WOMEN AND WORKPLACE TECHNOLOGY: EDUCATIONAL STRATEGIES FOR CHANGE

by

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ABSTRACT

Recent research focused on the impact of technological change shows that men and women are affected differently by such change, with women likely to suffer disproportionate negative impacts. This has been particularly true in the workplace.

In this work, popular views of technology were reviewed and analyzed in light of what each implies about the human/technology relationship. Original data about women's views of technology were obtained by means of a mail survey of clerical workers at Simon Fraser University. This was developed on the basis of earlier work with another union; some results from that study were also used.

In the first part of the study original data elicited information about attitudes towards technological change, and perceptions of present and future working conditions. Among the findings were: over 80% of respondants felt that technological change was inevitable and meant progress, 82% felt that it was important for business to introduce the latest technologies, but 96% also felt that other criteria than business criteria should be used in determining how it is introduced. While 21% of male respondants felt they should be entirely responsible for determining if a proposed technological change is appropriate or not, only 6% of the women shared this feeling.

In the second part of the study a workshop about technological change for women workers was designed, and a pilot test of its utility was conducted.

Of the educational programs reviewed, not all educational approaches are equally suited to the task of challenging popular views of technological change among groups of women workers. A review of educational approaches suggested that the most appropriate technique to this end was problem-posing popular education.

Technology assessment methodology was critically analyzed and reviewed as a tool for use in a workshop setting with women workers.

A pilot study was undertaken to determine the utility of the educational program, and to identify issues which might contribute to more effective educational programs. Preliminary findings indicated the workshop and materials were useful, and that technology assessment was a valuable educational tool. The pilot study also showed the value of using questionnaire results in designing curriculum. However, problems related to recruitment and access discouraged participation.

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Writing theses, like the rest of life is much easier when a person has support. Given that the study of women and technology is a fairly new area of concern, I have been very fortunate in that I have received a great deal of support from a number of people. My committee, Margaret Benston, Meredith Kimball and Hannah Gay has been a wonderful source of support and encouragement. They have given a great deal of time to reading and commenting on drafts of this work. Also, Arlene McLaren provided comments on an early draft of chapter three, and Sue Wendell provided comments on an early version of chapter four. In addition, Phil Bereano, from whom I first learned about technology assessment, has been a source of encouragement and support since we met in his classroom in 1978. Corlann Bush and Judy Smith, both of whom I met prior to returing to school, encouraged me to continue with my work, in the absence of an instituional affiliation. Fortunately, as a result of the hard work of the co-ordinating committee of the Women's Studies department at Simon Fraser University, who started the graduate program in which I am currently enrolled, there was eventually a place for me to study. I am grateful.

I have also been fortunate to live in Vancouver, which boasts a strong community interest in the social impacts of technology. To my delight, upon arriving in Vancouver, I found two groups who shared my concern about the social impacts of

technology on women. I am grateful for the support and stimulation I have received from members of the Women's Skills Microtechnology Working Goup, and the Inter-Union Microtechnology Working Group. So much suport and encouragement do I receive from these people that I can hardly stand the thought of missing meetings. For this I have to thank Margy White, Marcy Cohen, Nancy Jackson, Shiela McFadzen, Elizabeth Davakos, Kate McQuire, Maggie Benston, Marion Pollack, Elaine Decker, Lynn Bueckert, Elaine Bernard, Susan Stout, Ken Hansen, Jean Greatbatch, and anyone I might have forgotten.

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CHAPTER I

INTRODUCTION

For as long as there has been technology, there have been social critics concerned with how technology affects culture. Among those concerned with the social impacts of technological change have been academics, governments, workers and activists (luddites, the alternative energy/appropriate technology movement, the peace movement). As new technology has been introduced and the pace of technological change has quickened, concern about the social impacts of technological change has grown. Before the late 1960's, only the odd book about the impact of technology on society appeared, most notably Mumford, (1934) Giedon, (1948) Ellul, (1967) and Walker, (1962); since that time entire bodies of literature have emerged, representing various perspectives about the impact of technology on society.[1]

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[1] Historians of science and technology include White (1968) Vanderbilt (1974) and Flink (1970). Rosenberg (1972 & 1979) is concerned with the economics of technological change, while Pursell, (1979) Kasson (1976) Noble (1977) and York (1976) have been concerned with the relationship of technology to government. For material which addresses how workers are affected by technological change see Braverman (1974) and Noble (1984). Luddism is addressed by Robins and Webster (1985) and Kohl in Processed World 14(1985). Since the late 1960's the impact of technology on society has become a topic of university courses, as evidenced by texts edited by Teicg (1972) Bereano (1976) and Burke and Eakin, (1979). Material in praise of technology includes Florman (1976) Frekiss (1969) and Drucker (1970). Material questioning the extent to which humans control technology includes Commoner (1972) and Winner, (1977). For coverage of technology assessment which became institutionalised in the United States in 1972 see Porter et.al. (1980). Two anthologies, edited by Zimmerman (1983) and Rothschild (1983) marked the emergence of a body of literature concerned with

