Problems in European Civilization

The Scientific Revolution

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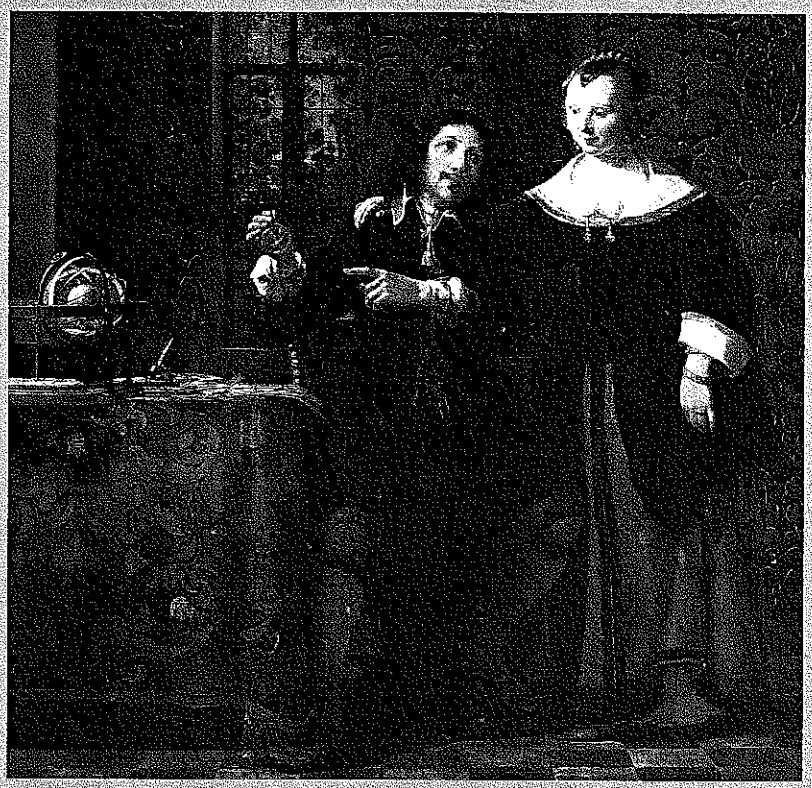

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The Scientific Revolution

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Did Women Have a Scientific Revolution?

The History of Science has broadened to include craftsmen, magicians, university professors, Puritans and Catholics, and even the common people, but many of the historians analyzing the broader context of the Scientific Revolution still cling to one tenet of the subject's traditional narrative: There are no women. Modern feminist historians refuse to accept this exclusion. They recognize that women in the sixteenth and seventeenth centuries were relegated to a largely subservient position in a patriarchal society, but nevertheless argue that women played a role in both the production of knowledge and its content.

The relationship of gender to science during the Scientific Revolution has been explored most vividly and controversially by Carolyn Merchant. The Merchant Thesis argues that the Scientific Revolution drove the female out of nature, which had long been associated with that sex. Increasingly in the seventeenth century, women and nature were viewed as disorderly, and in need of control. Nature, like women, had to be compelled to obey male rational rule; culture (male) had to triumph over nature (female). The mechanistic natural philosophy eliminated all living and female forces from nature, rendering it inert and exploitable. Hence, Merchant argues,

science in its maxims and epistemology expressed the misogyny of early modern society. The progressiveness of science thereby becomes problematic—at least from the point of view of those sensitive to gender issues.

Other recent attempts to understand the relationship of gender to the history of science concentrate on reintroducing women into the historical story. This kind of historiographical account traces the role particular women have played in the development of science. Thus, while most traditional historians of science, perhaps blinded by their own preconceptions, do not recognize women scientists or natural philosophers, that does not mean such women did not exist. Margaret Alic's *Hypatia's Heritage: A History of Women in Science from Antiquity through the Nineteenth Century* (1986) is emblematic of this approach, shared by and large in the work of Londa Schiebinger—although Schiebinger's account broadens the participation of women by broadening the definition of scientist.

