

in *Machine ex Dea: Feminist Perspectives on Technology*, ed. by Joan Rothschild, Pergamon Press, 1983

9

Women and the Assessment of Technology: to Think, to Be; to Unthink, to Free

Corlann Gee Bush

Everything is what it is, what it isn't, and its direct opposite. That technique, so skillfully executed might help account for the compelling irrationality . . . *double double think is very easy to deal with if we just realize that we have only to double double unthink it.*

—Dworkin 1974, p. 63.

Although Andrea Dworkin is here analyzing Pauline Reage's literary style in the *Story of O*, her realization that we can "double double unthink" the mind fetters by which patriarchal thought binds women is an especially useful one. For those of us who want to challenge and change female victimization, it is a compelling concept.

SOMETHING ELSE AGAIN

The great strength of the women's movement has always been its twin abilities to unthink the sources of oppression and to use this analysis to create a new and synthesizing vision. Assertiveness is, for example, something else again: a special, learned behavior that does more than merely combine attributes of passivity and aggressiveness. Assertiveness is an unthinking and a transcendence of those common, control-oriented behaviors.¹

Similarly, in their books *Against Our Will* and *Rape: The Power of Consciousness*, Susan Brownmiller (1974) and Susan Griffin (1979) unthink rape as a crime of passion and rethink it as a crime of violence, insights which led to the establishment of rape crisis and victim advocacy services. But a good feminist shelter home-crisis service is something else again: it is a place where women are responsible for the safety and security of other women, where women teach self-defense and self-esteem to each other. In like manner, women's spirituality is something else again. Indebted both

to Mary Daly for unthinking Christianity in *Beyond God the Father* (1973) and *The Church and the Second Sex* (1968) and to witchcraft for rethinking ritual, women's spirituality is more than a synthesis of those insights, it is a transformation of them.

In other words, feminist scholarship and feminist activism proceed not through a sterile, planar dialectic of thesis, antithesis, synthesis, but through a dynamic process of unthinking, rethinking, energizing, and transforming. At its best, feminism creates new life forms out of experiences as common as seawater and insights as electrifying as lightning.

The purpose of this chapter is to suggest that a feminist analysis of technology would be, like assertiveness, something else again. I will raise some of the questions that feminist technology studies should seek to ask, and I will attempt to answer them. Further, I hope to show how scholars, educators, and activists can work together toward a transformation of technological change in our society.

The endeavor is timely not least because books such as this, journal issues, articles, and conferences are increasingly devoting time and energy to the subject or because technologically related political issues such as the antinuclear movement and genetic engineering consume larger and larger amounts of both our news space and our consciousness. The most important reason why feminists must unthink and rethink women's relationship to technology is that the *tech-fix* (Weinberg 1966, p. 6) and the public policies on which it is based are no longer working. The tech-fix is the belief that technology can be used to solve all types of problems, even social ones. Belief in progress and the tech-fix has long been used to rationalize inequity: it is only a matter of time until technology extends material benefits to all citizens, regardless of race, sex, class, religion, or nationality.

Technology has expanded our productive capacity so greatly that even though our distribution is still inefficient, and unfair by Marxian precepts, there is more than enough to go around. Technology has provided a "fix"—greatly expanded production of goods—which enables our capitalistic society to achieve many of the aims of the Marxist social engineer without going through the social revolution Marx viewed as inevitable. Technology has converted the seemingly intractable social problem of *widespread* poverty into a relatively tractable one (Weinberg 1966, p. 7).

While Weinberg himself advocates cooperation among social and technical engineers in order to make a "better society, and thereby, a better life, for all of us who are part of society" (Weinberg 1966, p. 10), less conscientious philosophers and politicians have seen in the tech-fix a justification for laissez-faire economics and discriminatory public policy. Despite its claim to the contrary, the tech-fix has not worked well for most women or for

people of color; recent analyses of the feminization of poverty, for example, indicate that jobs, which have always provided men with access to material goods, do not get women out of poverty.

Social welfare programs based on the old male model of poverty do not consider the special nature of women's poverty. One fact that is little understood and rarely reflected in public welfare policy is that women in poverty are almost invariably productive workers, participating fully in both the paid and the unpaid work force. The inequities of present public policies molded by the traditional economic role of women cannot continue. Locked into poverty by capricious programs designed by and for male policymakers . . . women who are young and poor today are destined to grow old and poor as the years pass. Society cannot continue persisting with the male model of a job automatically lifting a family out of poverty . . . (McKee 1982, p. 36).

As this example illustrates, the traditional social policies for dealing with inequity—*get a job*—and traditional technological solutions—*produce more efficiently*—have not worked to make a better society for women. Therefore, it is essential that women begin the unthinking of these traditions and the rethinking of new relationships between social and technical engineering.

UNTHINKING TECH-MYTHS

In her poem, "To An Old House in America," Adrienne Rich describes the attitude that women should take toward the task of unthinking public policy in regard to technology: "I do not want to simplify/Or: I would simplify/By naming the complexity/It has been made o'er simple all along" (Rich 1975, p. 240). Partly because it is in their best interest to do so and partly because they truly see nothing else, most politicians and technocrats paint the canvas of popular opinion about technology with the broadest possible brushstrokes, rendering it, in pure type, as TOOL, as THREAT, or as TRIUMPH.² From each of these assumptions proceed argument, legislation, public policy, and, ironically, powerlessness. In order to develop a feminist critique of technology, we must analyze these assumptions and unthink them, making them simpler by naming their complexity.