While early work made some claims, since disputed, it also identified some critical issues, warranting further study. Giedion's (1945) work on the impact of technology on women's work in the home is a good example. In his work, Mechanization Takes Command, Giedion asserted that curtailed household drudgery, which resulted from technological change and improved organization, lead to greater independence, that is, to the enfranchisement of the housewife. Technology was seen as a liberating force, which would free women from drudgery while allowing them to more scientifically conduct their work in the home. While this assertion has been widely and successfully disputed (Cowan, 1974, 1976, 1983; Hartmann, 1974; Strausser, 1982; Vanek, 1974, 1978), Giedion's work was in some ways insightful. He recognized that women were affected differently by technology than men, and he sees the work process as separate from the use of mechanized tools. He not only accorded housework the status of work, which was organized in a particular way, he also recognized that the organization of the work process was imposed upon women.

Since Giedion's time, the organization of work processes imposed upon women, both in and outside of the home, has been more clearly defined. Studies by Hartmann, (1974; 1976) Glazer-Malbin, (1976) and articles in Rothschild, (1983) outline the work process in the home, and Albury and Schwartz, (1982) Hartmann, (1976) and Feldberg and Glenn, (1983) give important

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[1](cont'd) women and technological change.

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analyses of women's work outside of the home. As the widespread use of computers was ushered in in the late 70's and early 80's, labour's interest in technology and its effect on work has grown.[2] Women and workers began developing their own analyses of the future in light of technological change, with feminists focusing on how gender relations express themselves in relation to technology and technological change (See footnote one).

The last decade has brought with it material which explores the general dynamics of women's relationships to technology, as well as the particular impacts of technology on women's work. Important contributions include articles by Benston (1983a; 1983b) Feldberg and Glenn (1983), Menzies (1982), Werneke (1983), White, (1985) and Women's Skill Development Society (1981; 1986).

Early work in this area established that technology is an equity issue; that is that costs and benefits of technological change are not automatically distributed equally, but rather any power imbalance (e.g. gender relations) is mediated through technology. Cowan (1974, 1976, 1983) illustrates that while women have benefited in an absolute sense as a result of tehcnological change, their status relative to men has declined. Benston (1983) and Menzies (1981, 1982) have discussed changes occurring in women's work as a result of new technology. Both have noted that there is a decline in the amount of work

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[2]See for example Cockburn (1983), Cooley (1980), CSE (1980) Levidow and Young (1981; 1985), and Noble (1984).

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available, because of technological change. Smith (1979, 1983) has advocated conducting sex role impact studies about technology, while Bush (1983) has proposed a feminist method for assessing technology. Rothschild (1983) and Zimmerman (1983) have both edited books which include articles on a wide range of these concerns. Technology affects women and men differently, and this perpetuates women's inferior status to men (Smith, 1979, 1981; Zimmerman, 1981, 1983). Other work, which took the form of case studies about the effects of various technologies on women has substantiated this point (Cowan, 1974, 1983; Sharp, 1985; Vanek, 1974, 1978).

The last decade has also seen a growth in material which addresses three issues related to the impacts of technology on women's work in the paid labour force. They are 1) the effects of the increase in female participation in the paid labour force, (Swan 1982; Economic Council of Canada, 1983, Armstrong, 1984), 2) particular concern about the consequences of women's employment in jobs that are usually low paying and offer little opportunity for advancement into higher paying jobs which offer promotional opportunities (MacDonald, 1980). This has been linked to a general climate of recession and economic restructuring; 3) the general impact of technology on work, (Braverman, 1974; Noble 1977, 1979, 1984; Zimbalist, 1979).

Three main issues have become especially important. First, some literature has focused on the impact of micro-technology on the elimination of clerical, sales and service jobs. Although

evidence on the overall impact on employment remains controversial, most reports agree that it is the occupations in which women have traditionally worked which will experience the greatest layoffs (Menzies, 1981; Labour Canada, 1983; Science Council of Canada, 1980).

Secondly, some literature has focused on changes in the quality of work which occurs when technological innovation occurs during an economic restructuring. As skill structures undergo changes, changes occur in the type of employment opportunities available for women. One trend seems to be that during the later stages of computerization, women's work can become deskilled, and the sexual division of labour can increase (Benston, 1983; Hacker, 1979; 1981; Feldberg and Glenn, 1983; Zimmerman, 1983). Other trends which can occur including job diversification and reskilling, have been indentified in research conducted by Women's Skills Development Society (1986).

Thirdly, there has been concern with how the new technology will affect the organization of work, and how this in turn will affect the quality and quantity of employment open to women. For example, Reid and Schwartz (1982) have focused on the decline in full-time employment and the growth in part-time employment, and how this will affect women's wages and benefits.

Most work has focused on identifying the impacts of technology on women. The overall view is that there are major negative effects possible, and even likely. Beyond such

descriptive work, however, little attention has been paid to important issues of how women are responding to technological change and how technological change in the workplace supports and encourages inferior status to men. The question of what, if anything, can be done about the negative impacts women might experience as a result of technological change has also received little attention. [3] In short, most of the work about women, technological change and the workplace has been quick to describe the problems, while not providing any potential solutions.

