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Gendered Language and the Science of Colonial Silk

In May 1652, Virginia Ferrar conducted an experiment in her family garden at Little Gidding, Huntingdonshire, to determine the optimal growing conditions for silkworms. Her father carefully chronicled her methods and results in a letter that he sent to Samuel Hartlib, a Polish émigré and educational reformer who published the letter as the *Rare and New Discovery of a Speedy Way, . . . Found Out by a Young Lady in England, . . . for the feeding of Silk-worms . . . on the Mulberry-Tree Leaves in Virginia*. The religioscientific paradox of a cultivated commodity whose lowly origins could assume such heights of value—these were emblematic insects whose foul excretions were spun into sensuous silks—appealed to mid-seventeenth-century reformers who sought to refashion the nature of English empire at the height of Oliver Cromwell’s western design. For these writers, some of whom supported the Stuart monarchy, some of whom were aligned with the Protectorate, and most of whom were members of Hartlib’s loosely organized network of correspondents, silk represented the type of material good and spiritual symbol that both sides thought suitable in the reformation of English colonialism.

As they envisioned a new English enterprise, colonial industry, and science of sericulture, “projectors” sought ways to integrate raw goods and uncultivated peoples into a universal mercantile and spiritual economy.¹ This new program of silk work, Hartlib explained in the prefatory address to his “Ingenious Reader” in *Legacy of Husbandry*, would depend less on royal decrees that ordered large-scale landholders to purchase seeds from the Crown and plant mulberry trees on their estates (59–63) and more on empirically tested, commercially viable, gender-inclusive models like “the Experiment of a virtuous Lady of this Nation for the breeding of Silk-worms” (Hartlib, *Rare and New Discovery* A2). These interlocking programs of religious reformation, new knowledge, and gendered labor were borne out in the second edition of Virginia Ferrar’s silkworm trials, a

series of letters from John Ferrar and correspondents in Ireland, England, Virginia, and Germany that Hartlib published in 1655 under the new title of *The Reformed Virginian Silkworm; or, A Rare and New Discovery of a Speedy Way, . . . Found Out by a Young Lady in England. . .*²

As Hartlib's preface and editorial practices suggest, literacy, literary genres, and lettered transmissions of natural knowledge were central to the reformation of imperial silk and colonial Virginia. On the ground, silk works were utter failures. But as they were imagined, debated, and projected throughout the ends of English empire, silkworm letters by women and men reveal new insights into the fashioning of colonial designs, and the ways in which English projectors incorporated Near and Far Eastern methods and indigenous American sericultural practices into the new knowledge that they circulated through poetry and prose. While James I/VI's instructions of 1607 had gone "wholly out of print," multiple accounts of the "Lady's" method, "which seemeth to be brought unto a more perfect and speedy accomplishment than heretofore hath been known either here or in *France*," circulated among Anglophone readership communities in England, Ireland, Virginia, and Continental Europe (Hartlib, *Rare and New Discovery* A2).³

Unlike the "Muck-worms" who "conceal" their work "for private ends," Virginia Ferrar shared her silkworm techniques for public improvement in England, and the global community of saints more broadly. While the former was ruptured by civil war (1642–46, 1648–60), the latter had been torn into factions of Christians. Virginia Ferrar's natural knowledge was thus rooted in England and envisioned as part of a universal project to reform English empire and restore Adamic empire. Protestant projectors like Hartlib imagined that the better husbanding of commodities like silk would allow England and its foreign plantations to "overcome the burthen of povertie which for want of employment and decay of Trade, doth lie so heavie upon very many" (*Rare and New Discovery* A2). Introducing new trades was a responsibility of the blessed to the needy, allowing landless colonists and cash-poor indigenous people a chance to make use of "all the gifts of God" and to experience the spiritual and economic joys of dignified work. Therefore, this reformation of colonial industries like sericulture, and the reformation of English colonial planting, would require a new way of thinking about the value of labor, with a new eye turned to "profit withal toward others, as it becommeth the Members of the same Christian, and

Human, and Nationall Society” in “a good Commonwealths-man in the State, as well as in the Communion of Saints.”

These religioscientific designs, planned and projected in human and heavenly time, thus situated English silk work and gendered subjectivities in new geographies like colonial Virginia, where the reformation of sericulture made labor, rather than land, central to the refashioning of English empire. Instead of a model of colonial industry built on the planting of tobacco in virgin earth, seventeenth-century reformers argued for the harvesting of feminized silkworms. This was work whose “incredible ease and pleasure” would replace what former Virginia Company treasurer John Ferrar alliteratively called the “toyl you take about your Tobacco” (Hartlib, *Reformed Virginian Silkworm* 25, 10). The reformed model of silk work, Ferrar promised, would prove to be “the most precious eye-salve” to “the pernicious blinding smoak of Tobacco, that thus hath dimmed and obscured your better intellectuals” (20).

With this idea, Virginia Ferrar, named by her father after the colony “so that speaking unto her, looking upon her, or hearing others call her by her name he might think upon both at once,” set upon her silkworm experiments (M. Ferrar 42). In the New World, silkworms often died before growers could spin thread from the cocoons, leading sericulturists like Virginia Ferrar to begin new studies of food sources. It takes approximately two hundred pounds of mulberry leaves for a worm to produce one pound of silk, so this was no small matter (Wood 30). She fed the same kinds and amounts of mulberry leaves to two groups of worms, one living in trees planted in the family garden and the other housed in cabinets kept inside her chamber. After comparing the sizes and survival rates of the two groups at the end of their forty-five-day life cycles, she concluded, in the words of her father, “by the triall and experiment she so luckily made,” that outdoor cultivation produced better outcomes for silk, for the garden worms fed with mulberry leaves “grew and thrived wonderfully, and surpassed in largness of body those other wormes she kept in her chamber (she having been many a year a Mistris of Silkworms, and kept them by the Book-rules)” (Hartlib, *Reformed Virginian Silkworm* 9–10). Virginia Ferrar thus proved by experiment and experience that those “Book-rules” required revision, and she drew upon kinship networks and correspondence circles to share her results with a multilingual, transatlantic community of readers and reformers (10).

There were two important, overlapping aspects of Virginia Ferrar's model of silk work that distinguished her program from those of contemporary male growers: her results, what her father characterized as "a thing scarce credible" because they so greatly departed from standard practices, and the gendered language in which they were communicated (9). Virginia Ferrar's endorsement of outdoor growing suggested that shifting silkworm labor away from the home was ultimately more profitable to growers than the heavy intervention that previous authors had recommended. But the gendering of colonial labor, namely silkworms and their growers, also distinguished her work from other letters penned by Hartlib circle reformers. In tracts such as Edward Wiliams's *Virginia's Discovery of Silke-Wormes, with Their Benefit. . . .* and *Virgo Triumphans; or, Virginia in Generall, but the South Part Thereof in Particular. . . .*, written in collaboration with John Ferrar, silkworms were marked with masculine pronouns in the initial stages of the life cycle, but they shifted into grammatically feminine categories when they entered reproductive adulthood. However, in the account of Virginia Ferrar's silk work, written by John Ferrar, silkworms were gendered feminine throughout the life cycle, aligning them through grammatical gender with the biological sex of the grower rather than the productive and reproductive properties that they assumed in different ages.

In studies of seventeenth-century scientific literatures, these types of gendered ascriptions have often been read within a masculinist signifying tradition that subordinates the feminine, replaces real women involved in natural scientific inquiry with a symbolically feminine Nature, and dominates that Nature with feminizing language (Harding; Merchant, *Death of Nature* and "Scientific Revolution").⁴ By contrast, this essay suggests a way to treat the gendered language of feminine and masculine pronouns as what Ralph Waldo Emerson called "fossil poetry" (249), linguistic emblems that marked the interaction of women's and men's knowledge, methods, and labor with different grammatical categories of gender. By shifting the study of gendered language and seventeenth-century science from single-author works of natural history to collaboratively written treatises in vernacular sciences, we can use the gendered marking systems of early modern English to identify the ways in which women's knowledge and agency influenced the design of colonial scientific industries like sericulture, contributed to the scientific reformation of key sources of colonial wealth, and, ultimately, shaped the terms of imperial discourse about the

gendered nature of colonial labor. This is not a story about what happened on the ground, but rather the ideas of gender and science that early modern authors projected into a new world of print, and the language that allowed them to do so.

The study of gendered language is very much tied to the new literacies (Rapport and Cummins; Rasmussen; Bross and Wyss) and discursive forms that imperial promoters enlisted to refine their model of colonial planting. Silk works failed—repeatedly—in the colonial and early national periods, and they never replaced the planting of tobacco as early modern reformers hoped they might. But as one of the earliest examples of what Karen Ordahl Kupperman has called “natural” metaphors of colonization, sericultural literatures, like texts on apiculture and viticulture, left an important imaginative archive whose discursive legacy belies its economic failure as a “model for colonial design” (273). To recover the material contributions of white women like Virginia Ferrar, Mary Ward (née Mapletoft), and Mrs. Sarah Willoughby, writing and working in England and colonial Virginia, then, and to better understand the complex gendering of colonial commodities, natural knowledge, and cosmological bodies like silkworms, we need to read vernacular scientific texts in new ways.⁵

Vernacular scientific texts like instruction manuals and practical handbooks have often been overlooked by literary scholars because of their infelicities of expression, while historians who study the epistemological and institutional shifts of seventeenth-century sciences, as they were practiced and perfected by women and men in different places and spaces, tend not to focus on close readings of key terms, tracing instead changes over time in scientific reading practices, receptions, and materials that shaped early modern cultures of the book.⁶ In this essay, I compare the vocabularies of multiple editions of letters and tracts that reported on the silk work of women and men during a very brief period of imperial reimagining: between 1650, one year after the execution of Charles I, whose life John Ferrar celebrated in the two hundred self-bound copies of a book that he tried to sell to colonial planters, and 1655, when Oliver Cromwell’s forces expelled Spanish colonists from the island of Jamaica. During this five-year period, Edward Williams published three studies on colonial Virginian silk, and Hartlib published two different editions of Virginia Ferrar’s sericultural experiments in England, repackaging image plates and key terms for different readership communities who encountered multiple genres con-

tained within each text, including epistles, economic proposals, instructional prose, poetry, and travelers' reports. By integrating literary methods of close reading with histories of vernacular science, book history, and historical linguistics, I aim to show how literary scholars can shed new light on the languages of seventeenth-century scientific writing, especially the gendered language that has been debated in more than thirty years' worth of scholarship about mistranslation and metaphor in early modern science.⁷

There is some suggestion that the shifting gender pronouns of agricultural writers like Sir Hugh Platt, Gervas Markham, Walter Blith, and John Evelyn might reveal broader changes in early modern ideas about the animacy of organic matter, human agency, and the economy of natural knowledge in an era of colonial planting, but such a study exceeds the scope of this article.⁸ Instead, I will explain why silkworm treatises are well suited for a new study of linguistic and cultural gender in early modern English scientific literature, and why examining vernacular scientific texts like the Ferrar letters—and, thus, writers like Platt, Markham, and Blith, among others—might offer new approaches to the study of language, gender, and culture in the colonial Americas.

The silkworm, like all cosmological bodies, planted commodities, and biological beings, is in its very nature a form marked by fluctuation and change. Early modern writers like Guillaume de Salluste Du Bartas thus marveled at what Sir Thomas Browne called the silkworm's "strange and mystical transmigrations" (88). In his sixteen-line celebration of the "noble & admirable Creature," reprinted in both the *Rare and New Discovery* and the *Reformed Virginian Silkworm*, Du Bartas contrasts his reverence for the natural shifts of the silkworm with his disdain for mercurial humans. The cyclical nature of silkworm lives and deaths, "Two Births, two Deaths, here Nature hath assign'd her / Leaving a *Posthume*, dead-live Seed behind her" (lines 3–4), encapsulates the mysteries of the Resurrection, while the humans who received this life-giving death "[h]ath so profan'd" Christ's sacrifice with the "prodigall abuse" of "our proud age" (11–12):

That Shifters now, that scarce have bread to eat
 Disdain plain Silk, unless it be beset
 With one of those brave Metals, whose desire
 Burns greedy soules with an impartiall fire (13–16).

The natural symmetry of the shifting silkworm is set in opposition to unnatural changing desires for precious metals that debase modern life, highlighted in the rhyming internal symmetry of DuBartas's final quatrain: "Disdain plain . . . be beset" (13). Although the poetic silkworm is consistently feminized ("Nature hath assign'd her," "for her self she makes," "leaving a *Posthume*, dead-live Seed behind her"), John Ferrar glosses the verse with a neuter pronoun that distinguishes DuBartas's silkworm from those cultivated by his daughter, which he always recorded with feminine pronouns. "Had Du Bartas fully known all the vertues and rarities in this incomparable Creature, even a miracle in Nature, he would have enlarged his Poems in a more ample manner in the praise of it, to the great honour of the Creatour," Ferrar insisted in the preface of the first edition (Hartlib, *Rare and New Discovery A*) and the concluding page of the second edition (Hartlib, *Reformed Virginian Silkworm* 40).