The belief that technology represents the triumph of human intelligence is one of America's most cherished cultural myths; it is also the easiest to understand, analyze, and disprove. Unfortunately, to discuss it is to resort to clichés: "There's nothing wrong that a little good old American ingenuity can't fix"; "That's progress"; or "Progress is our most important product." From such articles of faith in technology stemmed Manifest Destiny, the mechanization of agriculture, the urbanization of rural and nomadic cultures,

the concept of the twentieth as the "American Century," and every World's Fair since 1893. That such faith seems naive to a generation that lives with the arms race, acid rain, hazardous waste, and near disasters at nuclear power plants is not to diminish one *byte* either Western culture's faith in the tech-fix or its belief that technological change equals material progress. And, indeed, like all generalizations, this myth is true—at least partially. Technology *has* decreased hardships and suffering while raising standards of health, living, and literacy throughout the industrialized world.

But, not without problems, as nay-sayers are so quick to point out. Those who perceive technology as the ultimate threat to life on the planet look upon it as an iatrogenic disease, one created, like nausea in chemotherapy patients, by the very techniques with which we treat the disease. In this view, toxic wastes, pollution, urban sprawl, increasing rates of skin cancer, even tasteless tomatoes are all problems created through our desire to control nature through technology. Characterized by their desire to go cold turkey on the addiction to the tech-fix, contemporary critics of technology participate in a myriad of activities and organizations (Zero Population Growth, Friends of the Earth, Sierra Club, the Greenpeace Foundation) and advocate a variety of goals (peace, arms limitation, appropriate technology, etc.). And, once again, their technology-as-threat generalization is true, or at least as true as its opposite number: in truth, no one, until Rachael Carson (1955), paid much attention to the effects of technology on the natural world it tried to control; indeed, technology has created problems as it has set out to solve others.

Fortunately, the inadequacy of such polarized thinking is obvious: technology is neither wholly good nor wholly bad. "It has both positive and negative effects, and it usually has the two *at the same time and in virtue of each other*" (Mesthene 1970, p. 26). Every innovation has both positive and negative consequences that pulse through the social fabric like waves through water.

Much harder to unthink is the notion that technologies are merely tools: neither good nor bad but neutral, moral only to the extent that their user is moral. This, of course, is the old saw "guns don't kill people, people kill people" writ large enough to include not only guns and nuclear weapons but also cars, televisions, and computer games. And there is truth here, too. Any given person can use any given gun at any given time either to kill another person for revenge or to shoot a grouse for supper. The gun is the tool through which the shooter accomplishes his or her objectives. However, just as morality is a collective concept, so too are guns. As a class of objects, they comprise a technology that is designed for killing in a way that ice picks, hammers, even knives—all tools that have on occasion been used as weapons—are not. To believe that technologies are neutral tools subject only to the motives and morals of the user is to miss completely

their collective significance. Tools and technologies have what I can only describe as *valence*, a bias or "charge" analogous to that of atoms that have lost or gained electrons through ionization. A particular technological system, even an individual tool, has a tendency to interact in similar situations in identifiable and predictable ways. In other words, particular tools or technologies tend to be favored in certain situations, tend to perform in a predictable manner in these situations, and tend to bend other interactions to them. Valence tends to seek out or fit in with certain social norms and to ignore or disturb others.

Jacques Ellul (1964) seems to be identifying something like valence when he describes "the specific weight" with which technique is endowed:

It is not a kind of neutral matter, with no direction, quality, or structure. It is a power endowed with its own peculiar force. It refracts in its own specific sense the wills which make use of it and the ends proposed for it. Indeed, independently of the objectives that man pretends to assign to any given technical means, that means always conceals in itself a finality which cannot be evaded (pp. 140–41).

While this seems to be overstating the case a bit—valence is not the atom, only one of its attributes—tools and techniques do have tendencies to pull or push behavior in definable ways. Guns, for example, are valenced to violence; the presence of a gun in a given situation raises the level of violence by its presence alone. Television, on the other hand, is valenced to individuation; despite the fact that any number of people may be present in the same room at the same time, there will not be much conversation because the presence of the TV itself pulls against interaction and pushes toward isolation. Similarly, automobiles and microwave ovens are individuating technologies while trains and campfires are accretionary ones.

Unthinking tech-myths and understanding valence also require greater clarity of definition (Winner 1977, pp. 10–12). Several terms, especially *tool*, *technique*, and *technology*, are often used interchangeably when, in fact, they describe related but distinguishable phenomena. *Tools* are the implements, gadgets, machines, appliances, and instruments themselves. A hammer is, for example, a tool as is a spoon or an automatic washing machine. *Techniques* are the skills, methods, procedures, and processes that people perform in order to use tools. Carpentry is, therefore, a technique that utilizes hammers, baking is a technique that uses spoons, and laundering a technique that employs washing machines. *Technology* refers to the organized systems of interactions that utilize tools and involve techniques for the performance of tasks and the accomplishment of objectives. Hammers and carpentry are some of the tools and techniques of architectural or building technology. Spoons and baking, washing machines and laundering are some of the tools and techniques of domestic or household technology.

