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Women, Feminism, and Technology

A Woman's Work Is Never Done

I saw a man the other day,
As savage as a Turk,
And he was grumbling at his wife
And said she did no work . . .
He said: You lazy huzzy!
Indeed you must confess;
For I'm a-tired of keeping you
In all your idleness.
The woman she made answer:
I work as hard as you,
And I will just run through the list
What a woman has to do.
*So men, if you would happy be,
Don't grumble at your wife so;
For no man can imagine
What a woman has to do.*

Lesley Nelson-Burns (c.1850)

A woman's place is in the wrong.

James Thurber (c.1950)

Feminist philosophy of technology is part of the larger movement and project of feminist philosophy in general. Feminist philosophy started in applied ethics (Alcoff and Potter, 1993), where issues of gender with respect to abortion, child rearing, sexist language, and general issues of male power

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and dominance are most obvious. However, as feminist philosophy developed, feminist philosophers moved to deal with foundational issues in theory of knowledge and metaphysics. During the 1970s, as a part of so-called second wave feminism (the First Wave being the fight for women's suffrage), feminist philosophy of science and technology arose, with writers such as Evelyn Fox Keller, Donna Haraway, and Sandra Harding. Feminist approaches to the theory of knowledge are often made in contrast with in and opposition to the standard positivistic, objectivistic and technocratic ones (see chapters 1 and 3).

A number of philosophical tendencies in the latter part of the twentieth century were exploited, developed, and extended by feminist epistemologists (theorists of knowledge) and philosophers of science and technology. Criticism of logical positivism and the psychologically and socially oriented post-positivist philosophies, such as those of Thomas Kuhn (as well as Stephen Toulmin, Paul Feyerabend, and Michael Polanyi), opened issues and topics concerning social and psychological biases in science for feminist philosophers (Tuana, 1996). Likewise, phenomenological and hermeneutic approaches from continental philosophy that eventually were assimilated in US philosophy gave an entrée to feminists to introduce the role of context, personal feelings, and social situation into the philosophy of science. Criticism of uncritical celebration of technological progress and futurological fantasies of total control of nature, raised by the ecology movement as well as earlier German and English Romanticism in philosophy (see chapter 11), opened the way for feminists to point out masculine aspects of the dominating attitude to nature. Pragmatic and existential critiques of the notion of the detached observer, with the "view from nowhere," to use Thomas Nagel's phrase, were assimilated by some feminists to criticize the notion of scientific and technological objectivity (Heldke, 1988). W. V. O. Quine's pragmatic criticism of the notion of decisive refutation of theories and of a sharp distinction between the empirical and the definitional truths in science led some feminist theorists of knowledge to reject the whole foundational approach to the theory of knowledge, which bases knowledge on the intuitive apprehension of indubitable truths by individual knowers (Nelson, 1990).

There are several areas of investigation of technology in relation to women. Among these are: (a) women's generally overlooked contributions to technology and invention; (b) the effect of technology on women, including household technology and reproductive technology; (c) gendered descriptions and gender metaphors of technology and nature and their role in society.

Women's Contributions to Technology and Invention

One area of research is that showing the often underrated contributions of women to technology and invention. From prehistoric food gathering and storage to the development of the COBOL business computer language women have contributed substantially to technology (Stanley, 1995). However, what is classified as technology has often biased the account to exclude or downplay women's contributions. Even the most eloquent and influential American historian of technological systems includes few women in his recent survey (Hughes, 2004).

For instance, the anthropology of the 1960s found a unifying theory of the development of modern *Homo sapiens* in the "Man the Hunter" theory. Big game hunting was seen as central to the development of human intelligence and social cooperation. Because men were predominant in big game hunting, this meant that men were responsible for the social advance of humanity. As Ruth Hubbard asked rhetorically in another context, "Have only men evolved?" (Hubbard, 1983). During the late 1970s under the influence of feminism a number of female anthropologists developed the "Woman the Gatherer" theory or account to emphasize the contributions of women to the food supply. Some of these accounts noted that the gathering of plants, nuts, and seeds and the trapping of small game was more important to general nutrition than the occasional big game hunt.

Lewis Mumford had earlier noted how the identification of technology with machines and weapons had overemphasized the male role in invention, and the importance of container and storage technology was often overlooked (we noted this in our discussion of animal technology in chapter 8). Mumford noted that although the extension of the leg in transportation devices and the extension of the arm in projectiles have been emphasized, a kind of prudery has led historians of technology to ignore the extension of the womb and the breast as storage or incubation devices (Mumford, 1966, pp. 140–2; Rothschild, 1983, p. xx). During the Middle Ages the invention of the quern or hand-cranked grain mill, a part of women's work, introduced the crank to mechanics (White, 1978).

