard Kroll, too, notes the connection between scientific knowledge and description: "The quality and scope of our knowledge of the world determines the quality and scope of our descriptions of the world; because to describe a thing is to appropriate, to *know* it, the quality and scope of our descriptions must also determine the quality and scope of our knowledge" (52). Consequently, descriptions of the natural world shape as well as reflect how it is perceived.

When descriptive vocabularies are codified according to disciplinary conventions they coalesce and are enacted at the level of genre. Widely theorized as "sets of conventions that make communication between writers and readers possible," genres both constrain and dictate what and how something is described (Broman 15). For example, new science's emphasis on detached observation meant that descriptions frequently effaced individual subjectivity. From ingesting arsenic to tasting pancreatic juice, experimental scientists regularly inserted themselves into their own investigations of nature.[75] And yet, in their accounts they deemphasize their physical role in

[75] In *An essay of the great effects of even languid and unheeded motion* (1685), Boyle writes of a "skillful chymist, [who] having in [his] presence, tasted some prepared arsenic, was quickly invaded by such symptoms, as he thought would soon kill him" (74); in 1664, Dutch physician and anatomist Regnier de Graaf catheterized the pancreatic duct of a living dog, which enabled him to collect pancreatic fluid; because of the fluid's taste,

experiments. Isaac Newton, for instance, describes a particularly shocking experiment in optics as follows:

> I took a bodkin (g h) & put it betwixt my eye and ye bone as near to the Backside of my eye as I could: & pressing my eye with ye end of it (soe as to make the curvature a, b c d e f in my eye) there appeared severall white dark & coloured circles r, s, t, etc. Which circles were plainest when I continued to rub my eye with ye point of ye bodkin, but if I held my eye & ye bodkin still, though I continued to presse my eye with it yet ye circles would grow faint & often disappear until I renewed em by moving my eye or ye bodkin. (qtd. in Gevirtz 101)

Although repeatedly inserting a needle into his eye, Newton represents himself as a detached, passive observer rather than an active, experiencing participant. In focusing solely on his eye and his method—although it is hard to imagine anyone wanting to replicate the experiment—Newton creates a distancing effect that allows one to forget he is simultaneously acting as experimenter and specimen. As Gevirtz notes, Newton's detachment here is at odds with his "infamous pugnacity" (101). That is to say, his description is not characteristic of the man but rather of the genre. His account manages to be both precise and accurate while also wholly incomplete as his experience is filtered entirely through the prism of scientific description and the attendant expectations of it.

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which he described as "most gratefully acid, sometimes almost insipid, sometimes, auster, often times salt, but most often acidly salt," de Graaf posited that the pancreas was vital to digestive processes (qtd. in Ragland 16); Douthwaite aptly describes such self-experimentation as "autobiographical empiricism" (72); and Schiebinger discusses the implications of it. For more on the way natural philosophers portrayed their embodiment as disembodiment, see Shapin, *Never Pure*, especially 237-258 and Gevirtz 64-70.

Scientific descriptions do not simply represent "the ideas in the Mind of him that uses them" (Locke III.II.2: 405). Instead, they shape what to look for and *how* to see. Brian Ogilvie's work on natural history serves as a useful illustration of this process. During the Renaissance, botanists, faced with inaccurate descriptions of the natural world handed down from antiquity, took to the field, carefully cataloguing nature so as to develop a new, more accurate picture. The shift toward experiential description and observational report revealed a lexical shortage that, Preston notes, required the use of similitudes and neologisms (48). Consequently, late seventeenth-century natural philosophers of all stripes added a mass of information to that already known, created a technical vocabulary, and began to develop what Ogilvie terms "a science of describing" (7). The creation and acceptance of a readily available technical vocabulary did more than cohere a disparate discipline; it also trained the botanist's eye. As Ogilvie explains, "what one observes is, to a large extent, a function of what one has been trained to observe and the vocabulary that has been elaborated to express it" (140). Seventeenth-century botanists, therefore, "condensed but also recapitulated their own experience of nature" based on generic conventions and a regularized vocabulary (Ogilvie 141). For Ogilvie, this practice led to the development of scientific realism, which suppressed or distorted certain elements of a specimen to highlight others (201). Botanical descriptions and illustrations, for example, typically emphasize the shape and structure of plants more so than their color and odor (because the latter are difficult to relate) and collapse the particular into the general (Ogilvie 182). Consequently, description came to be a necessary but problematic component of empiricism. It simultaneously functioned to render in precise detail natural phenomena while never actually doing so.

The descriptive regime that emerged in the seventeenth century reflects and enacts disciplinary practices and concerns as much as it did the objects that were being described. In other words, scientific descriptions reinforced scientific methods. With new science's adherence to matters of fact, descriptions tend to emphasize parts over wholes. In accordance with the Lockean view of knowledge as "nothing but *the perception of the connexion and agreement, or disagreement and repugnancy of any of our Ideas*," those parts were, to the modern eye, rarely placed in a coherent and systematized narrative (IV.I.2: 525). In *Occasional Reflections* (1665), for example, Robert Boyle includes a "variety" of things "scarce imaginable," including "Upon the manner of giving meat to his dog," "Upon clouds rising out of the sea, and falling down in rain not brackish," and "Occasional Reflections upon the Accidents of Ague" (13). Although Boyle describes his writing as "loose and desultory" and readily admits to "the incoherence of subjects," his practice of describing natural phenomena was typical of the period (*Occasional Reflections* a1r). This is not to say, however, that seventeenth-century scientific treatises and practice lacked system. Quite to the contrary, Boyle's writing exemplifies the programmatic and systematic form of description and approach to experimentation that the Royal Society adopted. Their "Scheme of Heads of Inquiry" served to systematically organize and elicit information from others. In routinizing and regularizing description, however, the Society made the detached observation they so prized all but impossible. Description became prescription and the direct testimony the Society required was, in effect, directed testimony, contingent upon style and form rather than a keen eye.

While the method of organizing information around a list of inquiries is most often associated with Robert Boyle it was, as Michael Hunter has shown, practiced by the

Society long before and almost certainly inspired by Francis Bacon. In his *Historia naturalis* (1622) Bacon makes note of his method, writing that "in each Title, after an Introduction or Preface, Particular Topics or Articles of Inquiry are immediately proposed, as well to give light in the present, as to stimulate further inquiry" (qtd. in Michael Hunter, "Robert Boyle" 6). According to Dana Jalobeanu, Bacon's lists "read as examples of well-ordered, disciplined experimental inquiries, i.e., that they are what Bacon hoped his readers would learn in order to be able to assemble properly constructed natural and experimental histories" (325). In addition to offering suggestions, however, Bacon's lists provided a set of guidelines and instructions for how to observe, decipher, and write nature.

Ultimately, Bacon aimed to create protocols for experimentation and a descriptive regime to accompany them. Suspicious of the empirics, Bacon put forth a fairly rigid set of rules so as to move from a "blind and stupid" form of empiricism to one that was educated (*Works* IV.I: :70). That is, he sought to differentiate "learned experience" (*Works* IV.I: 110) from the "woods of experience" (*Works* IV.I: 81). For Bacon one cannot successfully investigate the nature of anything in the thing itself because "the universe to the eye of the human understanding is framed like a labyrinth; presenting as it does on every side so many ambiguities of way, such deceitful resemblances of objects and signs, natures so irregular in their lines, and so knotted and entangled" (*Works* IV: 18). Consequently, observation was to be understood as a skill requiring a trained and practiced eye. In order to accomplish such training Bacon drew up modes of inquiry, a fundamental part of which were lists meant to "formalize and extend patterns of 'good and exact inquiry' and to generalize them into a methodology of experimentation"

(Jalobeanu 339). Part of Bacon's attempt to cultivate learned experience therefore rested on directions for further experimentation. While his instructions were meant to enable detailed descriptions, they created a situation in which experience and representing experience became inextricable and predetermined. For example, to test the effect of cold, Bacon tells experimentalists to "Take a small bladder of the thinnest skin you can find. Blow it up and tie it off, and bury it in nitre for some days; and then take it out and see if the bladder has gone down at all" (qt. in Jalobeanu 329). By telling experimentalists precisely what to look for Bacon is doing more than giving directions; he is prescribing the results of their experimentation. Afterall, by focusing on the change in size, an experimentalist might easily miss a change in color or odor. As such, Bacon's process of inquiry is not a process of discovery; it is guided observation. His methodology is, as he writes, meant to act as a "corrective spice" (*Works* III.1: 226) that allows one to see in the "daylight of experience" (*Works* V: 231). Bacon's forceful rhetoric implies that any other form of experimental method is wrong. A "corrective" requires and assumes an initial error. As such, doing anything other than what Bacon calls for is to accept, at least according to his terms, that you are in error. Experience, as Bacon deems it, does not involve observing and describing nature as it is but, rather, nature through the highly mediated lens of convention and protocol.

Midway through his career, Boyle enthusiastically adopted Bacon's use of heads (Michael Hunter "Robert Boyle"; Lynch). Describing the practice in his preface to *New Experiments and Observations Touching Cold* (1665), Boyle (wrongly) points to it as something new, writing that his "method is not exact" but was necessitated by "how comprehensive a Theme [he] had pitch'd upon, and how much more comprehensive,

future discoveries and hints might make it" (b4r). As such, Boyle opted to "draw up a company of comprehensive Titles, under which might commodiously be rang'd most of the Particulars [he] had observ'd, reserving those few, that were not so easily referable to any of those, to be thrown at last into a Section by themselves" (b4r). Like Bacon, Boyle not only provided an organizational structure for data but also structured an agenda for future experiments others might wish to take on; his "titles" served to provide hints for further inquiries. To justify his use of heads, Boyle argued that it was "highly useful for the discovery of the nature of a Body to consider how many wayes it may be examin'd, or (if you will) how many distinct *Phaenomena* and representations of itself, it may be made to exhibit" (qtd. in Michael Hunter, "Robert Boyle" 10). What Bacon and Boyle offered was not simply information but a method of describing.

Boyle adopted Bacon's notion of learned experience as enthusiastically as he did his heads of inquiry. As does Bacon, Boyle tries to mitigate issues with sensory impressions and experience through a program of reflection. For Boyle, the virtuosi:

> consult Experience both frequently and heedfully; and, not content with the Phaenomena that Nature spontaneously affords them, they are solicitous, when they find it needful, to enlarge their Experience by Tryals purposely devis'd; and ever and anon Reflecting upon it, they are careful to Conform their opinions to it; or, if there be just cause, Reform their Opinions by it. ("Christian Virtuoso" XI: 292)

Boyle's word choice, here, is telling. Experimentalists are to "Conform their opinions." That is, they are to revise their initial understanding of an experience or experiment according to a standard set of procedures or "tryals" which Boyle has defined.

Consequently, Boyle's hallmark of a good scientist does not rest on unadulterated experience, authentic testimony, or spontaneous sensory impressions. In writing that the virtuosi "enlarge their Experience" by "tryals" and "reflecting upon it" he asks for more than detached observation. In so doing, Boyle simultaneously suggests that experience is the bedrock on which science should be based at the same time as he recognizes its instability. Boyle's assumption that virtuosi "conform" or "reform" their opinions implies that without these trials experience is always flawed and must be corrected by their systems.

Travel writing serves as an instructive example as to how the Society dictated, directed and, therefore, influenced observation according to the principles set out by Bacon and Boyle. As Hunter writes, in 1661 a body of sixteen fellows was selected for "considering of proper questions to be inquired of in the remotest parts of the world" (qtd. in Michael Hunter, "Robert Boyle" 14). Documents or lists of inquiries were drawn up for specific locales, such as the Americas, Iceland, Turkey, Guinea, etc., and published in *Philosophical Transactions*. Not relegated to land, sailors too received "Directions for Sea-men, bound for far Voyages" (qtd. in Michael Hunter, "Robert Boyle" 15). While these lists were meant to act as guides for the kind of information the Society was interested in, they undoubtedly influenced the reports they engendered.[76] For example, Boyle directed travelers to record "latitude and longitude, the air, meteors, sea-water, rivers, tides and currents" along with flora and fauna as well as the "stature, Shape, Colour, Features, Strength, Agility, Beauty (or the want of it), Complexions, Hair, Dyet,

[76] Carey argues that the relationship between natural history and travel was not as unidirectional as these lists might imply; the journeys people took and the items they brought back frequently suggested new courses of investigations and experiments.

Inclinations and Custums that seem not due to Education" of native peoples (qtd. in Michael Hunter, "Robert Boyle" 23). By dictating precisely what characteristics travelers should take note of Boyle almost certainly influences what and how they see. Consequently, a traveler following Boyle's directions could not possibly provide the Society with an unmediated or detached observation. Instead, observers were to "conform" their opinions and limit their investigations to the guidelines set forth by the Society.

Bacon's and Boyle's highly mediated approach to observing natural phenomena is mirrored in the language they use to describe nature writ large. Boyle echoes Bacon's reference to educated experience in his description of "the World" as:

> the great Book, not such much as of Nature as of the God of Nature . . . crowded with instructive Lessons, if we had but the Skill, and would take the Pains, to extract and pick them out: The Creatures are the true Aegyptian Hieroglyphicks, that under the rude forms of Birds, and Beasts, &c. conceal the mysterious secrets of Knowledge, and of Piety. (*Occasional Reflections* 47)

According to such descriptions, and there were many of this sort, natural philosophers defined their roles as readers. Like literacy, observation needed to be taught and required the habits of mind that Bacon and Boyle extoll. Observation, however, is only part of the process of creating knowledge. In order for one's observations to be meaningful, one needed to relay them to another and did so in a disciplined and educated manner. As such, these accounts represent a mastery of genre more so than one's experiences.

Originally proposed by Bacon, enthusiastically taken up by the Society, and popularized by Boyle, this form of scientific inquiry prescribed the kinds of observations

that were to be made. Bacon's and Boyle's scheme thereby initiated not just a practice of scientific investigation but also a mode of scientific description, subsequently ushering in a narrative form and working to solidify generic conventions to fit that form. For some scholars, Boyle's patch-work frame and the vast array of subjects he treats within his treatises evidences his desire to identify new ways of writing that could accommodate new ways of knowing (Bratach 213). And while it is true that the seventeenth century saw an epistemological shift in the way in which nature was approached, the miscellaneous and episodic descriptions that characterized seventeenth-century science writing were not, formally speaking, new.

As the next section demonstrates, the prescriptions put forth by Bacon and Boyle that influenced and ultimately came to dictate scientific observation and description have their most obvious corollary in seventeenth-century epistolarity and the letter-writing manuals that codified it into a cohesive practice. Boyle's inquiries operate much like letters, which, Beebee notes, were "an ideal, readily available form for attempting to construct mini-narratives" (6). Both letters and heads of inquiry describe and narrate the natural world in an episodic fashion. Moreover, like descriptions of the natural world, the letter represents the world not as it is but through particular generic conventions and a set vocabulary popularized by letter-writing manuals of the period.