This work is an attempt to move toward such solutions. It attempts to gather information about how women respond to technological change and use that information to develop an educational program that might encourage women to become more involved in designing technology and recognising how it is used in their lives. To this end, the attitudes, beliefs and feelings towards technological change of a test group of women clerical workers were investigated. Second, educational materials and a curriculum for a workshop to teach women workers about technological change in an empowering way were developed and a preliminary assessment of their usefulness was carried out, through a pilot study. The pilot study yielded information which will improve the effectiveness of future efforts to conduct labour education for women on technological change.

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[3]For exceptions see Women's Skill Development Society, 1982, 1986.

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In discussing this study, I begin in chapter two by considering popular attitudes towards technology, and models of the human/technology relationship, especially those held by workers. Workers' views of technology are discussed. Original research, and the work of Taviss, (1972) suggests that popular views of technology are contradictory. Among the possible explanations for explaining these contradictions is the one offered by Noble (1982) that ideological subordination at the point of production ensures that workers remain somewhat blind, or at least powerless in relation to workplace technology. Through looking first at models of the human/technology relationship and popular attitudes towards technology, and later at the contradictions in workers attitudes towards technology, it has become clear that challenging popular views towards technology will be an important step in an educational program designed to encourage a resolution of workers' contradictory attitudes towards technology, and equity in relation to technology.

In chapter three educational approaches suggested by a wide range of adult educators are critically reviewed. Like popular attitudes towards technology, many approaches to adult education contribute to the reproduction of a dominant ideology such as the supposed women's inferior status to men. A thorough investigation of a range of approaches proves that despite its limitations, this material does prove to be useful in developing a socially transforming approach to adult education. However,

adult educators have neglected to consider the education of workers about technological change in the workplace, so that a new, informative approach needs to be developed to teach women workers about technological change.

In chapter four technology assessment, a unique form of policy analysis, is critically reviewed. In particular, the extent to which technology assessment might be used as an educational tool with women workers, is considered. After discussing the limitations of technology assessment, I present a model for assessing technology, which, unlike traditional technology assessment models, should aid women in determining how they are affected by technological change. The chapter ends with a brief discussion of how technology assessment might be used as an educational tool, within the educational framework developed in chapter three.

In chapter five, the development of those research instruments which are employed in the study are discussed. First, the questionnaire used to elicit workers attitudes, beliefs and feelings about technological change is discussed. The development of the curriculum and design of the workshop which was conducted for women workers about technological change are then discussed. Next, the pilot study which was undertaken to investigate the value of the workshop and related materials, is discussed.

In chapter six the results of the questionnaire are discussed, and in chapter seven, the results of the pilot investigation of the workshop and curriculum about technological change are discussed. Finally, in the concluding chapter, the implications of the questionnaire results and results from the pilot study are discussed in terms of their implications for labour education for women.

CHAPTER II

TOWARDS A CRITICAL VIEW OF TECHNOLOGY

In order to understand social change, and certainly to
direct it, a social theory is necessary. A theoretical
model of the way in which society operates is important
as a basis for purposeful social policies.....However,
there is no commonly accepted social theory, or
ideology..(Bereano, 1976 p.53).

While there is little agreement about the specific details

of the effects of technology on society, many writers agree that

the type of society currently being formed is different from

earlier forms of society. This new form of society has been

called postindustrial by Bell (1967), the post-scarcity society

by Bookchin (1971) and Noble (1984) cites frequent use of the

term second industrial revolution to describe the new era. As

was pointed out in the introduction, there is an increasing

effort to analyse the effects of technology on society, and to

go beyond these broad characterizations to determine the general

dynamics of human/technology interaction.

For Gay (in press) good models are important because in

addition to helping us think about the past and present, they

influence how we plan for the future. In light of the goals of

this work to explore women workers' attitudes towards technology

and to develop empowering educational materials in relation to

technological change, it is important to explore the various

models which explain the dynamics of human/technology

interactions. By discussing and analysing current approaches to

the study of human/technology interactions, it is possible to

explicitly formulate an approach which will be used in developing educational materials. In addition to developing such a model of technological change, it is important to understand the popular views of technology on which various models of the technology/society interactions are based.

The Technology/Society Relationship

One of the most frequently discussed views of technology is that articulated by Ellul (1967) in The Technological Society. Technology is seen as operating free of human control, and humans are viewed as technology's subjects. Human consciousness is viewed as formed by technology, in the interest of technological progress. Ellul views the process of technological change as ireversible, and cites only three conditions which might alter its path. They are 1) a general war, 2) a form of revolutionairy awakening, and 3) Godly intervention.

Underlying Ellul's (1967) perspective is his separation of machine from technique. Technique is the systematic organization of the human environment into rational, purposive methods and ends. Technique in the sense that Ellul uses it is the sum of individual techniques used to ensure a given end. As Olsen (1983) points out, to Ellul, technique has become an end in itself, and people are but a component of its autonomous force. The machine is not the problem, however much it contributes to the process. Rather, technique amplifies problems caused by

machines, but does not depend on machines for its existence. Ellul divides technique into four branches, mechanical, economic, organizational and human, the last three of which have been subject to human dominance, which has resulted in our problematic technological society.