Feminist theories of language are richly nuanced, and no single article can fully explain the philosophical complexities of Luce Irigaray, Julia Kristeva, and Hélène Cixous on the linguistic and cultural subordination of the feminine, or what Judith Butler frames as "the power of language to subordinate and exclude women" (26). However, it is worth pointing out that while twentieth- and twenty-first-century critics have suggested that language works hegemonically to mark the feminine as "the signification of lack" and "the unrepresentable absence effected by (masculine) denial," texts written during the crucial gender shift of early modern English offer an alternative explanation of the marking power of language (Butler 27–28). These texts are not concerned, as Butler is, with the cultural intelligibility of gender or the performance thereof; instead, seventeenth-century texts like the Ferrar and Williams treatises reveal important distinctions between cultural and linguistic gender precisely in the moment when the English language was completing its long and uneven shift from grammatical to natural gender. Silkworm treatises offer an especially rich corpus because so many of them were translated from languages that retained linguistic gender, such as French, while others were written by native Francophones. And yet in texts by men like royal sericulturalist John Bonoeil, silkworms either appear in plural forms ("the Silk-worms," "they," "them") or else as singular nouns that are not reduced to pronouns ("the Worme"), even when other cosmological elements, such as mulberry trees, were marked with gendered pronouns: "The more space of ground the

Mulberry tree hath freely by himselfe, and the more frankly the ayre and Sunne comes to it, the greater it growes, and brings the better leaves" (*Observations* 12). Bonoeil's treatise, like many of the instruction manuals and sericultural literatures published by his contemporaries, thus suggests that the gendered ascriptions of silkworms adopted by English projectors were not inherited in translation from Romance languages in Europe.⁹

As historical linguist Anne Curzan has shown, grammatical gender was the rule rather than the exception among the languages of the early modern world (48–55). The gender shift of early modern English has traditionally been understood as the result of the loss of inflectional endings in Old and early Middle English nouns and modifiers. However, of all the Germanic languages that participated in this change, only English experienced an accompanying shift in linguistic gender, complicating for Anglophone scholars what philosopher of science Pierre Hadot calls a "highly interesting" argument about gender in the history of early modern science (136). After the emergence of the pronoun *she* in the textual record of Middle English, and before the near-universal adoption of the neuter pronoun *its* in the late seventeenth century, early modern English worked unevenly through a discursive and epistemological process in which linguistic gender, a formal set of grammatical principles that classifies and declines parts of speech by masculine and feminine genders, was incorporated into categories of cultural gender, what we might call the definitions, values, and normative and counternormative expressions of masculinity and femininity expressed in particular social contexts and historical moments. Thus, grammatical gender in seventeenth-century writing does not necessarily cohere with cultural gender systems. In the case of silkworms, Virginia Ferrar's feminine insect proved "that she is not a nice curious kinde of *Silkworme*; but stout and robustous" (Hartlib, *Reformed Virginian Silkworm* 23), while the masculine worm discovered in Williams's *Virginia's Discovery of Silke-wormes* was "tender" and "delicate," a "mysterious Creature" who does not spin "if wee sort him not with a lodging proper and agreeable to his nature, who can no lesse disprofit bee ill accommodated in his habitation, then in his nourishment" (7, 10).

Because of the collapse of linguistic and cultural gender in early modern English, monolingual Anglophone scholars have interrogated the relationship between grammatical and natural gender from a particular cultural and linguistic perspective. They wonder, as historian of science Margaret J.

Osler helpfully puts it, “whether speakers of languages that have gendered nouns ascribe social and psychological meanings to those genders” (73). But the study of grammatical gender and its relationship to broader social categories of men, women, and gender systems did not begin with the gender shift in English. According to feminist linguist Anna Livia, the earliest debates in Europe to link pronouns and politics emerged in the sixteenth century, an unsurprising development given, as Livia argues, that in moments of social turbulence groups with opposing viewpoints often turn to language to reinforce their demands for social change or to insist on continuity with past traditions, even, and especially, when that continuity is imagined (6). Linguistic gender is not just another case of “pronoun envy,” then, but rather a complex marking system that indexes a wider set of changing ideas about the nature of the world, humankind’s ability to know the inner properties of the things around us, and our potential to use that knowledge for public benefit and private gain.

These large-scale changes in early modern epistemologies, imperial science, and gender systems are perhaps easier to study in lettered microdramas (Mignolo) that recorded conversations from everyday life than in natural histories that tried to show the order of ordinary and extraordinary things. In this sense, the Ferrar letters represent an especially helpful corpus because we can trace the shifts in linguistic gender, gendered personas, and broader ideas about colonial labor as family manuscripts were translated into multiple printed forms. By collating and comparing the silkworm tracts of 1652 and 1655, including the body of the experiments and the supplementary materials, we can identify points of overlap and divergence in the printed transmission and circulation of women’s and men’s sericultural knowledges.

In the *Rare and New Discovery*, for example, Virginia Ferrar’s findings followed a map, drawn by her father, that situated the Virginia colony on the “Sea of China and the Indies” (fig. 1) and a poem written by Richard Ferrar, “From a *Virginia*-Planter in *England* to the Virgin-Lady *Virginia*.” In rhyming couplets, the familial poet praised “the Lady,” a literary persona that stood in for his flesh-and-blood relative, for having translated the miraculous and material labor of feminized silkworms, “Her wonders, both in Nature and in Works / Ador’d by th’ *Persian*, and their neighbouring Turks,” to the colony that “boasts thy name in happy houre”: “A *Virgin*, thou, VIRGINIA is thy Name, / which shall unto VIRGINIA add more

FIGURE 1. John Ferrar, *A mapp of Virginia discovered to ye Falls* (London, 1651). Courtesy of the John Carter Brown Library at Brown University.

fame" (A3, A2v). Virginia Ferrar's empirical study was thus bookended by fanciful geographies of a transpacific Virginian colony, a transatlantic English body politic, and the mystical body of a female sericulturalist that was poetically incorporated into the environment of the virgin colony. These verbal and visual imaginaries throw into sharp relief the differences between her family's aesthetic of colonial reformation and her new program of silkworm growing. Virginia Ferrar's findings were the product of an experientially driven approach to silkworm cultivation in which her steps and missteps were carefully chronicled, tested, and repeated after multiple conversations and epistolary exchanges with other growers, and they confirmed the benefits of outdoor growing. John Ferrar, meanwhile, offered untested theories about double harvests that he hoped "upon triall it will be found" (Hartlib, *Rare and New Discovery* 8). But in the first edition, as in the second, the fanciful maps, poems, and notes were printed together with the detailed account of Virginia's actual experiments.

On November 28, 1653, some eighteen months after he had first written to Hartlib about his daughter's experiments, John Ferrar sent a missive that

situated the family's essays into silk within a larger, circum-Atlantic context. In the year and a half separating the first and final silkworm reports, Virginia Ferrar had learned about other methods of silkworm cultivation, both from firsthand conversations in England and from travelers' reports on Turkish and indigenous Virginian sericulture (Hartlib, *Reformed Virginian Silkworm* 19–25). As she debated silkworm food sources and cultivation methods with growers in England, she also exchanged a silk winding wheel, samples of Virginia silk grass, silkworm eggs, and “Books of *Health and Wealth*” with her collaborators, including Hartlib circle correspondents in Ireland and Germany and family members in England and Virginia (16, 7–9, 23, 28–32). While the text of her first experiment was reprinted verbatim in the second edition, a page-and-a-half-long “advertisement” made clear for her readers that she was deeply engaged in epistolary and material exchanges with a broader sericultural community (19–20).

John Ferrar's marginalia reinforced Virginia Ferrar's actual participation in transatlantic networks, and, at the same time, he suggested wildly new possibilities of a transpacific passage through the virgin colony. Confirming Virginia Ferrar's store of silkworm eggs, he converted his daughter's experiences into a third-person literary figure: “The Lady hath of these Silke-bottoms in her Cabinet as Jewels to convince the incredulous, they are ten times bigger then any in Europe to admiration, and of infinite encouragement to the work” (Hartlib, *Reformed Virginian Silkworm* 9). After mentioning her shipments of manuals and materials across the Atlantic, John Ferrar addressed his marginal comments to the planters, claiming that “[t]he way to speedy wealth was by some hundreds of you to remove some 60 miles more South by land, and to attempt the discovery of the Westerly Sea, on the border of Virginia, and both two very easily atchieved, &c.” These marginal notes on Virginia Ferrar's transatlantic exchanges of silkworm books and eggs and John Ferrar's fantasy of the colony's transpacific opening situated the Ferrar family in new geographies and networks of knowledge, both real and imagined, suggesting how silkworm books and agricultural improvement literatures functioned as sources of new knowledge and material objects, and how the printing of family letters allowed writer-editors like John Ferrar to discuss actual things and fanciful designs in the same breath.

For his part, John Ferrar had also developed new ideas on silk work in the years between the first and second editions, largely the product of

intellectual and material exchanges with women like Virginia Ferrar and colonial planters like Edward Digges. In response to Digges's letter from Virginia on June 21, 1654, in which the loyal planter noted, "My people differ very little from the rules set down in your, Mr. Williams *his Booke*, and as Esquire *Samuell Hartlib* hath also directed in his advertisement of Silkworms unto us; only in the hatching of the Worms-Eggs, they are more curious" and, thus, "I could not this spring meet with any of those Bottoms" (Hartlib, *Reformed Virginian Silkworm* 28), John Ferrar offered a brief account of his own search for methods to unwind silkworm bottoms "with ease, to the great advantage of the Planters of the Silk-trade in *Virginia*" (29). After the restoration, Digges sent silk samples to Charles II and affirmed in the *Philosophical Transactions of the Royal Society* that "I never observed, that the smell of *Tobacco*, or smels that are rank, did any waies annoy the worm" (26). But in the still-formative moment of early tobacco growing and vigorous imperial imagining, in 1654 Digges could report that John Ferrar's "many and severall Letters, printed papers, and Queries" had inspired his own essays into colonial silk, even when the planter had misunderstood the different methods of Williams and "the vertuous Lady *Virginia*" and the different natures of Virginian and English mulberries. For whatever was lost in the translation of natural knowledge around the Atlantic, we know that these exchanges encouraged growers on both sides of the ocean to experiment with new methods (Hartlib, *Reformed Virginian Silkworm* 28–29). In 1652, John Ferrar had described his untested ideas alongside his daughter's empirical trials; two years later, however, he had adopted the authoritative voice of writers of instruction manuals, directing his readers in Virginia to follow practices that he had developed in England.

While some materials were shared between the editions of 1652 and 1655, including excerpts from Du Bartas and an emblem poem "in the fashion of the bottom" (fig. 2), these poetic elements were placed in new contexts when they reappeared in the second edition. The map of Virginia, divided into parts that were "ould" ("Carolana") and "new" (Maryland), with its plotting on "the Sea of China and the Indies" had disappeared. Additionally, Hartlib's edition of the *Reformed Virginian Silkworm* replaced the poems by Virginia Ferrar and her cousin Ferrar Collet with three different sets of texts: letters from growers in Germany, Ireland, Virginia, and Oxford, England (7–8, 30–31); a "Loving Advertisement to All

FIGURE 2. “*The fashion of the Bottom*” (Hartlib, *Rare and New Discovery* 12; Hartlib, *Reformed Virginian Silkworm* 18), *Special Collections Research Center, Earl Gregg Swem Library, College of William and Mary*.

the Ingenious Gentlemen-Planters in Virginia,” written by “V.F.” but told through the persona of “the Lady” (19–20); and six pages of “Ryming lines (for Verses they deserve not the name)” that “her Brother a young Scholar hath collected out of Letters, that were sent her from *Virginia* and given her” (qtd. on 32, poem on 33–38). In the first edition, the final word was given to the poems, verses of Virginia Ferrar, “Upon the Silk Reel” and “To the Virginia Gentlemen Planters,” and some of Ferrar Collet’s playful works, including anagrams wherein “Mistresse Virginea Ferrar” became “Minervas Rarer Giftes Rise” and acrostics such as “To my Precious Couzen, Upon Her Experiment to Promote the Silken Trade in the Colonie of Virginia.” As Ferrar Collet spelled his cousin’s name down the page, his verse equated the virgin sericulturalist with the virgin colony, fit home for a feminized insect whose “Gain to the World thy Downy Reptill brings / It lectures to thy sex in silent Laws.” The first published report of Virginia Ferrar’s experiments was thus bracketed between two different images of silkworms and scientists, the one a translation of manuscript illustrations into an emblem poem printed in the shape of a cocoon (figs. 2 and 3) and the other a four-part series in which “Virginea Ferrar” was anagrammed from “Veri faire Garner” and “I ever ralgn farr” to “In rarer figure” and, ultimately, “Rare fair Virgin.” In Ferrar Collet’s imaginative play of space, syntax, and science, the “Ana” was separated from the “grams” by those four lines of nominal conversion, playing with Virginia Ferrar’s name, her knowledge (Minerva), and the raw materials from her experiments to create his own silkworm-like shape in which two pointy ends appeared at the head and tail of a rounded, lettered form.¹⁰

FIGURE 3. Virginia Ferrar or John Ferrar, silkworm cocoon drawn in the Ferrar family copy of Gerhard Mercator, *Atlas; or, A Geographicke Description of the World* (London, 1635), 904. Courtesy of the John Carter Brown Library at Brown University.

Unlike Hartlib's *Reformed Commonwealth of Bees*, with which the *Reformed Virginian Silkworm* was sometimes printed and sold, Collet's closing lines in the first edition distinguished the bees of "feminine monarchy" from the silkworms of reformed colonial industry: "No clam'rous Bee, that works with murmurings, / Equals her toil. How quietly she draws / A *rachnes* finer twist? Lo here a Text" (Hartlib, *A Rare and New Discovery* A2v). Both sericulture and apiculture were feminized modes of labor, the one, as in Hartlib circle correspondence, a metaphor for colonization inspired by the natural order of things, and the other an example of "feminine monarchy," explored in learned natural histories like Charles Butler's *The Feminine Monarchie, or The Histori of Bees* (as the first edition of 1609 was titled). Silks and honey, two potential sources of colonial wealth, were central to seventeenth-century proposals for the reformation of colonial Virginia; by naturalizing both feminine labor and sovereign rule, reformers argued for an explicitly feminine program of colonial reform, and at a time when England had neither king nor queen, they grounded the hierarchy of monarchs in metaphors that were inspired by the natural world.