A feminist critique of the public policy debate over technology should, thus, unthink the tripartite myth that sees technology in simple categories as tool, triumph, or threat. In unthinking it, we can simplify it by naming its complexity:

- A tool is not a simple isolated thing but is a member of a class of objects designed for specific purposes.
- Any given use of tools, techniques, or technologies can have both beneficial and detrimental effects at the same time.
- Both use and effect are expressions of a valence or propensity for tools to function in certain ways in certain settings.
- Polarizing the rhetoric about technology enables advocates of particular points of view to gain adherents and power while doing nothing to empower citizens to understand, discuss, and control technology on their own.

"Making it o'er simple all along" has proven an excellent technique for maintaining social control. The assertion that technology is beneficial lulls people into believing that there is nothing wrong that can't be fixed, so they do nothing. Likewise, the technophobia that sees technology as evil frightens people into passivity and they do nothing. The argument that technology is value-free either focuses on the human factor in technology in order to obscure its valence or else concentrates on the autonomy of technology in order to obscure its human control. In all cases, the result is that people feel they can do nothing. In addition, by encouraging people to argue with and blame each other, rhetoric wars draw public attention away from more important questions such as who is making technological decisions?, on what basis?, what will the effects be?

CONTEXT, CONTEXT, WHITHER ART THOU, CONTEXT?

In unthinking the power dynamics of technological decision making, a feminist critique needs to pay special attention to the social messages whispered in women's ears since birth: mother to daughter, "Don't touch that, you'll get dirty"; father to daughter, "Don't worry your pretty little head about it"; teacher to young girl, "It doesn't matter if you can't do math"; woman to woman, "Boy, a man must have designed this."

Each of these statements is talking about a CONTEXT in which technological decisions are made, technical information is conveyed, and technological innovations are adopted. That such social learning is characterized by sex role stereotyping should come as no surprise. What may be surprising is not the depths of women's ignorance—after all, women have, by and large, been encouraged to be ignorant—but the extent to which men in

general, inventors, technocrats, even scholars, all share an amazing ignorance about the contexts in which technology operates. There are four:

1. *The design or developmental context* which includes all the decisions, materials, personnel, processes, and systems necessary to create tools and techniques from raw materials.
2. *The user context* which includes all the motivations, intentions, advantages, and adjustments called into play by the use of particular techniques or tools.
3. *The environmental context* that describes nonspecific physical surroundings in which a technology or tool is developed and used.
4. *The cultural context* which includes all the norms, values, myths, aspirations, laws, and interactions of the society of which the tool or technique is a part.

Of these, much more is known about the design or developmental context of technology than about the other three put together. Western culture's collective lack of knowledge about all but the developmental context of technology springs in part from what Langdon Winner calls technological orthodoxy: a "philosophy of sorts" that has seldom been "subject to the light of critical scrutiny" (Winner 1979, p. 75). Standard tenets of technological orthodoxy include:

- That men know best what they themselves have made.
- That the things men make are under their firm control.
- That technologies are neutral: they are simply tools that can be used one way or another; the benefit or harm they bring depends on how men use them (Winner 1979, p. 76).

If one accepts these assumptions, then there is very little to do except study processes of design and invent ever-newer gadgets. The user and environmental contexts become obscured if not invisible, an invisibility further confirmed by the fact that, since the Industrial Revolution, men have been inventors and designers while women have been users and consumers of technology. By and large, men have created, women have accommodated.

The sex role division of labor that characterizes Western societies has ensured that boys and girls have been brought up with different expectations, experiences, and training, a pattern that has undergone remarkably little change since the nineteenth century.

Games for girls were carefully differentiated from boys' amusement. A girl might play with a hoop or swing gently, but the "ruder and more daring gymnastics of boys" were outlawed. Competitive play was also anathema: A "little girl

should never be ambitious to swing higher than her companions." Children's board games afforded another insidious method of inculcating masculinity and femininity. On a boys' game board the player moved in an upward spiral, past temptations, obstacles, and reverses until the winner reached a pinnacle of propriety and prestige. A girls' playful enactment of her course in life moved via a circular ever-inward path to the "mansion of happiness," a pastel tableau of mother and child. The dice of popular culture were loaded for both sexes and weighted with domesticity for little women. The doctrine of (separate) spheres was thereby insinuated in the personality of the child early in life and even during the course of play (Ryan 1979, p. 92).

It is difficult to invent a better mousetrap if you're taught to be afraid of mice; it is impossible to dream of becoming an engineer if you're never allowed to get dirty.

As compared to women, men do, indeed, know a great deal about what they would call the "design interface" of technology; they know more about how machines work; they discovered the properties of elements and the principles of science. They know math, they develop cost-benefit-risk analyses; they discover, invent, engineer, manufacture, and sell. Collectively, men know almost everything there is to know about the design and development of tools, techniques, and systems; but they understand far less about how their technologies are used—in part because there is less money in understanding than in designing, in part because the burden of adjusting to technological change falls more heavily on women. What is worse, however, is that most men do not know that they do not know anything about women and the user context.