Among the factors that Ellul (1967) views as central to the development of technological society is technical intention, which has resulted in part from the marriage of science and technology.[1] As Bush (1983) points out, Ellul ascribes a "specific weight" to technology. So, for Ellul, technology is not neutral, but rather is a power endowed with its own force, which functions independently of objectives assigned to given technical means. Ellul does not feel the system is totally autonomous, and so he asserts that people will never be totally ruled by machines. He also does not view individual or collective action as powerful enough to alter the direction of technological change. Ellul, often referred to as a technological determinist, articulates a position which Mesthene (1970) has characterized as 'technology is inevitable doom.'

Ellul's view, while a minority rather than popular view of technology is important because he insists that technology is not just machines, but rather, that it also includes the social organization of society. While the concept of technique is useful, the power Ellul ascribes to machines and his sense of

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[1]The marriage of science and technology is discussed at great length in Noble's _America By Design_ (Oxford University Press, London, 1977).

machines as immutable are concepts which, as Gay (in press, p.3) points out, are counter to much critical and feminist theory. Feminist theory and critical thinkers assume that desirable social change is possible; since people create society they can change society.

While Ellul's vision is referred to by Olsen (1983) as dystopian, Mesthene (1970) considers it pessimistic. For Mesthene, technology is not independent of the society in which it develops and flourishes. Technology is not an autonomous force, but rather has social origins. While Mesthene is quick to point out that technology has an impact on society, he attributes this to the social setting in which technology is introduced. As Bush (1983) points out, although Mesthene describes three views of technology: 1) the motor of all progress, 2) an unmitigated curse, and 3) not worthy of special notice, he sees these as the dominant views in western cultures, but he fails to identify the view of technology to which he himself subscribes; the technology as neutral tool argument.

Mesthene (1970) along with Bush (1983) analyzes these three different views of technology, from which point he develops his own. While his characterizations of these popular views are quite broad, there is corroboration for them from other sources. Among others, Taviss (1972) in an article reporting on a survey of popular attitudes towards technology presents findings which indicate that Mesthene's characterizations are fairly accurate. For Mesthene, technology is knowledge organized for the

achievement of practical purposes. In constructing his view of technology, Mesthene begins with the assumption that technological change induces, or 'motors' social change, in two interrelated ways.

First, technology creates new personal and cultural opportunities, and second, it generates new problems. He views technology as having both positive and negative effects, at the same time. New tools create new opportunities, and inevitably, individuals and groups will attempt to capitalize on the new opportunities. During this process, in addition to gain some form of loss will occur. His inevitable technological changes are introduced into inevitable social situations; hence he does not address the distribution of the gains versus losses, but rather focuses on the potential of technology to solve problems created by earlier technologies.

Mesthene's (1970) view of technology, like Ellul's, (1967) is important, but of limited use to feminists. While Mesthene's and Ellul's views of technology (1967) make very different, and in some ways oposite claims about the technology/society relationship, one notable similarity exists. Both authors view technological change as inevitable. For Ellul, technological change is inevitable doom, while for Mesthene, technological change is inevitable progress. For both Mesthene and Ellul, with the sense of inevitability of technology comes abolishment of responsibility to look at whether or not the effects of technology are distributed homogeneously, and are experienced

equitably.[2] For women this translates into an assumption that men and women equally experience the social impacts of technological change, good or bad.

Several views underlie Mesthene's model of the technology/society relationship. Included among them are that technology is progress, it is neutral and value free, and how it is used determines if it is good or bad. Along with this is the underlying idea that ultimately the negative effects will be overcome (by the application of more technology) and that progress will result. Mesthene's model does not encourage an in depth analysis of the technology/society relationship. His model which too simply states that technology motors social change, only accommodates a description of the effects of technology on society. It does not encourage an analysis of what fuels what he describes as the motor of change.

In contrast, a feminist model of technology, in addition to allowing for collective action, should encourage an in depth analysis of how the process of technological change occurs. In light of many women's strained relationships with technology, a feminist model of technology must be practical, shedding insight on the ordinary and day to day aspects of life. A feminist model of technology should aid in the identification of sources of conflict experienced by women. In this sense it should locate technology in a social context. But most important, a feminist

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[2]Equitable should be understood here as fair and just, in particular, in relation to gender.

model of technology should encourage vision. For, without a change-provoking vision, women run the risk of living in a future which merely echoes, rather than transforms the past.

Fortunately, it is not necessary to begin building a feminist model of technology from scratch. Bush has developed a model of technology which, along with her definition of technology, encourages an unthinking and rethinking of the effects of technological change on women. By focusing on various contexts within which technology operates, including the user context, Bush's model becomes personal and practical enough to be of use to women. In addition, unlike Mesthene who recognizes there are costs and benefits associated with technology, but fails to consider the distribution of these, Bush develops a model of technology which encourages an analysis of how the costs and benefits of technology are distributed.