In more recent centuries the assumption that women have not been inventors, as claimed by Voltaire (Stanley in Rothschild, 1983, p. 5), has led the stories of women inventors to be ignored, covered up or misinterpreted. Often it is assumed that if women made any inventions they concerned "women's work," i.e. housework. One women inventor of a design for a

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river dam had her patent application misinterpreted as a design for a “dam” in a kitchen sink! As in other areas, such as literature, the production or invention of women was attributed to their husbands. The frequently disputed case of Catherine Green’s contribution to the invention of Eli Whitney’s cotton gin is a famous example. Green probably suggested the use of a brush to remove the cotton lint that stuck to the teeth of the cylinder (Stanley, 1995, p. 546). Emily Davenport made crucial contributions to Thomas Davenport’s small electric motor. Ann Harned Manning jointly invented a mechanical reaper with her husband William Manning before McCormick invented his, but it is the husband William who generally is given credit.

Technology and Its Effects, Particularly on Women

Two areas that most obviously have had effects specifically on women are household technology and reproductive technology.

Household technology

During the twentieth century a number of mechanical inventions changed the nature of housework. The washing machine, the vacuum cleaner, the gas, electric, and microwave ovens, and frozen food are examples. Indoor plumbing and the automobile also had great effects on household work and the allocation of time.

Surprisingly, the introduction of these household devices has not shortened the hours spent by house workers and mothers (Cowan, 1983). For upper-class women the decline of use of servants offset the greater efficiency of the washing machine, vacuum cleaner, and oven. For less affluent housewives the increased efficiency of these household devices increased output but did not decrease work. The washing machine saved time and effort over hand washing, but the use of both hired laundresses and professional laundries declined. The greater efficiency of the washing machine also led people to change their clothes and hence wash their clothes more frequently. The vacuum cleaner led to houses being much cleaner, but house size grew during the suburban boom of the 1950s. There were more areas to clean. Thus clothes and houses were both much cleaner, but cleaning houses and washing clothes was more frequent and extensive. The new ovens and prepared and frozen foods decreased food preparation time, but other activities took its place. Furthermore, the disappearance of many of the physically

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exhausting and obviously skilled activities involved in food preparation and cleaning often led to a decline in the respect husbands held for their spouse's housework. The widespread myth from at least the 1950s was that housewives had hardly any work to do.

The availability of the automobile changed the activities of housewives. Previously milk, bread, ice, and most groceries were delivered to the household door and physicians made house calls. With the automobile trips to the store and to the doctor became more frequent. Indirect effects of the development of the automobile system led to the spread of the suburbs, the growth of malls and supermarkets, and the decline of local mom and pop stores, all increasing the amount of travel needed for food shopping. The decline of public transportation, in part due to the dominance of the automobile, also means larger demands on the auto for transportation. Much time is spent transporting children to and from various activities.

Despite the improvements in household technology over three decades in (what used to be called) the "actually existing socialist" or Soviet style countries of Eastern Europe, the answer to the question "Does socialism liberate women?" seemed to be a qualified "No." In the Soviet Union, although women early worked full time, they were also expected by their spouses to do all the housework. There were some early experiments with collective laundry, and even cooking, but these were not sufficiently widespread or long lasting to ease the burden on women (Scott, 1974).

In the development of household technology there is a gender split between the designers (almost entirely male) and the consumers (mostly female). The central house vacuum is sold in Sweden by appealing primarily to the female user but also to the male as purchaser, lint dumper, and repairperson (Smeds et al., 1994). The microwave oven in Britain began as a "gee whiz" gizmo sold in stereo and electronics shops. Only later did it shift to be treated as an ordinary household appliance sold in appliance shops. In this latter placement sales techniques are focused on women's fears of complex technology and of the danger to health from insufficiently cooked items causing food poisoning (Ormrod, 1994).

Reproductive technology

A second area of technology that has obviously influenced women's lives is reproductive technology.

During the first years of second wave feminism in the early 1970s Shulamith Firestone's *The Dialectic of Sex* (1970) proposed that only separating women

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from pregnancy and childbirth through artificial wombs could achieve full equality of women. This technological fix approach was soon rejected by most feminists, who tended to emphasize women becoming more involved in and in control of their pregnancies. Later feminists, who emphasized the less desirable aspects of artificial reproduction technology as a means of power of male physicians over women, also rejected it.

Contraceptive and abortion technology is about delaying or avoiding pregnancy. Artificial insemination, embryo transplant, and other new reproductive technologies are about achieving pregnancy. Feminists have been concerned to extend the availability to women of contraception and abortion so that women are in control of whether and when they become pregnant. Feminist critics have focused on the alleged lack of concern for women's health in contraception research and development and the relative lack of research into chemical forms of male contraception. The case of Depo-Provera is an example. Depo is a contraceptive injection that lasts for three months. Because it doesn't involve the need to remember to use a physical contraceptive or to frequently take a pill, it was the contraceptive commonly given to Third World women, to aborigines in Australia, Maori in New Zealand, and women of color in Britain. It is claimed that US AID (Agency for International Development) channeled funds to the International Planned Parenthood Federation to distribute Depo worldwide. Data from studies in New Zealand by its manufacturer, Upjohn, were sent to company headquarters for statistical analysis and not released publicly. Critics have claimed that the published claims concerning the drug downplay side-effects such as cancer and bleeding (Bunkle, 1984).