Midcentury reformers like Virginia Ferrar developed new models of natural knowledge, while other projectors looked back in time to rehabili-

tate earlier ways of knowing. These writers took learned natural philosophies of antiquity and early modern natural histories, and they translated the received wisdom on bees into agricultural programs of colonial development. Bees, they argued, were insects whose “wit and industry” (*solertia et labore*) was harnessed by the “Princely feminine graces” of a queen who “freely yeeldeth hir self and hir Subjects, their labour and the sweete fruits thereof,” as Charles Butler put it in the third edition of 1634 (¶2-v).¹¹ In this envisioning, drones, or nonworker male bees responsible for impregnating the queen, stood in for idle and unproductive subjects whom Walter Blith called “the bane of a Christian State, and shame of a Christian Nation, [and who] would not so swarme amongst us” (10).¹² In his nine-point recommendation of colonial commodities that could replace tobacco, John Ferrar thus listed silk and silk grass as the best two options, followed by wines, furs, and “[t]he increasing of abundance of Bees for wax and honey, their food so plentifull in *Virginia*, as in Land no more, and if with an hatchet you do but slash your Pine-trees, Firre-trees, Locus, and other trees, there will store of liquor come out of them, on which the Bee will gather infinite store of honey and wax, as in *Russia* and other Countreys they do” (Hartlib, *Rare and New Discovery* 11, *Reformed Virginian Silkworm* 17). Under a reformed program of agricultural improvement, colonial Virginia and its slashed-open trees would become, if not a land of milk and honey, then certainly one of honey and silk.

While John Ferrar’s epistles appeared verbatim in both editions, and Virginia Ferrar’s experiments formed the core of both texts, Hartlib’s editorial stewardship and relationships with printers ensured both overlaps and divergences in the two published editions.¹³ The title of the second edition reveals important continuities with its predecessor, namely the book’s empirical emphasis on Virginia Ferrar’s trials and the integrated geography of Virginian botanical goods that were tested in England. But the title page also underscores an important difference. The first edition (fig. 4) was published by Richard Wodenothe, a printer whose work Hartlib largely financed at his own expense, with a frontispiece image of an ear of “Indian wheat” (maize) whose open stalks house a bird that stares at the page-long title of the volume (Barnard, “London Publishing” 4).¹⁴ The image—interesting though it is—bears no relation to the content of the volume, which only mentions birds as a silkworm predator and recommends the cultivation of niche agricultural goods, including silks, wine, and honey,

FIGURE 4.
Samuel Hartlib,
A Rare and
New Discovery
(London, 1652),
Special Collections
Research Center,
Earl Gregg Swem
Library, College of
William and Mary.

“of no or small difficulty to you and the Savages to enterprize,” rather than staple crops like maize (Hartlib, *Rare and New Discovery* 16–17).

The second edition, however, was printed for religious writer Giles Calvert by John Streater, a former soldier and an explicitly political writer most famous for translating the classical republicanism of Aristotle’s *Politics* and the bloody lessons of the life of Julius Caesar into a contemporary vernacular that united opposition to Oliver Cromwell’s Protectorate (Raymond 568–71). The curious image of the open ear of corn introducing the *Rare and New Discovery* was replaced with a fleur de lis border that framed the text of the *Reformed Virginian Silkworm* in a delicate balance between the aesthetics and imperial designs of the multiple Protestantisms of the mid-seventeenth century—visually enclosing the text to highlight the word, but doing so with a stylized flourish that looked outward to other cultures of nobility. The “reformed” second edition did not pare itself down to plain style; on the contrary, it added decorative elements like a broader

range of font sizes and a more ornate border. Thus, when the Puritan Protectorate was at the peak of its power in England, Protestant reformers like Hartlib and the Ferrars negotiated different aesthetics of seventeenth-century print culture to situate their colonial projections in an unstable political environment.

Some of these changes were more than ornamental, and they reflected the new ideas about silk culture that had been developed in epistolary exchanges between the first and second printings. As the frontispiece of facing pages in the first edition was replaced with a single sheet in the second edition, so too did the role of place shift on the printed page between the two printings. In the *Rare and New Discovery*, the largest textual element was the proclamation of “DISCOVERY,” written in capital letters and declared in the largest font on the page; a secondary role was played by the place that would benefit from these scientific discoveries and incorporations of indigenous people into the English silk economy, “their Conversion to the Christian Faith, the Glory of our Nation, which is the daily humble prayer OF VIRGINIA for VIRGINIA.” In the *Reformed Virginian Silkworm*, however, the emphasis shifted to place, as “VIRGINIAN” became the most prominent word on the page, suggesting how and where the second edition might retell the reformation of the act of discovery and the science of colonial silk (fig. 5).

As these lettered and material changes and exchanges make clear, Virginia and John Ferrar formed an important part of a broader Protestant community that labored throughout the divisive years of the English Civil War to improve the silk industry of colonial Virginia. The overlapping discourses of agricultural improvement and religioscientific reform was common to New World projectors aligned with the Protectorate, like Hartlib, and those sympathetic to royalists, like the Ferrars. As scholars like John Barnard have argued, mid-seventeenth-century English print culture allowed for the crossing of these party lines with surprising ease (introduction). Amid violent conflicts and political protests at the height of the Protectorate, then, a feminized model of colonial labor originally endorsed by the Stuart monarchy and its Cavalier planters was also, rather remarkably, supported by an international body of Protestant readers and the Puritan Roundheads or “Augustinian Platonists” who challenged the legitimacy of the Crown (Loemker 3).

Their agreement on the centrality of silk to English colonial designs do

FIGURE 5.

Samuel Hartlib,
 The Reformed
 Virginian Silk-
 Worm (London,
 1655), *Special
 Collections
 Research Center,
 Earl Gregg Swem
 Library, College of
 William and Mary.*

not, however, mask the very real points on which growers, writers, and reformers disagreed. In many ways, the divisions within this community on weighty matters of religiouscientific cultivation and colonial planting are as important as those without. By comparing the collaborative projects of John and Virginia Ferrar with those advanced by John Ferrar and Edward Williams, we can appreciate some of the ways in which gendered language reveals key differences about scientific knowledge, colonial industry, and relationships between and among indigenous communities, colonial planters, and imperial apologists in England. In 1650, Williams published three different editions of his account of colonial silk work, the second of which, *Virginia: More Especially the South Part Thereof, Richly and Truly Valued*, was seemingly titled in response to Richard Hakluyt's translation of O Fidalgo de Elvas's *Relaçam verdadeira dos trabalhos no descobrimento da provincia da Frolida*. . . , a Portuguese soldier's survey of Florida and its

surrounding lands.¹⁵ In 1609, Hakluyt published his translation for the Virginia Company as *VIRGINIA Richly Valued, by the Description of the Maine Land of Florida*. . . ., and in 1611, he printed a second edition for a more public audience, *The Worthy and Famous History, of the Trauailes, Discouery, & Conquest, of That Great Continent of Terra Florida: Being Liuely Paraleld, with That of Our Now Inhabited VIRGINIA*. Williams thus positioned his text as part of an ongoing dialogue in a vibrant literary market, and he worked extensively with writers in his own time, especially John Ferrar. As he explained in the third preface of the first edition,

Neither doe I appropriate the honour (if any due) of being the sole author of this Tractate, the whole substance of it full of good wishes and generall intentions, was communicated to me by a Gentleman of merie and quality . . . whose permission I obtained to make it publicke, is Mr. *John Farrar* of Goding in Huntingdonshire, a persō of quality & fortunes, who has made good his affections to that incomparable Country, by hazarding a considerable summe towards the advancing of the first Plantation. (*Virgo Triumphans* [C4–C4v])¹⁶

These substantial exchanges of ideas, and the practices of joint authorship, led Williams to concede, “there is little of mine in this, but the Language, and some few additionall collections, the Substance is entirely the Gentlemen above mentioned, which I thought fit to declare” ([C4v]). Our analysis of these collaborative literatures is therefore complicated—and ultimately enriched—by overlapping issues of authorship, gender, and genre in early modern print culture. A comparison of Williams’s treatises, inspired by John Ferrar but describing work performed by Williams, with the multiple letters published by Hartlib, written by John Ferrar but describing the trials of Virginia Ferrar, reveals key differences in the gendered language of these natural scientific essays, especially because John Ferrar’s ideas were explained in Williams’s language and Virginia Ferrar’s ideas were explained by John Ferrar.

The first part of this essay has employed methods of collation to compare two printed accounts of the same silkworm experiment designed and conducted by a woman whose work indexed the gendered language of sericultural methods that were developed in England and projected into colonial Virginia. The remainder of this essay will focus on the gendered languages of different silkworm treatises and the implications of that language

for the design of colonial silk industries operated by indigenous and English women and men in Virginia.

Protestant projections for a feminized colonial silk industry—one in which multilingual reformers throughout the Atlantic world looked to Chinese and Persian practices in the Old World and Iberian examples in the Americas—emerged in a determinative moment in the formation of English imperial identity and policies. By the end of 1655, English soldiers had invaded Jamaica and supplanted Spanish colonists on the island that would become the crown jewel in the colonial scientific knowledge economy of early modern England (Dunn, *Sugar and Slaves* 149–87, 189–223; Stearns 226–32). And by the last quarter of the century, colonial Virginia had shifted from small-scale cultivation of tobacco by farmers to large-scale plantations that shaped Chesapeake society in ways that are impossible to understate, as both Lorena S. Walsh and Timothy H. Breen have shown. But New World projectors did not know how the stories of Cromwell's invasion or colonial tobacco would end when they designed improvement schemes that advanced the small-scale, decentralized production of wines, silks, and honey. These explicitly feminized emblems of sensuality and sweetness carried far different cultural connotations, imperial images, and religious resonances than the industrial-scale regimes of rum, tobacco, and sugar that ultimately dominated Atlantic trade, determined who arrived to the Americas in what condition, and as Richard S. Dunn has shown in his study of sixty years of census data from the Mesopotamia plantation in Westmoreland, Jamaica, who survived to transmit the genomic and cultural codes of one generation to the next (“Sugar Production”).¹⁷

The political, economic, and cultural shifts required to translate imperial aspirations and expressions from rum to wine, sugar to honey, and tobacco to silk were registered in treatises that explained how to reform the colonial industries of viticulture, apiculture, and sericulture. With a better scientific understanding of these agricultural sectors, Hartlib circle projectors argued in texts like Hartlib's *Reformed Virginian Silkworm* and *Reformed Commonwealth of Bees* and Williams's *Virginia's Discovery of Silke-Wormes* that the instantiation of feminized modes of colonial labor—human and nonhuman alike—could become commercially viable ways to wealth and satisfying millenarian fulfillments. Silk work designs and sericultural literatures thus contributed to a formative debate about the nature of English

empire, at a time when plantation monocultures had not yet been made conceptually, culturally, or commercially dominant.

As these reformers were convinced of the urgency of their task, both for the earthly ends of the English economy and the restoration of Adamic empire, they looked south and east, near and far, for models on which to fashion their designs. Although scholars have long cited Columbus's search for a more direct route to China as evidence of Asia's importance in the geographic imaginary of the European "discovery" of America, new work in early American studies is helping to establish a broader appreciation of the ways in which sixteenth- and seventeenth-century Eastern imperial systems of tribute collection, religious hierarchies, and racial classifications influenced European empires in the Americas, and how travelers like John Smith applied their experiences in Turkey to frame their telling of New World adventures (Burbank and Cooper; Greer, Mignolo, and Quilligan; Banerjee). For mid-seventeenth-century silk works promoters like Williams, China represented a crucial geographic parallel, economic precedent, and spiritual model of how not to be: "The Easterne Nations oppressed with the slavery of those illustrious horseleeches their princes," Williams predicted, "will come under our shadow, and by a thicke repayre to our most glorious and happy Mayden, live with us in that liberty, which Nature in their Creation intended to the nobles of his creatures Mankind" (*Virginia: More Especially the South Part* 36). In the preface to that second edition, immediately following a copy of the Ferrar map but before beginning his survey of England's "just title" to "Virginia in Generall," Williams argued that Virginia's latitudinal "parallel" with China, "which beyond dispute lye open to those Seas which wash the South-West parts of Virginia," would make its silk works equal or exceed "the more opulent Provinces of the East to their wealth, reputation, and greatnes (besides the most Christian of all improvements, the converting many thousands of the Natives)" (B3v–B4).

The incorporation of these "many thousands" of indigenous souls into what Charles Webster has called the "international spiritual brotherhood" of the Hartlib circle (32) would thus enable the productive reformation of a colony whose cultural geography was destined to rewrite the Chinese story of silk. In this way, the Chinese imperial past was prologue to reformers' designs to position colonial silk in a seventeenth-century world whose markets were increasingly controlled by and connected to imperial

movements of people and power. When the Chinese monetary system collapsed in the fourteenth century, a three-thousand-year tradition of using silk as currency was replaced by use of precious metals (Schoeser 13). As Dennis O. Flynn and Arturo Giráldez have persuasively argued, China's adoption of the silver standard allowed early modern Hapsburg traders to traffic American silver from Potosí and Zacatecas to Eastern markets where silver commanded a favorable two-to-one exchange rate relative to prices in Europe, encouraging the Holy Roman Empire to invest in the types of metallurgical technologies that would allow for increased production of silver bullion and continued advantages in global markets (xix–xx). Chinese antecedents—geographic, technical, and imperial—thus figured formatively into English attitudes and orientations toward Virginia's silk colonies, and the gendered systems that structured Asian silk production may well have influenced English imperial designs in ways that have not yet been recognized.

Silk technologies were transferred from Asia to the Middle East and, ultimately, Europe and the Americas. In that process, the deeply gendered order and aristocratic image of Eastern sericulture may also have been absorbed in the westward movement of silk culture. Ceremonial rites like those chronicled in the Confucian *Li Ki* underscored the complementary silk work of women and men, including the clearing of ground and the planting of mulberry trees (Confucius 1: 262–67, 236–41). In the language of images, however, aristocratic women who produced silk and reproduced children were the focal points. Silk iconographies were closely associated with noble women, from the T'ang Dynasty (618–907) scroll of "Ladies Preparing Silk" in China to Kitagawa Utamaro's *Joshoku Kaiko Tewaza Kusa* (ca. 1800) in Japan (Sullivan). Silk production is hard, brutal work performed by skilled laborers whose trained fingers move quickly to unwind stubborn silk threads over vats of boiling water. But in visual enactments of silk work, as in sericultural literatures, the work was represented as light and easy, and images explicitly linked feminized labor of silk production and reproduction (fig. 6). For example, in the eighth plate of Utamaro's twelve-part series *Silkworm Culture, Handiwork of Women*, two women bring children of different ages into the silkworm house to observe the hatching of moths. The fertile sprouting of the insects in the left panel visually reinforces the representation of mother and child on the right, connecting the reproduction of silkworms with the reproduction of

FIGURE 6.
"VIII: Watching Moths." Kitagara Utamoro, *Silkworm Culture, Handiwork of Women* (ca. 1800). Used with the permission of the Book Club of California. Original in the Huntington Library, Pasadena, CA.

human families and ultimately preparing viewers for the ninth print, the production of silk thread. The move from reproduction to production accompanies a positional shift, as the winding stick in the ninth print visually divides the pane into two vertical columns. Here, three women casually wind silk, as one worker spins three cocoons into a single thread, another plays with a head scarf, and a third lounges against the loom, reed in hand (fig. 7). In ritual ceremonies and texts, it is clear that men and women play a part in silk production, but in the images of silk work produced in China and Japan, the work is aligned with noble women who delicately labor in hatching houses and at winding wheels.