Bush begins developing her model of technological change by questioning the assumptions on which popular and academic opinion about technology - that technology is seen as neutral tool, as threat, or as triumph- are based. In disputing the asumption that technology is neutral, Bush (1983) considers guns.

Guns are a tool through which a shooter acomplishes his or her objectives. A gun can be used to kill another person for revenge, or to kill an animal for dinner. In the same way that 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 (Bush, p.154, 1983).

Further, to believe that technologies are only neutral tools

subject to the user's motives and morals is to miss their

collective significance.

In making this point Bush points out that Ellul identifies

something like valance when he describes the 'specific weight'

with which technique is endowed. She quotes Ellul (1967)

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 conceal in itself a finality which cannot
be evaded (Quoted in Bush, p. 155, 1983).

Technological systems, even individual tools have a tendency to

interact in similar situations in an identifiable and

predictable fashon. In discussing valance, Bush stresses the

importance of specific wieght to Ellul's concept of

technological determinism. Valance, however suggests that the

pull of technology is not totally determined, or totally random.

The result is that technology affects society in some

predictable ways.

The assumption that technology is a neutral tool is

appealing because it focuses on the human side of technology,

implying that technological problems are only social ones.

Further it implies that a simple change in those who control

technology will ameliorate technology's negative effects.

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Also problematic for Bush (1981) is the assumption that technology is a threat, the source of evil and cause of all contemporary ills including pollution, urban sprawl and tasteless tomatoes. Given this assumption, the solution to problems is seen as a retreat from technology. As Bush points out, the technology as threat assumption "is appealing because it provides an enemy to serve as a focus for frustration and discontent" (Bush, 1981, p.). This view also offers one simplistic solution to many extremely difficult problems: get rid of the machines.

The "technology as triumph" argument suggests that "since it is the job of technology to solve problems, there are no problems that technology cannot solve" (Bush, 1981, p. 6). All problems (e.g. acid rain, nuclear waste, exploding rockets) are seen as temporary glitches in a perfectible system. This assumption is appealing because it allows people to ignore the negative consequences of technology.

Along with Gay (in press) and Noble (1984), Bush (1983) recognizes the threat popular models of the technology/society relationship pose to the fight for women's equality. Bush explains this phenomenon:

> The assertion that technology is beneficial lulls people into believing that there is nothing wrong that can't be fixed, so they do nothing....The argument that technology is value-free either focuses on the human factor in technology in order to obscure its valance 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...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? (Bush, 1983, p.156)

From this type of analysis of popular opinion about
technology it becomes clear that popular models about
technology-that technology is tool, threat or triumph are
partially correct, while at the same time they are contradictory
and simplistic. Tools for example are not value free; one tool
may lead to the invention of others, and all tools and machines
increase one's ability to do work, which affects the
environment, beyond the innate capacity of the inividual (Bush,
1983).

Along with a recognition of the inadequacies of popular
opinion about technology comes the realization that technology
operates in several contexts. Bush (1981) outlines four; the
design or development context, the user context, the
environmental context and the cultural context.[3] The interaction
of technology with each of these contexts is reflected in her
definition of technology:

> 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,

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[3] The design or development context includes all the decisions
materials, personnel, processes, and systems necessary to create
tools and techniques from raw materials. The user context
includes all the motivations, intentions, advantages, and
adjustments called into play by the use of particular techniques
or tools. The environmental context refers to the effect of the
technology on the environment in which a technology or tool is
developed and used. The cultural context includes all of the
norms, values, myths, aspirations, laws and interactions of the
society of which the tool or technique is a part (Bush, 1983a &
b). (A more complete description of the contexts of technology
can be found in the appendix).

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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, 1981 p.1).

Through examination of the effects of a technology in the

various contexts in which it operates, she locates technology in

a social context. By defining the user context in which

technology operates, Bush (1983) gives technology a human

dimension where others have not. The effects of technology on

the user are given priority, along with another neglected area,

the effects of technology on the culture. Also, by defining

technology as a human cultural activity, through inverse logic

technology becomes something which can be subject to collective

action. People are no longer entirely subjects of technology,

but somehow create it as well.

By exploring the effects of technology in different

contexts, it becomes clear that technology is an equity issue.

The adaption of a technology will alter the distribution of

costs and benefits associated with the technology, within the

different contexts in which the technology operates. Bush

illustrates this in two examples, one which describes the

effects of the acquisition of horses on Native American women;

the other describes the effects of conversion from horses to

diesel power and electricity on farm women. In both cases,

"while a woman's absolute status was greatly improved...her

status relative to men actually declined" (Bush, 1983,

p.162).[a]

Among the virtues of this definition of technology is the inclusion of advantage. According to Bush (1983) acceptance and adaption of a technology reflect an assumption on the part of its developer and user that advantage will be gained through use of a new technology, and in competitive situations, others will be disadvantaged. In the workplace, when technology is used for competitive reasons this is useful, as it allows us to see that technology is socially constructed according to particular values. While Bush ascribes a specific weight or valance to technology, others, notably Braverman (1974), Noble (1984), and Feldberg and Glenn (1983) further elaborate on the social construction of technology.