An apparently surreptitious campaign during the 1950s and 1960s of massive sterilization of poor, Hispanic women in Puerto Rico without informed consent of the subjects is another example of direct reproductive control of Third World women.

The proponents of reproductive technology have emphasized the increase in freedom of choice that the new reproductive technologies have offered women. Contraception, *in vitro* fertilization, embryo implantation, and genetic screening are among these technologies. The ability to prevent pregnancy, the ability of previously infertile women to bear children, and the ability to screen for and abort fetuses with genetic defects are presented in terms of extended capability and free choice. Feminist critics of the new reproductive technologies, on the other hand, have noted that the new possibilities have imposed subtle pressures and constraints on women. Infertile women are expected to make use of the new reproductive technologies

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to be able to reproduce. Women are expected to screen for and abort “defective” fetuses. A woman who does not make use of genetic screening or who elects to give birth to a child with a genetic defect is considered morally derelict by those who accept abortion and the new technology (Rothman, 1986). Critics in the disability rights movement have also noted that the eagerness to eliminate “defective” embryos shows society’s negative attitude to the disabled. Racial, ethnic, and class issues also enter into eagerness to abort the potentially disabled (Saxton, 1984, 1998).

Radical feminist critics of the new reproductive technologies have claimed that they are a means for the mostly male physicians to control the one human act (pregnancy and childbirth) that men are unable to do. In early societies there was a religious mystique about the reproductive powers of women. In the Renaissance and early modern period one of the dreams of the alchemists was to produce the homunculus or little person by purely chemical means. This would allow male alchemists to achieve the one ordinary human task of which they had previously been incapable. Some feminist theorists of technology have seen modern reproductive technology as a fulfillment of this age-old dream of male capability and power. Feminist critics have seen contemporary genetic engineering and test tube babies as a fulfillment of the homunculus fantasies of alchemists, such as Michael Maier’s *Atalanta Fugiens* (1617, emblems 2–5, 20, see Allen and Hubbs, 1980).

Maier, with his highly sexually charged and often misogynist symbolism, was a favorite alchemist of Isaac Newton, who rejected contact with women (Dobbs, 1991, n123). Maier was evidently also involved in the conquest of Native Americans. On his visit to England he was an associate of at least three members of the Virginia Company, planning to settle America, two of whom associated this project with alchemical ideas, including those of Maier. Maier’s own *Atalanta* may have been, in turn, partly inspired by anticipation of a colony in Virginia (Heisler, 1989).

The replacement of female midwives with male surgeons in the early modern period was a shift in who had knowledge of and power over childbirth. The early surgeons’ takeover was facilitated by the development of a simple technology, the medical forceps, introduced in the 1730s. Despite the fact that in this early period the surgeons killed more than they cured, often overusing the forceps, damaging both infant and mother, they were able to present themselves as experts more worthy of respect than the midwives (Wajcman, 1991).

Later, more technologically sophisticated and successful developments in obstetrics, including anesthetics, along with the move of birthing from the

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home into the hospital, completed the medicalization of pregnancy and childbirth. Pregnancy became pathology rather than a natural process and part of human life. Caesarian sections were performed more often than necessary (sometimes for the convenience of the physician, who then did not have to wait during hours or days of labor). This, along with induction of childbirth and episiotomy, led to the management and control of pregnancy, and control shifting from the mother and midwives to the male physicians.

Within the new reproductive technologies, techniques of sex selection have the most direct and obvious effect on gender discrimination. Because of the valuation of male offspring over female offspring in traditional societies, China and India have been involved in extensive selection of male embryos and abortion of female embryos.

One area that shows the complexity and ambivalence of the new technologies is ultrasound imaging. Although this has become a routine part of medical management of pregnancy, several studies have cast doubt on the value of routine ultrasound imaging on the improved health of fetuses and offspring. The ultrasound image allows the physician to be in control of knowledge of pregnancy that is superior to that of the mother. It also shifts the kind of knowledge involved. Traditionally the mother's feeling of quickening and of kicking in the womb was the means of sensing the fetus. This has been replaced by the visual imagery of the ultrasound image. Many writers since Friedrich Nietzsche (1844–1900) have noted that visual perception is a more detached, "distanced" kind of perception than that of the other senses (Jay, 1993). During the past few centuries visual perception has been given priority over other senses, such as touch and smell. The visual is linked to the geometrical and objective account of the world of modern science. The mother's feeling of the fetus is part of the mothers' own bodily sensations, while the visual image is an image from the "outside." The attention is on the screen, not on the mother's body. The ultrasound images show the fetus as if isolated in space, ignoring the bodily medium in which it is suspended, giving the impression of independence of the fetus from the mother. They are similar to the floating or flying fetus in the final scene of *2001: A Space Odyssey*, thereby eliminating the presence of the mother, and associating the fetus with high medical technology rather than human gestation (Arditti et al., 1984, p. 114).