4.2 DICTATING *ARS DICTAMEN:* LETTERS AS GENRE

It is tempting to see seventeenth-century letters, especially personal letters, as tantalizingly autobiographical. However, letter writing, as James Daybell has argued, involved far more than literacy; according to Daybell, "organization and persuasiveness, linguistic and verbal dexterity, rhetorical and social adroitness, as well as technical and

legal expertise" were among the skills letter writing required (5). Letter writing was guided by and indebted to strictures put forth by letter-writing manuals, such as John Hoskyn's *Direccions for speech and style* (ca. 1599) or Heneage Finch's *Certain rule & observations for a secretary* and *Superscriptions and addresses of letters* (ca. 1665). As the latter titles suggest, letter-writing manuals established set vocabularies, provided organizational schema, and even included instructions on how to properly fold missives. Because letter writing was seen as pedagogical, serving as a means by which to teach grammar, Latin, and composition, school boys were trained in the art of letter writing, which further reinforced the conventions set forth in manuals.[77] In *Right Teaching of Useful Knowledge* (1649), for example, George Snell advocates "dictat[ing] to their Scholars models, and forms of well penn'd letters to everie degree of persons premised; that upon anie sudden occasion offer'd they taking pen and paper, may bee abel to dispatch a well-composed letter" (104). As such, students should be instructed in "the most useful phrases and forms of speech for Epistolarie stile," "phrases of inchoation," and "Interlocutorie forms," and know how "to conclude letters" with a "subscription . . . filled with verie affectuous, and vigorous words" (Snell 104-105). Likewise, in his *Scholars Guide* (1665), Ralph Johnson too remarks on style. Sounding much like Sprat, Johnson argues that "all epistiles must be written in a low, short, and pithy style, without affectation, periphrase, or garrulity" and that "all Epistles shun Tautologies, by varying the phrase, when the same sense is repeated" (6). Casting his suggestions as "Rules," Johnson makes clear that his advice is not to be taken as mere suggestion (16).

[77] For more on the use of letter-writing manuals in academic and vocational training, see Mitchell.

Instructions for composing letters even occurred in texts not solely devoted to epistolarity, such as Thomas Blount's *The Academie of Eloquence* (1654). In a section following a discussion of Bacon's lesser forms, in which Blount addresses "the Portals and postern-doors of stile and speech, and of no small use," Blount provides a "collection of letters and addresses" along with some "particular Instructions and Rules premised for the better attaining to a Pen-perfection" (A4v). As with many manuals of the period, Blount organizes his examples by way of heads, including "A passionate letter of affection" (156), "To a Lady upon her weaving hair-bracelets" (167), "Upon the late Commotions" (170), "Upon the New-year" (223), and so forth.[78] In so doing, Blount provides both instruction and examples that could be easily identified and adapted. Blount's demarcation highlights a keen sensitivity to genre, especially in the epistolary form. Not all letters were of a kind and therefore required a different vocabulary and approach. While Blount narrowly categorized letters based on specific situational use, others, like Johnson, divided them into more general categories: demonstrative ("such as respect praise or dispraise"), deliberative ("such as tend to persuade or dissuade"), and judicial ("such as accuse or defend") (17-19). Although usually classed as familiar letters, even love letters were subject to generic prescription; based off of models set forth by Petrarch and Pietro Bembo, love letters were expected to contain "lofty tones" and "lengthy plaints on the exquisite agonies of love" (Cohen 193). All letters—including those of the personal and familiar variety—conformed to and were shaped by strict

[78] Blount's organizational structure was not uncommon for letter-writing manuals, even those in manuscript form. Green notes that one such collection, spanning from 1545-1597, was "arranged under the heads of advice, answers to petitions, orations, and letters commendatory, consolatory, exposulatory, gratulatory orations, narratory, and supplicatory" (104).

interpretive models. Consequently, while letters supposedly represented a writer's innermost thoughts, the way in which those thoughts were framed was regularized and regulated by letter-writing manuals.

From teaching school boys grammar and Latin as well as providing models for correspondence, letter-writing manuals permeated early modern life.[79] As Lawrence Green writes, collections of letters and exemplars proliferated by the end of the sixteenth century, mostly in manuscript form. While the print market for letter-writing manuals lagged behind its manuscript counterpart, there was an increase in demand by the mid seventeenth century; according to Green "from 1570 to 1650, the English averaged sixteen [letter-writing manual] printing[s] each decade, and from 1650 to 1700 they averaged twenty-seven" (105). The nearly two-fold increase can, in part, be attributed to the Restoration's craze with all things French; with the return of Charles II many writers sought to import French culture, leading to the translation of numerous manuals (Green 113-114). The increase in letter-writing manuals is also likely due to changing conceptions of the nature of letters. The humanist impulse of the Renaissance led to more flexible, personal epistolary forms than the medieval period allowed (Daybell 2). Consequently, letter writing began to be seen as a social behavior "through which one's courtesy and civility were demonstrated and measured" (Schneider 43). As such, and as Cohen argues, letter writing was "a highly conventionalized undertaking"; letter writers were "necessarily directed by and made use of the ideas, forms, and words that their

[79] The relative paucity of contemporary criticism centered on letter-writing manuals as compared to epistolarity belies the importance and impact of these guides. As Poster argues, "Letter-writing instruction has existed in a well-attested tradition from the earliest known Western cultures to the present" (1).

culture provided" (192). The prescriptive nature of letter-writing manuals solidified and codified epistolary conventions. Consequently, letters came to reflect the "easy, intimate style, and the expression of individual feeling of affection" that seventeenth-century letter-writing manuals encouraged (Daybell 6).

Seventeenth-century letter-writing manuals suggest a firm understanding of how letters operated during the period. Despite the recognition that letters were frequently passed around and read aloud, however, some scholars read the "easy, intimate style" that letter-writing manuals prescribed as indicative of private correspondence. Consequently, and as Janet Todd notes, modern scholars frequently see personal letters as more authentic than public letters. This has led to assumptions that private letters somehow serve as a conduit to the writer's innermost thoughts. In his study of letters in the 1640s, Gerald MacLean, for example, points to the intercepted letter, arguing that these "letters necessarily threaten to reveal their writers" (182). For MacLean, "Letters cannot help but risk exposing writers as they truly are" (182). Todd presents a contrasting view. She argues that such letters only served to reinforce the notion that even personal letters were public, asking "how could a letter be private when even a king's intimate letters to his queen had in living memory been paraded before the public?" (426). Views of the private letter as private have led to the rise of dangerous assumptions. As Todd notes, the modern view of personal letters as authentic and autobiographical mean that "we value letters because they have the appearance of genuine, modern subjectivity, and because we often ignore their generic, rhetorical features" (418). Like Todd, Diana Barnes too notes that letter writing is "not a natural mode of writing in any simple sense" (5). For Barnes, the letter is a "sociable form that speaks for the group rather than the individual"; it "provides

the discourse and rhetoric to conceptualise a more inclusive vision of community" (1). In that way, letters, like the Society's "Scheme of Heads of Inquiry," represent and reveal a particular orientation to the world that is dictated by the protocols associated with its form.

Amy Elizabeth Smith offers a more useful distinction than that of private and public. In so doing, Smith has argued that epistolary discourse is not monolithic and should not be read and theorized as such. Letters published in *Philosophical Transactions* and used to conduct and transmit scientific knowledge, for example, were written for a broader community, even if addressed to a sole individual; formal letters, as Smith calls them, "do not foster the illusion of private letters made public" (186). Familiar letters, on the other hand, were written, or purported to be written, for individual readership, even if widely disseminated or fictionalized. In pointing out the rhetorical differences between familiar and formal letters, however, Smith also points to the way in which letter writing, even that of the more intimate kind, was a highly stylized and conventionalized endeavor. Seventeenth- and eighteenth-century men and women were well aware of letters as such and read them accordingly. Although calling familiar letters "thoughts just warm from the brain without any polishing or dress," Alexander Pope, for example, notes their constructed nature, referring to them as "the very dishabille of the understanding" (qtd. in Amy Elizabeth Smith 185). And, as any seventeenth- and eighteenth-century amatory writer and reader was well aware, dishabille is a carefully affected state that only hints at nudity. Letters, whether formal or familiar, represent more than just the expression of individual experience and impressions; they also represent a performative act that is

dictated by an already established set of expectations and, consequently, elicited an already established set of responses.

From the practice of science to the upkeep of the social, letters served as objects of discussion as much as sites of information. Peter Conroy argues that such practices, especially the communal discussion of letters at literary salons, led to the "recognition of the letter as a genre, as a public discourse rather than a private one" (413). This recognition paved the way for the epistolary novel, which "took upon itself that particular way of rendering the outside world that the letter had already conditioned the reading public to accept as normal" (413). In other words, readers and writers were highly attuned to a particular form and style that both influenced and reflected the way they described and understood their surroundings. As such, letter writers frequently called attention to the mechanics of their own writing, reinforcing that they are constructing natural and social phenomena though purporting to simply note them. For example, in her 1717 letter to Pope, Lady Mary Wortley Montagu writes:

> I am at this present moment writing in a house situated on the banks of the Hebrus, which runs under my chamber window. My garden is full of all cypress trees, upon the branches of which several couple of true turtles are saying soft things to one another from morning till night. How naturally do *boughs* and *vows* come into my mind, at this minute? and must not you confess, to my praise, that 'tis more than an ordinary discretion that can resist the wicked suggestions of poetry, in a place where truth, for once, furnishes all the ideas of pastoral? (118)

In her description, Montagu not only calls attention to her writing as writing but notes the way in which it impacts what she sees; the trees and turtle doves outside her window

become “boughs and vows.” Although she asserts that truth provides ideas of the pastoral, the formula is likely reversed. Undoubtedly, Montagu’s poetic view of her surroundings was impelled by her intended recipient: Pope. As Janet Gurkin Altman notes, the “awareness of a specific second-person addressee can alter the character and experience of the first-person writing self” (91). Because letters are carefully constructed artistic devices whose conventions were defined by strict guidelines presented in letter-writing manuals, they blur the boundaries between the real and the fictional. Consequently, and like descriptions of the natural world, the letter represents the world not as it is but through particular conventions and vocabulary.

The next section argues that in *Love-Letters* Behn uses the epistolary form to critique empiricism. Referring to the period as the “blessed Age of swearing, and the hopeful Reign of evidences,” Behn’s politics and mistrust of the law bleed into her mistrust of empiricism and the objectivity it ostensibly promises (A3r).[80] In the context of the novel, Silvia’s and Philander’s letters supposedly attest to “the soft affairs of love” (A8v). What they actually demonstrate, however, is a mastery of formulaic description. Philander and Silvia seduce one another and readers alike. In Todd’s words, the whole thing is a “hoax” predicated on “an illusion of immediacy and directness through skill with the epistolary form” (424). Through Philander and Silvia's letters, Behn demonstrates that the episodic and miscellaneous representation of experience shows just how radically open to suggestion the course of knowledge could be; she further suggests that attempts to rein it in by way of generic conventions did little to ameliorate the

[80] In regard to Behn’s politics, Todd writes “Behn did not have the later English and Whiggish respect for the law and had no sense that it comprehended truth; for her, the law gave verdicts not revelation, and embodied power rather than justice” (426).

problem. Ultimately, *Love-Letters* argues that there is no unadulterated access to nature or experience—and, indeed, adultery is a prominent theme throughout the text.

4.3 EPISTOLARY ROMANCE: THE 'CANT AND STUFF' OF DESCRIPTION

Love-Letters, published between 1684 and 1687, does not take new science as its primary topic of discussion. Instead, the three parts comprising it follow a typical amatory plot and serve as a *roman a clef* dramatizing the Monmouth rebellion and affair between Lord Grey, i.e., Philander, and his sister-in-law Lady Henrietta Berkeley, i.e., Silvia. Nor does it adhere to a strict epistolary form. Book I is made up of letters between the two lovers, Book II mixes letters with narration, and Book III eschews the letter form almost entirely. Although Behn does not explicitly address new science within the *Love-Letters*, one should not discount the culture in which it was produced. As Anne Bratach has remarked, the relationship between prose fiction and empirical study in the late seventeenth century was widely accepted (209). Moreover, during the same period that she penned *Love-Letters,* Behn was actively and prolifically writing about new science. Even in works that were not explicitly about science, such as *Love-Letters*, Behn employed methodologies similar to those used in experimental science and the language of natural philosophy operates throughout.[81] In her translation of Fontenelle's *A Discovery of New Worlds* (1688) as well as in *Oroonoko* (1688), for example, Behn mirrors the natural philosopher's approach to nature, inventorying and accumulating information for reflection. In *Oroonoko*, Bratach explains, Behn takes "empirical

[81] According to Gevirtz, *Love-Letters* is "riddled with allusions to the latest scientific knowledge: Silvia explains how the motion of her blood changes with her emotions and feels Brilljard's pulse to see if he is lying, Antonett describes a young clergyman wooing her with natural philosophy, and so on" (37).

investigation as the theme of her narrative, and, moreover, effectually turns her narrative into the site of generic experimentation" (211). Pointing to the narrator's characterization of *Oroonoko* as a tale of "natural Intrigue," Bratach connects Behn's language of romance to that of philosophy, suggesting that both novelists and natural philosophers shared the belief that "unadorned nature" is entertaining enough without the art of embellishment (216). In *Love-Letters*, Behn suggests that description based on experiential observation are never unadorned, whether they occur in a philosophical treatise or a romance.

Behn uses the tools of natural philosophy, most especially Boyle's insistence on close observation followed by reflection, to expose the fault lines in the Society's method of investigation. While the reflective habits of mind encouraged by natural philosophers supposedly democratized science, suggesting anyone could practice, they actually inculcated a system in which writing and observation were intertwined.[82] As Karen Bloom Gevirtz notes, the narrative structure of Behn's epistolary romance turned novel, that is, Behn's shift from the multiple perspectives embodied in letters to the singular perspective of the third person narrative, allows Behn to probe the limits of language and the Society's insistence that language bring "all things as near the Mathematical plainness, as they can" (Gevirtz 39-42; Sprat 113). By extension, then, Behn also interrogates scientific realism, ultimately arguing that there is no unadulterated access to nature or experience. The epistolary novel was an apt vehicle for Behn to challenge the premises of new science because it creates, in Altman's words, the "illusion of reality,"

[82] For more on Boyle and the habits of mind he attempted to cultivate in the wider population, see J. Paul Hunter "Boyle"; Harwood, "Introduction"; and Michael Hunter *Boyle*.

thereby mimicking the effect of scientific realism at the same time as it employs the episodic structure of Boyle's heads (6).

In Philander's first letter to Silvia, and, indeed, the first letter of the novel, Behn illustrates the way in which formalized descriptions lose meaning and particularity. Within the letter, Philander calls Silvia an "unresistable *Idea*"—the ghost of whom is more present to him than when he "parted from [her]" (1). In so doing, Philander explicitly points to the way in which his subsequent description is a representation that is seemingly based on his own desire rather than on Silvia, herself. And yet, his rhetoric is remarkably formulaic. He describes her as possessing:

> all the charmes of blooming youth, with all the Attractions of Heavenly Beauty! Loose, wanton, gay all flowing her bright hair, and languishing her lovely eyes, her dress all negligent as when I saw her last, discovering a Thousand ravishing Graces, round white small Breast's, delicate Neck, and rising Bosome, heav'd with sighs she would in vain conceal; and all besides, that nicest fancy can imagine surprising— (1)

In comparing his vision to "when [he] saw her last," Philander notes the constructed nature of his description and the quandary it creates: Silvia is an absent presence at the same time as she is just an "Idea"—an idea that, notably, is not unlike most descriptions of heroine's bodies. It is as if Philander is following a set of protocols for observing and describing Silvia's body—not unlike the natural philosophers who were likewise expected to align their descriptions with a set of established conventions and vocabulary.

Although Behn was concerned with the instability of language, she takes her critique one step further. For Behn the issue is not simply one of language and

representation; it is an issue of genre. Philander's description of Silvia follows the conventions of romance as well as natural philosophy. Silvia's qualities are inventoried in list form and she is represented as a series of parts—"hair," "eyes," "breast's," "Neck," and "Bosome"—that never add up to their whole. Moreover, on becoming too impassioned, Philander draws back—he "dare[s] not think on." Like natural philosophers, Philander attempts to maintain distance, to sound rational and detached rather than "mad and raving." Given the already arduous nature of his description, however, Philander's reticence to continue points to the constructed nature of his description; he is simply following the conventions of amatory intrigue: the "Cant and Stuff . . . which Lovers serve themselves with, on occasion" (268). Through Philander, Behn, thereby points to the way in which descriptions, because guided by the dictates of genre, are never unadorned. Consequently, and as Behn demonstrates throughout *Love-Letters*, attempts to ameliorate the instability of language by way of systematized and formulaic descriptions only heightened it.