Early modern French and English silkworm treatises retained the aristocratic contexts and performative rituals of Eastern sericulture as they

FIGURE 7.
 “IX: Winding the Thread.” Kitagara Utamoro, *Silkworm Culture, Handiwork of Women* (ca. 1800). Used with the permission of the Book Club of California. Original in the Huntington Library, Pasadena, CA.

pertained to women, as John Ferrar, Jr., proclaimed in his off-rhyming lines that “Queenes of the best edition need not scorne / In her owne Livery to serve this Worm,” but the principles of gender complementarity did not make the translation (Hartlib, *Reformed Virginian Silkworm* 36). In English-language texts where both men and women worked with silk, spinning thread “[o]ut of her rich belly by her mouth” and winding it “by a Reelee turning with hand of man,” the worms were gendered to match the people who grew them and harvested their silk, whether for personal profit or public instruction (36). Interestingly, the books that most draw on women’s sericultural knowledge and feminized silkworms—*A Rare and New Discovery* and the *Reformed Virginian Silkworm*—do not have images of women’s work, unlike the prints from texts in which men grow

FIGURE 8. John Bonoeil, "By this figure is shewed the fashion of the Engine, how to wind off the silke from the cods, with the furnaces and cawtherns for that purpose." *His Maiestie's Gracious Letter* (London, 1622), 15. Special Collections Research Center, Earl Gregg Swem Library, College of William and Mary.

worms, including *His Maiestie's Gracious Letter* (fig. 8) and *Virginia's Discovery of Silke-Wormes* (fig. 9). These images contain small differences in the woman's dress and the winding stick, but neither representation was original; Williams's plate was reproduced from a run of Bonoeil's, while the image in a different version of Bonoeil's *His Maiestie's Gracious Letter* was reprinted from the English translation of Olivier de Serres's *Perfect Use of Silkworms* (Geffe). As multiple images of women and men winding silk were produced and reproduced in sericultural literatures throughout the century, these visual representations of complementary forms of gendered labor contrasted with the very different enactment of sericultural work that was produced through language. Women like Virginia Ferrar tended worms that were marked with feminine pronouns, while male-husbanded worms shifted between male, female, and neuter grammatical categories. These forms of pronominal resiliency not only index the moments when women, rather than men, perform silk work, but they also reveal important understandings of the gender of reproduction in the colonial period.

FIGURE 9. Edward Williams, "This figure representeth the Engine, to wind off the silk from the Cods, with Furnaces and Cawlderns necessary thereto." Virginia's *Discovery of Silke-Wormes* (London, 1650), 15. Special Collections Research Center, Earl Gregg Swem Library, College of William and Mary.

Male authors who described men's silk work used different gender pronouns to mark what colonial sericulturists called "shifts" or "sicknesses" in the four stages of the life cycle: (1) infancy, (2) adulthood, and (3) emergence as caterpillars (4) that spin silk thread cocoons (Tuskes, Collins, and Tuttle 4).

Here a few notes about silkworm cultivation are necessary before we can appreciate the gendered nature of English designs and their implications for imperial imaging. Colonial sericulturists argued for the importation of *Bombyx mori* eggs from Europe, but they also hoped that North American silkworms, especially wild varieties of saturniid moths like *Antheraea polyphemus*, *Anisota senatoria*, *Callosamia promethea*, and *Hyalophora cecropia*, might allow them to produce new kinds of silk (Tuskes, Collins, and Tuttle 52–54; Ewan 130). But a four-thousand-year history of domestication of *Bombyx mori* by Chinese sericulturists made the species ideal for commercial silk production, so colonial reformers largely recommended the Spanish strategy of introducing domesticated worms

from the Old World into their American colonies in the initial years of operation (Liu 1, 10). With the support of the Crown, planters like Edward Digges imported *Bombyx mori* eggs and silkworm experts from England, France, Italy, Spain, and Turkey to Virginia, one of the earliest accommodations of native American resources to materials and practitioners transplanted from abroad (Hatch 52–55).

After the harvest, planters were to send the raw thread to England, where Protestant weavers recently displaced from France and Holland would convert the colonial commodity into a mercantile mode of exchange. The global demand for textiles expanded throughout the seventeenth century, and English projectors happily followed Iberian precedent in seeking profit from colonial silk. After unsuccessful attempts to introduce silk culture to Hispaniola in 1501 and coastal Carolina between 1521 and 1525, the first guild established in New Spain was that of silk weavers, who in 1542 organized as a professional artisan network that spun the raw fruits of Mixtec silk colonies in western Mexico (Cope 10; Borah, *Silk Raising*). Indigenous communities were often assigned tribute taxes in precious metals, but in places like Tejupan, silk stood in for silver. As Woodrow Borah has argued, regions like the Mixteca Alta were too far removed from urban centers to make agricultural goods or heavy metals worth the portage, “but silk in hanks, ready for weaving, could easily be transported and find a ready market among the Spanish population, which was avid for luxury goods” (“The Indians of Tejupan” 7). Spanish-American silk works thus ran successfully in Michoacán, Nueva Galicia, and Oaxaca, even expanding eastward into Yucatán and northward into Pánuco, until merchants found ways to route cheaper silks from China through the port of Manila, claimed by Spain in 1572 (Schoeser 53–55). Both of these elements of New Spanish silk works—competition and closeness with China and the fashioning of indigenous natural knowledge into economic tribute networks—influenced English projectors’ ideas about the way to reform their own colonial industries.

New manuscript evidence suggests that English reformers like the Ferrars looked to Spanish America not just as an imperial example of extractive mineral wealth but also as a model of colonial industry more broadly. Janice Neri and Danielle Skeeahan have recently traced a heavily annotated edition of Gerhard Mercator’s *Atlas; or, A Geographicke Description of the World*, now held at the John Carter Brown Library, to Virginia and John Ferrar. As Neri and Skeeahan suggest, Virginia, who signed her

FIGURE 10. John Ferrar and Virginia Ferrar, marginalia surrounding “The Description of New Spaine,” Gerhard Mercator, *Atlas; or, A Geographicke Description of the World* (London, 1635), 905. Courtesy of the John Carter Brown Library at Brown University.

entries with a decorative “V,” and John, “who marked his contributions with the initials “J.F.,” exchanged ideas about what would and would not work in the production of colonial silk and the cultivation of silkworms in British America. There is some debate about whether Virginia Ferrar or another member of the extended Ferrar kinship network participated in these debates, but there is no doubt about where the ink met the paper (fig. 10). The interlinear conversation and illustrations began at the end of Mercator’s section on “New Virginia” (904), flowed backward into the main body of the chapter (903), and ultimately wrapped around the map and description of western Mexico (905), framing mineral-rich lands like Guadalajara (“Guadalaiaara”) and Zacatecas (“Catatequas”); ports like Petalán and Cacalutla (“Catalutla,” north of Acapulco) that, unlike John Ferrar’s western Virginia, actually opened to the Pacific Ocean; and regions where Spanish colonists had successfully collaborated with Mixte-Zapotec sericulturalists in perhaps the earliest colonial silk works of the Americas. The

place of this conversation is probably just an accident of printing, reflective more of Mercator's order of maps than anything else, but it is nevertheless true that substantial references to Spanish-American industries, ranging from mining to agriculture, make their way into both published accounts of Virginia Ferrar's silkworm trials.¹⁸

If Chinese imperial precedent had shaped English ideas about the suitability of silk in mid-Atlantic climates, Spanish experience with New World silk proved the commodity's viability. Reformers like John Ferrar argued that reformed silks could be just as lucrative as "that contemptible, beggarly *Indian Weed*, TOBACCO" (Hartlib, *Reformed Virginian Silkworm* 27), if only planters would consider the matter with what Hartlib circle reformer Gabriel Plattes called "the intellectual eyes beholden of all men of good understanding" (195). At first blush indigo, "but a Weed," was a highly unlikely source of colonial wealth, and yet dyes from the Americas commanded great attention in global markets, prompting Ferrar to ask what was "Coucheneal the rich Scarlet die, but a Fly, or the excrements of the *Indian Fig-tree*?" (Hartlib, *Reformed Virginian Silkworm* 24). Christian understandings of inversion were central to the idea that overlooked American commodities could reveal themselves as sources of wealth. Just as Milton's Raphael instructed Adam to be "lowly wise" (*Paradise Lost* 8: 173), Protestant reformers encouraged each other to apply the lessons of Christian parable to the reformation of colonial industry; in the beatitudes of Matthew 5:5 ("Blessed are the meek, for they shall inherit the earth") and the body of Christ, the high becomes low and the low high. Taking the possibility of inversion to heart, writers like Dr. Robert Child insisted, "though it may seem ridiculous to many, to affirm that *Magots*, *Butterflies*, should be of any importance; yet I desire them to consider, that we have our Honey, the sweetest of foods from *Bees*, which are Cattel of this kind: also, our *Silks*, *Sattins*, *Plushes*, and bravery from the poor *Silk-worm*, which may be called a *Magot*, *Caterpillar*, or *Butter-fly*, &c" (85). Thus, John Ferrar concluded with full faith in the science of silk and the immediacy of reform, "Nothing then wants to make *Virginia* rival *Peru* for wealth, more then to perswade the Planters to provide themselves this Winter (to lose no more time) of as many of the Natural Worms bottoms as possibly they can," searching "in the Woods on the dis-leaved trees" (Hartlib, *Reformed Virginian Silkworm* 26–27).

For as much as New World projectors saw native mulberry trees and

latitudinal parallels with China as natural signs of silk forewritten into the virgin colony by the Author of the Book of Nature, there were two very real obstacles to the development of Virginia silk works: silkworms and their food sources. The domesticated silkworm developed by Chinese sericulturists was a flightless variety that would mate in captivity as long as its growers protected it from predators. As William Bullock observed, these conditions made silkworm cultivation a poor choice for the land-rich but labor-poor colony (Thompson 118–20). And while seventeenth-century projectors correctly confirmed large stores of mulberry trees in the Virginia colony, they misidentified the species. White mulberries (*Morus alba*) had long been agreed on as the best source of silkworm food, and even late-nineteenth-century promoters like the Women's Silk Culture Association declared that "[t]he silk which it produces is of the finest quality" (8). But the American mulberry on which reformers naturalized their designs, *Morus rubra*, produced red berries. As they reckoned with this color difference and crucial material fact, reformers concluded that the Virginian variety was not really a red mulberry tree, but that it was instead a white mulberry that grew red berries.

The projection of a white tree that bore red fruit was both convenient for reformers insistent on finding a replacement for colonial tobacco and a conceptually available interpretation because of early modern color classifications and taxonomies. In 1620, John Bonoeil glossed the state of seventeenth-century knowledge of what we now call, in the Linnaean system, *Morus nigra* (black mulberry), *Morus alba* (white mulberry), and *Morus rubra* (red mulberry).¹⁹ "Of the white Mulbery tree," he wrote:

there are manifestly knowne three kinds, which neverthelesse are onely distinguished by the divers colours of the fruit, which are white, blacke, and red, and severally brought forth by severall trees: all which three sorts, notwithstanding the difference of the colour of the fruit, beare but one name of the white Mulbery tree. These three sorts resemble all one another, both in leaves which they bring forth, all of a meane greatnesse, and a smooth feeling, the wood being yellow within. (*Observations* 6 [erratum, 8 in source])

The three varieties of mulberry trees thus shared the same internal essence ("yellow within"), grew the same kinds of leaves, and were called by the same name ("beare but one name of the white Mulberry tree"). The only

difference was the color of their berries, though here, too, there were multiple interpretative possibilities. As Bonoeil noted in the case of “the three sorts of white Mulberry trees, there is choyce also to be made,” for white mulberry trees with black berries produced larger leaves “than any of the other white Mulberry trees, bearing either the white, or the red berry” (8–9). The next best option, he asserted, was to plant white mulberry trees that bore white berries. However, black mulberry tree leaves, when fed to silkworms, produced “grosse and course silke, but the white Mulberry tree leafe makes fine, & high-prized” (6 [erratum, 8 in source]). Colonial sericulturalists were thus instructed to cultivate worms fed with black-berry-bearing white mulberry trees, but not black mulberry trees. The confused color terminology and classificatory practices of early modern sericulture allowed New World projectors to (mis)read the mulberry-tree rich landscape of Virginia as evidence of providential designs for a colonial silk industry and a reformed English imperial economy, even though there was good material evidence and experience on the ground that suggested otherwise.

Red mulberries are suited for human consumption and animal feed, but *Bombyx mori* do not take to the leaves as well, making a large-scale silk industry highly improbable without the right kind of *Morus*. This was well known to Chinese growers, European observers, and indigenous sericulturalists, as evidenced by John Smith’s observation on the proximity of mulberry trees to native towns (“By the dwelling of the Salvages are some great Mulberry trees”) and his report of a silkworm experiment in Bermuda, where the company left “a French-man to make triall of the Mulberies for Silke, but he did not bring any thing to perfection; excusing himselfe, they were not the right Mulberies he expected” (2: 108, 356). Likewise, in 1639, when one-time Virginia governor Sir Francis Wyatt returned for another term, he came bearing explicit instructions to survey the state of white mulberry tree cultivation rather than red varieties (Hatch 23–24). In other words, when midcentury Protestant reformers insisted that Virginia was so suited to silk work that it would exceed Chinese imperial history and counter the colonial scientific silver industries of Spanish America, they did so with several decades’ worth of good evidence to the contrary.