From the preliminary conceptualization to the final marketing of a product, most decision making about technology is done by men who design, usually subconsciously, a model of the physical world in which they would like to live, using material artifacts which meet the needs of the people—men—they best know. The result [is] technological development based on particular sets of male conditioning, values, and roles. . . (Zimmerman 1981, p. 2).

Ironically, until very recently, most women did not realize that they possessed information of any great significance. With all the cultural attention focused on the activity in the developmental context, it was hard to see beyond the glare of the spotlights into the living rooms and kitchens and laundries where women were working and living out the answers to dozens of un verbalized questions: How am I spending my time here?; How is my work different from what I remember my mother doing?; Am I really better off?; Why does everything seem so out of control? Rephrased, these are the questions that will comprise a feminist assessment of technology: How have women's roles changed as a result of modern technology?; Has women's

status in society kept pace with the standard of living?; Do women today have more opportunities or merely more expectations?; What is the relationship of material possessions to personal freedom?

Think for a moment about washing machines. Almost every family in the United States has access to one; across the country, women spend thousands of hours each day in sorting, washing, drying, folding, and ironing clothes. The automatic washing machine has freed women from the pain and toil described so well by Agnes Smedley (1973) in *Daughter of Earth*. But as washing technology has changed, so too has clothing (it gets dirtier faster) and wardrobes (we own more clothes) and even standards of cleanliness (clothes must be whiter than white), children change clothes more often, there are more clothes to wash. Joann Vanek (1974, p. 118), in her work on time spent in housework, asserts that women spent as much time in household related tasks in 1966 as they did in 1926.

More has changed, however, than just standards of cleanliness. Doing laundry used to be a collective enterprise. When I was a child in the late 1940s and early 1950s, my mother and grandmother washed the family's clothes together. My grandmother owned a semi-automatic machine but she lived 45 miles away; my mother had hot water, a large sink, and five children. Every Sunday, we would dump the dirty clothes in a big wicker basket and drive to my grandmother's house where all the womenfolk would spend the afternoon in the basement, talking and laughing as we worked. By evening, the wicker basket would again be full, but this time with neatly folded, clean smelling piles of socks, sheets, towels, and underwear that would have to last us a week. Crisply ironed dresses and slacks, on hangers, waited to be hung, first on those little hooks over the side doors of the car, then in our closets at home.

Nostalgic as these memories are, doing laundry was not romantic. It was exhausting, repetitious work, and neither my mother nor I would trade in our own automatic washers to go back to it (Armitage 1982, pp. 3–6). Yet, during my childhood, laundry was a communal activity, an occasion for gossip, friendship, and bonding. Laundering was hard work, and everyone in the family and in the society knew it and respected us as laborers. Further, having laundry and a day on which to do it was an organizing principle (Monday, washday; Tuesday, iron; Wednesday. . .) around which women allocated their time and resources. And, finally, there was closure, a sense of completion and accomplishment impossible to achieve today when my sister washes, dries, folds, and irons her family's clothes everyday or when I wash only because I have nothing to wear.

Admittedly, this homey digression into soap opera (One Woman's Wash) is a far cry from the design specification and cost-benefit analyses men use to describe and understand the developmental context of washing machines, but it is equally valid for it describes the user context in the user's terms.

Analyzing the user context of technological change is a process of collecting thousands and thousands of such stories and rethinking them into an understanding of the effects of technological change on women's lives.³ From unthinking the developmental context such and rethinking the user context, it is only a short step to studying the environmental and cultural contexts of technological change. Of these, our knowledge of the environmental context is the better developed, partly because we have given it more serious attention but mostly because environmental studies has been a legitimate career option for men.

While concern about the effects of technology on the natural environment is an idea that can be traced back to de Crevecoeur (1968 [1782]) and James Fenimore Cooper (1832), Rachael Carson (1955, 1961, 1962) is the person most responsible for our current level of ecological awareness and for the scientific rather than aesthetic basis on which it rests. As we learn more about the fragile reciprocity within ecosystems, we begin to unthink the arrogance of our assumption that we are separate from and superior to nature. In an ecosystem, it is never possible to do only *one* thing; for every action there are chain reactions of causes and effects. The continued survival of the world depends upon developing more precise models of the environment so we can predict and prevent actual catastrophe without being immobilized by the risking of it.

Perhaps no one could have foreseen that the aerosol sprays we used to apply everything from paint to anti-perspirant would degrade the earth's ozone layer, but no one seems to have asked. That drums for burying toxic waste would eventually corrode and leak seems so obvious that millions ought to have been able to predict the risk, yet no one seems to have had the desire or the clout to deal with the problem of hazardous waste before it became a crisis. In pursuit of progress, we have been content to ignore the ecological consequences of our technological decisions because, until it was pointed out to us, we did not realize that there *was* an environmental context surrounding the tools we use.

The environmental impact analysis (EIA) has become the most popular means by which governments and industries attempt to predict and assess the ecological impact of technological change. While most EIAs are long, tedious, and nonconfrontive, the idea behind them and much of the work that has gone into them is sound. In her articles on appropriate technology, Judy Smith (1978, 1981) from the Women and Technology Project in Missoula, Montana, has suggested that sex-role impact reports could be used to improve our understanding of the cultural context of technology in much the same way that the EIA has improved our knowledge of the environmental context.