Using the highly formulaic genre of epistolary romance, Behn shows how dictating what one should observe and how to report it alters one's experience. That Behn's use of the epistolary form is "not necessarily innovative" on its own has, for some, detracted from the novel (Gevirtz 40). Robert Mayer, for example, argues that *Love-Letters* should not be read as a novel because nothing in it would have been seen as revolutionary or a new form of discourse (151). As Todd has noted, for critics like Mayer "something in Behn's use and creation of letters does not pass modern muster" (419). And yet, as Todd argues, *Love-Letters* is "*about* letters" (423). In looking for innovation in Behn's use of the epistolary form or authenticity in the letters themselves, we miss the

point. Behn's conventional use of the epistolary genre is exactly to her purpose. Through it Behn problematizes the relationship between experience and description and thus empiricism in general. What Behn understands is that the impact generic features have on shaping the discourse of epistolary romance is akin to the impact of those that shape the discourse of science. In both cases the method is as unstable as the self on which it is premised.

Behn's characters are much like Ogilvie's botanists or Boyle's travelers. They know the genre in which they are writing and address themselves accordingly. Philander, for example, is well aware of the "Cant and Stuff, as this, which Lovers serve themselves with, on occasion" (268). He writes his letters accordingly, filling them with descriptions of his torment, tireless devotion, and desire to "press thee with kisses; folding thee in my transported arms, and following all the dictates of love without respect or awe!" (12). Likewise, Silvia explicitly demonstrates her knowledge of the "Rhetorick of Love," describing its features as "half-breath'd, interrupted words, languishing Eyes, flattering Speeches, broken Sighs, pressing the Hand, and falling Tears" (27). As such, her "Soul is ever fixt" and she is able to end what "Discourse you please . . . all in Love!" (27). In calling their shared language "Rhetorick" Silvia points to the way in which the letters function, thereby emphasizing their form over their content. Eloquence of expression is not required, so long as they express themselves through the language of love. The excessively emotive nature of Philander's and Silvia's letters has led some critics to characterize them as tiresome; for John Richetti, Philander's "unrelenting amatory rhetoric" is "of the most flatulent sort" (*English Novel* 22). More charitably put,

Philander's unceasing linguistic foreplay is utterly trite. However, it is purposefully so. Behn leans heavily on the conventions of romance to expose that they are conventions.

Silvia and Philander's respective experience of one another as lovers and, in particular, their description of that experience is influenced by their mutual understanding of what lovers do and say. Their letters are integral to that process. As Green has written, the rediscovery of classical influences, like Cicero's familiar letters, and the effort to incorporate and use this classical rhetoric to project the presence of the human writer led "to the realization that all such created senses of the human self are to some degree rhetorical fictions, that skilled writers can choose among available fictions and that recipients can participate in such fictions" (102). Therefore, when Silvia and Philander describe their actions and behaviors their descriptions often follow the formulaic language of epistolary romance. Silvia, for example, writes that she

> threw [her]self down on that bank of grass where we last disputed the dear but fatal business of our souls . . . There with ten Thousand sighs, with remembrance of the tender minutes we past, then I drew your last Letter from my Bosome; and often kist, and often read it over; but oh! who can conceive my torment, when I came to that fatal part of it, where you say you gave your hand to my sister? I found my soul agitated a Thousand different passions . . . I threw my self with fury on the ground, and prest my panting heart to the cold earth, then rise in rage and tear my hair, and hardly spare that face that taught you first to love. (4)

Here she describes her "Torment" in terms resonant of what she has earlier termed the "Rhetorick of Love." Although she claims that "no Arts of speaking could have talk'd [her] heart away," her letter explicitly suggests otherwise (27). Silvia is in the throes of

passion precisely because she has reread Philander's missive and she reconstructs her experience of doing so in terms that are reminiscent to his. In so doing, Silvia enacts and engages in the mutually reinforcing nature of description; returning to Barnes, Silvia "rewords the tropes" (84). Whether salacious or scientific, the representation of one's experience is already prescribed and these prescriptions, in turn, influence the way one experiences or observes. Silvia and Philander's adherence to the generic conventions of epistolary romance thereby continue to ensnare one another because it renders their experience recognizable.

Behn emphasizes the way in which genre lends credibility to one's assertions by dramatizing what happens when writers do not follow its dictates. When Philander strays in Book II, his epistolary philandering gives away the game rather than his actions. After all, Silvia's suspicions are not new; in Book I she frequently questions his motives, lamenting his marriage to her sister and foretelling her own ruin. What is new, however, is Philander's response to her. Though Philander still professes his ardor, he does so in a way that fails to satisfy the conventions of epistolary romance. In addition to being comparatively terse, his letter is devoid of the hyperbolic, florid descriptions that marked his earlier prose; instead, he asks Silvia's "Pardon for leaving her" and writes that he has: "felt all your Pains, I have burnt with your Feaver, and sigh'd with your oppressions" (150). Silvia rightly readers Philander's claims as disingenuous because, as she notes, they are not accompanied by detailed descriptions of his torment, that is, what feeling all her pains and burning with her fever consisted of for Philander. Silvia is therefore quick to tell him that his letter "'tis all cold—Short—Short and cold as a dead Winter's day" and lacking in "all thy pretty Flatteries of Love" (156). In his response, Philander accuses

her of loving "the Flatterer, and not the Man, the Lover only, not *Philander*" (199). As Silvia intuits and what Behn suggests is that the two are inseparable. As a surrogate for his physical being, Philander's letters and the way in which he describes his experience of Silvia within them are inextricably intertwined. Philander the man and Philander the flatterer are one and the same. Whereas Philander's accusation calls into question all of his previous letters, to suggest, even, that they were merely filled with "cant," Behn implies otherwise. Philander's feelings, though fickle, were nevertheless experienced by him as authentic. By taking on the persona of the lover he became the lover and in casting it off he became, among other things, a poor correspondent.

In coupling Philander and Silvia's emotional distance with their geographical distance—he is in France and she in the Netherlands—Behn speaks to an issue of concern in the Royal Society: the verifiability of individual observations. As Daniel Carey has discussed, travel writing, though frequently consulted and taken as truth, raised the possibility of "lying by authority," that is, the possibility that travel writers might take advantage of "the distance between their observations and confirmation of additional witnesses" (269-270).[83] By juxtaposing Philander's continued insistence of constancy alongside his confession to Octavio, that he is, indeed, pursuing another woman, Behn probes the limits of direct testimony and the difficulty of regulating it. Rather than reforming his ways, Philander simply attempts to revise his prose. Directly tying Philander's misdeeds to stylistic conventions, the narrator notes that Philander's "Stile of Letters" evidences "that first Symptom of a dying Flame" (202). In so doing, the narrator not only points out the way in which Philander has failed in meeting the expectations of

[83] See also Shapin, *Social History* 245.

genre but also the way in which a mastery of genre can obfuscate truth. The problem with direct testimony, as Behn casts it, is that it is actually directed testimony.

The tension between direct and directed experience plays out throughout *Love-Letters* but is encapsulated by Silvia in Book I and made starker by Octavio in Books II and III. Early on, Silvia describes her thoughts as "unstudy'd" (208) and laments that "words do not enough express [her] soul" (34). Given the way in which her language of devotion mirrors that of Philander's, however, study appears to be exactly what she is doing. When she strays from the subject of her devotion to Philander's political activity, he offers her a gentle corrective—asking, "Where learnt her tender Heart the Notions of rigid Business: Where her soft Tongue, form'd only for the dear Language of Love, to talk of the concerns of National and Kingdoms?" (40). According to Todd, Book I shows "the intellectual growth of a letter writer and letter reader learning how to understand and manipulate signs, and how to represent herself so as to raise desire in the other" (428). That is, Silvia becomes, like Behn, a master of the epistolary form and filters her feelings through that lens.

Silvia's mastery of genre becomes even more apparent when compared to Octavio's lack thereof. In Book II the narrator notes that Octavio writes in "haste and Disorder" as the reader "may plainly see by the Stile" (341). In pointing out Octavio's style, Behn points out the nature of directed experience. Octavio's letter appears disordered because he is. Were he to refine his prose the missive would be different—or at least different enough that his style would be of little note. Octavio, however, "knew no Guile" (322). By contrast, and as we are told in the opening to Book I, Silvia has been

"taught" to understand that the "pain and languishment" she felt "'twas Love" and frames her experience accordingly (A7v).

Whereas natural philosophers cast their descriptive practices as a project of decoding, Behn implies that description entails a process of encoding. As Todd notes, Behn's background as a spy inevitably led her to associate letters as ciphers. For Behn, the letter does not represent "authentic subjectivity" but is, instead, "a kind of foe that must be mastered" (432). Not surprisingly, then, Silvia and Philander spend much time attempting to parse one another's letters, attempting to see through "the little arts" each employs.[84] Octavio's reaction to Silvia's rebuff in Book II further reinforces the point. After receiving from Octavio a gift of bracelets along with a confession of love, Silvia admonishes him, writing: "You but ill judge of my Wit, or Humour, *Octavio,* when you send me such a Present, and such a Billet, if you believe I either receive the one, or the other as you design'd" (175). As the narrator notes, however, Octavio reads her response "without a sigh, nor complained he on her Rigours," because he knows "only she that sends him back his own Letters without reading 'em can give despair" (177). By understanding the conventions of love letters, Octavio is able to read Silvia's response for what it is—an invitation for continued correspondence—rather than for what it says.

[84] In Book I, Philander responds to Silvia's unease with his marriage to her sister, writing "your little arts might do well in a beginning flame" (20); in Book II, Silvia accuses Octavio of employing "little Arts" to woo her in Philander's absence (154); later, Philander tells Octavio that once love has grown dull "we have recourse to all the little arts, the aids of flatterers, and dear dissimulation, (that help-meet to the lukewarm lover) to keep up a good character of constancy, and a right understanding" (188); in Book III, the narrator, commenting on Hermione's hold over Cesario notes of a maiden Queen "who made herself idolized by that sole piece of politic cunning, understanding well the stubborn, yet good nature of the people; and gained more upon them by those little arts, than if she had parted with all the prerogatives of her Crown" (456).

For Behn, the issue is not a matter of language; the act of describing and reflecting on one's experience with another has a material and bodily effect. When expressing apprehension at her upcoming tryst with Philander, Silvia writes: "My Soul bodes some dire effect of this bold enterprise, for I must own (and blush while I do own it) that my Soul yields obedience to your soft request, and even whilst I read your Letter, was diverted with the contrivance of seeing you" (22). In noting her response to Philander's letter, Silvia describes her experience as one that takes place as a consequence of description—that "rhetorick of love" or "cant and stuff" Philander has sent—and casts her response within the conventions of the letter as well. She relates her feeling within the prescribed genre conventions to which she is responding. That Silvia purports to "blush" further suggests that the effects manifest beyond mental—they are experienced physiologically. As surrogates for themselves, Silvia's and Philander's letters are both material and immaterial in nature. In gesturing toward Silvia's physicality, Behn highlights the profound materiality of experiential investigation that the epistolary form holds in tension.

Behn reinforces the point that Silvia and Philander's romance is predicated on generic conventions by making it play out not only in utterly predictable, or uninnovative, ways, but also by creating a mirror effect in which the relationship plays out over and over with little variation. Silvia and Philander's relationship is an analogue for Lord Grey and Henrietta Berkely's relationship and in the context of the story, nothing but a repeat of Mertilla and Philander's relationship. As the narrator explains in "The Argument" to Book I, Philander, struck by Mertilla's beauty, "steals her away, and marries her. But see how transitory is a violent passion, after being satiated, slights the

prize he had so dearly conquer'd" (A7v). Book II becomes a re-enactment of the same premise, with a slightly different cast of characters. As he did with Mertilla, Philander whisks Silvia away, marrying her to his proxy, Brilljard, but living with her as her husband. Later, distanced from and disenchanted with Silvia, Philander turns his attention to another beauty. Philander is the epistolary lover and romance figure. He cannot be anything but. It is written into his very name and into his role. In casting Philander as such, Behn critiques the so-called reality that the epistolary form offers—suggesting that, as with scientific writing, it is a performance that precludes genuine experience or stability.

The call-and-response nature of letters enacts the seventeenth century's understanding of knowledge as a process of accretion, embodied by and impelled in Boyle's scheme of inquiry. As noted, Boyle's methodology not only provided suggestions for further study but also created and imposed a template for how to write up results, part of which was to point to areas of further study. Consequently, more and more information was amassed. In her translator's preface to *A Discovery of New Worlds*, Behn points to the Society's project of speaking in plain language, writing "by a certain Rhetorical Figure, peculiar to themselves," the French "imply twenty Lines, to express what an *English* Man would say, with more Ease and Sense in five" (A7r). *Love-Letters* suggests that we might take this translation as tongue-in-cheek. While Behn might appreciate the Society's emphasis on "deliver[ing] so many things, almost in an equal number of words," she questions in *Love-Letters* whether theory matches practice (Sprat 113). After all, letters beget more letters and along with Silvia and Philander, readers are

left to sort out and weigh their words. The amount of data and its subjective nature makes it difficult to do so.

While Behn's sensitivity to language is tied to her understanding of genre, she deploys it in *Love-Letters* to question the role of genre and method. The "incoherence of the subjects" addressed in natural philosophy lead, as Boyle says, to "a loose and desultory way of writing" (*Occasional Reflections* a1r). And just as the Royal Society organized the massive influx of data through an interpretive schema so too does the editor of *Love-Letters*, who, we are told, found the missives "in their Cabinets" and placed them "as exactly as possible" "in the order they were sent" (A7v). Behn's fictional editor reveals his role in shaping the narrative at the same time as he attempts to conceal it. Given that experimental spaces took a narrative form, that is "an author organizes elements in much the same way as a scientist does," the editorial reveal implies something about the way both fiction and science work (Bratach 221). In including the possibility that the letters may, in fact, be out of order and include only those found in the cabinet, the editor hints at the narrative's incompleteness.

Consequently, Behn notes the fragmented nature of *Love-Letters* from its very start. In so doing, Behn shows that, even when combined into a whole, the fragments are not particularly instructive because each letter by itself is a closed system. As Altman explains, "the letter retains its own unity while remaining a unit within a much larger configuration" (169). Behn's individual letters, then, act similarly to Boyle's individual inquiries. Both emphasize what J. Paul Hunter describes as a particular way of understanding the world: "immediacy, personal observation, subjectivity of response, circumstantiality, empirical modes of thinking, and the desire to systematize" ("Boyle"

276). For Hunter, new science opened up an availability of interpretations that early novelists capitalized on. A text was able to create a coherent reading of an otherwise disorganized, subjective mass of data. In *Love-Letters* Behn uses the epistolary form to critique the episodic and miscellaneous nature of science writing and to unmask its insistence on and veneer of objectivity. Like a trained novelist, a trained experimentalist is able to weave a masterful narrative that functions by a degree of verisimilitude but is fictional, nevertheless.