These projections were not limited to early modern English settlers in Virginia, however. Even after seventeenth-century geospatial theories of similarity had fallen out of favor, silk promoters continued to insist on

America's natural likeness to China. Some two hundred years after silk had failed in Virginia, growers in New England argued that mulberry trees in their home states were providential signs of silk designs, resolving at a meeting of September 28, 1842, "that inasmuch as in America and China the mulberry tree is found in the native forests, it is a manifest indication of Divine Providence, that this country, as well as China, was designed to be a great silk growing country" (Field, Senechal, and Shaw 3). On the other side of the country, private societies in late-nineteenth century California underwrote projects to convert underproductive economic agents, namely "women in their homes who desire to add something to the family income," into capital-generating agents in a silk industry that could "embody a mine of as yet untold wealth for this favored region" (C. Williams 3, 10). In sum, even though silkworm cultivation had failed in England under James I/VI, silk work projectors actively encouraged the planting of mulberry trees and the growing of worms in colonial Virginia. And even though silk works failed in Virginia, promoters continued to suggest it as a viable way to incorporate women into the economies of eighteenth-century Georgia, early national New England, and turn-of-the-century California, providing an alternative to plantation slavery in the South and employing laborers arriving from Italy and rural New England in the manufacturing economy of the North. The reality of silk's failure as a source of colonial wealth did little to dampen the legacy of enthusiasm with which it was marketed as a cure for a variety of social, cultural, and economic ills and anxieties that clustered around inequalities of gender, race, and wealth in these different places and times, underscoring our need to better understand the gendered and cultural dimensions of England's earliest silk work designs in the New World.

Whether or not they knew they were incorrectly classifying the tree, misreading red berries as signs of a white tree allowed reformers to argue with triadic insistence that worms were "Naturally found / to live, Feed and spin" in Virginia, fitting their readings of the landscape to the future they wanted to project for England and its foreign plantations (Thompson 120). On a localized scale, the move from tobacco to silk would divert production from plantations to small-scale silkworm houses and cabinets, re-imagining the "nothingness" of tobacco smoke into a new fiber of colonial industry, the home (Knapp). This social and economic decentralization would bring agricultural goods and worksites physically closer to domes-

ticated spheres of influence in what Edward Williams called, in terms that read the whole of the virgin colony as a single source of silkworm houses or cabinets, “those Countries which Nature created for her Cabinets of excellency” (*Virginia: More Especially the South Part* 35).

On a larger scale, reformers hoped to leverage silk production into access to currency. Colonial Iberian amalgamation technologies had allowed for the mining and minting of every variety of American silver, but British America’s reliance on tobacco as a medium of exchange forced the colonies to compete with each other for specie, while England used what little it had to subsidize its own imports (Bargalló). The use of a perishable crop as currency, and the lack of coin, put the English on both sides of the Atlantic at what John Huxtable Elliott calls with tremendous understatement “an obvious disadvantage” (94). Such was their near complete dependence on tobacco that the Virginia Assembly used it to reward landholders for their planting of mulberry trees (Hatch 43). To develop a viable silk industry that could generate what John Ferrar called “a real-royall-solid-rich-staple Commodity,” rather than one that was all “smoak and vapour,” reformers would need to develop their knowledge of silkworms, a task that women and men like Virginia Ferrar and Edward Williams took up in earnest (Hartlib, *Reformed Virginian Silkworm* 10). Their findings were expressed in gendered terms that revealed how one commodity could generate different ideas about the right way to cultivate scientific and economic relationships with indigenous sericulturists, colonial planters, and growers throughout the circum-Atlantic theater of nature.

The first two editions of Williams’s reports from Virginia contain extensive descriptions of the colony’s similarities to Persia and China, but only the third edition explains how colonists might actually raise worms. Williams’s instructions in *Virginia’s Discovery of Silke-Wormes* begin by establishing the natural accord of colonial silkmen and Virginia silkworms. The former, a “governour,” had been removed from England, while the latter was “aboriginally native” to “the South of Virginia” and had been “transplanted” to the colony. The two nonnative bodies shared a particular kind of correspondence in their gendered positions and labor relationship: “Whatever we naturally desire and abhorre, does this Creature by the prosperity or infelicity of his labour show a most experimentall resentment of” (10). The silkworm’s outward revelation of the “natural desire” of the grower was complemented by the way in which both transplants made their homes in

the virgin colony, as the worm “makes his affection of habitation” match that of the “master” (10), and, like “the noblest of Creatures, Man,” the silkworm fails to thrive “if wee sort him not with a lodging proper and agreeable to his nature” (10). Thus the silkman had to monitor the worm carefully, ensuring “his disposition and safety” as an infant (“the beginning of his apprentissage”) and later tending to “his station” to maximize “the benefit of his labours” in the days leading to adulthood (10, 12, 19, 26).

In these early stages, the worms were always marked with masculine pronouns. But once the worms were ready to be mated, Williams’s silkman was ordered to perform a purification ritual to reconcile what had been a masculine “affinity” between master and mastered into a generative complementarity that accommodated newly feminized worms. Williams, like Bonoeil before him, argued that the silkman’s colonial body was so thoroughly infused with tobacco that he had to “purifie the ranknesse of his own breath” before he could enter the silkworm houses at this crucial reproductive stage. He was instructed “when fasting” to draw near the worms only upon taking “good Wine . . . with the odour whereof the worme is highly cherished.” After cleansing the inner temple of his body with this preparatory work of fasting and taking wine, the “governor” attended to the outer temple of the silkworm house, sweeping the floor, coating it in vinegar, and adorning it with lavender, spike, rosemary, thyme, and other such “quickenning armoatics” as frankincense and storax (21).

As he became “master of an exact purity,” Williams’s silkman protected “the chast and magnificent Creatures” from the “ill breathings” that “make this innocently noble Creature expresse her resentment by her own death, or sicknesse” (21). Here is the crucial gender shift in the treatise: the worms go from male to female, reflecting their changing states of fertility and their changing relationship to the tobacco-stained silkman who emerges from his ritual-like cleansing as a pure cultivator. By transforming the sexual economy of purity through ceremonial performance and resexing the silkworms through language, the “governor” changed colonial silk from natural possibility to an industry as viable as tobacco cultivation. In this resexed model of colonial labor, planters could harvest silkworms whose molting masculinity and grammatical shift from male to female indexed their fertility, signaled a new understanding of the gendered relationship between grower and grown, and suggested that an alternative to colonial Virginian tobacco or South American silver was both possible and practicable.

For John Ferrar, it was just as clear that colonial silk works could serve as England's answer to Spain's silver, if only the planters would follow his daughter's findings. "Do but as she hath done; follow but with good courage your cheerfull leader, and doubtless you shall finde (what she desires you may,) namely, *Great profit and pleasure* in an honest imployment. This Silken-Mine will be to you of more benefit then a Mine of silver," he promised (Hartlib, *Reformed Virginian Silkworm* 9). Less clear than his modified version of the Iberian command to *seguid vuestro jefe* ("follow but with good courage your cheerfull leader") is the gendered language that he used to describe his daughter's trials in the family garden. In a series of confused feminine pronouns, he establishes the full interchangeability of the feminized silkworm and the female grower, describing how "when her young Mulberry-tree in her Garden began to put out its buds, then her Silkworm-eggs began to hatch, as the nature of this wise creature is, when her food begins once to appear, she comes forth of her shell" (9). Despite the reproductive change, the feminine pronouns in both printed versions of the Ferrar letters remain consistent markers of silkworm and silkwoman.

We can trace John Ferrar's interventions to other shifts in gender and genre within the printed reports, as when he converted a first-person petition authored by Virginia Ferrar, "A Loving Advertisement to All the Ingenious Gentlemen-Planters in Virginia Now upon the Designe of Silk. By V.F.," into a third-person letter addressed to the "Gentlemen" by "the Lady" (Hartlib, *Reformed Virginian Silkworm* 19). In celebration of "the singular favour of Providence to you and the Lady," and noting "that such a blessing may not be longer wanting to you," John Ferrar shared accounts from travelers in the Middle East and colonial Virginia, who "have out of their superlative benigne affections, and publike spirit, imparted to the Lady these ensuing Relations . . . which the Lady earnestly desires may thus be with all speed made known to you all" (19–20). In his recirculation of these reports, John Ferrar consistently gendered the silkworms with neuter pronouns. Speaking on behalf of "the Lady" to introduce the documents, he reported that these "Gentlemen-Travellers of credit, & Merchants of reputation" were "wonderfully taken with the love of Virginia, and no less zealously affected to the advancement of the Silk-trade in that Land . . . which naturally produceth not onely Mulberries for food, but the Silk-worme it selfe, in that wonderful greatness of the wilde Silk-bottom" (19). Likewise, the first traveler in Virginia used the same gender-neutral pronoun ("it"),

noting that he had seen growers build shelters from reeds “to protect this noble profitable creature & to defend it from the birds” (20).

But once the experiential knowledge of “the Lady” was written into the discussion, the silkworms shifted into grammatically feminine pronouns. When John Ferrar seconded a Turkish report and eagerly declared “the same hath been found true in *England*, that the Mulberry-tree will leave twice in a Summer, the Lady had the experience of it, and therefore much more will it do with you,” he reintroduced “the Lady” and changed the gender of the silkworms accordingly (Hartlib, *Reformed Virginian Silkworm* 21). In his next mention of the silkworm, the insect that had been an “it” now became a “she”: “For the glorious Worm is so infinite in multiplication, with that celerity as is incredible, so that she will never be defective unto you” (21). The consistent feminization of Virginia Ferrar’s silkworms and sericultural knowledge in the printed reports of her experiments thus distinguishes women’s and men’s silk work and helps to underscore the material and methodological differences between growers like Virginia Ferrar, John Bonoeil, and Edward Williams.

If the gendered language of seventeenth-century silkworm treatises throws into sharp relief competing images of gendered labor in the colonies and gendered science in England, the ideas behind that language reveal two key ways in which Virginia Ferrar’s findings contradicted the “Book Rules” of indoor growers like Bonoeil and Williams. First, she determined that worms did not need man-made houses, for worms housed in trees were larger and produced greater amounts of silk thread than the indoor worms grown in cabinets. Williams, by comparison, had recommended the quite specific construction of ventilated cabinets with “Pyramidicall” shelves “of most beauty and safety to the Wormes,” each four inches narrower than the last, raised at least two feet from the damp ground, “and because this Creature loveth any thing that is white and luminous, it will sort excellently well with his disposition and safety, to parget or plaster the inside of the house very well and smooth” (*Virginia’s Discovery of Silke-Wormes* 11). Williams’s rules for his delicate worms largely followed the instructions of royal grower John Bonoeil. According to Bonoeil, silkworm houses built in Virginia ought to be made of wood oiled with juniper and stocked with four-foot wide, five-story tall shelves that were placed one and one-half feet from one another within a structure that was divided into two sections, one for worms and one for leaves (*His maiestie’s Gracious Letter*

5–6, 9). Both parts of the house were to be well ventilated and well heated, with windows decorating the walls and ovens anchoring both ends of the house. Throughout the shed growers were to place heated pots filled “with certaine branches of Rosemary, or Tyme, Roses, or other sweet smels, for that is a meane to keep the house in a temperate and reasonable heat” (7). Although Bonoel simplified the instructions for silkworm houses between his first and second treatises, and although he claimed that poor families in his natal Languedoc, as well as in the countrysides of Provence, Sévennes, Avignon, and “in some part of *Italy*” reserved part of their one-room cottages for silkworm growing, “yea and many times the Wormes thriue better in them, then in Great Chambers with other men,” his second edition still provided rather elaborate descriptions of the design and construction of silkworm houses (4). At certain points in the Ferrar letters, gendered pronouns distinguish sericulturalists by sex; here, though, the difference between Virginia Ferrar and male growers, including one aligned with the Stuart monarchy and one who solicited the support of a Parliament that voted to abolish that monarchy, was marked by a lettered account of material records like silkworm houses and cabinets.

The other key distinction between Virginia Ferrar’s sericultural methods and those of male growers was, however, more explicitly linked to sex, as she determined that growers could take a much less active role in mating silkworms than Williams’s ceremonies had suggested. Virginia Ferrar’s experiments with indoor and outdoor growing led her to conclude that minimal human intervention produced higher yields. Williams had called for a purification ceremony that was elaborate and decorous in its performance, while she, by contrast, developed a program of silk work that was simple and pared down to the most basic elements. It was, in other words, already as pure as the “plain manner” in which her results were communicated to English planters and Protestant projectors.²⁰ Her methods did not involve any mating of worms by human growers, and her worms were not hatched in delicate cabinets or set on sensuous fabrics. For imperial reformers, these findings had implications far beyond Little Gidding. If what was most natural worked best in England, her father wrote, these results might also be applied to reform the struggling silk works, labor shortages, and impure economy of “her dearly beloved *Virginia* (for so you must give her leave to call it),” for “so she concluded, and so must all you” (Hartlib, *Reformed Virginian Silkworm* 9).

By mapping the gendered pronouns onto work performed by men and women, we can see how these markings reveal different approaches to sericulture. If put into practice, Virginia Ferrar's program of outdoor growing would produce very different spatial relationships between garden plots and human houses than the infrastructure required to support the cultivation methods endorsed by Edward Williams. In the world of print, her procedures also suggest a different relationship between grower and grown than the model proposed by Williams. Beyond these material differences in cultivation habits and the organization of human and nonhuman homes through language and space, the gendered language of the treatises also reveals key differences in the collaborative methods and commercial reforms that Hartlib circle reformers like Virginia Ferrar, John Ferrar, and Edward Williams designed for colonial Virginia. All three authors endorsed a collaborative approach to the planting of mulberry trees and the harvesting of leaves, the collecting and growing of worms, and the weaving and manufacture of threads and silks, but they had very different ideas about the role that raw and finished materials should play in fashioning relationships between indigenous Virginians, colonial planters, and English and non-English people in England. I conclude this article with a discussion of the implications of those programs for English colonial policies with indigenous communities and for interimperial relations between England and Spain.