Ultrasound has been claimed to change the very notions of "inside" and "outside" with respect to mother and fetus. One writer calls the ultrasound a kind of "panoptics of the womb," along the lines of Michel Foucault's

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(1977) notion of universal surveillance. *Life* magazine, in one of the earliest popular accounts of ultrasound, claimed it works “precisely the same way a Navy surface ship homes in on an enemy submarine” (1965, quoted in Petchesky, 1987, p. 69). One physician writing in a major medical journal used phrases very much in the Baconian mode (see the section on metaphor below), such as “the prying eye of the ultrasonogram,” “stripping the veil of mystery from the dark inner sanctum,” and “letting the light of scientific observation fall on the shy and secretive fetus.” Indeed, Harrison calls the fetus a “born-again patient” (quoted in Hubbard, 1983, pp. 348–9). The anti-abortion movie *Silent Scream* makes use of medical imaging (with acceleration of the speed of the images, and an unrealistically large model of the fetus) to persuade the viewer that the fetus is a person. In several US states, laws have been proposed to require viewing of ultrasound images of the fetus by women seeking an abortion. The ultrasound scan, a technology with numerous undoubted medical advantages, can be used as a weapon to present the “fetus *in situ*” (now treating the woman as a mere lab vessel), as if independent of the mother bearing it. The imaging can be, alternatively, an extension of the age-old voyeurism of the male “gaze,” with women objectified and depersonalized, similar to the images of pornography in this respect.

Workplace technologies and women

Not all the technologies that have affected women are specifically oriented toward women’s traditional roles as mother or as housewife. Industrial technologies have affected women’s occupations. One debated example is the typewriter in relation to women entering the clerical workforce.

Earlier accounts of the development of the role of secretary as populated by women rather than men by the 1920s tended toward a technological determinist account, linking the shift in gender identification of the job to the rise of the typewriter. It has been noted, however, that Japan developed a largely female clerical force without the use of the typewriter. Indeed, the increase of women in secretarial and clerical jobs in the USA began during the Civil War, a decade and a half before the typewriter was more than a rarity. The design of the typewriter as a cross between a piano and a sewing machine seemed appropriate to women. Women had occupied the low-wage job of hand copying, and the typewriter was widely used for copying. The development of stenographic writing to take dictation led to the training of women typists in stenography, which was originally a male field. As women were trained and credentialed in typing and stenography at secretarial schools,

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stenography became women's work. For small businessmen the power over a woman assistant gave a sense of authority and prestige. Given the low wages of female copyists, and their successors, the typist-stenographers, the job became less attractive to men. The typist-stenographer role was a bridgehead to being hired in other clerical jobs, leading to the new characterization of clerical work as female rather than male by the 1920s and 1930s (Srole, 1987).

Technology as "Male," Nature as "Female": Metaphors of Nature and Technology

There is a rhetoric of "Man and Technology" and of "Man's Domination of Nature." It has been noted by a number of feminist writers that nature is generally portrayed as female, as in Mother Nature or virgin lands. Scientists and technologists are generally portrayed as male. This convention goes far back in time. Ecologists like to cite the earth goddess Gaia, and James Lovelock has used her name to designate his theory of a self-adjusting biosphere, including both chemicals, such as atmospheric gases, and organisms.

With the rise of early modern science in the sixteenth and seventeenth centuries there was, according to Carolyn Merchant and others, a downgrading of the status of the earth mother (Merchant, 1980). This was associated in part with the rise of exploitation of nature. Miners who lacked reverence for the earth, and saw it not as a living thing but as an inorganic, lifeless mass, would be less restrained in their excavations and extraction.

Much early thought on nature, such as that of the early Greek natural philosophers, treated matter as alive (hylozoism). However, in the seventeenth century, the mechanistic view in its original form treated matter as wholly passive and inert. Aristotle had treated matter as passive in analogy to the female and form as active in analogy to the male. However, the early atomists and mechanists further emphasized the passivity and deadness of matter. Thinkers in the hermetic tradition treated the forces and powers of matter as active, but in opposition to them the early mechanists such as Descartes denied any active powers to matter. Newton realized that, contrary to Descartes, forces were necessary to produce an effective theory of physics, but Newton denied that the forces resided in matter. He claimed that they were a separate form of "active principle."

Although Newton borrowed ideas from alchemy in developing his concept of force, he degraded the female principle in theory of matter and had a

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pathological aversion to social contact with women. Newton became angered at his friend John Locke and refused to speak to him because Newton thought that Locke was attempting to involve him with women. One of his alchemical metaphors was “ye menstruum of [your] sordid whore.” More than other alchemists, Newton was fascinated by “the net,” a chemical associated with the net by which Vulcan traps Mars and Venus when they are caught *in flagrante delicto* (Westfall, 1980, pp. 529–30, 296; Dusek, 1999, p. 185).