And we do need something, for we know next to nothing about the interactions of culture and technology, having always seen these as separate

phenomena. Most people welcome technological change because it is *material*, believing that it makes things better, but it doesn't make them different. They resist social change because it is *social* and personal; it is seen as making things different . . . and worse. The realization that technological change stimulates social change is not one that most people welcome.

Feminists need to unthink this cultural blindness. Because women are idealized as culture carriers, as havens of serenity in a heartless world (Lasch 1977), women are supposed to remain passive while the rest of the culture is allowed, even encouraged, to move rapidly ahead. Women are like the handles of a slingshot whose relatively motionless support enables the elastic and shot to build up energy and to accelerate past them at incredible speeds. The culture measures its progress by women's stasis. When women do try to move, when they try to make changes rather than accommodations, they are accused of selfishness, of me-ness, of weakening the family, of being disloyal to civilization (Rich 1979, pp. 275-310).

However, it is crucial that feminists continue to unthink and rethink the cultural contexts of technology for a reason more significant than our systematic exclusion from it: it is dangerous not to. Technology always enters into the present culture, accepting and exacerbating the existing norms and values. In a society characterized by a sex-role division of labor, any tool or technique—it has valence, remember—will have dramatically different effects on men than on women.

Two examples will serve to illustrate this point. Prior to the acquisition of horses between the late sixteenth and mid-seventeenth centuries, women and dogs were the beasts of burden for Native American tribes on the Great Plains. Mobility was limited by both the topography and the speed at which people and dogs could walk. Physical labor was women's province in Plains culture, but since wealth in those societies was determined by how many dogs a person "owned" and since women owned the dogs, the status of women in pre-equestrian tribes was relatively high—they owned what men considered wealth (Roe 1955, p. 29). Women were central to the economic and social life of their tribes in more than the ownership of dogs. They controlled the technology of travel and food: they were responsible for the foraging, gathering, and preserving of food for the tribe and, in many cases, determined the time and routes of tribal migration. They had access to important women's societies and played a central part in religious and community celebrations (Liberty 1982, p. 14).

Women's roles in Plains Indian societies changed profoundly and rapidly as horses were acquired and domesticated. In less than two centuries—for some tribes in less than a generation—a new culture evolved. The most immediate changes were technological and economic; horses became the technology for transportation and they were owned by men. Women could still *own dogs*, but this was no longer the measure of wealth it had been.

With their "currency" debased, women's status slipped further as important economic, social, and religious roles were reassigned to men. As the buffalo became a major source of food and shelter, the value of women's foraging activities decreased. Hunting ranges were expanded, causing more frequent moves with women doing more of the packing up and less of the deciding about when and where to go. As each tribe's hunting range increased, competition for land intensified; and warfare, raiding, and their concomitants for women—rape and slavery—also increased.

Of course, not all the effects were negative. Technologies are substitutes for human labor: horses made women's work easier and more effective. Also, several tribes, including the Blackfeet, allowed a woman to retain ownership of her own horse and saddle. However, a woman was seldom allowed to trade or raid for horses, and her rights to her husband's herd usually ended with his death.

Thus, for Native American women, the horse was a mixed blessing. It eased their burdens and made transportation easier. But it also added new tasks and responsibilities without adding authority over those tasks or increasing autonomy. The opposite was true for men; the horse provided few new tasks and responsibilities—men had always been responsible for hunting, defense, and warfare—but it did enhance these traditional roles, giving men more decision-making authority, more autonomy, and more access to status. Paradoxically, while a woman's absolute status was greatly improved by the changes from dog to horse culture, her status relative to men actually declined. In this manner, horses changed the nature of Native American culture on the high plains, but women and men were affected in profoundly different ways.

A similar phenomenon occurred at the end of the horse farming era in the Palouse region of Idaho and Washington in the United States. During the 1920s, it was common for a farmer to employ 15 to 25 hired men and to use 25 to 44 horses to harvest his crops; farmers and their hands worked back-breaking, twenty-hour days. On the other hand, women also worked long days during harvest, cooking five meals a day for as many as forty people. During the year, women were responsible for a family's food, nutrition, health, safety, and sanitation. Women's work had economic value. Performing their traditional roles as wives, mothers, and homemakers, women were economically crucial to the survival of the labor intensive family farm (Bush 1982). Unfortunately, in the same manner that the horse made a Plains Indian woman's work easier even as it lowered her status relative to men, so too did the conversion from horses to diesel power and electricity ease the farm wife's hardships while it decreased the economic significance of her labor. In both cases, technological innovation had profoundly different consequences for men's and women's work. In both cases, the innovation was coded or valenced in such a way that it loaded the status of men's roles while eroding status for women.

TECHNOLOGY AND EQUITY

Technology is, therefore, an equity issue. Technology has everything to do with who benefits and who suffers, whose opportunities increase and whose decrease, who creates and who accommodates. If women are to transform or "re-valence" technology, we must develop ways to assess the equity implications of technological development and develop strategies for changing social relationships as well as mechanical techniques. To do this, we must have a definition of technology that will allow us to focus on such questions of equity.