My article also seeks to include women—or at least one woman, Margaret Cavendish, Duchess of Newcastle—in the cast of characters belonging to the Scientific Revolution. Indeed, Cavendish's most important natural philosophical work has recently been published in the Cambridge Texts in the History of Philosophy series, a sign that she has been added to the traditional canon. Like Merchant, I am interested in the role of gender in the articulation of natural philosophical ideas. I examine the question of whether Cavendish's science reflected "female" sensibilities, which gave a female Nature a larger role in her system, and I argue that the skepticism towards authority in early modern science could be used to justify a critique of traditional gender roles.

Even in the traditional historiography of the History of Science, the role of aristocratic women as patrons of learning—if not producers of knowledge—has been recognized, as well as their increasing importance as audiences and disseminators of the new science in the salons of the seventeenth and eighteenth centuries. Schiebinger reflects the new interest in the sites of intellectual activity, arguing that it was not inevitable that women would be excluded from the formal scientific institutions created in the seventeenth century. Nevertheless, women were, and so Schiebinger—reflecting historiographical traditions from Zilsel to Findlen—broadens the arena of scientific activity in order to reconceptualize women's roles in science. She shows

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that women of the lower classes played an important role not only in the social space of the craft guilds, but also as participants in the technical culture of artisans. Once the History of Science broadens its parameters, women are seen to play a more important role. As much as men may have wanted to eliminate the female from their science and their associations, they still lived in a world with women.

Carolyn Merchant

The Death of Nature: Women, Ecology and the Scientific Revolution, 1980

Carolyn Merchant draws on an abundance of literary and nonliterary sources to support her argument that nature and the female were connected in the worldview of medieval and early modern Europeans. The disorder in the heavens revealed by the telescope, and the disorder in the world revealed by the discoveries of the new world, resulted in an effort to control the physical world, just as disorderly women, personified by the witch, needed to be controlled in the social world. Both needed to be rendered passive and inert. Merchant argues that Francis Bacon elaborated an epistemology that implicitly transferred the inquisitional techniques used in the interrogation of witches to the discovery of nature's secrets.

Dominion over Nature

Disorderly, active nature was soon forced to submit to the questions and experimental techniques of the new science. Francis Bacon (1561–1626), a celebrated "father of modern science," transformed tendencies already extant in his own society into a total program advocating the control of

Carolyn Merchant, *The Death of Nature: Women, Ecology and the Scientific Revolution* (San Francisco: HarperSanFrancisco, 1980). Pages 164–172 from Chapter 7, Dominion over Nature.

nature for human benefit. Melding together a new philosophy based on natural magic as a technique for manipulating nature, the technologies of mining and metallurgy, the emerging concept of progress and a patriarchal structure of family and state, Bacon fashioned a new ethic sanctioning the exploitation of nature.

Bacon has been eulogized as the originator of the concept of the modern research institute, a philosopher of industrial science, the inspiration behind the Royal Society (1660), and as the founder of the inductive method by which all people can verify for themselves the truths of science by the reading of nature's book. But from the perspective of nature, women, and the lower orders of society emerges a less favorable image of Bacon and a critique of his program as ultimately benefiting the middle-class male entrepreneur. Bacon, of course, was not responsible for subsequent uses of his philosophy. But, because he was in an extremely influential social position and in touch with the important developments of his time, his language, style, nuance, and metaphor become a mirror reflecting his class perspective.

Sensitive to the same social transformations that had already begun to reduce women to psychic and reproductive resources, Bacon developed the power of language as political instrument in reducing female nature to a resource for economic production. Female imagery became a tool in adapting scientific knowledge and method to a new form of human power over nature. The "controversy over women" and the inquisition of witches—both present in Bacon's social milieu—permeated his description of nature and his metaphorical style and were instrumental in his transformation of the earth as a nurturing mother and womb of life into a source of secrets to be extracted for economic advance.

Bacon's roots can be found in middle-class economic development and its progressive interests and values. His father was a middle-class employee of the queen, his mother a Calvinist whose Protestant values permeated his early home life. Bacon took steps to gain the favor of James I soon after the latter's ascent to the throne in 1603. He moved from "learned counsel" in 1603 to attorney general in 1613, privy councillor in 1616, lord keeper in 1617, and, finally, lord chancellor and Baron Verulam in 1618. His political objectives were to gain support for his program of the advancement of science and human learning and to upgrade his own status through an ambitious public career.