Not only were feminine qualities downgraded or dismissed in the theory and metaphors of matter, but the new natural philosophy was also seen as masculine. Henry Oldenburg, the correspondent for the Royal Society, argued for a “masculine philosophy.” Joseph Glanville, a historian of the Royal Society, also demanded a “manly sense” and advocated avoiding the deceit of “the woman in use” (Easlea, 1980, p. 214). Oldenburg not only advocated a “manly philosophy” but demanded that “what is feminine . . . be excluded” from the philosophy of the Royal Society. Thomas Spratt, who wrote an early history of the Royal Society, likewise identified the intelligence of the crafts as masculine (Keller, 1985, pp. 54, 56; Dusek, 1999, pp. 128–36).

Francis Bacon (whom we have encountered both in the discussion of the philosophy of science as proponent of inductive methods in science and in the discussion of technocracy as forerunner of technocracy and booster of the value of natural knowledge in the prosperity of society) used a variety of gender images for the relationship of the (male) scientist with (female) nature. He used the image of marriage. He also used the imagery of voyeurism and seduction of nature. He associates the male investigator of nature with the probing of secret places and the forcing of nature to reveal her secrets. The quotation in Bacon that has caused the most controversy is:

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 afterwards to the same place again. Neither ought a man make a scruple of entering and penetrating those holes and corners when the inquisition of truth is his whole object. (Harding, 1991, p. 43)

Feminist writers have associated this passage with the fact that Bacon dedicated his work to King James I, who was active in investigating and persecuting witches. This passage is notorious, but there are many other gendered treatments of nature as slave and object of capture (Farrington, 1964, pp. 62, 93, 96, 99, 129, 130).

Feminist critics of Bacon have seen the relationship of male experimenter to nature as a kind of forceful seduction, verging on date rape. Allen Soble

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(1995), in his defense of Bacon, identifies the relation of investigator and nature with marriage and argues that marital rape was legal in Bacon's day (and for a long time afterward). He also claims that one cannot find a "smoking gun," by which Bacon directly linked experiment with the rape of nature, or associated the investigation of nature with the torture of witches. Nevertheless, the passage cited above and many others show that Bacon places his consideration of the investigation and manipulation of nature within a gendered context.

One may say against this analysis of the metaphors of early modern science and technology that they are not essential to the science and technology themselves. The experiments, laws of nature, and mechanical inventions stand by themselves and the metaphor is only exterior decoration. However, the imagery of male gender in the investigation of nature is so pervasive, continuing to our time, that one may argue that such images and metaphors have an effect on the image of science and technology that plays a role in the recruitment and motivation of scientists and engineers.

Evelyn Fox Keller (1985) and others, using psychological object relations theory (Chodorow, 1978), have claimed that the very norm of detachment and objectivity in science and technology is associated with the male model. According to object relations theory, boys have to break with their mothers in the formation of their identity in a way that girls do not. The masculine stereotypes of lack of emotion, detachment, and objectivity fit with the image of science. These popular images of science and technology influence the recruitment of students into the fields. Girls in middle and high school who have talents for science and technology are discouraged from pursuing advanced technical subjects by the popular images of scientist and engineer. These images of nerd, on the one hand, or aggressive controller of nature, on the other, conflict with the "feminine" personality traits that society encourages girls to develop. Girls also fear that even excessive intelligence or talent for technical subjects will discourage boys' interest in them.

David Noble in his *A World without Women* (1992) has emphasized that priests and monks who were not married and supposed not to have sexual relations with women carried out medieval scholarship. The academic world grew from the medieval universities, such as Oxford, Cambridge, Paris, Padua, and elsewhere, which had clerical origins and solely male inhabitants. Women were not admitted to major universities until the nineteenth century. Many eminent US men's undergraduate universities, such as Yale, did not become coeducational until around 1970. Women could not pursue advanced work at the major universities until the nineteenth century in

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Russia and the twentieth century in parts of Western Europe. When the mathematics faculty of Göttingen, Germany, resisted accepting one of the world's leading experts on algebra because she was a woman, the mathematician David Hilbert asked in exasperation, "Is this a university or a Turkish bath?" (Reid, 1970). The exclusion of the feminine was not simply in imagery and psychology but in the institutional structure of academic science and technology.

The debate concerning the issue of relevance of metaphors to science and technology is related to the positivistic and post-positivistic philosophies of science, as well as to the definition of technology in terms solely of hardware or of rules, versus the technological systems definition, which includes social relations within technology (discussed in chapter 2).

According to the positivistic view, science consists of the formal deductive apparatus of the theory and the observational data. Models, metaphors, and heuristic guidelines for discovery are not part of the "logic" of science but part of its "psychology." For the most part they are in the context of discovery, not of justification. Only the logic of explanation and confirmation in the latter is significant for knowledge. However, some philosophers of science, such as Mary Hesse (1966), Rom Harré (1970), and Marx Wartofsky (1979), have argued that models are an important part of scientific theories and explanations.