CHAPTER 5

DISTANT READING THE BODY, 1640-1699[85]

For seventeenth-century men and women, to know one's body was to know one's place in the world. As Jonathan Sawday, Erin Goss, David Hillman, and Carla Mazzio have argued, the body represented a capacious amalgam of political, moral, and religious values; it variously represented "the possibilities of science" (*Body Emblazoned* 33-34); "the literary and social discourse of sensibility and sentiment" (26); and was "the most common vehicle for the making of social and cosmic metaphors" (xiii). The body was an abstract concept that encompassed the operations of systems and the relations among parts and wholes. Yet, when human bodies were described, they were often invoked synecdochically through their physically perceptible parts: their lips and muscles, bones and skin, or fingers and toes. We find this pattern most clearly in the practice of anatomy, where bodies became visible through dissection. Writing in 1698, Welsh physician Martin Lister describes the anatomy room filled with disconnected parts and pieces. After mentioning Mr. Bennis, a visiting Englishman, who was "working by himself upon a Dead Body, Breast and Belly gutted," Lister shifts his description: "Here a Basket of Dissecting Instruments, as Knives, Saws, &c. And there a Form with a Thigh and Leg flayed, and the Muscles parted asunder: On another Form an Arm severed after the same

[85] Mann, Rachel and Michael Gavin. "Distant Reading the Body, 1640-1699." Accepted by *Review of English Studies*.

manner: Here a Trey full of Bits of Flesh, for the more minute Discovery of the Veins and Nerves" (63-64). Scattered across tables, mixed in trays, and pinned against blocks of wood, the human body is decomposed into a catalogue of parts in a way that, for example, the knives and saws are not. In effect, Lister's description effaces the body's structural integrity as well as its singular identity. It is unclear, and clearly unimportant, whether these "bits of flesh" and "Muscles parted asunder" came from the same corpse. Rather than presenting the body as a coherent physical entity, anatomists partitioned it into smaller and smaller pieces to better understand their interactions.

Consider by contrast how Helkiah Crooke uses the word *body* in the opening chapter of *Mikrokosmographia* (1615):

> As the soule of man is of all sublunary formes the most noble, so his Body . . . [is] the measure and rule of all other bodies. There be many things which set foorth the excellency of it, but these especially among others. The frame and composition which is vpright and mounting toward heauen, the moderate temper, the equal and iust proportion of the parts; and lastly, their wonderfull consent & mutuall concord as long as they are in subiection to the Law & rule of Nature. (4)

Whereas body parts are visible, touchable, and tasteable objects, the body is something else entirely. Here, it functions as a normative ideal and abstract whole—a form, a frame, a composition, a just proportion.

In what follows, we explore how these two ways of writing about the body operate in seventeenth-century fiction and natural philosophy, especially in anatomy. Our

method is a kind of distant reading for conceptual analysis.[86] We measure the diction of sentences like those quoted above to see how bodies were described, then use statistical techniques to identify patterns in those descriptions. Such patterns expose writers' latent assumptions about the meanings of words and their proper use. Our corpus is drawn from the *Early English Books Online* collection, as transcribed and published by the Text Creation Partnership.[87] From this dataset, we extracted two smaller corpora: one that gathers fiction, drama, and poetry and another focused on anatomical writing and similar works in medicine and natural philosophy. Our goal in analyzing these corpora is to uncover a common discourse of embodiment across these very different contexts.

Scholars have long noted that particularized descriptions of human bodies rarely appear in seventeenth-century fiction. More often, fictional characters serve as vehicles of actualized but largely *disembodied* values. The body in seventeenth-century fiction is, in an important sense, *absent*. According to Goss, fictional bodies "can mean but cannot be" (124). In the analysis that follows, we argue that this apparent absence reflects a tension in the very concept of the body, which always presupposes a categorical distinction between visible parts and constituted wholes. Bodies are perceived and described through close attention to their parts, but when bodies are conceived as such,

[86] For distant reading, see Moretti. Peter de Bolla pioneers the use of computational techniques for conceptual history. For the application of more advanced methods to this line of inquiry, see Gavin et al.

[87] The Text Creation Partnership was not entirely limited to EEBO, but also transcribed a smaller number of documents from *Eighteenth-Century Collections Online* and *Evans Early American Imprints*. See http://www.textcreationpartnership.org/. The documents themselves can be searched and accessed through the Oxford Text Archive (http://ota.ox.ac.uk/tcp/) or downloaded in bulk from Github at https://github.com/textcreationpartnership/. Data used in this essay will be made available prior to publication at https://github.com/michaelgavin.

they are described as abstract entities that organize the whole. This distinction is difficult to see at the level of close reading but unmistakable at larger scale. Deep conceptual structures at work underneath both anatomy and fiction, we argue, underlie a conception of the body that informs more particularized notions of mobility, sociality, and physicality.

5.1 BACKGROUND

The practice of natural philosophy in the sixteenth and seventeenth centuries depended on the development of protocols for scientific description that presented natural phenomena as systems of parts. As more and more of the natural world came to be known, more and more needed to be described. Simultaneously, previously accepted knowledge needed to be tested against new discoveries, leaving natural philosophers and historians with a mass of information to sift through and organize. Scientific descriptions of all kinds tended to break natural phenomena into smaller, more manageable pieces. Botanical texts, such as Nehemiah Grew's *The Anatomy of Plants* (1682), for instance, describe in great detail various parts of plants rather than their wholes: "a *Plant*, as well as an *Animal*, is composed of several *Organical Parts*" (A3v). Likewise, Robert Boyle's study of human blood addresses its "colours," "tast," "odour." "heat," "inflammability," and "aerial particles," as well as its composition of "salt" and "oyls" (*Memoirs* 11-12). Thomas Willis's *Practice of Physick* (1681) advocates a view of the body that "resolves all bodies into particles of Spirit, Sulphur, Salt, Water, and Earth" because "this Hypothesis Determinates Bodies into sensible parts, and cuts open things as it were to the life" (2). With their relentless attention to parts, seventeenth-century scientific descriptions share consistent lexical patterns despite their very different objects of study.

This descriptive regime is best exemplified by the field of anatomy, which explicitly constructed knowledge of the body using new techniques of empirical description. Anatomy, as it was practiced in the period, was pioneered in Italy and is largely indebted to Andreas Vesalius (1514-1564), professor of surgery and anatomy at the University of Padua and, later, Imperial physician to Emperor Charles V. Prior to Vesalius, the purpose of anatomical demonstration was not so much to make new discoveries as to illustrate already known truths, usually Galen's or Modino's. Under this earlier model, the anatomist sat above the proceedings reading aloud from a text, the *ostensor* pointed out the body's parts accordingly, and the surgeon performed the dissection. After noting errors in Galen's anatomical accounts, Vesalius rejected textual authority and urged anatomists to turn, instead, to the "non-lying book of the body" (qtd. in Cunningham, *Anatomist Anatomis'd* 29).[88] In so doing, he collapsed the three distinct roles of the anatomist into one; hands deep in viscera, the anatomist now simultaneously cut, showed, and taught. Anatomists across Europe adopted the Vesalian method, leading to the modern notion of *autopsia*, or seeing for oneself. By the early seventeenth century, conceptions of the body began to change accordingly. Under English physician William Harvey, the body began to be defined by its internal organization rather than as a static, unified entity. In Harvey's *Prelectiones Anatomiae Universalis*, which he delivered while conducting public dissections as the Lumleian Lecturer for the Royal College of Physicians, Harvey presented a physiological orientation to the body that distinguished him from his predecessors, such as Vesalius. As Luke Wilson has argued, Harvey was concerned, primarily, with the "causes, functions, and purposes of anatomical structures"

[88] See also French 145-7.

(62-95). Accordingly, for Harvey "the end of anatomy is to know, or to be thoroughly acquainted with, the parts and to know the very reason for their existence . . . in order to know why, one must study 1. The action and 2. The use of the parts" (qtd. in Luke Wilson 80). As the body became a physiological object, knowing the body meant recognizing the function, not just the form, of its parts. This shift led to important discoveries, such as the circulation of the blood, and dramatically changed how the body was conceived and the way anatomy was practiced.

As anatomy grew in popularity and the body became central to demonstrations rather than subservient to anatomical texts, commercial demand for body parts increased. In England, the noose's inability to keep up led to rampant corruption at the Tyburn tree where hangings took place up to eight times per year and the hangman delivered to the highest bidder.[89] Anatomists began supplementing 'fresh' corpses with soft body parts preserved in jars. While methods for preserving dry preparations, i.e. skin, skeletons, and bones, had been used for centuries, methods for preserving wet preparations, i.e. soft tissue, were not commonplace until 1663, when Robert Boyle demonstrated the possibility of preserving human and animal tissue in alcohol (Cunningham, *Anatomist Anatomis'd* 231-251). Under Boyle's method, organs were suspended in the "Spirits of Wine" (a distillation otherwise known as aquae vitae), which preserved them against putrefaction while making them available for visual inspection (Boyle, *Some Considerations* 26). Named after the preparation room in which they were preserved, preparations differed from specimens in important ways. As Simon Chaplin notes, the purpose of specimens was to preserve and, when necessary, reconstruct the outward

[89] See Cunningham *Anatomist Anatomis'd* 223; Linebaugh; and Richardson 52-72.

appearance of animals (*John* 101-103). By contrast, preparations were meant to reveal the inner structures of humans, animals, and plant tissue and, as described by Samuel Johnson, were "made by process of operation" (qt. in Chaplin, *John* 103, n. 153). The market for preparations soared. By 1793, for example, John Hunter had amassed a collection of at least seventeen thousand.[90] The use of preparations within anatomical demonstrations reflects Harvey's understanding of anatomy's aim: to study the action and use of the parts. As a result, the body was represented as an interchangeable system of parts rather than a unified whole at the very moment it became integral to anatomical study.

Anatomical textbooks of the period are likewise dominated by efforts to portray the body as a series of micro-systems. Ostensibly, these micro-systems are interrelated and contribute to the integrity of the whole body (Cregan 5; Landers "Dissection"). As Crooke explains, delineating the body's parts, which he defines as "a body cohearing or cleaving to the whole," was the means by which to understand the body (28). Hence, anatomical textbooks, which detail the minutiae of the body's parts, are divided and subdivided seemingly ad infinitum. Crooke's compendium, for example, is divided 485 times. For Matthew Landers, Crooke's manifold divisions participate in a larger argument; each subject "represents a single partition within a larger philosophical discussion, for which the body of man is an analogue—a microcosm of universal knowledge" (*Anatomy* 58-59). However, at the same time that anatomists defined their practice as one invested in uncovering the whole of man, their language was caught up

[90] For more on Hunter's collection, see Cunningham "Quis custodiet" and Chaplin "John Hunter."

entirely in the discourse of body parts. In *Enquiries into Human Nature* (1680), Walter Charleton recommends that anatomists attend to "the Conformation *and* Texture *of every part*" while tracing their "*various* Sympathies *and* Antipathies" ("Preface").

Tracing such "Sympathies" meant treating body parts as pieces of a common system, and so the anatomist's discourse of parts was simultaneously tied to a discourse of motion. The primary purpose of dissection, according to French anatomist Andre du Laurens, was "to observe the motion of the internal parts" (qtd. in Guerrini 230). After Harvey theorized the circulation of the blood in 1628, the body was understood to be necessarily in motion, with nutrients, humours, and other fluids coursing through its veins. For Harvey and many others, action was, therefore, the means by which to reveal a part's final cause and to understand the body in toto. As a result, Benjamin Goldberg explains, the practice of dissection was linked to that of physiology. Attempts to uncover an organ's microstructure were attempts to map the movement of the body's fluids. The concept of the *body* provided the underlying basis for that map; it served as a presumptively unified whole that drew each of its parts into knowable relation. Bodies in this physiological sense provided a space for the movements of other things.

Anatomists were not the only ones to link body and motion. As Kimberly Skelton explains, from increased transportation routes and detailed atlases to the pendulum clock, seventeenth-century Englishmen and women increasingly understood their world and selves as being in a state of continuous motion. As a result, fictional bodies regularly traverse the countryside and, even when sedentary, are never static. Within imaginative writing of the period motion was deeply implicated in embodiment because it served as an explanation for the passions, morality, and changes in the body and mind. As such, the

vexed relationship between the body and its parts that characterizes anatomical writing is likewise present in seventeenth-century literature; as with descriptions in natural philosophy, fictional bodies became legible through their parts. In fiction and poetry, however, the individuated parts took on lives of their own, in many ways subsuming the body as such. Body parts were often foregrounded, but the body as an integrated whole rarely makes vivid appearance. Represented only through and by its parts, the body is a strangely non-specific, non-physical entity; to return to Crooke, it operates as a form, frame, and composition whose existence is rarely more than implied by its parts. In this way, the body is not so much a thing that moves but a space where movement occurs, a field of possibilities that can simultaneously represent social, moral, divine, and corporeal structures.

Even in more explicitly pornographic texts and the illustrations accompanying them, the body becomes a site where corporeality and metaphor merged. Erotic woodcuts and engravings, Sarah Toulalan explains, "made use of visual metaphors and symbols" such as swords and voluminous drapery rather than featuring wholly naked bodies (233). Likewise, in Rochester's "The Imperfect Enjoyment," the anatomical penis is depicted as a "dead cinder" (l. 33), "dart of love" (l. 37), and an "all-dissolving thunderbolt (l. 10), standing in, simultaneously, for man's soul, identity, and masculinity. In Kathleen Lubey's reading, "the imagination itself recedes as an explicit topic as Rochester focuses on bodily eruptions of sexual action that are untethered to the generative mind, suggesting the imagination's impotence to shepherd the body into intended forms of actions and intimacy" (61). Similarly, Jonathan Kramnick writes, "In one of literary history's most celebrated evocations of impotence, the mind proves altogether unable to

provoke the body" (113). In fictional works the body tends to represent emotions and normative ideals that are often said to manifest physically but that are expressed mostly through action.

For example, Charles Cotterell's translation of La Calprenède's *Cassandra* (1642-1649) closely follows the heroic prose of the original, telling a tale of star-crossed lovers who are eventually united. Upon first meeting Oroondates, the prince of Scythia, Lysimachus is in awe of his social superior who, he says:

> the Gods had endowed with all the most excellent parts, that can render a person accomplished; his face was marvellously handsome, and through a beauty which had nothing of effeminate, one might observe something so Martial, so sparkling, and so Majestick, as might in all hearts make an impression of Love, Fear, and Respect at once; his stature exceeded that of the tallest men, but the proportion of it was wonderfully exact, and all the motions of his body had a grace, and liberty that was nothing common . . . and the union of so many excellent parts, added to the obligation he had to him, imprinted so true an affection in his heart, as neither length of years, nor the accidents which after happen'd to them, were ever able to diminish. (3)

Lysimachus's description, which registers Oroondates as a series of "parts," speaks to the way in which descriptions of the body are fused with descriptions of social and ethical qualities. Notice how the first use of "parts," which refers to Oroondates's mental faculties, is quickly replaced by descriptions of body parts. Although Lysimachus turns his attention from Oroondates's innate refinement to his physical appearance, his description of the latter serves to reinforce the former: Oroondates's face is majestic and

his motions graceful precisely because he is a man of parts. Consequently, Oroondates's "excellent parts" are "imprinted" upon Lysimachus's (metaphorical) heart and would "make an impression" in "all hearts." In this way, Oroondates's body is typical of fictional bodies during the period.

We do not mean to suggest, however, that anatomical conceptions of the human body as system were unknown to fiction writers, nor that narrative somehow occludes attention to organic systems. Indeed, the physician Walter Charleton, whom we cited above as an authority on anatomy, also wrote fiction. In the *Ephesian Matron* (1659), the title character lies emaciated and prostrate over her husband's tomb. Upon ingesting wine, however, her body is revitalized and Charleton relies on a diction that is striking for its anatomical specificity: the matron's "heart and arteries renew[ed] their intermitted pulses" and her "vitall Organs seemed to perform their offices aright" (22-23). Her lips are later described as "swelling with a delicious vermilion tincture," and her cheeks as "overflowing with pleasing blushes," while "Balmy-sweat exstill[s] from the pores" of her "snow-white skin" (47). Variously pulsing, swelling, and overflowing, the matron is "ingulphed in the delightfull transports of *new Love*" (48-49). By fusing the matron's physical and emotional states, Charleton's description blends anatomical and fictional discourse and points to an area where physiology converges with subjective experience.