When Williams first speculated on the potential for indigenous people to join his idealized English community, he was seriously doubtful about the manner of colonial scientific collaboration. In the first instance of indigenous and English partnerships in the exploitation of natural resources, colonial ironworks at Falling Creek ("The Falls," plotted on either side of the middle fork of the James River in the Ferrar map), "the treachery of the Indians" had "crushed it in the beginning," while "the backwardnesse of the *Virginia Merchants*" was responsible for the failure "to reerect it" (*Virgo Triumphans* 5). But by the end of his addresses to Parliament and the Privy Council, Williams was convinced that a commonwealth knit together by silk thread would bind English and indigenous people in solidarity against imperial Spain:

Besides what wee have sayd of Silke wee shall find the Indian profitable to himselfe, and as in the Staple of Wines, of which when he has received the whole knowledge, wee cannot make the least tittle of doubt, but that

he will with all eagerness prosecute it: First, because it concernes his belly, to which no people under Heaven are more indulgent; and secondly, his Wife and Children who plant his Corne may take the charge of the Vineyard with not much more labour. But that which turnes to our advantage is, that the Indian communicating the knowledge of the Grape to his Neighbours, and they transmitting it all along as far as New Spain, will stir up the Spanish jealousie to interdict all Viti-culture amongst them, and as far as the extent of his power can fathome to prosecute severely all such Natives as shall make it a subject of their industry to the prejudice of Spain. (34 [actual, not erratum page])

By focusing on agriculture rather than mining, and on feminized sources of colonial wealth like silk and wine rather than industries like tobacco and rum, projectors like Williams imagined that they could harvest the productive labor of indigenous women. Because the English defined masculinity partly in terms of husbandry and agricultural work, exercises that indigenous Algonquins saw as “woman-like,” English writers considered native men to be effeminate, “and the men often idle,” though they praised the industry of indigenous women who “doe the rest of the work” (Smith 2: 116). But in midcentury English Protestant projections, the collaboratively coerced husbanding of silk, wine, and honey would reform relationships between English colonists and native communities and, thus, remap knowledge networks and commercial relationships between English and Spanish America (“as far as New Spain”).

Williams’s discussion of natural scientific and geopolitical collaboration between colonial planters and native growers appeared only in the first two editions of the text, both of which were addressed to public bodies like Parliament and the Privy Council. The third edition, addressed exclusively to colonial planters, had no such mention of the benefits of forming partnerships with native communities, though it contained detailed instructions on silkworm growing, and was the only edition to do so. Collaboration, for Williams, had a decidedly political function in the production of colonial silk, and he divided the making of English imperial wealth into discourses for different audiences of politicians and practitioners.

Williams’s model of silken allegiances with indigenous growers manages to dismiss the knowledge of native people in anything not immediately tied to their own survival and to imagine how that knowledge could make possible new colonial industries and cartographies for English sub-

jects (who, in Williams's estimation, were concerned not only with their physical survival but also with their spiritual satisfaction). Williams speculated that indigenous peoples' "curiositie" and disinclination to labor might lead them to silkworm cultivation or collection, and that they might convert to Christianity by watching the marvelous transformations of the worm. The silk-made Christians, he reasoned, would want to be clothed, "reduced to civility," and would in due course adopt settled agricultural lives rather than nomadic patterns of hunting and gathering (*Virginia: More Especially the South Part* 31). As evidence that native communities would take to silkworm cultivation as readily as silkworms would take to native mulberry trees, Williams cited the complementary timing of the silkworm harvest within larger cycles of indigenous agriculture, and he referenced their practice of keeping "Wives, Slaves, and Children," especially among "the Werowances et Reguli," which generated a surplus pool of growers and collectors from whom "a quarter of the population could be put to work," which "would hardly faile from being a universal labour" (32, 34). In a sense, he was right. Indigenous men probably would take to growing just as worms would take to red mulberries—which is to say, not very much. What Williams failed to understand, in addition to the nature of Virginian mulberry trees, is that planting, whether corn or vine, was an affront to indigenous masculinities and that native men would most likely resist this feminization of labor (Fedick; Slater).

Williams concluded his discussion of collaborative possibilities with indigenous communities by suggesting a model of collection that would do little to correct the asymmetries of colonial power, but might align better with men's traditional roles within indigenous foodways. He suggested that English soldiers, militarized along the border of Spanish Florida, be paired with indigenous guides, and that they reconnoiter the forest "by conference with the Indians" to collect silkworm bottoms and other botanical samples (*Virginia: More Especially the South Part* 37). According to Williams, this kind of relationship with a reformed indigenous body politic—converted to Protestantism, collectors of native silkworms, and clothed in "the Universall not of Nature" that freed them from their "bravery of habits"—would make possible a better division of American space. As native communities collaborated with the English in the collection of silkworms and the surveying of woodlands for valuable commodities ("examples of all Mineralls, Drugges, Dies, Colours, Birds"), they would also

provide a demographic and commercial buffer between English and Spanish settlements. In the final stage of Williams's colonial silk design, their partnership would be solidified with improved communication about the human and environmental conditions of the borderlands ("drawne to the life in colours, which [by an invitation of reward] will be a surer meanes of discovery" [37]).

The gender shifts in Williams's masculine model of nature ("his creatures"), glossed elsewhere in this edition and the two other editions of 1650 with more conventional feminine pronouns, reflect on a geopolitical scale the pronominal shifts of silkworm instructions that registered changing conditions and relationships between master and worm. This gendered language also indicated the crucial role of collaboration—willing or coerced, met with acceptance or resistance—in colonial scientific literatures that sought earnestly for ways to reform political and economic relationships within the colonies and among colony and metropole. Williams's model of silkworm cultivation, his tentative suggestion of collaboration with indigenous people he very much distrusted and whose intelligence and abilities he largely dismissed, and his conviction that a reformed colonial silk industry could restructure English political economy and trade relationships with imperial China and Spain both connect him with and distinguish him from the ideas circulated by other Hartlib circle correspondents, especially Virginia and John Ferrar. They held different ideas about the right ways to refashion the silk works of colonial Virginia, and in many ways, their proposals are as different from each other as they are from those of Edward Williams.

Because John Ferrar did not share the optimism of his daughter regarding the "[m]anner of the Indian frindshipp," he endorsed a much more restricted form of collaboration with native growers and collectors than what Virginia Ferrar projected for the colony. As John Ferrar suggested to the planters, "if you would but shew the Savages samples of all kinde of things, you should soon by them know more in a moneth what is in that Countrey to be had then you had done these 40 years" (Hartlib, *Reformed Virginian Silkworm* 16). He proposed a partnership that recognized the value of native knowledge, but he made clear that this was an asymmetrical relationship in which English definitions of value and access to currency determined the forms of compensation: "and for reward they would bring in of all kindes unto you, what they have and you desire to know, so a sud-

den discovery may be made of all things in that land to your infinite gain” (16). Once indigenous people collected silkworm bottoms and delivered them to the English for spinning, they would be compensated with five shillings’ worth “in any Commodities they desire. And thus by the blessing of Almighty God, there may be good hope of their civilizing and conversion; so that they may be likewise great gainers both in body and soul” (11). These fixed terms of material redemption—English goods measured in hard currency exchanged for natural resources and knowledge measured in weights and pounds—were complicated by John Ferrar’s model of redemptive religiouscientific practice. He understood indigenous people to be both valuable contributors to silkworm colonies and unredeemed souls whose incorporation into the English spiritual economy would enable the full realization of the reformist ends of *The Reformed Virginian Silkworm*. For him, the colony would provide the raw materials and the colonists to whom he wrote would use “your better intellectuals” to underwrite silk production: “where Worms and Food abound naturally, and the Inhabitants are born with Brains, the advancement of the Silk Trade must needs be proportionable: upon which double score *Virginia* hath the advantage of any place in the yet discovered World; I mean for Worms and Food, which may be thus severally demonstrated” (25). In this highly traditional model of colonial relations, the “Brains” for agricultural industry, as his concluding clause clarified, were nowhere to be found outside of England.

If John Ferrar dismissed the potential of native knowledge while at the same time making indigenous people central economic agents and spiritual converts, Virginia Ferrar treated native practitioners in the same terms with which she evaluated her female and male collaborators in Virginia. The language in the printed letters was her father’s, as we know from the pronouns and literary personas, but the ideas were hers. In her many lettered exchanges, “the Lady” requested that planters compile a report of silkworm life cycles, habitation, and reproduction in the colony, “what by any *English* or *Savage* hath bin any way observed in her,” and she was especially eager to compare the feeding habits of Virginian mother worms after they laid their eggs, noting that “these in the old World never eat after they once begin to spin” (Hartlib, *Reformed Virginian Silkworm* 22). On the gendered nature of silkworm reproduction, and human growers’ abilities to understand those cycles, she saw English and native growers as equally capable contributors of natural knowledge. But by the end of her letter to

the planters, she explicitly solicited reports of native sericultural practices, asking “what do the *Savages* call them, or know any use of them?” (23). In John Ferrar’s model of reformed colonial silk works, indigenous people were the collectors whom English redeemers rewarded with goods; in Virginia Ferrar’s version, English planters were the collectors of indigenous knowledge, silkworm eggs, mulberry leaves, and “Bottoms to satisfie all men, who are like the Queen of *Sheba*, must better trust their eyes than eares” (23). If the planters could not be trusted to accurately report on indigenous sericultural methods, then perhaps, she figured, they could at least supply raw materials for future experiments. Both John and Virginia Ferrar proposed hierarchical relationships that fully accord with the early modern nature of—and belief in—inequality; what is interesting is that they placed indigenous and nonnative peoples in different positions within their reformist projections. If indigenous and colonial growers shared the same possibility of contributing to a transatlantic body of knowledge at the beginning of Virginia Ferrar’s letter, by the end of the text it is clear that she is more interested in what the planters can tell her about native sericulture than in what they report of their own work.

I suspect that her heightened interest in indigenous natural knowledge systems stems from her limited access to indigenous sericulturalists, limited relative to the exchanges that she enjoyed with growers in England, in Ireland, and on the Continent. Virginia Ferrar’s rich network of collaborators connected women and men through kinships and marriages in eastern Virginia and the English Midlands, while her lettered exchanges with Hartlib circle correspondents linked her to like-minded communities in Germany and Ireland, where growers debated the implications of her findings for the relationship of art to nature, endorsed her methods but doubted the merits of her father’s economic proposals for colonial reform, and suggested new food sources to try, including dandelions and lettuces (Hartlib, *Reformed Virginian Silkworm* 30–32, 37). As these letters make clear, she formed part of an active and engaged community of reformers on both sides of the Atlantic, and she networked silkworm knowledge, eggs, and silk grass directly through her cousin Mary Ward, Lawrence Ward (d. 1660), Sarah Willoughby, and Dr. Richard Russell in Norfolk, as well as a Mrs. Thomas Burbage and a Mr. Wright in Nansemond County, alongside “her kinsman Esquire Ferrar” (Hatch 53).²¹

Although her father had endorsed the viability of a double harvest, Vir-

ginia Ferrar was more skeptical about this untried possibility. She therefore solicited samples of colonial worms to determine whether growers could wring a second round of silk during the calendar year. To better contextualize the potential sources of cultivatable wealth, she requested a comprehensive natural history of the colony, including details on soil composition, water sources, dyes, and mineral wealth, for which she directed planters to distill and dissect the sources of the “unknown wealth you have” (Hartlib, *Reformed Virginian Silkworm* 23). In a detailed explanation of how to cook down colonial goods, she “prays you (and all is for your own gain) to bore and cut all your trees,” grind the fibers into a pulp, and boil the essences “in a Skillet” with linen or wool cloth “with some Allom, and you shall instantly finde and see what rich Colours they will make.” Her father proposed rewarding collectors with commodities, while she offered to compensate her collaborators with exchanges of knowledge and practical instructions that transferred the language and practice of food preparation into “the things, the wayes, the means to advance *Virginia’s Prosperity*” (24). The point here is not that Virginia’s program of colonial design was preferable to or kinder than her father’s. Indigenous people may very well have preferred to receive tangible things or prestige goods that they could use or trade for political alliances or commercial benefits rather than English ideas that they may or may not have valued, and colonial planters proved far more interested in the proven profitability of tobacco than the lost fruits of red mulberry-fed silkworms. What this passage shows, however, is how John and Virginia Ferrar participated in the same community of Protestant reformers while also advancing different ideas about how colonial reforms ought to be practiced on the ground, proposing different methods of testing their ideas, and disagreeing about who ought to play which roles in the process. The gendered language of their correspondence, especially the pronouns that writers like Edward Williams and John Ferrar use to describe the silkworm trials of women and men, allows us to appreciate the different religioscientific, economic, and cultural implications of these projects as they circulated within family networks and international communities of readers.

Colonial scientific industries like silk were explicitly commercialized sectors that sought to combine natural knowledge and raw goods in the service of economic and spiritual empire, whether they were recorded in Hakluyt’s modeling of Portuguese America, Spanish legal archives con-

taining the petitions of indigenous sericulturalists in Oaxaca, or English designs projected by Hartlib circle correspondents throughout the New World. Far from prohibiting people from developing competencies in sericulture (or apiculture or silver metallurgy or any number of sectors), Hapsburg imperial agents and English promoters encouraged colonial subjects, especially women and indigenous people, to participate in these colonial industries—sometimes to great advantage and sometimes with devastating consequences for the women and men who put these ideas to work. Given the economic aims and spiritual imperatives of the Protestant project of restoring Adamic empire, we should not be surprised that New World projectors looked to women and men for ideas, or to Eastern and indigenous practices to improve the science of silk. Nor should we be surprised that seventeenth-century English writers recorded the knowledge systems and cultivation methods of “Chineses,” “Savages,” and planters in the conventional terms of the period, including gendered pronouns that mark cosmological bodies as male, female, and neuter.