Social historians of science and technology and sociologists of scientific knowledge have claimed that the broader social and cultural images and metaphors play a role in the acceptance and spread of scientific theories. For instance, Darwinian natural selection was stimulated by Malthus's theory of the economics of human overpopulation (which also was a trigger for the independent co-discoverer of the theory, Alfred Wallace) and by Quetelet's work in social statistics. The acceptance of Darwinism was aided by the resemblance of the theory to that of the competitive capitalist free-market economy (Gould, 1980; Young, 1985).

A more controversial example is that the model of the universe as one of atoms moving and colliding in empty space, with no natural up or down, mirrored the competitive, capitalist, free-market economy, replacing the hierarchical Aristotelian worldview of the Middle Ages in which things had their natural place, and the levels of the hierarchy were levels of value (Brecht, 1938; Macpherson, 1962; Rifkin, 1983; Freudenthal, 1986).

Similarly, the technical or hardware understanding of technology would exclude the imagery and cultural values that inventors or users of technology might associate with the technology as not really part of the technology.

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The technological systems definition of technology includes the social organization of the maintenance and consumption of the technology. Hence images and metaphors that motivate inventors or make the technology attractive to consumers have a role in the technology. If, for instance, the imagery of making a “second creation” of life and the taking over by male scientists and medical men of the power and mystery of human reproduction motivates molecular biologists, genetic engineers, and reproductive physicians, then it is a part of the social system of that technology and culture of that technology.

Variant Feminist Approaches to Theory of Knowledge in Changing Science and Technology

Sandra Harding (1986) classified approaches to science in a way that has relevance to technology as well. The position closest to the traditional and widespread theory of scientific knowledge is **feminist empiricism**. Feminist empiricism aims to reform science and its technological applications – for instance, in medicine – by correcting bad science. It accepts standard empiricist or even positivist accounts of the nature of scientific knowledge, claiming that what is wrong is simply bad science and false claims about women.

Much of feminist science criticism has been directed at biological theories of women’s intellectual inferiority and lack of motivation as explanations of women’s lack of participation in science and technology. Numerous accounts of women’s lack of mathematical ability are allegedly based on psychology and brain science. The accounts have shifted over time but have managed to maintain claims of a lack of female abstract reasoning ability. With the discovery and popularization of differences in the two hemispheres of the brain, right associated with intuitive and holistic grasp and left associated with language and formal thinking, women (but also non-Western people in general) were initially claimed to be right-brained, intuitive, and non-logical. This image fit with popular stereotypes. After it became obvious that girls’ language development led boys’ the story changed. The recent version is that women are left-brained, skilled in language, but this is now used against women’s abstract abilities. It is claimed that mathematical, spatial, and geometrical skills are associated with the right brain, and that boys are right-brained with superior spatial skills. This neglects purely linguistic and non-spatial areas of math, as in logic and computer science. The extreme extension of this approach is the speculative claim that men have a

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“math gene” that women lack. This is based on differences in SAT scores. There is no genetic evidence for the supposed sex-linked “math gene” (Moir and Jessel, 1992; Hammer and Dusek, 1995, 1996).

The alleged discovery that women have larger connective tissue (splenium) between the two parts of the brain has been used to claim that women are less able than men to separate thought and emotion. Biologist Anne Fausto-Sterling (2000) among others has pointed out the small samples and non-replicable nature of the studies that make these claims. Feminist studies have also criticized the scientific quality of studies in sociobiology and more recently evolutionary psychology that give a supposed evolutionary basis for the claims about women’s lack of abilities in abstract or technical fields.

Feminist empiricists believe that an honest and accurate use of traditional scientific methods will undermine biases against women in science and technology. As feminist empiricism exposes more and more bias in the descriptions of human and animal behavior, one is led to question the extent to which scientific method, traditionally applied, is sufficient to expunge sexist bias. If the leading peer-reviewed journal *Science* can publish an article on “transvestitism” among hanging flies (Thornhill, 1979), even though the insects do not wear clothes, one wonders whether traditional peer review can function to correct for bias.

Other feminist approaches claim that more substantial changes in our usual accounts of science and technology are needed. Feminist **standpoint theory** is a more radical approach. The structure of the theory is based on an aspect of Marxist theory. Georg Lukács (1923) claimed in his early work that the standpoint of the worker, central to the process of industrial production, but also oppressed and alienated, gave a privileged access to knowledge denied to the comfortable and detached capitalist owner. The worker as “self-conscious commodity” had direct, personal insight into reification of the self that the capitalist or professional did not. Feminist standpoint theory makes a similar claim for the position of women as central to society’s reproduction but oppressed. Unlike men, who generally take for granted and do not notice the gender exclusions and gender discrimination built into the structure of the technical community, women are forced to become aware of the biases directed against them.