Since others have developed models of technology which consider contexts in which technology operates, it is useful to look at other models in addition to Bush's. Pacey (1983) also considers the contexts within which technology operates. He has developed another definition of technology which is very similar to the definition developed by Mesthene (1970). In an attempt to stress the human side of technology, Pacey refers to technology-practice which is

> the application of scientific and other knowledge to
> practical tasks by ordered systems that involve people
> and organizations, living things and machines. (Pacey,
> 1983, p.6)

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[a] This phenomenon also occurs in the home; for elaboration see Cowan's <u>More Work For Mother</u> Basic Books, New York, 1983.

Pacey maintains that habitual use of the word technology in a restricted sense has resulted in some of the wider aspects of technology-practice being forgotten. He claims these aspects are brought into the forefront by the term technology-practice, which is composed of the technical, organizational, and cultural aspects of technology.[5]

To his credit, Pacey (1983) points out that beneath the overt technical difficulty associated with technology lie questions about the organizational aspects of technology, which have political connotations. As an example, he makes reference to the introduction of technology into the workplace:

> ...an issue about control over work raises questions about where power lies in the workplace, and perhaps ultimately, where it lies within industrial society (Pacey, p.12, 1983).

Unlike Ellul (1967) and to some extent Mesthene, (1970) Pacey's model implies that if the system surrounding technology can be better understood, better decisions about technology can be made.[6] This is a great departure from Ellul's or Mesthene's thinking on this subject. Within Ellul's (1967) framework, there would be no point in attempting to intervene in the technological change process, as technology is seen as

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[5] The technical aspect includes knowledge, skill, technique, tools, machines, chemicals, liveware, resources, products and wastes. The organizational aspect includes economic and industrial activity, professional activity, users and consumers, and trade unions. The cultural aspect of technology-practice includes goals, values and ethical codes, belief in progress, awareness and creativity. There is a rough parallel between these and Bush's (1983) design, user and cultural contexts.

[6] This is an assumption on which the area of technology assessment, discussed in chapter 4, was built.

autonomous. While Mesthene (1970) recognizes that social impacts result from technological change, and mentions that they can be mitigated to some extent, he views the impacts of technology as being value-neutral, and consequently misses much of the significance of intervening in the technological change process.

Pacey's perspective is a departure, like Bush's, from earlier models of the technology/society relationship in its consideration of aspects of technology-practice.[7] Gay argues that a model similar to Pacey's which considers the organizational and cultural aspects of technology will have considerable political advantages, "and not the least of these will be that the needs of women will, far more likely than is the case at present, be taken into account" (in press, p.6). However, while Pacey's model is useful in its consideration of aspects, or contexts within which technology exists, his definition of technology still seems remote, and could be misinterpreted to imply a one-way relationship between technology and society, where technology affects society, and society responds.

While this model begins to place technology in a social context by describing its aspects, Pacey's failure to be more specific in describing how the various aspects interact, and his

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[7]There are only a few others who try to broaden the definition of technology in this way and these are not generally as successful. For example, Hanny and McGinn also considered "external contexts of modern technology." They outline five of them: the governmental context, the environmental context, the financial context, the social context and the political context.

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failure to discuss what, if anything is mediated through the use of technology, make his model of human/technology interaction, incomplete. While similar to Bush, (though less thorough) Pacey does consider the potential of perceptions about technology to limit cultural definitions of technology, and consequently, how people interact with it.

Bush, on the other hand, in discussing the contexts of technology places technology in a social context and encourages the reader to think about technology as having a social bias. However, the concept of valance, while helpful in challenging the claim that technology is neutral, makes the causal relationship somewhat ambiguous. Valance implies that technology is designed to perform certain ways in certain situations. However, this term can be understood in an Ellulian sense, implying technology affects people, but people in turn do not have the ability to affect technology. While it invites people to consider that there is a social bias in machine design, it does not gaurantee that technology will be critically reviewed from this perspective.

Social Bias in the Design of Technology

> At every point, these technological developments are
> mediated by social power and domination...by
> legitimating notions of progress, and by the
> contradictions rooted in the technological projects
> themselves and the social relations of production
> (Noble, 1984, p.324).

Noble (1979) points out that most studies of production focus primarily on the ways in which technology affects social relations, and there has been little attention paid to illustrating precisely how technology reflects social relations. While Bush (1983) is not explicitly concerned with production (at least not financially remunerated production), a similar concern can be expressed about her work.

Although Bush's conception of technology considers advantage, the full ramifications of including the concept of technological development for advantage (which of course implies competition) are not thoroughly explored. One could stretch the concept of valance of technology to be understood as a reflection of social relations, which may in fact be how it was intended. However, by linking the propensity of technology to function in certain ways in specific situations to the technology itself, (as the concept of valance may be understood), rather than linking it explicitly to the social system which produces it, is to limit a potentially comprehensive understanding of the social bias of technology. While Bush's is a very useful, workable model, it must be somewhat expanded for use with groups of women workers.