And yet, even when the human form is described in distinctly physical and tactile terms, as with Charleton's matron, the body—in the holistic sense we think of today—is rarely more than implied. Aphra Behn's Mertilla serves as yet another example. In "The Argument" for Book I of *Love-Letters Between a Nobleman and his Sister* (1684) Mertilla is described as a "shape excellent," in possession of "a most agreeable stature," a

"face a little inclined to round, soft, smooth and white," "a Mouth curiously made, dimpled and full of sweetness," "her Nose a little *Roman*," with "Arms and Hands exactly shap'd" (A6r). According to the narrator, "nothing was wanting to compleat the joys of the young Philander" (A7v). As human readers, we subconsciously piece together Mertilla's various parts. We are so good at understanding the body as a gestalt it does not even matter that, as far as bodies go, Mertilla's is actually pretty incomplete. Where, after all, are her feet? The synecdochic formula of physical description means that the body, considered in its entirety, always remains hidden beneath its describable parts.

The willfully naive perspective provided by strict attention to diction points to a tension in our concept of embodiment. In both fiction and anatomy, the body is an always-in-motion vehicle that is knowable through descriptions of its independent parts, systems, and actions. Consequently, many scholars read characters' bodies as mere constructs: "register[s] for social anxieties" (Packham 29), metaphors for the larger social and political body (Gallagher "The Body"; Marjorie Garber), simultaneously biological and discursive (Canning), "constellation[s] of different kinds of sensory and perceptual engagement with the world" (Gallagher and Raman), and so forth. For Lyndal Roper, the fictional body is an "irritatingly non-physical abstraction" (17). The body's subservience to the mind is so ingrained that to theorize corporeality requires, as Elizabeth Grosz has argued, "major epistemological upheavals not only for the humanities, which have tended toward idealism, but equally for the natural and social sciences, which have at least aspired to materialism" (x). In both fiction and anatomy, we find writers juggling similar conceptual problems. The "upheaval" Grosz anticipated may be better understood as a constant source of tension between ideality and materiality, a kind of fault line in the

conceptual structure of the body that came under new pressure in the late seventeenth century. In the analysis that follows, we offer semantic modelling as one possible way to uncover these conceptual pressures.

5.2 DATA AND METHODS

Our data is drawn from the publicly available EEBO-TCP corpus, which includes about 32,000 texts from the EEBO, Evans, and ECCO collections. These texts were transcribed and encoded with basic descriptive markup by the Text Creation Partnership. We focus on texts published from 1640 through 1699. Out of this larger collection (which totals 18,311 documents), we used an algorithmic process to create two smaller subsets: the first includes 100 documents of novels, plays, and poetry and the second includes 100 documents related to anatomical discourse.[91] When we say anatomical discourse we are not referring to human anatomy, per se, nor even necessarily to anatomical textbooks. Instead, we are pointing to a particular type of description and pattern of word use that is exemplified by anatomy but which occurs in a sweeping range of texts and contexts. Our analysis traces concepts related to embodiment through these smaller collections, contrasting word-use patterns over them and situating each against the context of the larger EEBO-TCP corpus.

After selecting these 200 documents, we then carved those documents into pieces. They were edited by Text Creation Partnership (TCP) and encoded according to specifications by the Text Encoding Initiative (TEI).[92] When encoded using eXtensible

[91] For a complete list of documents included in the two collections, see https://github.com/michaelgavin/distant-reading-the-body/blob/master/README.md.
[92] For a brief rationale and description of the EEBO-TCP encoding schema, see http://www.textcreationpartnership.org/why-sgmlxml-encoding/.

Markup Language (XML), different sections of a document are tagged with descriptive markup.[93] Front and back matter are differentiated from the main body of the text, and, within the body, textual elements like paragraphs, lines of poetry, tables, and figures are noted separately. Primary divisions like chapters are conventionally marked using a tag that separates each document into its key elements. For our analysis, we extracted every element from each text, treating them as separate bags of words. In the anatomical corpus, the elements typically correspond to different parts of the anatomy, with chapters that survey major systems and organs separately. In the literary corpus, elements typically correspond to novels (in a collection of novels), letters, groups of poems, or, in the case of drama, acts and scenes. The word frequencies for each were counted and compiled into large matrices: the anatomical corpus measures the distribution of 18,304 unique word types over 10,463 sections, and the somewhat smaller literary corpus measures 12,577 word types over 7,425 sections. As one would expect, the vocabularies across these two collections vary significantly; they share only 7,661 word types.[94]

The 'bag-of-words hypothesis' refers to a specific concept from the disciplines of corpus linguistics and information retrieval.[95] It says that the distribution of the vocabulary of a document will correlate with its relevance to a search query, independent

[93] The fundamental principles of text markup were first outlined in Goldfarb. For a succinct and early account of markup as a tool for literary editing and analysis, see McQueen; see also Burnard et al.
[94] For the distinction between word types and tokens, as well as for a general overview of issues in corpus linguistics, see McEnery and Andrew Hardie.
[95] See Turney and Patrick Pantel. See also Stephen Clark.

of word order in that document (Salton).[96] This allows researchers to represent documents—or, in our case, sections of documents—as sequences of numbers that reflect word frequencies. In our anatomical corpus, for example, each section is represented by a sequence of 18,304 numbers, most of which are zeroes, that count the appearance of each word in that section. Correspondingly, every word can be represented as a sequence of numbers that reflect its use in each document. In the anatomical corpus, each word is defined by a sequence of 10,463 numbers, most of which are also zeroes, reflecting its frequency in each element.

Representing texts as bags of words allows them to be compared geometrically. Any sequence of numbers can be thought of as a point in multidimensional space. Vectors with a similar distribution of values will sit near each other in that space; vectors with very different values will sit far apart. The distance between any two points in vector space is conventionally measured by taking the cosine distance that separates their vectors. Values of cosine distance range from 0, in which case the vectors share no values and are perfectly orthogonal, to 1, in which case the vectors sit on the same line.[97] In turn, comparing words geometrically enables researchers to measure semantic similarity. The theory of semantic space posits that word meaning corresponds to relative proximity in such spaces.[98] Rather than represent meaning by attaching terms to putative definitions, distributional models represent meaning by identifying clusters of proximate words in

[96] For the history of how this theory developed following Salton's 1975 publication, see Dubin.
[97] For a concise explanation of the cosine similarity measurement for information retrieval, see Turney and Pantel, and for linguistics see Stephen Clark. For a more general discussion of the theory of semantic space, see Widdows and Lowe.
[98] Sahlgren calls this the "geometric metaphor of meaning" (18).

multidimensional space. For example, over EEBO, the words most semantically similar to *pancreas* include *glandules, intestines, membranes, spleen,* and *fibres*. Such calculations do not provide a definition of *pancreas* but they expose latent connections among words and draw silhouettes of conceptual systems at play in a corpus. In an important recent study, Peter de Bolla has argued that such collocation patterns reveal the underlying structure of discourse, or what he calls the architecture of concepts. In early modern studies, the same theoretical principle has been used by Michael Witmore and Jonathan Hope to organize Renaissance drama into thematic clusters.

By using the principles of semantic similarity we were able to build a representative collection of texts that feature what we are calling anatomical discourse, using a word-vector representing *pancreas* as our starting point. Because the pancreas achieved special importance during the seventeenth century, the word was used in very particular and precise ways, unlike the word *anatomy*, which had become, by this time, polyvalent in meaning. Johann Georg Wirsüng, Prosector of the University of Padua, discovered the pancreatic duct in 1642, sparking a flurry of follow-up experiments. In 1664, Dutch physician and anatomist Reinier de Graaf catheterized the pancreatic duct of a living dog, which enabled him to collect pancreatic fluid; because of the fluid's taste de Graaf posited that the pancreas was vital to digestive processes. In so doing, he countered previous anatomical understandings of the pancreas, including that of Vesalius who thought the pancreas was placed under the stomach "like a prop, or pillow" (qtd. in de Graaf 16). Once it was associated with digestive function, the pancreas become the focus for much anatomical and medical writing. Over the EEBO-TCP collection, the terms that co-occur with *pancreas* within a context window of five words are *body* (53), *part* (51),

sweet (46), *vessels* (46), *called* (40), *bread* (40), *two* (38), *substance* (36), *parts* (34), *great* (32), *through* (32), and *use* (31). We refer to this linguistic pattern variously as 'anatomical discourse,' 'anatomical writing,' or 'body talk.' Without presuming to limit the boundaries of the discourse or the topics it might address, we chose documents with diction and patterns of word use that most closely resembled this vocabulary. Among these are books on anatomy, medicine, midwifery, and botany.

The heterogeneity of our first subcorpus speaks to the far-reaching extent of anatomical discourse and description. The association of *sweet* and *bread* with *pancreas*, for example, provides a glimpse of the way body talk ranges beyond the human body and encompasses a wide range of topics, even the culinary. Descriptive patterns that characterize anatomical writing occur in texts as far afield as dentistry, such as Charles Allen's *The Operator for the Teeth* (1686), medical tracts, like Nicolas Blegny's *New and Curious Observations on the Art of Curing the Venereal Disease* (1676), chemical treatises, such as Thomas Emes's *A Dialogue between Alkali and Acid* (1698), and pneumatical texts, like Robert Boyle's *A Defence of the Doctrine Touching the Spring and Weight of the Air* (1662). Anatomical language even appears in recreational guides, like Richard Blome's tract on "horsmanship, hawking, hunting, fowling, fishing, and agriculture."

To get a clearer general picture of the different contexts in which anatomical language was invoked, we sorted our corpus into groups and projected them onto a two-dimensional graph. Figure 5.1 illustrates relations among the 100 books with word-frequency counts most similar to words that appear in the context of *pancreas*. Each of the symbols represents a single document and each type of symbol represents texts that

share linguistic similarities. Most of the documents sort into two large groups made up of textbooks on anatomy, chirurgery (surgery), medicine, and chemistry. Closely related clusters include books on non-human anatomy, like zoology, botany, and entomology, as well as those on more specialized medical topics, including several on midwifery, such as *Aristotle's Master-piece*, and a few individual works on topics like dentistry or the gout. The groupings suggest subtle commonalities and variations in the books' diction. The botanist's project of taxonomy is akin to the entomologist's concern with cataloguing various parts of individual insects, so texts like Grew's *The Anatomy of Plants* (1682) and Jan Swammerdam's book on flies, *Ephemeri vita* (1681), are clustered together. We do not mean to suggest, however, that these groupings represent hard and fast distinctions. Each of the selected works blend into each other in many ways. Each of the larger groups include books on human anatomy, and all of the works feature anatomical writing in the broad sense that we are using it in this essay.

Seventeenth-century literature is similarly heterogeneous, so there too we adopted a categorically neutral approach. Our literary subset was selected by culling 100 documents most semantically similar to *All the Histories and Novels Written by the late Ingenious Mrs. Behn* (1698). First published by Samuel Briscoe, *Histories and Novels* contains twelve of Behn's prose works as well as a brief biography of Behn and went through three editions between 1698 and 1700. Given Behn's prominence in the critical tradition of the early novel, but without presuming to dictate what counts as literature, we consider her prose to be paradigmatic of a type of book published between 1640 and 1699. The twelve most frequent words in Behn's *Histories and Novels*, excluding stopwords, are *love* (1162), *heart* (648), *great* (542), *prince* (542), *never* (476), *time*

(474), *himself* (462), *man* (430), *give* (424), *day* (418), *king* (410), and *little* (410). The 100 documents using the most similar vocabulary include Behn's other works as well as most of her peers'. Among these are books by women writers like Jane Barker and Catharine Trotter, but men writers are present as well, including John Dryden, William Congreve, Charles Gildon, and Matthew Prior. Aristocratic poets like Sedley, Dorset, and Rochester appear, as do writers translated from French and Spanish. This sample is not meant to be an authoritative bibliography of seventeenth-century literature. The diction of John Milton's and Katherine Philips's poetry, for example, is too different from Behn's for their works to have been included among the 100 most similar. Our goal was to find the documents that most closely resemble the discourse that literary scholars emphasize when writing the history of how bodies are represented in later seventeenth-century fiction.

As with our collection of anatomical texts, we used word frequencies to create clusters of our fictional texts. As Figure 5.2 shows, word-use patterns sometimes align with contemporary generic divisions, but not always neatly and sometimes not at all. The largest and most distinct cluster is made up primarily of long romances translated from French, Spanish, and Italian sources, like those of Scudéry. Drama is scattered pretty evenly across the clusters. For example, Dryden's comedy *Marriage a la Mode* (1673) and his tragedy *Cleomenes* (1692) are more lexically similar than they are different. Likewise, epistolary romances, such as Behn's *Love-Letters*, and collections of love poetry both feature florid prose and a conventionalized vocabulary meant to express the torments of passion. They share much in common with travel narratives, such as John

Dunton's *A Voyage Round the World* (1691) and Behn's *Oroonoko* (1688). Poetry anthologies make up a closely related but distinct subgroup.

In the analysis that follows, we will compare and contrast the two collections. We will begin by discussing the words most prevalent in each—although, as we will see, prevalence is a complex idea that can be modelled in different ways. Then we will examine and compare words' collocation patterns in each context. We will show that some words, like *heart*, are used in predictably different ways while others, like *scripture*, are used similarly. Given the very different vocabularies of each collection, words of embodiment tend to occupy very divergent regions in semantic space. These divergences can in turn be measured. The 7,661 words that appear in both corpora were ranked by cross-domain similarity, showing which words are used consistently across anatomical and literary discourse and which were used most differently. These terms are then available for further analysis, allowing us to expose areas of conceptual divergence and overlap.

As is probably clear, the mode of distant reading we practice in this essay is very different from those of Franco Moretti, Matthew Jockers, or Ted Underwood, for whom computational methods enable large-scale analyses that describe change over long periods of time.[99] Our concerns are narrower and more precise, so we prefer the analogy to anatomy, where the goal is more simply to attend to details that might otherwise be overlooked. For this reason, some of the findings we present below will not seem surprising at first glance, but here, too, the analogy to dissection is helpful. When opening

[99] See Moretti, especially chapter 3, "The Slaughterhouse of Literature." See also Jockers and Underwood, especially chapter 6, "Digital Humanities and the Future of Literary History."

a corpse, you are not surprised to find bones, muscles, and organs inside. Such systems are noted and delineated so that their connections and mutual operations can be identified. When analyzing a corpus, one should not be surprised by basic descriptive statistics. Collocation patterns are exposed so that their connotations and the assumptions underlying their use can be more accurately described.