By tracing the linguistic gender of seventeenth-century silkworm treatises, we can see how women’s and men’s silk work were marked in different ways, and how these markings reveal important differences in sericultural methods, collaborative practices, and commercial reforms. If we look for evidence of women’s marginalization from the historiography of seventeenth-century science, we are sure to find it writ large in the literary archive. But if we look at the same evidence from a slightly different perspective, if we shift our study of gender and genre from theoretically oriented natural philosophies to vernacular scientific literatures like silkworm treatises, we might also find linguistic clues that mark the collaboration of women and men in the development of scientific practices and natural knowledge that offered an alternative set of metaphors, a different program of religioscientific reformation, and a resexing of labor in English models of colonial development and imperial economies. These treatises, written between 1650 and 1655, do not tell us about the ways in which things actually happened, but rather what kinds of spiritual and economic empires reformers thought were possible, and what they considered to be the models of colonial labor and relationships with indigenous people that best befitted the English enterprise in the New World.

In this formative moment in the making of English empire and natural knowledge, Protestant reformers thought that even the goods that ulti-

mately became the defining monocultures of plantation economies in the American South, and those that were already cultivated on increasingly larger scales in the extended Caribbean—sugar and cotton—seemed like better alternatives to tobacco. Unlike the harvesting, curing, drying, and dressing of tobacco, John Ferrar insisted, in full denial of material reality, that even sugar and cotton, like silk, could be colonial industries of light labor and easy wealth. As he imagined, “The planting of Sugar-canes, that being no more laborious then the Indian wheat . . . and the Indians pains will onely be to cut them yearly down, and sell them to you,” while “[t]hat of the Cotton-tree is the like for many years, gathering of the cods of woll from them, as we do Roses from the Rose-bushes” (Hartlib, *Reformed Virginian Silkworm* 17). John Ferrar’s discussion of his daughter’s silk work provided the sexualized language (“cods of wool”) and feminized mode of labor that were key to reforming colonial scientific industry. Reformers imagined a new model of English and Adamic empire, one that shifted from land-based models of planting to (supposedly) labor-light enterprises in knowledge-rich sectors of honey, wine, and silk. Whether these fruits were produced and collected by indigenous people or English settlers, reformers like John Ferrar and his broader network of Hartlib circle correspondents fashioned the harvesting of crops like sugar and cotton into light work, the delicate stuff of roses and the ease of leisurely activity. This sanitized image of labor could exist in this particular moment for colonial reformers in mid-seventeenth-century Virginia and an imaginative Atlantic space of white readers because this was a moment of imperial projections and reformations, before brutally dehumanizing regimes of backbreaking labor performed by enslaved Africans and their descendants in sugar boilers and cotton fields became the core of everyday life, before crops like tobacco would both define populations and give meaning to colonial societies throughout the Americas.

NOTES

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1. In his *Essay upon Projects*, a proposal for the reformation of the English banking, public welfare, and education systems, with a special interest in women's academies, Defoe famously declared his era "The Projecting Age," or a time when cash-strapped England, reeling from war with France, welcomed ideas from "such a multitude of Projectors" who "rack their Wits for New Contrivances, New Inventions, New Trades, Stocks, Projects, and any thing to retrieve the desperate Credit of their Fortunes" (7–8). The *Oxford English Dictionary* identifies the first use of the term, meaning "proposer or founder of some venture," nearly one-hundred years earlier, in 1596 (1a).
2. In the first edition of the Ferrar reports, *Rare and New Discovery*, John Ferrar's letter was printed on the pages marked 1–11, following unpaginated extracts from Letellier's *Instructions*, poems by Guillaume DuBartas and Richard Ferrar, and the famous Ferrar map of Virginia. In the *Reformed Virginian Silkworm*, John Ferrar's letter is printed on 8–17, followed by a "Loving Advertisement by V.E." on 19–20. This text also appeared in the first edition (13), though it was not credited to Virginia Ferrar. Additional notes from John Ferrar were printed on 20–27 of the *Reformed Virginian Silkworm* and what would be 14–17 in the *Rare and New Discovery*. The pages are unmarked, but they follow 12 in order. In this article, I cite the Ferrar letters as they are printed within the first and second editions of the volumes published by Hartlib.
3. All emphasis is in the original, unless otherwise noted.
4. The scholarship that disagrees with Merchant's thesis is diverse, but much of it is summarized in essays in Koertge, esp. Newman. See also Vickers and Park.
5. While these colonial scientific letters mark individual English growers with different grammatical genders, writers unfortunately use plural nouns like "Indians" and "Savages" to describe indigenous sericultural communities, thus preventing us from using linguistic gender to identify native women and men who cultivated silkworms in trees and collected specimens "when they finde any bottoms in the woods" (Hartlib, *Reformed Virginian Silkworm*, 12, 11). But given that Algonquin men planted mulberry trees, and that some of these were adjacent to indigenous homes where women harvested corn, it is reasonable to expect that complementary systems of silkworm cultivation and collecting of cocoons (alternately called "bottoms" or "cods") would have been practiced by native women and men (Hartlib 8; Smith 2: 108).
6. Scholarship in literary studies, art history, and history of science has dramatically remapped the borders of seventeenth-century science by expanding the definition of scientific knowledge, institutions, and communications. The literature in this field is rich and expansive and a review of it exceeds the scope of this article (and my ability). The historiography of this rapidly expanding field,

- however, is explained by Shapin's introduction to *Never Pure*, 1–13. Some of the touchstone texts include Klein and Spary; Harkness; Grant; Findlen and Smith; Newman and Principe, *Alchemy* and "Some Problems"; and Johns.
7. On mistranslation, see Soble; and on metaphor, see Pesic.
 8. See Platt 15–16; Markham 192; Blith 27, 83, 160–61; and Evelyn 103.
 9. See also Letellier, *Mémoires* and *Instructions*, sometimes attributed to William Stallenge; and de Serres, *Théâtre*, partially trans. by Geffe as *Perfect Use of Silke-Worms*.
 10. The anagrams and acrostics are retained in the edition held at the Huntington Library, generously digitized on *Early English Books Online*.
 11. I quote from the third edition because it contains the prefatory address, "To the Queen's Moste Excellent Maiestie," from which the above passages are taken. In the 1634 edition, this letter precedes prefatory materials of the first two editions (Oxford, 1609, and London, 1623). These materials include, in the first edition, a letter and poems to the reader, a Latin-language sonnet to the author by Warner South (Warnerus South) and unsigned, English-language poems to the author and the reader. Appended to the second edition was a poem by George Wither that praised Butler for printing "Gods great book of Creatures / To reade his Wisdome, and their vsefull Natures," which, "like his Bees, makes honey too for vs" in his study of "this Common-wealth of Bees" (A2, Av).
 12. Blith argued against everything from flooding meadows using hybridized Dutch technologies to holding land in ancestral English commons, but like members of the Hartlib circle he saw good husbandry as "the Sinew or Marrow, holding together the Joynts of Monarchie" because, as he put it in his "Epistle to the Ingenious Reader," improving what land England already possessed was more effective than expanding into "a *New World* [that] hath of late been Discovered" (A2v). Thus, he instructed his readers to "Study Industry," itself a feminized way of knowing and mode of practice: "Improvement is neither Father nor Mother unto Plenty, but I may say it is the Midwife that Facillitates the birth" (A3). Harlib circle correspondents like Dr. Robert Child also believed that labor was the key to unlocking England's potential; Child argued in his "Large Letter" of 1651 that the English were "deficient" in "ordering of bees" and the production of silk, concluding, "In Virginia also the *Silk-worms* are found wilde amonts the *Mulberry-woods*, and perhaps might be managed with great profit in those Plantations, if hands were not so scarce and dear" (50, 52, 53).
 13. This discussion unfolds on 8v–10 of the eighteen-page edition of the *Rare and New Discovery*, including unpaginated prefatory materials, and 9–11 and 19–20 of the expanded, forty-page *Reformed Virginian Silkworm*.
 14. This image appears in the edition held at the Huntington Library, which has been generously made available on *Early English Books Online*.
 15. The "Gentleman of Elvas" chronicled the places in which members of the de Soto expedition saw red and gray mulberry trees (95), including the mulberry-rich region controlled by "the Lady of Cofitachequi" (53, 58), but only Hakluyt,

after comparing the report favorably to those of Álgvar Núñez Cabeza de Vaca, Antonio de Herrera y Tordesillas, and Thomas Hariot, explicitly connected these natural resources to the possibility of colonial silk works: "A fourth chiefe commodity wee may account to be the great number of Mulberrie trees, apt to feede Silke-wormes to make silke: whereof there was such plentie in many places, that, though they found some hempe in the countrie, the Spaniards made ropes of the barks of them for their brigandines, when they were to put to sea for *Nova Hispania*" (A3v). This was not the first time that Hakluyt had called for English investment in colonial silk. Nearly seventy years before Hartlib circle reformers began to design new models of silk work, Hakluyt's *Particular Discourse* had re-circulated French explorer Jean Ribault's report on Florida and the Carolinas. Ribault had noted "there be Conies, and hares, silkewormes / in marvelous number, a greate deale fairer and better then be our silkewormes," material facts that Hakluyt used to endorse agricultural colonization, following Portuguese models of woade (an indigo-like dye) and sugar planting in the Azores and Madeira, rather than the mineral exploitation of Spanish America (Hakluyt, *Particular Discourse* 16).

16. The third preface is addressed "To the Reader," while the first two prefatory letters address Parliament and the Privy Council.
17. Sugar crop cycles shaped the family structures and reproductive health of a community. A woman who conceived in March, midway through the most labor-intensive period of the harvest, would deliver in December, two months after the end of the second-most-intensive steps of holing and planting and one month before the harvest cycle began again. She was more likely to deliver a live birth than a woman who, in conceiving in October and delivering in July, would have spent her second and third trimesters in the most grueling periods of the harvest.
18. I thank Lisa Voigt for pointing me toward Neri and Skeehan's exciting find.
19. On the gendered origins of Linnaean taxonomy, see Schiebinger.
20. On Puritan plain style and indigeneity, see Dippold.
21. The documentary record on "Esquire Ferrar" is fragmented, incomplete, and complicated by John Ferrar's use of the term "Esquire" to refer both to his lettered correspondents ("Esquire Hartlib") and to educated legal practitioners. There is genealogical evidence to suggest that "Esquire Ferrar" might refer to Virginia's cousin Richard, who signed his verse epistle, included in both the 1652 and 1655 editions, "ex AEde Trinitaris: Junior." Tyler, however, suggested that the "honored kinsman" could be William Ferrar, an uncle who died in Jamestown, although Virginia would have only been about ten years old at the time of his death. It is perhaps more likely that she exchanged silkworm ideas and samples with William's Virginia-born sons, William and John, who fought against indigenous communities and ultimately served as a sheriff, justice, and Burgess toward the end of his life (93). A final possibility, suggested by Barbour, is that "her kinsman" refers to Mary Ward, whose brother Ferrar Mapletoft lived in close prox-

imity to the Wards in Virginia. In the edition of Hartlib's *Rare and New Discovery* held at the College of William and Mary, one "John Mapletofte" wrote a two-page poem dedicated to Virginia Ferrar, "Reason's Lady," whose "brave Genius loseth not it selfe / In petty Housewifeing . . . No *Health* and *Wealth* of Kingdoms is your Care, / Manly *Virago*, such a matchless grace," and her epistemological violation of gender rules: "Since you have tane up the Gantlet and defie / Fond men who challenge the Monopoly / Of Wit and Judgment, meaning to entale / Their Brains as well as Land to their Heir-males" (A3).

WORKS CITED

- Banerjee, Pompa. "The White Othello: Turkey and Virginia in John Smith's *True Travels*." *Envisioning an English Empire: Jamestown and the Making of the North Atlantic World*. Ed. Robert Appelbaum and John Wood Sweet. Philadelphia: U of Pennsylvania P, 2005. 135–51.
- Barbour, Reid. "Her Kinsman Esquire Ferrar." Message to the author. 28 June 2012. E-mail.
- Bargalló, Modesto. *La amalgamación de los minerales de plata en Hispanoamérica colonial* (Mexico City: Compañía Fundidora de Fierro y Acero de Monterrey, 1969).
- Barnard, John. Introduction. *The Cambridge History of the Book in Britain*. Vol. 4, 1557–1695. Cambridge: Cambridge UP, 1998. 1–26. 7 vols.
- . "London Publishing, 1640–1660: Crisis, Continuity, and Innovation." *Book History* 4 (2001): 1–16.
- Berlin, Ira, and Philip D. Morgan, eds. *Cultivation and Culture: Labor and the Shaping of Slave Life in the Americas*. Charlottesville: UP of Virginia, 1993.
- Blith, Walter. *The English Improver, or a New Survey of Husbandry Discovering to the Kingdome*. . . . London: Wright, 1649. Early English Books Online.
- Bonoeil, John. *His Maiesties Gracious Letter to the Earle of South-Hampton, Treasurer, and to the Councell and Company of Virginia*. . . . London: Kingston, 1622.
- . *Observations to Be Followed for the Making of Fit Roomes, to Keepe Silkwormes In*. . . . London: Kingston, 1620. Early English Books Online.
- Borah, Woodrow. "The Indians of Tejupan Want to Raise Silk on Their Own (Oaxaca, Mexico, 1543)." *Colonial Lives: Documents on Latin American History, 1550–1850*. Ed. Richard Boyer and Geoffrey Spurling. Oxford: Oxford UP, 2000. 6–10.
- . *Silk Raising in Colonial Mexico*. Berkeley: U of California P, 1943.
- Breen, Timothy H. *Tobacco Culture: The Mentality of the Great Tidewater Planters on the Eve of Revolution*. 2nd ed. Princeton: Princeton UP, 2001.
- Bross, Kristina, and Hilary E. Wyss, eds. *Early Native Literacies in New England: A Documentary and Critical Anthology*. Amherst: U of Massachusetts P, 2008.