Not surprisingly, there are no such empowering definitions in the existing literature. Equity has not been a major concern of either technophobes or technophiles. In fact, most definitions of technology fall short on several counts. The most commonly accessible definitions, those in dictionaries, tell us little: Webster's "the science of the industrial arts" and "science used in a practical way," and the American Heritage Dictionary's "the application of science, especially to industrial and commercial objectives" and "the entire body of methods, and materials used to achieve such objectives" are definitions so abstract as to be meaningless. Other attempts clarify function but lose the crucial connection to science, as in James Burke's (1980, p. 23) "the sum total of all the objects and systems used to produce goods and perform services."

Better definitions connect technology to other categories of human behavior and to human motivation:

A form of cultural activity devoted to the production or transformation of material objects, or the creation or procedural systems, in order to expand the realm of practical human possibility (Hannay & McGinn 1980, p. 27).

On rare occasions, definitions do raise equity questions as in John McDermott's attempt:

Technology, in its concrete, empirical meaning, refers fundamentally to systems of rationalized control over large groups of men, events, and machines by small groups of technically skilled men operating through organizational hierarchy (McDermott 1969, p. 29).

However, this definition is really defining *technocracy* rather than *technology*. More often, there are romantic definitions that enmesh us in cotton candy:

[Technology's task] is to employ the earth's resources and energy income in such a way as to support all humanity while also enabling all people to enjoy the whole earth, all its historical artifacts and its beautiful places without any man enjoying life around earth at the cost of another (Fuller 1969, p. 348).

While no one could argue with such ideals, Buckminster Fuller leaves us where the boon and bane theorists leave us—confounded by double-think. It is impossible to ask tough questions of such a definition or to examine closely why technology does not now support all humanity equally.

More distressing is the tendency of scholars to use the generic “he/man” to represent all of humanity. For example, “without one man interfering with the other, without any man enjoying life around the earth at the cost of another” is a statement that completely disregards the fact that, around the earth, men enjoy their lives at *women’s* cost. Similarly, statements such as “because of the autonomy of technique, man cannot choose his means any more than his ends” (Ellul 1964, p. 40) and “the roots of the machine’s genealogical tree is in the brain of this conceptual man . . . after all it was he who made the machine” (Usher 1954, p. 22) grossly mislead us because they obscure the historical and contemporary roles that women have played in technological development.⁴ Worse, they reinforce the most disabling myth of all, the assumption that men and women are affected similarly by and benefit equally from technological change.

Therefore, because of the oversimplification of some definitions and the exclusion of women from others, feminists need to rethink a definition of technology that both includes women and facilitates an equity analysis. Such a definition might be:

Technology is a form of human cultural activity that applies the principles of science and mechanics to the solution of problems. It includes the resources, tools, processes, personnel, and systems developed to perform tasks and create immediate particular, and personal and/or competitive advantages in a given ecological, economic, and social context (Bush in *Taking hold of technology* 1981, p. 1).

The chief virtue of this definition is its consideration of advantage; people accept and adopt technology to the extent that they see advantage for themselves and, in competitive situations, disadvantage for others. Thus, an equity analysis of an innovation should focus on benefits and risks within the contexts in which the technology operates. An equity analysis of a technology would examine the following:

The Developmental Context

- the principles of science and mechanics applied by the tool or technique
- the resources, tools, processes, and systems employed to develop it
- the tasks to be performed and the specific problems to be solved

The User Context

- the current tool, technique, or system that will be displaced by its use
- the interplay of this innovation with others that are currently in use
- the immediate personal advantage and competitive advantage created by the use of technology
- the second and third level consequences for individuals

The Environmental Context

- the ecological impact of accepting the technology versus the impact of continuing current techniques

The Cultural Context

- the impact on sex roles
- the social system affected
- the organization of communities
- the economic system involved and the distribution of goods within this system

A specific example will serve to illustrate how an equity analysis might be approached. Refrigeration was “invented” in the 1840s in Apalachicola, Florida, by John Gorrie as a by-product of his work on a cure for malaria (Burke 1980, p. 238). Gorrie’s invention was a freezing machine that used a steam-driven piston to compress air in a cylinder that was surrounded by salt water. (As the piston advances, it compresses air in the cylinder; as the piston retracts, the air expands.) An expanding gas draws heat from its surroundings; after several strokes of the piston, the gas has extracted all the heat available from the surrounding brine. If a flow of continuously cold air is then pumped out of the cylinder into the surrounding air, the result is air conditioning; if the air is continuously allowed to cool the brine solution, the brine itself will draw heat from water, causing it to freeze and make ice. If the gas (air) or brine is allowed to circulate in a closed system, heat will be drawn from the surrounding air or matter (food), causing refrigeration.

The Developmental Context

Thus, refrigeration applies the laws of science (specifically the properties of gases) and the principles of mechanics (thermodynamics and compression) to perform the tasks of making ice, preserving and freezing food, and cooling air. Refrigeration also solves the problems of retarding food spoilage and coping with heat waves, thereby creating personal advantage. The re-

sources and tools used include a gas, a solution, a source of energy, and a piston-driven compressor.

The developmental context is enormously complex and interconnected; however, a general analysis would include all the supply, manufacture, and distribution systems for the refrigeration units themselves—everything from the engineers who design the appliances, to the factory workers who make, inspect, and pack them, to the truckers who transport them, to the clerk who sells them. A truly expansive analysis of the developmental context would also include the food production, packing, and distribution systems required to make available even one box of frozen peas as well as the artists, designers, paper producers, and advertisers who package the peas and induce us to buy them.