Bacon's mentor, James I, supported antifeminist and antiwitchcraft legislation. During the "controversy over women," females had challenged

traditional modes of dress considered as appropriate to their place in society. In Holland, for example, young women were criticized for wearing men's hats with high crowns. In England, the title page of a work called *Hic-Mulier or The Man–Woman* (1620) showed a woman in a barber's chair having her hair clipped short, while her companion outfitted herself in a man's plumed hat. In an attempt to keep women in their place in the world's order, King James in that same year enlisted the aid of the clergy in preventing females from looking and dressing in masculine fashions: "The Bishop of London had express commandment from the king to will [the clergy] to inveigh vehemently against the insolence of our women, and their wearing of broad-brimmed hats, pointed doublets, their hair cut short or shorn, and some of them [with] stilettos or poinards . . . *the truth is the world is very much out of order.*" (Italics added.)

In 1616, Mrs. Turner, accomplice in the murder of Sir Thomas Overbury, had been sent to the gallows by James wearing the yellow, starched ruffs she had brought into vogue and that he detested. As the king's attorney general, Bacon participated in the controversy, since it was his role to bring charges for the poisoning of Overbury against the Countess of Somerset. Overbury had publicly (through a poem, "The Wife") opposed the romance between his close friend, subsequently Earl of Somerset, and the countess. The perfect wife, he said, was one who combined goodness, virtue, intelligence, and common sense but not too much "learning and pregnant wit," for "Books are a part of man's prerogative." Angered by his insults, and fearful of his influence, the countess contrived to poison Overbury through the help of a physician's widow, Mrs. Turner, and an apothecary named Franklin.

Bacon prepared two versions of his charge against the countess, one should she confess, the other should she plead not guilty. At the packed trial, at which some places sold for £10–50, the countess confessed, but was spared. Mrs. Turner, however, was convicted and sent to the gallows, and "as she was the person who had brought yellow starched ruffs into vogue, [it was decreed that] she should be hanged in that dress, that the same might end in shame and detestation."

The Overbury case increased interest in the popular controversy over women and resulted in the publication of several editions of Overbury's poem and a number of reactions to the murder; for example, "A Secret Second Husband for Sir Thomas Overburies' Wife, Now a Matchless Widow" (1616) and Thomas Tuke's "A Treatise Against Painting and

Tincturing of Men and Women: Against Murder and Poysoning: Pride and Ambition" (1616).

Bacon was also well aware of the witch trials taking place all over Europe and in particular in England during the early seventeenth century. His sovereign, while still James VI of Scotland, had written a book entitled *Daemonologie* (1597). In 1603, the first year of his English reign, James I replaced the milder witch laws of Elizabeth I, which evoked the death penalty only for killing by witchcraft, with a law that condemned to death all practitioners.

It was in the 1612 trials of the Lancashire witches of the Pendle Forest that the sexual aspects of witch trials first appeared in England. The source of the women's confessions of fornication with the devil was a Roman Catholic priest who had emigrated from the Continent and planted the story in the mouths of accused women who had recently rejected Catholicism.

These social events influenced Bacon's philosophy and literary style. Much of the imagery he used in delineating his new scientific objectives and methods derives from the courtroom, and, because it treats nature as a female to be tortured through mechanical inventions, strongly suggests the interrogations of the witch trials and the mechanical devices used to torture witches. In a relevant passage, Bacon stated that the method by which nature's secrets might be discovered consisted in investigating the secrets of witchcraft by inquisition, referring to the example of James I:

> *For you have but to follow and as it were hound nature in her wanderings, and you will be able when you like to lead and drive her afterward to the same place again.* Neither am I of opinion in this history of marvels that superstitious narrative of *sorceries, witchcrafts, charms,* dreams, divinations, and the like, where there is an assurance and clear evidence of the fact, should be altogether excluded. . . . howsoever the use and practice of such arts is to be condemned, yet from the speculation and consideration of them . . . a useful light may be gained, not only for a true judgment of the offenses of persons charged with such practices, *but likewise for the further disclosing of the secrets of nature. Neither ought a man to make scruple of entering and penetrating into these holes and corners, when the inquisition of truth is his whole object—as your majesty has shown in your own example.* (Italics added.)