5.3 ANALYSIS

We begin our demonstration of comparative textual anatomy by identifying the most prevalent and obvious differences across our two collections. Table 5.1 features three different measurements used to determine words' significance: raw frequency, Mann-Whitney ranking, and z-score standardization. These three tests correspond intuitively to three different kinds of 'aboutness': raw frequency provides the most general picture of a collection's vocabulary; Mann-Whitney shows which words come up most commonly as topics of discussion; and z-score standardization exposes words used with unusually intense focus.[100] Based on raw frequency, the most common words in anatomical writing are highly general descriptive terms like *being*, *out*, and *same*, and, of course, *parts*, *part*, and *body*; the Mann-Whitney and z-score tests expose a language of comparative description (*thin*, *easily*, *quantity*, *lower*, *observed*, *somewhat*), general terms denoting physicality (*substance*, *motion*), and named anatomical parts (*bones* and *vessels*). In the literary subcorpus, little attention is paid to these kinds of terms. Instead, persons are rendered through ethical and social frames: raw frequency returns a general discourse of subjectivity (*love*, *great*, *time*, *man*, *life*), while Mann-Whitney and z-score

[100] Many techniques for comparing corpora exist. For a comprehensive and synthetic survey, see Kilgarriff and Kilgarriff and Tony Rose.

tests draw out a language of friendship (*friend, friends*), ethical evaluation (*fortune, happy, honour*), mental states (*thoughts, hopes*), and sexuality (*passion, affection*). Concepts that denote embodiment are comparatively rare but can be glimpsed in sexualized terms like *beauty, fair, bed,* and *eyes.*

Beyond mere frequency, we can also test to see which words are used most similarly across the two domains. In Figure 5.3 the y-axis displays the frequency of each term (combined over the two corpora) and the x-axis displays the semantic similarity across them, with ticks showing standard deviations from the mean. As anybody would expect, the word *heart* is used in very different ways. In the context of anatomy, *heart* appears when writers are discussing the circulatory system, so some of the most common words in textual segments that include *heart* are *blood, motion, body, arteries,* and *veins.* In literary discourse, by contrast, *heart* operates metaphorically and is usually bound up in a language of *love.* These differences can be measured, and in fact the two words (*heart*$_1$ and *heart*$_2$) have a similarity score of just .44, which means they share a little less than half of their context words in common. This is significantly below average. Across the 7,661 words used in both collections, the average similarity score is about .58, with most values falling between .5 and .65. Some words are almost identical. For example, words directly involving religion are used quite consistently regardless of context. Sentences that contain words like *scripture* (.80), *hebrew* (.80), and *moses* (.79) tend to be very similar, whether or not those sentences appear in anatomical or literary writing. On the other hand, words that are rare or archaic, or that are subject to alternate spellings, such as *earle* (.14) and *councell* (.16), vary most widely. In general, higher frequency words tend to be more similar, rather than less, because they regress toward a common

mean. Figure 5.3 displays the distribution of the total shared vocabulary of each corpus, highlighting terms that are either unusually similar or unusually distinct. The abstract language of subjectivity so prevalent in the literary corpus (*love*, *man*, *first*, *self*, *good*, *men*) includes, in fact, some of the most semantically consistent terms, while words like *heart* and *blood*, which have metaphorical connotations not relevant to anatomy, are among the most semantically disparate. However, not all corporeal terms are so different: notice, toward the lower right of the graph, the terms *flesh* and *substance*, which are, perhaps surprisingly, among the words with the most consistent signification.

These general differences can be further specified by examining the conceptual structure of individual terms in each local context. (See Tables 5.2 and 5.3.) We begin with *body* and *motion*, which we know from previous scholars are likely to be qualitatively relevant. In both contexts, the term *body* has a very general, wide-ranging application, and so the terms in its conceptual neighborhood—those used most often in the same textual divisions—reach out toward the general themes of each corpus. In contrast, *motion* has a much more specific field of application. In anatomical writing, *motion* associates tightly with causal accounts of how *force* acts on *bodies* and their *parts*. In literary texts, *motion* is just as interesting and just as deeply implicated in the conceptual structure of embodiment. There, however, *motion* is bound up with descriptions of characters who trade *look*s with their *eyes* and who *find beauty* and *honour* by *degrees*. In both contexts, *motion* requires a vocabulary of measurement and comparison against which bodies as such become observable and knowable.

The terms *flesh*, *substance*, and *nerves* point, in turn, to some of the most important areas of conceptual overlap between fictional and anatomical bodies. The

nerves are nodes where internal and external sensations meet. As the primary connection between the body and the brain, the nerves dictated one's experience. Linking physiology to the passions, Descartes writes in *The Passions of the Soul* (1649): "Those we refer to things outside us, namely to the objects of our senses, are caused (at least when our opinion is not false) by those objects, which, exciting movements in the organs of the external senses, excite some in the brain too by the mediation of the nerves, which make the soul feel them" (31). Across both contexts, then, *nerves* are closely associated with the action of *animal spirits*, which connect, in anatomy, throughout the nervous system (*spinal*, *brain*, *muscles*) and in fiction to the *outward* expressions of what seems *rational* and *sensitive*. Within the fictional corpus, *substance* overlaps strongly with *nerves* and *flesh*, sharing many similar associations. The word *flesh* is one of our more curious findings. Anatomists didn't use *flesh* to refer to muscles or tissue but to describe sexual morality, and when novelists and poets mentioned *flesh*, they mostly referred to food. Yet, the general diction of appetite and desire binds these two senses of *flesh* close together in vector space, and so *flesh* is one of the more consistent terms over the whole.

These five keywords—*body*, *motion*, *nerves*, *flesh*, and *substance*—provide semantic anchors in the vector-space model around which a more general discourse of embodiment becomes visible. Tables 5.2 and 5.3 list the terms most semantically similar to these five keywords in both corpora. Figures 5.4 through 5.7 flatten word-use patterns down to two principal components, much like a word cloud, except that the position in the graph reflects semantic similarities among the terms.[101] As such, they represent in graphical form the semantic structures of seventeenth-century body talk. Each graph

[101] Lay 480-483.

represents the terms as composite entities (*body* and *motion*, and *nerves*, *flesh*, and *substance*, respectively) and displays the thirty terms that appear most closely in their shared vicinity.[102] In Figure 5.4 we see that in anatomy the *body* operated primarily as a focal point for empirical inquiry. The cultural logic of the anatomical demonstration, inherited from Andreas Vesalius, structures the vocabulary surrounding *body* and *motion*, which is predominantly concerned with observation and empirical reasoning. Notice, for example, that *body* and *motion* are closely surrounded by a rich language of empirical description, with words connoting knowledge (*consider*, *think*, *see*, *suppose, know*, and *believe*) and causality (*effects, effect, hypothesis*) especially predominant. Outlying terms involving chemistry (*acid*, *alkali*, *coagulate*) suggest that they, too, appeared in textual segments that narrate the experience of scientific observation.

As a physical object of flesh and substance the prepared body parts are exposed and named. Indeed, Figure 5.5 offers one of this essay's few glimpses into the intoxicatingly rich diction of seventeenth-century anatomy. Because of the rich vocabulary of anatomical description surrounding *nerves*, *flesh* and *substance* become outliers and do not appear in the graph. What is left is a representation of the body as perceived by *anatomists* (notice that term appears near the top), who find categorically similar named body parts, like *muscles*, as well as kinds of nerves, glands, and vessels. Perhaps most interestingly, *nerves*, *flesh*, and *substance* connote the sensual experiences of the anatomists themselves, who often described body parts in terms of their taste and texture, which call our attention back to the messy and intrinsically physical experience

[102] For the basic principles behind vector composition, see Erk.

of anatomical demonstration. In literature, by contrast, human bodies rarely taste or feel like anything at all.

When bodies appear in poetry, drama, and fiction, they are most often connected to intersubjective experience. (See Figures 5.6 and 5.7). The key aspect to notice about Figure 5.6 is how it divides into roughly three parts. In the center, *body* and *motion* connect most closely to an abstract language of physical description, much like in the anatomical corpus. This abstract physicality bridges two very different concepts of embodiment. On the left, the language of intersubjective action connotes what bodies do; notice all the verbs. On the right are terms of physiology most common to literary texts of the period. In Figure 5.7, *flesh* and *substance* are similarly situated within the corpus, whereas *nerves* becomes an outlier and so becomes excluded from the plot. However, the physiological terms (*spirits*, *rational*, *sensitive*, etc.) that also appeared in Figure 5.6 make their appearance here as well. Indeed, this cluster of terms can be understood as the conceptual hinge that binds together more abstract and volitional concepts of embodiment, from Figure 5.6, with the fleshy and substantive references here, which predominantly involve disease and disorder.

Despite their differences, anatomy and fiction share one important feature. In both, the terms *body* and *motion* are surrounded by strong verbs that connote various ways of knowing. In anatomy, that knowledge is self-consciously empirical and involves observation and the testing of hypotheses. In fiction and poetry, that knowledge emerges among the interactions of the characters themselves, whose beliefs are tested against each other's actions. In any case, bodies are objects to be observed and so they are enveloped in a language of knowledgeable discovery.

That said, actual discussion of named parts of the human body are rare in seventeenth-century fiction, and when specific organs are named they tend to be surrounded by a very thin and repetitive descriptive vocabulary. A novel might mention a character's *eyes* or *lips*, but these words have very few synonyms and dissolve into a widely diffuse field of reference that devotes little sustained attention to corporeality as such. (See Table 5.4.) Associated with *joy, trembling, love,* and *touch*, lips and eyes denote a kind of psychosomatic physicality; one that is manifest through experience, usually desire, rather than through the depiction of recognizable, composite features. That is, lips and eyes are felt and known when they function as mediators between and registers of self and the outside world. While embodiment is represented through body parts, those parts become defined and relevant through their interaction with and reaction to others.

The extrinsic and, in some ways, detached, experience of the body and its parts is likewise apparent in the use of *bone.* Like *flesh*, *bone* refers not to human bodies but to eating and cooking; that is, to animal bodies that have been cut up and served as food. Indeed, the underlying conceptual formation subtending *flesh* and *bone* suggests that dismemberment, consumption, and taste are more important aspects of the seventeenth-century body than literary histories generally acknowledge. When animal bodies are included in that history, body parts often appear in discourse as objects to be consumed, as food. Butchering and preparing meat shares much in common with anatomical demonstration, of course, and those commonalities appear obliquely through the semantic data. One might say that the seventeenth-century body becomes socially realized when served on trays.

In the preceding discussion we have examined the semantic associations of each corpus separately. Where we have described areas of overlap, we have relied mostly on qualitative judgments. But such overlap can also be teased out statistically. Table 5.5 displays only connections that are shared across both corpora. For each term, values display the product of the semantic similarities ($s_1 s_2$) that separate it from the keyword in each corpus. For example, the similarity between *body* and *great* in the anatomical corpus is .62, and in the literary corpus, .81. Multiplied together, the result is a composite similarity score of .51. Only words that are significantly similar in *both* corpora are teased out by this method, which reveals what is most novel-like in the anatomical corpus and what is most anatomical in the literary corpus, thus exposing a common vocabulary of embodiment. As we have emphasized throughout this discussion, the terms *body* and *motion* share a very coherent semantic structure and operate in both literary and anatomical discourse as organizing abstractions. The terms *substance*, *disease*, and *bones* anchor conceptual clusters that together represent a pretheoretical experience of the human body as such. Although we have argued that body talk is rarely explicit in literary discourse, we also see that it operates throughout, if generally submerged at the surface level. When seen from a conceptualist perspective, the fictional body's 'meaning' and 'being' (to return to Erin Goss's phrase) can no longer be placed in opposition but must be seen as deeply co-implicated and even mutually constitutive.

5.4 CONCLUSION

The conception of the body as a mereotopological system—a collection of interrelated parts that never add up to their sum—is precisely why *body* becomes such a capacious construct. Because bodies are composites, made perceptible synecdochically through

their named parts, *body* functions as an abstract conceit. It organizes those parts and is known through them, but cannot integrate them back into a cohesive whole. As we have shown, parts beget more parts, swelling the terminology of the body. Organs become associated with their vascular structure rather than with the flesh surrounding them. Arteries, veins, and nerves are particularized and differentiated. In its hyper-materiality the body becomes weirdly immaterial. And because it does, *body* serves as an umbrella term and a theoretical frame that stands in for and encompasses all kinds of values.

As an organizational conceit, *body* can, as we noted at the start of this essay, arrange not just its physiological parts but also the social order, forming a nexus between types of discourse and the larger scientific and literary milieu. Despite their differences, fictional and anatomical bodies point to ways of knowing that are both empirical and intersubjective—embodied knowledge is both physical and caught in a web of persons. Such knowledge hinges on abstraction. Because *body* points not just to one but to many things, seventeenth-century body talk constantly tests and traverses the boundaries that separate mind, substance, and sociality. Modelled computationally, the *body* gathers semantic parts that breathe, move, think, and act upon the world.

Table 5.1 The most frequent and most distinctive terms in the anatomical and literary collections

Anatomical Corpus						**Literary Corpus**					
Frequency (1,000s)		*Distinctiveness (Mann-Whitney)*		*Distinctiveness (z-score)*		*Frequency (1,000s)*		*Distinctiveness (Mann-Whitney)*		*Distinctiveness (z-score)*	
being	43.6	parts	7.1	bones	4.9	love	19.8	love	8.5	beauty	4.3
parts	24.0	body	6.2	parts	4.7	great	11.6	friend	8.2	loves	3.8
part	23.6	liquor	6.0	heat	4.6	time	10.7	fortune	8.0	fair	3.8
out	23.5	thin	5.9	patient	4.6	man	10.2	happy	7.9	silent	3.7
same	23.5	motion	5.9	lower	4.1	well	92.5	tell	7.8	yours	3.7
body	22.7	substance	5.6	substance	4.1	know	85.3	gone	7.7	bed	3.6
first	20.6	water	5.5	vessels	4.1	never	83.6	fair	7.6	passion	3.6
blood	22.7	heat	5.4	bodies	4.0	good	82.1	friends	7.3	betray	3.5
two	18.4	easily	5.4	solid	4.0	life	75.6	beauty	7.3	affection	3.5
great	18.3	quantity	5.4	motion	3.8	give	75.4	poor	7.3	wish	3.4
made	17.3	lower	5.3	blood	3.7	little	71.6	honour	7.2	friend	3.4
doth	16.8	observed	5.3	happen	3.6	king	69.8	thoughts	7.1	happy	3.4
therefore	16.5	somewhat	5.3	disease	3.6	day	67.7	hopes	7.1	fortune	3.4
many	15.8	matter	5.1	becomes	3.6	come	67.6	hear	7.0	love	3.3
water	15.8	vessels	5.1	body	3.5	heart	67.3	joy	6.9	eyes	3.3

Table 5.2 Terms most semantically similar to *body*, *motion*, *flesh*, *nerves*, and *substance* within the anatomical corpus

body		**motion**		**flesh**		**nerves**		**substance**	
body	1.00	motion	1.00	flesh	1.00	nerves	1.00	substance	1.00
without	0.70	moved	0.73	eating	0.57	nerve	0.59	part	0.52
another	0.69	move	0.61	concupiscence	0.56	pair	0.50	parts	0.52
parts	0.69	motions	0.54	regeneration	0.54	spirits	0.49	through	0.51
same	0.68	same	0.54	sin	0.53	brain	0.48	self	0.50
now	0.67	force	0.54	virgin	0.53	fibres	0.48	out	0.50
bodies	0.67	body	0.53	innocency	0.52	carried	0.47	body	0.50
whole	0.66	greater	0.53	eve	0.52	animal	0.46	without	0.50
first	0.66	according	0.52	adam	0.52	nervous	0.43	another	0.49
nothing	0.66	bodies	0.50	posterity	0.52	within	0.42	whole	0.49
out	0.65	less	0.50	brutal	0.52	spinal	0.41	little	0.48
nature	0.65	part	0.50	incarnation	0.51	muscles	0.40	same	0.48
before	0.65	parts	0.50	chastity	0.51	distributed	0.40	accident	0.46
part	0.64	cause	0.50	saved	0.51	flowing	0.39	whose	0.46
Self	0.64	rest	0.49	forbidden	0.51	sent	0.39	thing	0.46