For Braverman, (1974) author of Labor and Monopoly Capital, the study of technology grew out of attempts to understand occupational change. When initial research failed to present answers to the questions he posed, he broadened his interests to include the evolution of labour processes within occupations, as

well as the shifts of labor among occupations. In this context Braverman was led to include technology in his investigation. In doing so, he adapted a Marxian understanding of technology. "Technology, instead of simply producing social relations, is produced by the social relations represented by capital" (Braverman, 1974, p.20). Through theoretical and empirical analysis Braverman undermines the claim that new technology washes away boring jobs and replaces them with interesting and challenging jobs. Zimbalist (1979) points out that in doing this Braverman demonstrates the social bias of technology in capitalist society.

Braverman's (1974) work, however, has not escaped critical scrutiny. As Cohen and White (in press) point out, Braverman's proletarianization thesis, (which argues that the intent underlying the introduction of technology is to inevitably deskill the work force,) while making a great contribution to the definition of skill, fails to be generalizable across a range of clerical workplaces. In particular, Braverman's thesis implies that clerical workers face a diminishing supply of jobs as computers absorb clerical functions, and that remaining jobs will be routine, fragmented and highly controlled, offering little opportunity for advancement. Case studies conducted by Cohen and White challenge Braverman's assertion. In their research they found many contradictory trends emerging in the computerization of clerical work. While Braverman does demonstrate the social bias in technology, his analysis is class

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based, and excludes consideration of gender relations.[8]

Among those who have further explored issues initially addressed by Braverman (1974) is Noble, whose research (1979, 1984) on social choice in machine design reflects a comprehensive understanding of automatically controlled machine tools. In his first book, America By Design Noble (1977) shows that technology is not autonomous, but rather is the product of a social process, "a historically specific activity carried out by some people, and not others, for particular purposes" (Noble, 1979, p.18).

In describing the development of technology Noble points out that there is always a range of possibilities or alternatives that are delimited over time. Some are selected while others are not, based on social choices of those with the power to choose. These choices of course reflect "their intentions, ideology, social position, and relations with other people in society... technology bears the social 'imprint' of its authors" (Noble, 1979, p.19). Social impacts result not so much from the technology of production as the social choices which are embodied in the technology. Further, behind the technology which is affecting social relations lie the very same social relations; consequently, the technology tends to reinforce rather than challenge those relations.

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[8]This point is also made by Feldberg and Glenn (1983) whose work I discuss at greater length in chapter five.

By returning momentarily to the analysis of models presented in the beginning of this chapter we can see the real strength of this position. Noble (1979) asserts that with technology, the relationship between cause and effect is not automatic, but rather is mediated by a complex process whose outcome depends upon the relative strength of the parties involved. This of course implies that people can and do have an impact on the shape of technology in their lives. If we accept this position, we must then explain why women workers, in the face of potential control over technology, experience the range of negative impacts that have been documented. Noble's explanation and the course of action it implies are simple.

> "The technology of production is thus twice determined by the social relations of production: first, it is designed and deployed according to the ideology and social power of those who make such decisions; and second, its actual use in production is determined by the realities of the shop-floor struggles between classes" (Noble. 1979, p.19).

Technological development is a social process, and, like other social processes is marked by conflict and struggle, the outcome of which is indeterminate (Noble, 1984). Noble points out that adherents to views of technology expressed early in this chapter (technology as progress and technology as threat) are stuck in a web of beliefs which legitimate a lack of freedom. They have yet to learn there are no technological promises, and that there will be no technological salvation." For Noble, Technology serves simultaneously as the vehicle and mask of domination.

This analysis restores people to the role as subjects, rather than mere pawns of technology. Stressing that on the shop floor it is not only management choices that have an effect, Noble (1982) advocates direct confrontation. In addition, while vision is essential to politics, a strategy for the present is essential as well. After all, he cautions the reader, "what good is a strategy for the future without a strategy for survival in the present?" (Nobel, 1982 p.79). In addition to theory about technological change, this point has been put into practice by workers at Lucas Aerospace (see Cooley, 1980 and Wainwright and Elliot, 1982), and by Swedish workers, at the UTOPIA Project, (Swedish Center for Working Life, 1985).

Workers' Attitudes Towards Technology

Noble argues that ideas about technology serve an ideological function, as a mask of domination. Given this assertion, we should not be surprised to find confusion and contradictions surrounding workers' attitudes towards technology. Pacey (1983) is also concerned with confusion about technology. For him, technology has become a catch-word with many meanings. Because of the imprecise meanings associated with it, it becomes an arena for exploitation. He asserts that domination can be expressed through technology because people have a tangled set of unexamined beliefs about technology, which politicians, and those who operate other levers of power, exploit. Taviss' (1972) survey findings indicate that patterns

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of ambivalence in attitudes towards technology exist. The ambivalence is demonstrated when people agree with both positive and negative statements about technology. Taviss asserts that the patterns of ambivalences found in her sample may well represent those of a general population. Her findings are supported by original data from this and an earlier study (BRAC, 1986).