The strong sexual implications of the last sentence can be interpreted in the light of the investigation of the supposed sexual crimes and

practices of witches. In another example, he compared the interrogation of courtroom witnesses to the inquisition of nature: "I mean (according to the practice in civil causes) in this great plea or suit granted by the divine favor and providence (whereby the human race seeks to recover its right over nature) to *examine nature herself* and the arts upon interrogatories." Bacon pressed the idea further with an analogy to the torture chamber: "For like as a man's disposition is never well known or proved till he be crossed, nor Proteus ever changed shapes till he was *straitened* and *held fast,* so nature exhibits herself more clearly under the *trials* and *vexations* of art [mechanical devices] than when left to herself."

The new man of science must not think that the "inquisition of nature is in any part interdicted or forbidden." Nature must be "bound into service" and made a "slave," put "in constraint" and "molded" by the mechanical arts. The "searchers and spies of nature" are to discover her plots and secrets.

This method, so readily applicable when nature is denoted by the female gender, degraded and made possible the exploitation of the natural environment. As woman's womb had symbolically yielded to the forceps, so nature's womb harbored secrets that through technology could be wrested from her grasp for use in the improvement of the human condition:

> *There is therefore much ground for hoping that there are still laid up in the womb of nature many secrets of excellent use having no affinity or parallelism with anything that is now known . . . only by the method which we are now treating can they be speedily and suddenly and simultaneously presented and anticipated.*

Bacon transformed the magical tradition by calling on the need to dominate nature not for the sole benefit of the individual magician but for the good of the entire human race. Through vivid metaphor, he transformed the magus from nature's servant to its exploiter, and nature from a teacher to a slave. Bacon argued that it was the magician's error to consider art (technology) a mere "assistant to nature having the power to finish what nature has begun" and therefore to despair of ever "changing, transmuting, or fundamentally altering nature."

The natural magician saw himself as operating within the organic order of nature—he was a manipulator of parts within that system, bringing down the heavenly powers to the earthly shrine. Agrippa, however, had begun to explore the possibility of ascending the hierarchy to the

point of cohabiting with God. Bacon extended this idea to include the recovery of the power over nature lost when Adam and Eve were expelled from paradise.

Due to the Fall from the Garden of Eden (caused by the temptation of a woman), the human race lost its "dominion over creation." Before the Fall, there was no need for power or dominion, because Adam and Eve had been made sovereign over all other creatures. In this state of dominion, mankind was "like unto God." While some, accepting God's punishment, had obeyed the medieval strictures against searching too deeply into God's secrets, Bacon turned the constraints into sanctions. Only by "digging further and further into the mine of natural knowledge" could mankind recover that lost dominion. In this way, "the narrow limits of man's dominion over the universe" could be stretched "to their promised bounds."

Although a female's inquisitiveness may have caused man's fall from his God-given dominion, the relentless interrogation of another female, nature, could be used to regain it. As he argued in *The Masculine Birth of Time*, "I am come in very truth leading to you nature with all her children to bind her to your service and make her your slave." "We have no right," he asserted, "to expect nature to come to us." Instead, "Nature must be taken by the fore-lock, being bald behind." Delay and subtle argument "permit one only to clutch at nature, never to lay hold of her and capture her."