Table 5.3 Terms most semantically similar to *body*, *flesh*, *motion*, *nerves*, and *substance* within the literary corpus

body		**motion**		**flesh**		**nerves**		**substance**	
body	1.00	motion	1.00	flesh	1.00	nerves	1.00	substance	1.00
great	0.81	eyes	0.62	humours	0.61	spirits	0.44	humours	0.62
making	0.80	nature	0.62	meats	0.56	sensitive	0.42	spirits	0.57
man	0.80	degrees	0.61	parts	0.56	innated	0.41	meats	0.56
giving	0.80	find	0.61	sharp	0.54	sharp	0.40	sharp	0.55
never	0.79	never	0.61	spirits	0.54	rational	0.40	parts	0.55
long	0.79	times	0.60	substance	0.53	meats	0.39	moisture	0.55
good	0.78	body	0.60	animal	0.52	humours	0.38	moist	0.54
well	0.78	hand	0.60	salt	0.51	animal	0.38	innated	0.54
time	0.78	honour	0.59	sharpness	0.51	sharpness	0.38	rational	0.53
way	0.78	part	0.59	rational	0.50	figure	0.34	sensitive	0.53
manner	0.78	beauty	0.59	dry	0.50	vital	0.34	flesh	0.53
two	0.78	found	0.59	especially	0.49	figures	0.34	animal	0.52
away	0.78	way	0.59	created	0.48	actually	0.33	sharpness	0.52
little	0.78	look	0.59	causes	0.47	outward	0.33	dry	0.51

Table 5.4 Representations of bodily organs in seventeenth-century fiction. Select semantic similarities across the literary subcorpus: *heart*, *bone*, *lips*, *womb*, and *veins*

heart		**bone**		**lips**		**womb**		**veins**	
heart	1.00	bone	1.00	lips	1.00	womb	1.00	veins	1.00
love	0.84	roasted	0.69	eyes	0.57	virgins	0.57	humours	0.49
found	0.84	dish	0.58	joy	0.55	generation	0.52	cold	0.48
eyes	0.81	capon	0.56	touch	0.55	bride	0.51	blood	0.47
never	0.81	roast	0.55	love	0.54	mainly	0.51	heat	0.47
look	0.80	lamb	0.53	hand	0.54	virgin	0.51	outward	0.46
moment	0.80	boyled	0.52	happy	0.54	conception	0.50	parts	0.46
fair	0.80	mutton	0.52	turn	0.53	naked	0.50	earth	0.46
happy	0.79	dyet	0.50	trembling	0.52	husbands	0.49	nature	0.44
tender	0.79	marrow	0.48	lovely	0.53	infants	0.49	work	0.44
joy	0.78	oysters	0.46	even	0.52	modesty	0.49	once	0.42
day	0.78	lace	0.45	fatal	0.51	women	0.48	substance	0.42
honour	0.78	course	0.45	heart	0.51	sundry	0.46	through	0.42
find	0.78	legs	0.44	never	0.51	male	0.46	force	0.42
little	0.77	carcass	0.41	look	0.51	breasts	0.46	face	0.41

Table 5.5 Select overlapping semantic similarities across the literary and anatomical corpora: *body*, *motion*, *substance*, *disease*, and *bones*

body		**motion**		**substance**		**disease**		**bones**	
body	1.00	motion	1.00	substance	1.00	disease	1.00	bones	1.00
great	0.51	body	0.32	parts	0.28	ensue	0.25	bone	0.19
part	0.49	motions	0.30	animal	0.18	cure	0.24	head	0.07
way	0.49	part	0.29	body	0.16	diseases	0.22	part	0.07
whole	0.49	force	0.29	spirits	0.16	distemper	0.21	called	0.07
well	0.49	greater	0.27	matter	0.16	sick	0.21	lower	0.07
nothing	0.49	way	0.27	figure	0.16	patient	0.20	two	0.07
nature	0.48	parts	0.26	heat	0.15	humours	0.19	fingers	0.07
manner	0.47	move	0.26	actually	0.15	malignant	0.18	middle	0.06
little	0.46	nature	0.26	bodies	0.15	sometimes	0.18	third	0.06

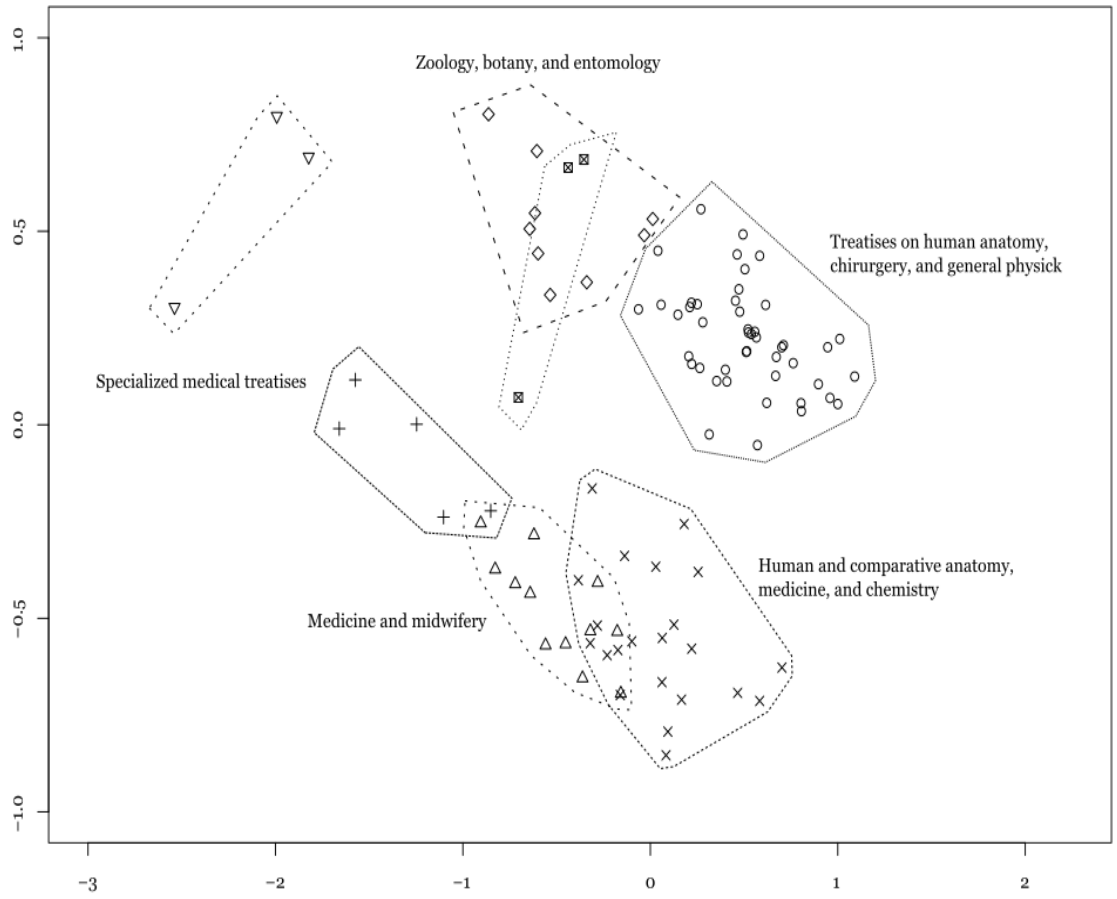

Figure 5.1 Topical clusters in the anatomical corpus based on word frequency[103]

[103] Note, the graph visually reduces multi-dimensional space into just two dimensions, so groups that appear to overlap are not actually contained within one another.

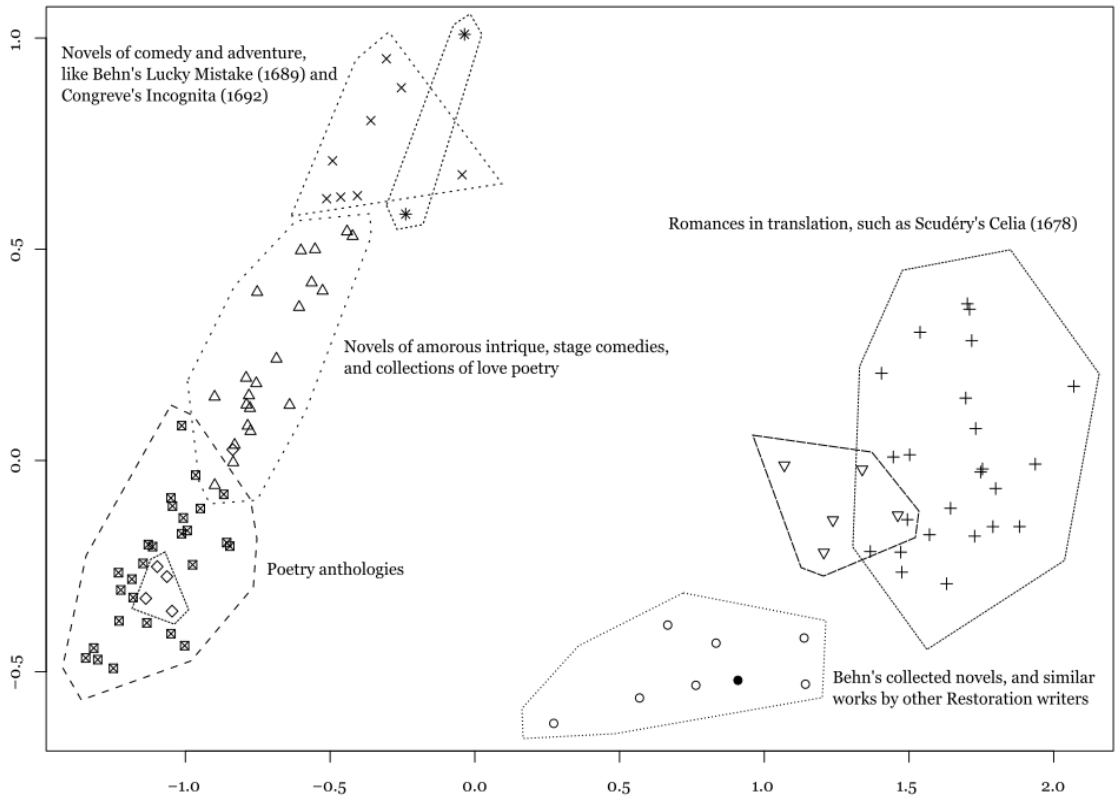

Figure 5.2 Topical clusters in the literary corpus based on word frequency[104]

[104] Note, the graph visually reduces multi-dimensional space into just two dimensions, so groups that appear to overlap are not actually contained within one another.

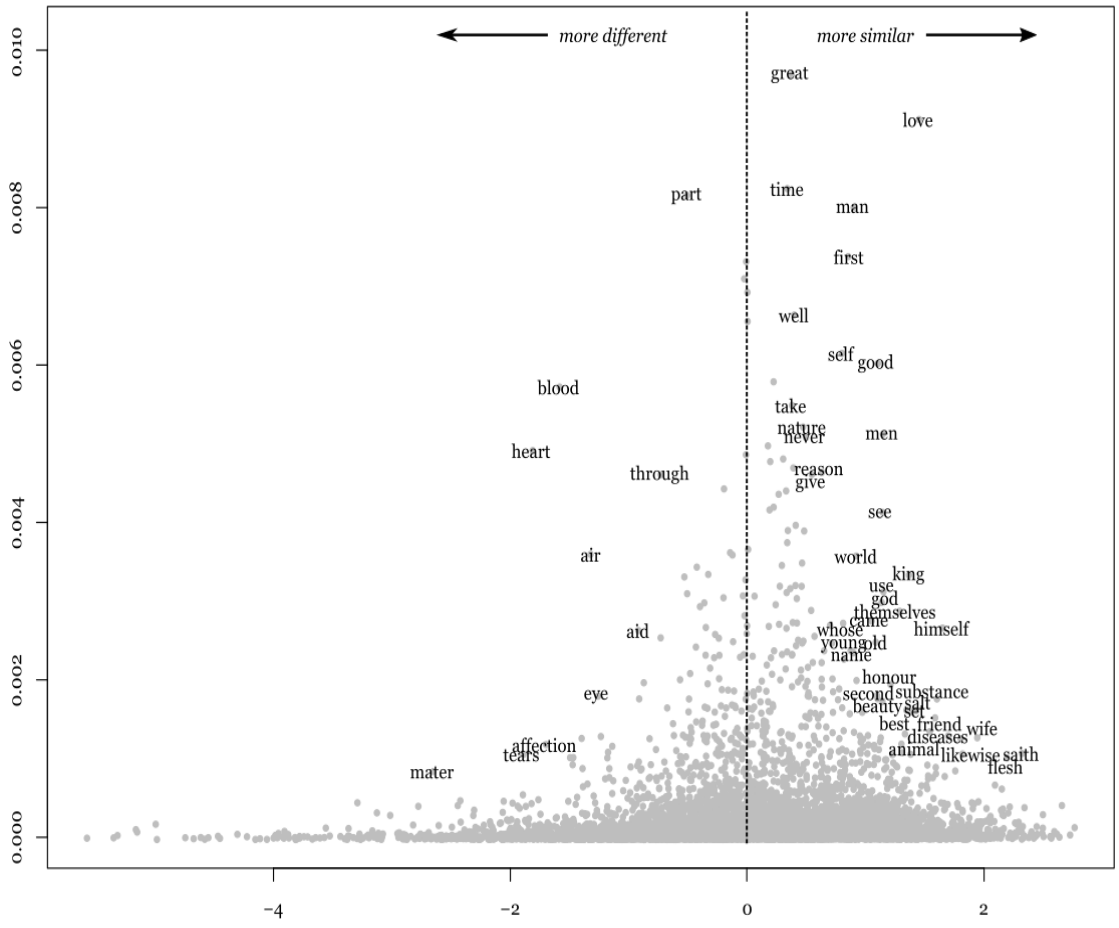

Figure 5.3 Comparison between the two collections

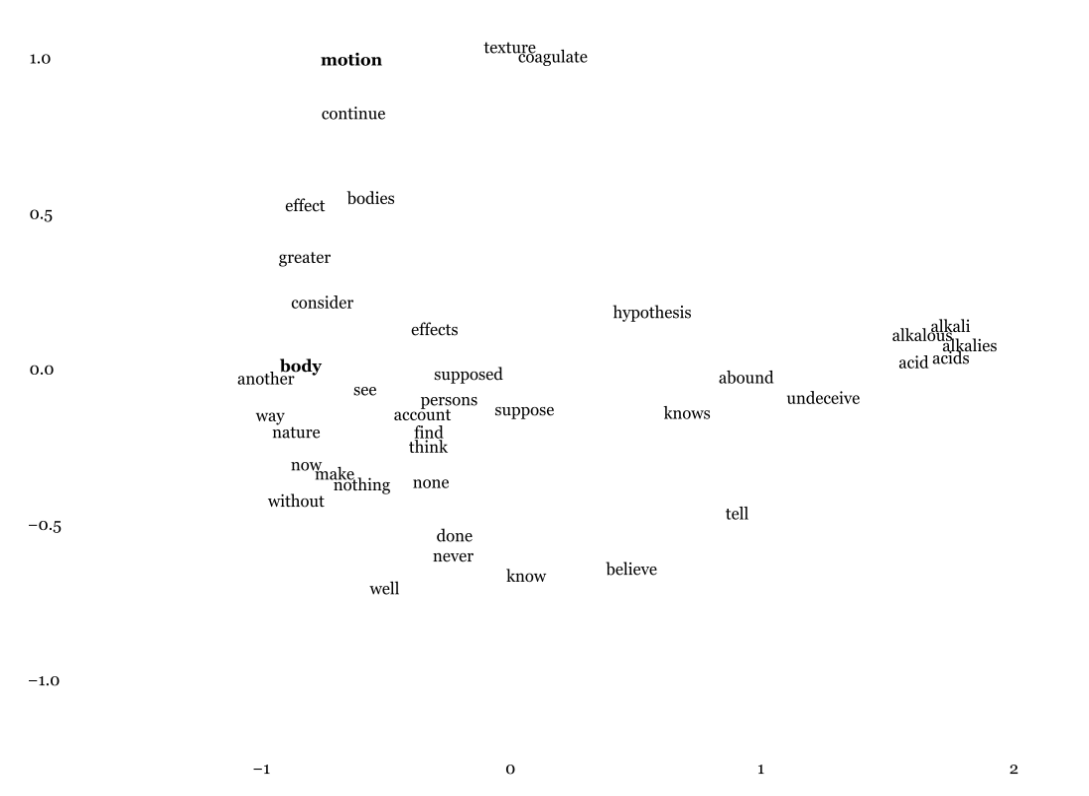

Figure 5.4 Semantic neighborhood of the terms *body* and *motion* in the anatomical subcorpus