The User Context

Refrigeration has affected our lives in such a myriad of ways that elaborating on them all would require another paper in itself. Refrigeration has important commercial uses as well as medical ones, and it would not be overstating the case to assert that there is no aspect of modern life that has not been affected by refrigeration. Nonetheless, a more limited analysis of refrigeration as it has affected domestic and family life in the United States is both revealing and instructive.

To the self-sufficient farm family of the early twentieth century, refrigeration meant release from the food production and preservation chores that dominated much of men's and women's lives: canning garden produce to get the family through the winter; butchering, smoking, and drying meat from farm-raised hogs and cattle; milking cows daily and churning butter. The advantages of owning a refrigerator in such a situation were immediate and dramatic: food could be preserved for longer periods of time so there was less spoilage; food could be cooked ahead of serving time allowing women to spend less time in meal preparation; freezing produce and meat was a faster, easier, and more sanitary process than canning or smoking, again saving women time and improving the family's health. The refrigerator thus generated positive changes for women, freeing them from hard, hot work and improving their absolute status. However, the second and third level effects of refrigeration technology were not as benign for women as the primary effects.

Since refrigeration kept food fresh for long periods of time, fresh produce could be shipped across country, thus improving nutrition nationwide. Food processing and preservation moved out of the home, and new industries and services paid workers to perform the duties that had once been almost solely women's domestic responsibility. Within the home, the nature of

women's work changed from responsibility for managing food production to responsibility for managing food consumption. Also, farmers stopped growing food for family subsistence and local markets and started growing cash crops for sale on national and international markets. Opportunities for employment shifted from farm labor to industrial labor, and families moved from rural areas to cities and suburbs. Thus, the use of refrigeration changed the work roles of individual women and men and, through them, the economy, the content of work, and the nature of culture and agriculture.

The Environmental Context

An analysis of the environmental context of refrigeration technology would examine the effects of the developmental and user contexts on the environment by asking such questions as: Since refrigeration affects agriculture, what are the ecological effects of cash crop monoculture on, say, soil erosion or the use of pesticides? Since refrigeration retards the growth of bacteria and preserves blood and pharmaceuticals, what are the consequences for disease control? What are the effects of increased transportation of food on energy supplies and air pollution?

The Cultural Context

Finally, an examination of the sex role impact of refrigeration technology would reveal a disparate effect on men and women. In the United States, men have been largely responsible for food production, women for food preservation and preparation. Refrigerators were a valenced technology that affected women's lives by, generally, removing food preservation from their domestic duties and relocating it in the market economy. Women now buy what they once canned. Women's traditional roles have been eroded, as their lives have been made easier. On the other hand, men, who originally had very little to do with food preservation, canning or cooking, now control the processes by which food is manufactured and sold. Men's roles and responsibilities have been loaded and their opportunities increased, although their work has not necessarily been made easier. Refrigeration has, thus, been adopted and diffused throughout a sexist society; we should not be surprised to learn that its effects have been dissimilar and disequitable.

THE GREAT CHAIN OF CAUSATION

Of course, not one of us thinks about the effects of refrigeration on soil erosion or women's status when we open the fridge to get a glass of milk.

We are gadget-rich and assessment-poor in this society, yet each private act connects us to each other in a great chain of causation. Unfortunately, to think about the consequences of one's actions is to risk becoming immobilized; so the culture teaches us to double think rather than think, and lulls us into believing that individual solutions can work for the collective good.

Of course, we can continue to double think such things only so long as we can foist negative effects and disadvantages off onto someone else: onto women if we are men, onto blacks if we are white, onto youth if we are old, onto the aged if we are young. Equity for others need not concern us as long as *we* are immediately advantaged.

Feminists above all, must give the lie to this rationale, to unthink it; for if the women's movement teaches anything, it is that there can be no individual solutions to collective problems. A feminist transformation of technological thought must include unthinking the old myths of technology as threat or triumph and rethinking the attendant rhetoric. A feminist unthinking of technology should strive for a holistic understanding of the contexts in which it operates and should present an unflinching analysis of its advantages and disadvantages. Above all, a feminist assessment of technology must recognize technology as an equity issue. The challenge to feminists is to transform society in order to make technology equitable and to transform technology in order to make society equitable. A feminist technology should, indeed, be something else again.

NOTES

1. I am indebted for this insight to Betsy Brown and the other students in my seminar "The Future of the Female Principle," University of Idaho, Spring 1982.
2. In *Technological Change: Its Impact on Man and Society* (1970), Emmanuel Mesthene identifies "three unhelpful views about technology: technology as blessing, technology as curse, and technology as unworthy of notice." He does not mention the "technology as neutral tool argument," perhaps because he is one of its leading proponents.
3. Obviously, oral history is the only way that scholars can accumulate this data. Oral historians should ask respondents questions about their acquisition of and adaptation to household appliances. Such questions might include: "When did you get electricity?"; "What was the first appliance you bought?"; "What was your first washing machine like?"; "How long did it take you to learn how to use it?"; "What was your next machine like?"; "When did you get running water?"; "Are you usually given appliances for presents or do you buy them yourself?"; etc.
4. This situation is slowly changing thanks to much good work by Elise Boulding (1976), Patricia Draper (1975), Nancy Tanner and Adrienne Zihlman (1976), and Autumn Stanley (1984, and this volume).