Post-Kuhnian philosophy of science emphasizes the extent to which guiding assumptions over and above the formal theories and bare observational data function. Paradigms include ideals of theory, as well as an image of nature. Feminists have claimed that stereotypical images of science and technology, as control and manipulation of nature (rather than, say, understanding

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and cooperation with nature) and as analytical breakdown and reduction of systems to their simplest parts (as opposed to recognition of holistic effects and emergent levels of systems), have gender bias behind them. Feminist standpoint theory claims that women's situation forces them or at least makes them more likely to become aware of these biases than are men.

One objection to feminist standpoint theory, as it is to the Marxist version of standpoint theory originated by Lukács, is to question whether oppression and pain themselves are automatic tickets to objectivity. They might produce their own distorting biases.

Some feminists argue, as do many **ecofeminists** (see chapter 11) and feminist participants in disarmament or anti-nuclear movements, that women's nature, including their involvement in childbearing and childrearing, makes them more apt than men to be concerned with the existence of future generations and the preservation of the planet. On a broader scale, feminists committed to a notion of women's nature, as well as ecofeminists in general, claim that women are "closer to nature." Whether attributing it to male and female natures or to the power structure of society, ecofeminists claim that there is a connection between patriarchy or male domination of society and values of domination and control over nature.

Male nature is claimed to tend to abstract and reduce, to "murder to dissect," while women respect the integrity, complexity, and fragility of natural systems. Another claim is that women are cooperative and non-hierarchical, while men are predisposed to be competitive and hierarchical. It is claimed that many technological networks and systems reflect the centralized control and hierarchy of a male-dominated society and that greater participation of women would lead to a more decentralized and democratic technology.

One irony of the position that holds that there is a women's nature and a men's nature is that it parallels the claims of the sociobiologists and other biological determinists who use similar accounts to claim that women are unsuited for technology because of the same characteristics that the women's nature theorists attribute to them. The difference is that the women's nature theorists positively value the irrationality and emotionality that traditionally has been regarded as inferior to male rationality. The women's nature theory also repeats the imagery and metaphors of much of the rhetoric of the scientific revolution, with science as "male" and nature as "female," and the relation of scientist to nature as that of man to woman. While the sociobiological "anatomy is destiny" theorists claim that women's lack of ability to totally detach their abstract thought from their emotions,

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and their supposed lack of aggressive competitiveness, make them lack scientific and technological ability, the women's nature theorists claim that these very attributes will either eliminate technology as we know it or lead to a more humane and beneficial science and technology.

Opposed to the theory of women's nature are **postmodernist feminism** and the anti-essentialist claim that gender is socially constructed. Postmodernism is a diverse movement of the last decades of the twentieth century that among other things denies that there is the possibility of a complete system of knowledge or a metaphysical account of ultimate reality (see the sections on post-industrial society, media, and postmodernism in chapter 6). Postmodernism would deny that feminist standpoint theory could lay claim to the possession of the *true* standpoint.

Postmodernism is a relativism that claims that there are a variety of standpoints with equal claim or lack of claim to the truth. Postmodernism also denies that there are essences (see chapter 2). Words and definitions are arbitrary. There are no natural classes of things or natures of things. In particular, postmodernist feminism denies that there is a women's nature. Gender is socially constructed (see chapter 12). That is, the personality characteristics that a society attributes to women and to men do not reflect a real nature of women or of men but are a product of the society itself.

Another feature of postmodernism is the denial of a unified identity of the self. Postmodernist feminism emphasizes the extent to which individuals are identified with a number of groups. Women are not simply women but women of a certain race and class. Because of this the female "essence" cannot be used to characterize a woman's political and social place.

Donna Haraway is a postmodernist feminist who has greatly contributed to the construal of science and technology. In her *Primate Visions* (1989) she shows how the interplay of gender and race affects the portrayal of the great apes in science and in popular discourse. In her "Manifesto for Cyborgs" (Haraway, 1985, 1991) she develops the category of the cyborg, a combination of human and machine, to undermine the dualities of the human and the mechanical and to reject the notion of a human essence. The cyborg originated in technological speculation concerning long-range space travel and in science fiction, but Haraway and others since have claimed that in fact this interpenetration or inseparability of the human and the technological is characteristic of our condition. In contrast to the romantic and the essentialist feminist opposition of the natural to the technological, the cyborg shows the two as inextricably intertwined. This cyborg breaks down the line between human, animal, and machine. Genetically engineered organisms and even,

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in Haraway's more recent work, companion animals such as dogs blur the boundary between the natural and the artificial. Haraway's use of cyborgs to erase the traditional boundaries that humanism and essentialism have erected is similar in many respects to Bruno Latour's use of technology-human hybrids or "quasi-objects" to undermine the opposition between traditional positivist objectivism and social constructionism (Latour, 1992, 1993).