Nature existed in three states—at liberty, in error, or in bondage:

> *She is either free and follows her ordinary course of development as in the heavens, in the animal and vegetable creation, and in the general array of the universe; or she is driven out of her ordinary course by the perverseness, insolence, and forwardness of matter and violence of impediments, as in the case of monsters; or lastly, she is put in constraint, molded, and made as it were new by art and the hand of man; as in things artificial.*

The first instance was the view of nature as immanent self-development, the nature naturing herself of the Aristotelians. This was the organic view of nature as a living, growing, self-actualizing being. The second state was necessary to explain the malfunctions and monstrosities that frequently appeared and that could not have been caused by God or another higher power acting on his instruction. Since monstrosities could not be explained by the action of form or spirit, they had to be the result of matter acting perversely. Matter in Plato's *Timaeus* was recalcitrant and had to be

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forcefully shaped by the demiurge. Bacon frequently described matter in female imagery, as a "common harlot." Matter is not devoid of an appetite and inclination to dissolve the world and fall back into the old Chaos." It therefore must be "restrained and kept in order by the prevailing concord of things." "The vexations of art are certainly as the bonds and handcuffs of Proteus, which betray the ultimate struggles and efforts of matter."

The third instance was the case of art (techné)—man operating on nature to create something new and artificial. Here "nature takes orders from man and works under his authority." Miners and smiths should become the model for the new class of natural philosophers who would interrogate and alter nature. They had developed the two most important methods of wresting nature's secrets from her, "the one searching into the bowels of nature, the other shaping nature as on an anvil." "Why should we not divide natural philosophy into two parts, the mine and the furnace?" For "the truth of nature lies hid in certain deep mines and caves," within the earth's bosom. Bacon, like some of the practically minded alchemists, would "advise the studious to sell their books and build furnaces" and, "forsaking Minerva and the Muses as barren virgins, to rely upon Vulcan."

The new method of interrogation was not through abstract notions, but through the instruction of the understanding "that it may in very truth dissect nature." The instruments of the mind supply suggestions, those of the hand give motion and aid the work. "By art and the hand of man," nature can then be "forced out of her natural state and squeezed and molded." In this way, "human knowledge and human power meet as one."

Here, in bold sexual imagery, is the key feature of the modern experimental method—constraint of nature in the laboratory, dissection by hand and mind, and the penetration of hidden secrets—language still used today in praising a scientist's "hard facts," "penetrating mind," or the "thrust of his argument." The constraints against penetration in Natura's lament over her torn garments of modesty have been turned into sanctions in language that legitimates the exploitation and "rape" of nature for human good. The seventeenth-century experimenters of the Accademia del Cimento of Florence (i.e., The Academy of Experiment, 1657–1667) and the Royal Society of London who placed mice and plants in the artificial vacuum of the barometer or bell jar were vexing nature and forcing her out of her natural state in true Baconian fashion.

Scientific method, combined with mechanical technology, would create a "new organon," a new system of investigation, that unified knowledge with material power. The technological discoveries of printing, gunpowder, and the magnet in the fields of learning, warfare, and navigation "help us to think about the secrets still locked in nature's bosom." "They do not, like the old, merely exert a gentle guidance over nature's course; they have the power to conquer and subdue her, to shake her to her foundations." Under the mechanical arts, "nature betrays her secrets more fully . . . than when in enjoyment of her natural liberty."

Mechanics, which gave man power over nature, consisted in motion; that is, in "the uniting or disuniting of natural bodies." Most useful were the arts that altered the materials of things—"agriculture, cookery, chemistry, dying, the manufacture of glass, enamel, sugar, gunpowder, artificial fires, paper, and the like." But in performing these operations, one was constrained to operate within the chain of causal connections; nature could "not be commanded except by being obeyed." Only by the study, interpretation, and observation of nature could these possibilities be uncovered; only by acting as the interpreter of nature could knowledge be turned into power. Of the three grades of human ambition, the most wholesome and noble was "to endeavor to establish and extend the power and dominion of the human race itself over the universe." In this way "the human race [could] recover that right over nature which belongs to it by divine bequest."

The interrogation of witches as symbol for the interrogation of nature, the courtroom as model for its inquisition, and torture through mechanical devices as a tool for the subjugation of disorder were fundamental to the scientific method as power. For Bacon, as for Harvey, sexual politics helped to structure the nature of the empirical method that would produce a new form of knowledge and a new ideology of objectivity seemingly devoid of cultural and political assumptions.