REFERENCES

Armitage, Susan. 1982. Wash on Monday: The housework of farm women in transition. *Plainswoman* VI, 2:3-6.

- Boulding, Elise. 1976. *The underside of history: A view of women through time*. Boulder, Colo.: Westview Press.
- Brownmiller, Susan. 1974. *Against our will: Men, women and rape*. New York: Simon and Schuster.
- Burke, James. 1980. *Connections*. Boston: Little, Brown.
- Bush, Corlann Gee. 1982. The barn is his; the house is mine: Agricultural technology and sex roles. *Energy and transport*. Eds. George Daniels and Mark Rose. Beverly Hills, Calif.: Sage Publications, 235-59.
- Carson, Rachel. 1955. *The edge of the sea*. Boston: Houghton Mifflin.
- Carson, Rachel. 1961. *The sea around us*. New York: Oxford University Press.
- Carson, Rachel. 1962. *Silent spring*. Boston: Houghton Mifflin.
- Cooper, James Fenimore. 1832. *The pioneer*. Philadelphia: Carey & Lea.
- Daly, Mary. 1968. *The church and the second sex*. New York: Harper & Row.
- Daly, Mary. 1973. *Beyond God the father: Toward a philosophy of women's liberation*. Boston: Beacon Press.
- de Crevecoeur, Michel Guillaume St. Jean. 1968. *Letters from an American farmer: Reprint of 1782 edition*. Magnolia, Mass.: Peter Smith.
- Draper, Patricia. 1975. !Kung women: Contrasts in sexual egalitarianism in foraging and sedentary contexts. *Toward an anthropology of women*, Ed. Rayna Reiter. New York: Monthly Review Press:77-109.
- Dworkin, Andrea. 1974. *Woman hating*. New York: E. P. Dutton.
- Ellul, Jacques. 1964. *The technological society*. New York: Knopf.
- Fuller, R. Buckminster. 1969. *Utopia or oblivion: The prospects for humanity*. New York: Bantam Books.
- Griffin, Susan. 1979. *Rape: The power of consciousness*. New York: Harper & Row.
- Hannay, N. Bruce; and McGinn, Robert. 1980. The anatomy of modern technology: Prolegomenon to an improved public policy for the social management of technology. *Daedalus* 109, 1:25-53.
- Lasch, Christopher. 1977. *Haven in a heartless world: The family besieged*. New York: Basic Books.
- Liberty, Margot. 1982. Hell came with horses: Plains Indian women in the equestrian era. *Montana: The Magazine of Western History* 32, 3:10-19.
- McDermott, John. 1969. Technology: The opiate of the intellectuals. *New York Review of Books* XVI, 2 (July):25-35.
- McKee, Alice. 1982. The feminization of poverty. *Graduate Woman* 76, 4:34-36.
- Mesthene, Emmanuel G. 1970. *Technological change: Its impact on man and society*. Cambridge, Mass.: Harvard University Press.
- Rich, Adrienne. 1975. *Poems: Selected and new 1950-1974*. New York: W. W. Norton.
- Rich, Adrienne. 1979. Disloyal to civilization. *On lies, secrets and silence: Selected prose*. New York: W. W. Norton.
- Roe, Frank Gilbert. 1955. *The Indian and the horse*. Norman, Okla.: University of Oklahoma Press.
- Ryan, Mary P. 1979. *Womanhood in America: From colonial times to the present*. 2nd ed. New York: Franklin Watts.
- Smedley, Agnes. 1973. *Daughter of earth*. Old Westbury, N.Y.: The Feminist Press.
- Smith, Judy. 1978. *Something old, something new, something borrowed, something due: Women and appropriate technology*. Butte, Mont.: National Center for Appropriate Technology.
- Smith, Judy. 1981. Women and technology: What is at stake? *Graduate Woman* 75, 1:33-35.
- Stanley, Autumn. 1984. *Mothers of invention: Women inventors and innovators through the ages*. Metuchen, N.J.: Scarecrow Press.
- Taking hold of technology: *Topic guide for 1981-83*. 1981. Washington, D.C.: American

- Association of University Women.
- Tanner, Nancy; and Zihlman, Adrienne. 1976. Women in evolution: Part I: Innovation and selection in human origins. *Signs* 1 (Spring):585-608.
- Usher, Abbott Payson. 1954. *A history of mechanical inventions*. Cambridge: Harvard University Press.
- Vanek, Joann. 1974. Time spent in housework. *Scientific American* 231 (November): 116-20.
- Weinberg, Alvin M. 1966. Can technology replace social engineering? *University of Chicago Magazine* 59:6-10.
- Winner, Langdon. 1977. *Autonomous technology: Technics-out-of-control as a theme in political thought*. Cambridge: MIT Press.
- Winner, Langdon. 1979. The political philosophy of alternative technology. *Technology in Society* 1:75-86.
- Zimmerman, Jan. 1981. Introduction. *Future, technology and woman: Proceedings of the conference*. San Diego, Calif.: Women's Studies Department, San Diego State University.