An example of such a nature/culture hybrid and its resonance in both science and quasi-religion is the dolphin. *Cosmodolphins* (Bryld and Lykke, 2000) is a feminist cultural studies work, utilizing Heidegger, Cassirer, various postmodern thinkers, and feminist philosophers, that reveals the ambiguities and ironies of contemporary attitudes to nature and the universe. High technology projects for space travel and extraterrestrial communication mirror quasi-religious beliefs about higher intelligences in outer space and New Age visions of harmony with nature. Dolphins have long been considered intelligent and worthy companions of humans. They have also been thought to be models for communication with alien intelligences by leaders of the SETI (Search for Extraterrestrial Intelligence) community. The experiments of neuroscientist John C. Lilly started as traditional, cruel, constraining and invasive neurophysiologic probes, but led Lilly to believe he was actually speaking with dolphins. Lilly himself moved to sensory deprivation tank immersion and LSD to attempt to achieve dolphin-like consciousness. His experiments received favorable popular attention worldwide, and many non-scientists today believe that human-dolphin conversation has been achieved.

The popularity of dolphin and orca performances at aquaria and aquatic parks show the popular fascination with cetaceans. Dolphin imagery has spread in advertisements for telecommunications and computer software. Carl Sagan, the solar system scientist of extraterrestrial life and TV popularizer of science, met a waitress at a Virgin Islands restaurant who then became Lilly's assistant, and soon came to head the research while Lilly was immersed, drugged, and incommunicado. Another leading physicist and popularizer of science, Philip Morrison, veteran of the Los Alamos A-bomb project and MIT professor, early advocated communication with dolphins as a bridge to communication with extraterrestrials. New Age occultists and NASA scientists are shown to share certain mythic and quasi-religious attitudes to dolphins. The claimed objective detachment and impersonality of science becomes mixed with religious awe and a desire to fuse with the cosmos. The masculinist image of cosmic domination through space travel becomes entangled in an ironic dialectic with the feminist and ecological

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utopia of unimpeded communication and cooperation with nature. The *Cosmodolphins* authors' project is to undermine the masculine/high technology versus feminine/occultism split. The cosmic fantasies of the proponents of the space program closely resemble those of spiritual ecofeminists and New Age occultists (Bryld and Lykke, 2000, p. 36).

The strange association of dolphins with extraterrestrials by both New Agers and mainstream scientists parallels the role of apes, both as symbol of idyllic nature and as agents of space exploration. Donna Haraway, in her chapter "Apes in Eden: Apes in Space" (Haraway, 1989, pp. 133–9), uses the *National Geographic* image of the hand of ape and woman (Jane Goodall) entwined (which also appears on the dust jacket of the book) as somewhere between holding hands and the touching of fingers of God and Adam in Michelangelo's Sistine Chapel ceiling. Surprisingly, in the contrast of apes in space with those in Eden, Haraway doesn't mention Tom Wolfe's portrayal of the jealousy of the human Apollo astronauts for the space apes in *The Right Stuff* (1979) or the movie made from it (1983).

Apes as well as dolphins are objects of human communication (see chapter 8), but are also physical objects to be manipulated and exploited by the military, as the dolphins are used to find undersea mines. Just as apes are often implicit stereotypic stand-ins for African or African American humans, from Tarzan to sociobiological studies of male inner city aggression (Goodwin, 1992; Breggin and Breggin, 1994; Wright, 1995; Sherman, 1998), so the ape–female relationship from King Kong to African primate researchers Jane Goodall and Dian Fossey can stand in for sexual as well as interracial relationships in popular culture. A recent, less literarily elegant example of apes as extraterrestrials, standing in for issues of gender and race, is the kiddy cartoon Scooby-Doo video *Space Ape at the Cape* (2003), set in Cape Canaveral, prior to a space launch with a trained ape. A rapidly growing supposed alien is thought to be from an extraterrestrial egg, but turns out to be an African American female researcher covering up the failure of her SETI science project, dressed in an ape suit.

Conclusion

Feminist philosophy of technology deals with a variety of issues with a variety of approaches. It counters the traditional downplaying of women's historical and contemporary role in technology, both as users and as innovators. It investigates the aspects of technology that particularly impact women

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in their traditional roles as mothers and homemakers, through reproductive technology and household technology. It also examines broader issues of masculinist attitudes to technology and nature, in which male technology manipulates and dominates female nature. Feminist philosophers of science and technology have been particularly sensitive to the metaphors and cultural resonance of technology that are often dismissed by the technologists themselves. Feminist philosophy of science and technology does not speak with one voice. Investigations range from empirical criticisms of biological, psychological, and technological claims about women's nature or (lack of) ability, to alternative visions of how science and technology might be if women had more say in the directions of research and development. Postmodernist feminism investigates the inadequacies of the very dichotomy between humans and nature that lies at the basis of much traditional philosophy of technology.

Study questions

- 1 Is the urge to dominate and control nature particularly male? Is it an outgrowth of capitalism? Of the Judeo-Christian tradition? Is it human nature?
- 2 Do you think the low representation of women in the fields of physics and physical engineering will change greatly in the near future? Why?
- 3 Does the notion that technologies have a "valence," are structured in such a way as to be easier to use for the purposes of some groups and not others (such as men and not women), make sense, or is technology intrinsically neutral with respect to uses and users?