- Browne, Thomas. *Religio Medici*. London: Scot, Basset, Wright, and Chiswell, 1682. *Early English Books Online*.
- Burbank, Jane, and Frederick Cooper, eds. *Empires in World History: Power and the Politics of Difference*. Princeton: Princeton UP, 2010.
- Butler, Charles. *The Feminine Monarchie; or, A Treatise concerning Bees*. . . . Oxford: Barnes, 1634. *Early English Books Online*.
- Butler, Judith. *Gender Trouble: Feminism and the Subversion of Identity*. New York: Routledge, 1990.
- Child, Robert. "A Large Letter concerning the Defects and Remedies of English Husbandry, Written to Mr. Samuel Hartlib." Hartlib, *His Legacy* 1–96.
- Confucius. *Li Chi Book of Rites: An Encyclopedia of Ancient Ceremonial Usages, Religious Creeds, and Social Institutions*. Ed. Ch'u Chai and Winberg Chai. Trans. James Legge. 2 vols. New Hyde Park: UBooks, 1967.
- Cope, Douglas R. *The Limits of Racial Domination: Plebeian Society in Colonial Mexico City, 1660–1720*. Madison: U of Wisconsin P, 1994.
- Curzan, Anne. *Gender Shifts in the History of English*. Cambridge: Cambridge UP, 2003.
- Defoe, Daniel. *An Essay upon Projects*. Ed. Joyce D. Kennedy, Michael Seidel, and Maximillian E. Novak. New York: AMS, 1999.
- Digges, Edward. "An Extract of a Letter, containing Some Observations, Made in the Ordering of Silk-worms. . . ." *Philosophical Transactions, 1665–1678* 1: 26–27. doi:10.1098/rstl.1665.0017.
- Dippold, Steffi. *Plain as in Primitive: The Figure of the Native in Early American Literature, 1640–1700*. Diss. Stanford U, 2012. ProQuest. Web. doi 1267813597.
- Dunn, Richard S. *Sugar and Slaves: The Rise of the Planter Class in the English West Indies, 1624–1713*. Chapel Hill: U of North Carolina P for the Institute of Early American History and Culture, 1972.
- . "Sugar Production and Slave Women in Jamaica." Berlin and Morgan 49–72.
- Elliott, John Huxtable. *Empires of the Atlantic: Britain and Spain in America, 1492–1830*. New Haven: Yale UP, 2006.
- Elvas, Fidalgo de. *Relaçam verdadeira dos trabalhos*. . . . Évora: de Burgos, 1557.
- Emerson, Ralph Waldo. "The Poet." 1849. *Essential Writings of Ralph Waldo Emerson*. Ed. Mary Oliver. New York: Modern Library, 2000. 202–49.
- Evelyn, John. *Philosophical Discourse of Earth, Relating to the Culture and Improvement of It for Vegetation*. . . . London: Martyn, 1676.
- Ewan, Joseph. "Silk Culture in the Colonies." *Agricultural History* 43.1 (1969): 129–41.
- Fedick, Scott L. "Indigenous Agriculture in the Americas." *Journal of Archaeological Research* 3.4 (1995): 257–303.
- Ferrar, Michael Lloyd. "The Ferrar Papers at Magdalene College, Cambridge (Continued)." *Virginia Magazine of History and Biography* 11.1 (1903): 41–46.

- Field, Jacqueline, Marjorie Senechal, and Madelyn Shaw. *American Silk, 1830–1930: Entrepreneurs and Artifacts*. Lubbock: Texas Tech UP, 2007.
- Findlen, Paula, and Pamela H. Smith, eds. *Merchants and Marvels: Commerce, Science, and Art in Early Modern Europe*. New York: Routledge, 2002.
- Flynn, Dennis O., and Arturo Giráldez. *Metals and Monies in an Emerging Global Economy*. Aldershot: Ashgate, 1997.
- Geffe, Nicholas, trans. *The Perfect Use of Silke-Worms and Their Benefit*. By Olivier de Serres. London: Kingston, 1607. *Early English Books Online*.
- Grant, Edward. *A History of Natural Philosophy from the Ancient World to the Nineteenth Century*. Cambridge: Cambridge UP, 2007.
- Greer, Margaret Rich, Walter Mignolo, and Maureen Quilligan, eds. *Rereading the Black Legend: The Discourses of Religious and Racial Difference in the Renaissance Empires*. Chicago: U of Chicago P, 2007.
- Hadot, Pierre. *The Veil of Isis: An Essay on the History of the Idea of Nature*. Cambridge: Belknap-Harvard UP, 2006.
- Hakluyt, Richard. *A Particuler Discourse concerninge the Greate Necessitie and Manifold Commodities That Are Like to Growe to This Realme of Englande*. . . . Ed. David Beers Quinn and Alison Moffat Quinn. Cambridge: Cambridge UP for the Hakluyt Society, 1993.
- . *Virginia Richly Valued, By the Description of the Maine Land of Florida*. . . . London: Kingston and Lownes, 1609. *Early English Books Online*.
- Harding, Sandra. *The Science Question in Feminism*. Ithaca: Cornell UP, 1986.
- Harriot, Thomas. *A Briefe and True Report of the New Found Land of Virginia*. . . . London: Robinson, 1588. *Early English Books Online*.
- Harkness, Deborah. *The Jewel House: Elizabethan London and the Scientific Revolution*. New Haven: Yale UP, 2007.
- Hartlib, Samuel. *His Legacy of Husbandry Wherein Are Bequeathed to the Commonwealth of England, not onely Bradand, and Flanders, but Also Many More Outlandish and Domestick Experiments and Secrets*. . . . London: Wodnothe, 1655.
- . *Rare and New Discovery of a Speedy Way, and Easie Means, Found Out by a Young Lady in England, . . . for the Feeding of Silk-worms in the Woods, on the Mulberry-Tree Leaves in Virginia*. London: Wodenothe, 1652. *Early English Books Online*.
- . *The Reformed Common-wealth of Bees*. . . . London: Calvert, 1655. *Early English Books Online*.
- . *The Reformed Virginian Silkworm; or, A Rare and New Discovery of a Speedy Way, and Easy Means, Found Out by a Young Lady in England*. . . . London: Streater and Calvert, 1655. *Early English Books Online*.
- Hatch, Jr., Charles E. "Mulberry Trees and Silkworms: Sericulture in Early Virginia." *Virginia Magazine of History and Biography* 65.1 (1957): 3–61.
- Johns, Adrian. *The Nature of the Book: Print and Knowledge in the Making*. Chicago: U of Chicago P, 1998.

- Kitagawa Utamaro. *Twelve Wood-Block Prints of Kitagawa Utamaro: Illustrating the Process of Silk Culture* [Joshoku Kaiko Tewaza Kusa]. 1800. Trans. Jack Hiller. San Francisco: Book Club of California, 1965.
- Klein, Ursula, and Emma C. Spary, eds. *Materials and Expertise in Early Modern Europe: Between Market and Laboratory*. Chicago: U of Chicago P, 2009.
- Knapp, Jeffrey. *An Empire Nowhere: England, America, and Literature from "Utopia" to "The Tempest."* Berkeley: U of California P, 1992.
- Koertge, Noretta, ed. *A House Built on Sand: Exposing Postmodernist Myths about Science*. Oxford: Oxford UP, 1998.
- Kupperman, Karen Ordahl. "The Beehive as a Model for Colonial Design." *America in European Consciousness, 1493-1750*. Ed. Kupperman. Chapel Hill: U of North Carolina P for the Institute of Early American History and Culture, 1995. 272-94.
- Letellier, Jean-Baptiste. *Instructions for the Increasing of Mulberie Trees*. Trans. William Stallenge (?). London: Edgar, 1609. *English Books Online*.
- . *Mémoires et instructions pour l'establissement des meuriers; et art de faire la soye en France*. Paris: Jamet and Mettayer, 1603.
- Liu, Xinru. *The Silk Road in World History*. Oxford: Oxford UP, 2010.
- Livia, Anna. *Pronoun Envy: Literary Uses of Linguistic Gender*. New York: Oxford UP, 2001.
- Loemker, Leroy, ed. and trans. *Leibniz: Philosophical Papers and Letters*. Chicago: U of Chicago P, 1956.
- Markham, Gervase. *Booke of the English Husbandman*. . . . London: Norton and Sheares, 1635. *Early English Books Online*.
- Merchant, Carolyn. *The Death of Nature*. San Francisco: Harper and Row, 1980.
- . "The Scientific Revolution and the Death of Nature." *Isis* 97.3 (2006): 513-33.
- Mercator, Gerhard. *Atlas; or, A Geographicke Description of the World*. London, 1635.
- Mignolo, Walter. *The Darker Side of the Renaissance: Literacy, Territoriality, and Colonization*. 2nd ed. Ann Arbor: U of Michigan P, 2003.
- Milton, John. *Paradise Lost: An Authoritative Text, Backgrounds and Sources, Criticism*. Ed. Scott Elledge. New York: Norton, 1993.
- Neri, Janice, and Danielle Skeehan. "The Mystery of the Silk Worm: Conversations in the Reading Room and Beyond." *I Found It at the JCB: Online Journal of the John Carter Brown Library*. Aug. 2012. Web. 9 Nov. 2012.
- Newman, William R. "Alchemy, Domination, and Gender." Koertge 216-26.
- Newman, William R., and Lawrence Principe. *Alchemy Tried in the Fire: Starkey, Boyle, and the Fate of Helmontian Chymistry*. Chicago: U of Chicago P, 2002.
- . "Some Problems with the Historiography of Alchemy." *Secrets of Nature: Astrology and Alchemy in Early Modern Europe*. Ed. Newman and Anthony Grafton. Cambridge: MIT P, 2001. 385-432.
- Osler, Margaret. "The Gender of Nature and the Nature of Gender in Early Modern

- Natural Philosophy." *Men, Women, and the Birthing of Science*. Ed. Judith P. Zinsser. DeKalb: U of Northern Illinois P, 2005. 71–85.
- Park, Katharine. "Francis Bacon, Feminist Historiography, and the Dominion of Nature: A Response to Brian Vickers." *Journal of the History of Ideas* 69.1 (2008): 143–46.
- Pesic, Peter. "Wrestling with Proteus: Francis Bacon and the 'Torture' of Nature." *Isis* 90.1 (1999): 81–94.
- Platt, Hugh. *Jewell House of Art and Nature conteining Divers Rare and Profitable Inventions*. . . . London, 1594. Amsterdam: Theatrum Orbis Terrarum, 1979.
- Plattes, Gabriel. "Certain Notes, and Observations concerning Setting of Corn, and the Great Benefit Thereof. . . ." Hartlib, *His Legacy* 184–216.
- Ransome, David R. "They Found it at the JCB." *JCB Books Speak: Occasional Notes from the John Carter Brown Library*. 12 Nov. 2013. John Carter Brown Lib. Web. 12 Nov. 2013. <<http://blogs.brown.edu/jcbbooks/2013/11/11/they-found-it-at-the-jcb>>.
- Rappaport, Joanne, and Tom Cummins. *Beyond the Lettered City: Indigenous Literacies in the Andes*. Durham: Duke UP, 2012.
- Rasmussen, Birgit Brander. *Queequeg's Coffin: Indigenous Literacies and Early American Literature*. Durham: Duke UP, 2012.
- Raymond, Joad. "John Streater and the Grand Politick Informer." *Historical Journal* 41.2 (1998): 567–74.
- Schiebinger, Londa. *Nature's Body: Gender in the Making of Modern Science*. Second Edition. New Brunswick, N.J.: Rutgers University Press, 2004.
- Schoeser, Mary. *Silk*. New Haven, C.T.: Yale UP, 2007.
- Serres, Olivier de. *Théâtre d'agriculture et mesnage des champs*. Paris: Saugrain, 1600.
- Shapin, Steven. *Never Pure: Historical Studies of Science as if It Was Produced by People with Bodies, Situated in Time, Space, Culture, and Society, and Struggling for Credibility and Authority*. Baltimore: Johns Hopkins UP, 2010.
- Slater, Sandra. "'Nought but Women': Constructions of Masculinities and Modes of Emasculation in the New World." *Gender and Sexuality in Indigenous North America, 1400–1850*. Ed. Slater and Fay A. Yarbrough. Columbia: U of South Carolina P, 2011. 30–53.
- Smith, John. *The Complete Works of Captain John Smith (1580–1633)*. Ed. Philip L. Barbour. 3 vols. Chapel Hill: U of North Carolina P for the Institute of Early American History and Culture, 1984.
- Soble, Alan. "In Defense of Bacon." Koertge 195–215.
- Stearns, Raymond. *Science in the British Colonies of America*. Urbana: U of Illinois P, 1970.
- Sullivan, Michael. *Introduction to Chinese Art*. Berkeley: U of California P, 1961.
- Thompson, Peter. "William Bullock's 'Strange Adventure': A Plan to Transform Seventeenth-Century Virginia." *William and Mary Quarterly* 61.1 (2004): 107–28.
- Tuskes, Paul M., Michael M. Collins, and James P. Tuttle. *The Wild Silk Moths of*

- North America: A Natural History of the Saturniidae of the United States and Canada*. Ithaca: Comstock, 1996.
- Tyler, Lyon Gardiner. *Encyclopedia of Virginia Biography*. New York: Lewis Hist., 1915.
- Vickers, Brian. "Francis Bacon, Feminist Historiography, and the Dominion of Nature." *Journal of the History of Ideas* 69.1 (2008): 117–41.
- Walsh, Lorena S. "Slave Life, Slave Society, and Tobacco Production in the Tidewater Chesapeake, 1620–1820." Berlin and Morgan 179–99.
- Webster, Charles. *Great Instauration: Science, Medicine, and Reform, 1626–1660*. London: Duckworth, 1975.
- Williams, Carrie. *Mulberry Trees: The Silk Worm Market for Cocoons*. Minneapolis Beach: Van Antwerp, 1895.
- Williams, Edward.
- . *Virginia: More Especially the South Part Thereof, Richly and Truly Valued*. . . . London: Stephenson, 1650. *Early English Books Online*.
- . *Virginia's Discovery of Silke-Wormes, with Their Benefit*. . . . London: Stephenson, 1650. *Early English Books Online*.
- . *Virgo Triumphans; or, Virginia in Generall*. . . . London: Harper and Stephenson, 1650. *English Books Online*.
- Women's Silk Culture Association of the United States. *An Instruction Book in the Art of Silk Culture*. . . . 2nd ed. Philadelphia: Women's Silk Culture Assn., 1882.
- Wood, Frances. *The Silk Road: Two Thousand Years in the Heart of Asia*. Berkeley: U of California P, 2002.