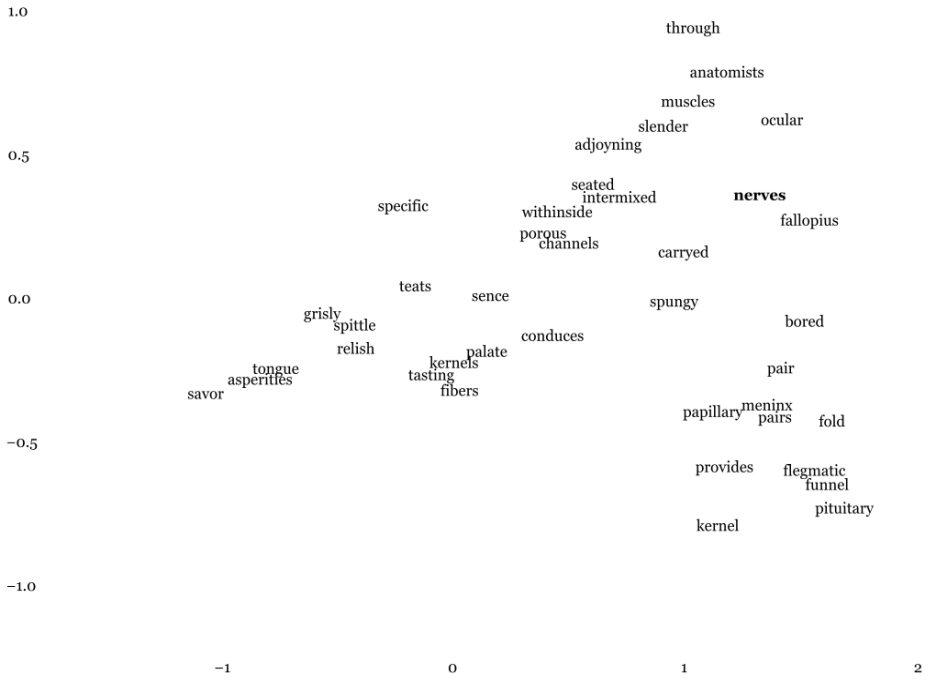

Figure 5.5 Semantic neighborhood of the terms *flesh*, *nerves*, and *substance* in the anatomical subcorpus

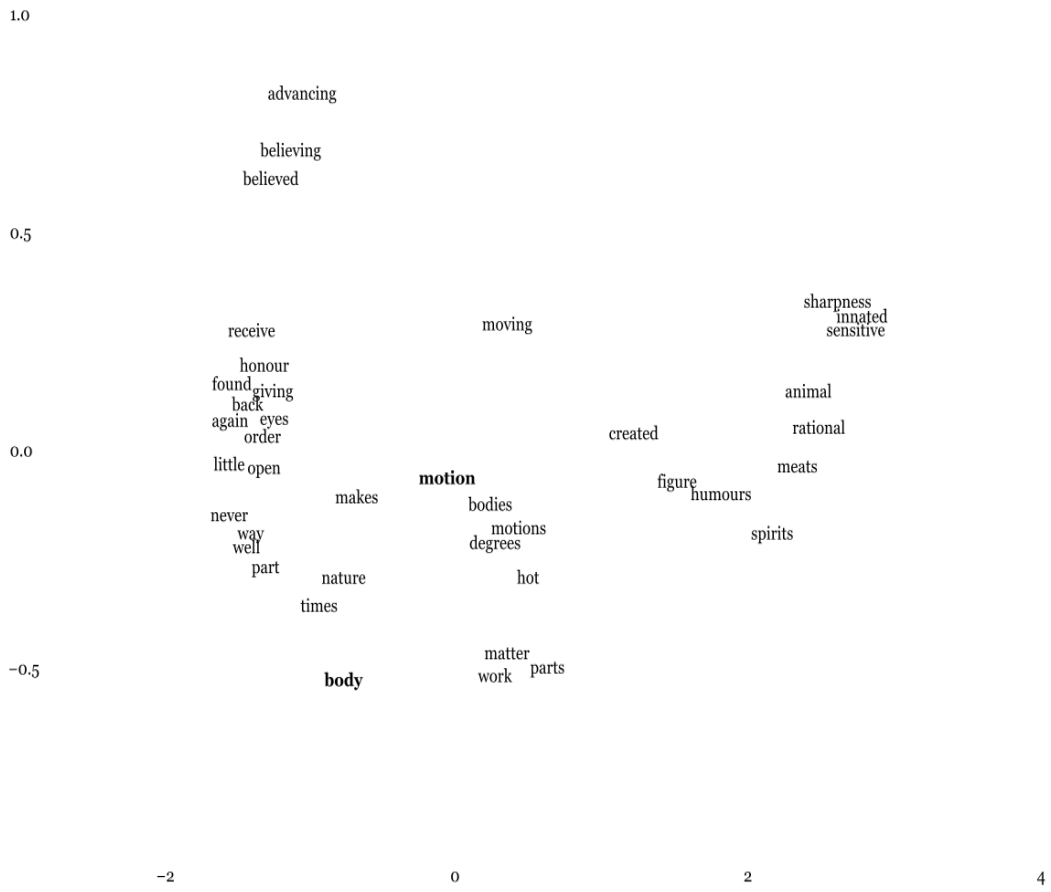

Figure 5.6 Semantic neighborhood of the terms *body* and *motion* in the literary subcorpus.

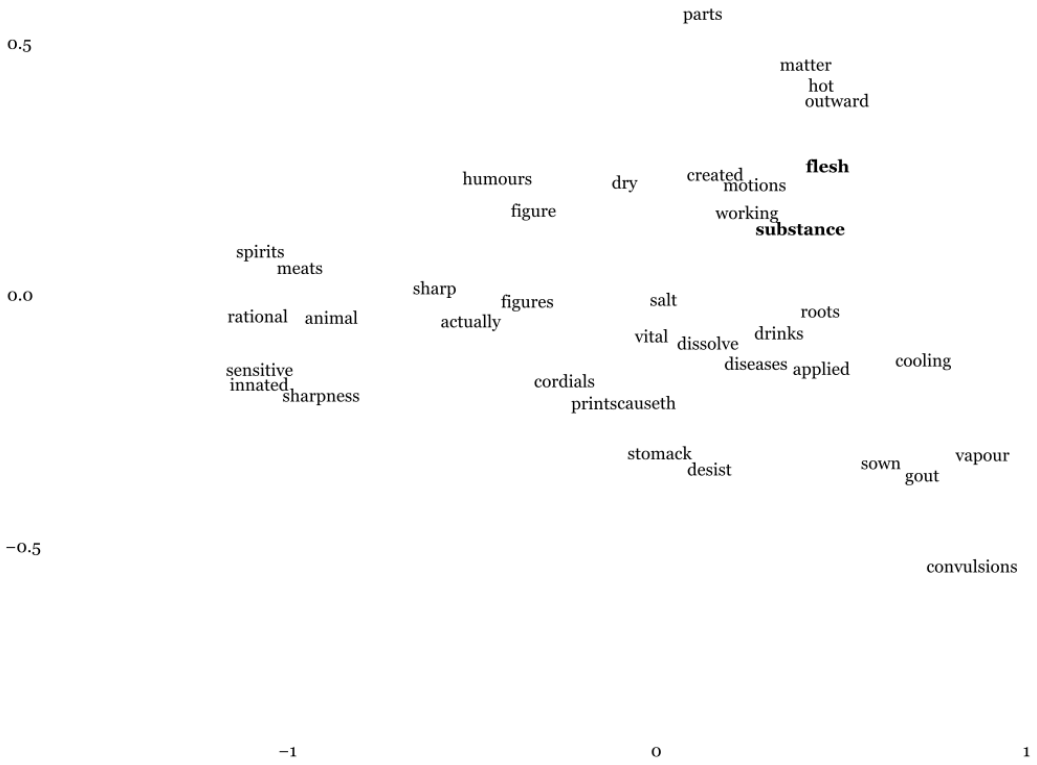

Figure 5.7 Semantic neighborhood of the terms *flesh*, *nerves*, and *substance* in the literary subcorpus

CHAPTER 6

CONCLUSION

The study of women's literature—from its hard-won inclusion in the canon and in classroom curricula to its place in scholarly criticism—has come a long way since the 1980s. So far, in fact, that to focus on women's literature is no longer a bold choice. Much of this progress is thanks to scholars such as Dale Spender, Sandra Gilbert, Susan Gubar, Janet Todd, Jane Spencer, Germaine Greer, and many others. The irony, as Isobel Grundy notes, is that women's writing, finally accepted as a legitimate object of study, has come at a time in which literature, itself, is becoming more and more devalued (9). Presumably the same can be said for other discrete fields of study, such as African-American and Lantinx literature. What, then, can late seventeenth- and early eighteenth-century women writers teach us that is not already known or that is still considered valuable outside a select circle of people who are devoted to nurturing minds rather than pocketbooks?

It seems to me that, despite their different strategies, all of the women in this particular study adopted a capacious view of imaginative writing—treating it as an object of aesthetic value, a gateway into cultural conversations, and an entree into intellectual and philosophical pursuits of all kinds. With atoms, blood, misguided scientists, moon-men, giant flies, dissection, and celestial musings filling the pages of plays, poetry, and fiction written by women, seemingly no topic was off limits. And no wonder; in the seventeenth century natural philosophy and literature were complementary and, in some

sense, co-dependent rather than in competition. Consequently, the poetic imagination offered women opportunities to reimagine and reconfigure existing tropes in order to narrativize and write themselves into the scientific conversations that were impacting their worlds, intellectually as well as socially. Perhaps, like them, we as literary scholars should worry less about defending our turf, closing ranks and insisting on the importance of the Humanities writ narrowly, and instead open it up. Like the women writers in this study, we can use interdisciplinarity to our advantage. The strange and intoxicating brew of science and literature is but one of many areas ripe for further study.

Undoubtedly, specialization—in literary periods, subject matter, even particular authors—has led to great advances in what we know, or think we know. Simultaneously, it has enabled English departments to create an identity distinct from that of departments of history (Underwood). More importantly, it has allowed us to give voice to a larger number of writers and thinkers, thereby disrupting a monolithic view of history, which, properly conceived, is really an overlapping set of histories. However, specialization has also come at some expense. It is now too easy to assume privilege for our set of concerns, too easy to claim priority for a writer or group of writers, and too easy to assert that a particular phenomenon originated within our period.

The very nomenclature we use often exemplifies our stubborn insistence on clinging to areas of specialization and to claiming for them primacy. The "Scientific Revolution" serves as a particularly apt example, given the nature of this dissertation. As Steven Shapin has written, such phrasing assumes a "coherent, cataclysmic, and climatic event that fundamentally and irrevocably changed what people knew about the natural world and how they secured proper knowledge of that world" (*Scientific* 1). This event

supposedly took place between the late sixteenth and eighteenth centuries, ushering in the modern world. As we know, of course, no such singular event occurred. Instead, a diverse set of cultural practices and methods across time, space, and place brought about small revolutions, if they can even be called that; revolution implies change and many historians are quick to assert the continuity between the seventeenth century and earlier periods (Shapin, *Scientific* 3-4). So too, we know that the so-called scientific revolution did not come about because people of the seventeenth and eighteenth centuries possessed a higher level of cognitive ability than their predecessors or were more technologically equipped. Although the first compound microscope wasn't invented until 1590, in the West the rudiments of microscopic technology, for example, were present as early as the thirteenth century (Bardell). Nor did the advancement of knowledge in the seventeenth century represent a great rupture with that of previous centuries. And indeed, the cultural phenomena I discuss in this dissertation—the fractured and atomized view of knowledge and the confluence of literature and natural philosophy—are not isolated to the late seventeenth and early eighteenth centuries, as scholars of the sixteenth and nineteenth centuries would be quick to point out, and rightly so.

Unlike today's scholars, seventeenth-century thinkers weren't specialists in the same sense, as Margaret Cavendish's *The World's Olio* or the Royal Society's "Scheme and Heads of Inquiry" demonstrate. And women, generally prohibited from receiving a formal education, were even less so. Nevertheless, great advances in knowledge occurred. It seems to me that one of the reasons they did so was precisely because of a lack of specialization. The view of knowledge as fractured and facts as mobile enabled a reordering of a mass of heterogeneous information and therefore of what was known.

Imaginative writing was especially conducive to this project of reorganization; through "hypothesis, stories of inventions, and the evolution of ideas through texts," imaginative writing, according to Clare Brant, "has its own reordering" (73). Take, for example, Anna Letitia Barbauld's "An Inventory of the Furniture in Dr. Priestley's Study" (ca. 1770s). In it, Barbauld uses the meronymic nature of the inventory form to itemize the objects the study contains: "A group of all the British Kings" (l. 7), "A rare thermometer" (l. 25), "A blotted proof-sheet, wet from Bowling" (l. 35), "The Fathers, ranged in goodly row" (l. 9), "Papers and books, a strange mixed olio" (l.29), and so forth. Through metaphor and a dense network of allusion Barbauld fuses scientific and poetic investigation; and, through regular meter and rhyme she transforms a "chaos dark" into an organized and recognizable form (l. 40). Undoubtedly this view of knowledge and poetics of scientific investigation was especially appealing to women, whose education was likewise often pieced together bit by bit. As this dissertation has shown, many writers of the seventeenth and eighteenth centuries, male and female, scientific and imaginative, reached centuries backward, exchanged information and ideas across the continent, and included within their work subjects that extend beyond what would seem to us to be their bailiwick. If seventeenth- and eighteenth-century men and women didn't care about crossing geographic and disciplinary boundaries or the heavy dross of time and somewhat arbitrary nature of periodization, why should we, the people who study their work, bother to?

I return, then, to the question with which this conclusion opened. What can we learn from late seventeenth- and early eighteenth-century women writers that we don't already know? Why should we study women writers beyond continuing the project of

recovery, worthwhile in its own right, or for personal and/or intellectual interest? Seventeenth- and eighteenth-century women writers used literature as a kind of bricolage that allowed them to enter conversations crucial to debates about the natural world and therefore conversations crucial to their place within the social world. As such, they exemplify a kind of thinking that allows them to redraw the circle, putting themselves at the center rather than on the periphery. Likewise, women writers used the nascent practice of scientific description and emergent language of system to create new systems of knowledge as well as new ways of thinking and being. From them, we can learn a more flexible, expansive form of scholarship that invites in and engages with concepts, ideas, themes, texts, and material artifacts beyond the traditionally literary and outside our fields of specialization. If that makes us seem too close to historians or cultural theorists, then so be it. Paradoxically, then, focusing on seventeenth-century women's writing teaches us, in some ways, how not to focus on seventeenth-century women's writing *as* women's writing and instead to see their voices as integral to rather than separate from the very culture that produced them.

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