Why would anyone think something is positive when it affects them adversely? These data (table 2.1) indicate that there is an overwhelming sense that technological change means progress, that it solves more problems than it creates, that technology is neutral and value free and that how it's used determines whether it is good or bad. Yet, the same workers feel that technology changed their jobs in ways they viewed as undesirable (table 2.2).

While Pacey (1983) discusses the imprecise definition of technology as a problematic cultural problem, Noble (1984) links these contradictions to a dominant ideology. Taviss (1972) links the contradictions in attitudes towards technology to other things. She points out that because there are many facets of technology, people easily see both the benefits and dangers of technology, causing them to agree with both positive and negative statements about technology. In addition, she points out that among the less advantaged and less informed survey respondents, people do not blame technology for their condition. She speculates that they fail to make an association between

technology and their condition because they have both an inability to see any connection between technology and feelings of malaise, and a strong awareness of the general benefits of technology. Taviss' findings suggest that people can not easily develop their own analysis of technology.

This is congruent with Noble's (1979; 1982) theory, though Noble goes into greater detail concerning the process which makes it difficult for workers to develop their own analysis of technology.

> ...those under assault hastily abandon the field for lack of an agenda...Their own comprehension and critical abilities confounded by the cultural barrage, they take refuge in alternating strategies of appeasement and accommodation, denial and delusion...What is it that accounts for this apparent helplessness on the part of those whose very survival, it would seem, depends upon resisting this systematic degradation of humanity?...there is a serious imbalance of power between the opposing forces, and perhaps an immobilizing fear on the weaker side in the face of so awesome an assault (Noble, 1982, p.8).

For Noble, confusion about the nature of technological development, which is rooted in the political and ideological subordination of people at the point of production, is the cause of this situation. In addition, this ideological subordination of people at the point of production has required that the 'technology question' be removed from its site and social context. It has "invalidated their perceptions, knowledge, and insights about what is to be done, and has rendered them dependent upon others for guidance" in relation to technological change (Noble, 1982, p.9).

TABLE 2.1

Workers' Attitudes Towards Technological Change[1]

Belief	% Agree[2]	
	Group A	Group B
Technology is neutral and value free, how it is used determines if it is good or bad	89	-
Technology itself is neutral and value free	--	48
The way technology is used determines if it is good or bad	--	91
Technological change means progress	74	88
Technological change will cause more problems than it solves	28	-
Technological change will occur whether we want it to or not	92	89
Technology is inevitable doom	22	17

Note:Percentages are rounded.
[1] Group A is airline workers, n=740. Group B is university clerical workers, n=254, data collected for this study.
[2] For Group B, responses are collapsed from "agree strongly" and "agree somewhat."
[3] See Chapter 5 for a discussion of methodology.

TABLE 2.2

Workers' Experiences Of Technological Change

	% Agree
	Group A[1]

New Technology Resulted In:

More specialized jobs	80
Less positive contact with co-workers	71
More stressful jobs	76
Perception of decreased job security	82

Characteristics Workers Find Desirable In A Job:

A variety of tasks	80
Contact with co-workers	73
A healthy environment	86

Note:Percentages are rounded.
[1] This table includes only airline worker's responses,
because different response categories were used on the clerical
workers' questionnaire. Airline workers could respond with
'increased' or 'decreased' while clerical workers also had a 'no

change' category. Refer to chapter 6 for a discussion of why
this
was so.

The reproduction of attitudes towards work and technology do not occur in a vacuum. They occur within an organized set of social relations which revolves around a struggle for power, between management and workers,[9] and between men and women (Hartmann, 1981a; 1981b). As was pointed out earlier, because the social relations behind technology are the same social relations which technology affects, there is little hope of challenging these relations. To this extent, technology, in its present form, perpetuates the status quo.

Many scholars have explored the relationship between the social relations of capitalism to those of gender (Benston, 1969; Hartman, 1979) and while little consensus exists about the particulars of this relationship, it is clear that the power relations of capitalism play a role in legitimating gender relations. Gender relations in turn help legitimate the power relations of capitalism. Any attempt to consider the relationship of technology to the workforce should take this into account.

Conclusion

In the beginning of the chapter, the assertions of model builders were discussed and it was shown that workers do indeed hold some of the views of technology described early in the chapter. Several assumptions have guided the educational

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[9]See Edwards, 1974, 1979 for a good discussion of the social relations of production.

approach being developed. First, it was assumed that challenging

popular ideology around technology will be crucial to educating

about technology. Second, it was argued that contradictions in

views held about technology indicate the strength of ideology in

controlling our views of technology. Finally, it has been

assumed that helping people understand the flaws of popular

views of technology can be a legitimate goal for education.

Second, Because of the importance of these assumptions,

verification of popular views and examination of the

contradictions was important.

The two groups of workers studied displayed popular

attitudes about technology, which, as we have seen, offer little

hope of challenging gender and class relations. It was verifed

that there are contradictions and ambivalences in attitudes

towards technology. In addition, given the strength of the

prevalent ideology about technology (as exemplified in tables

2.1 and 2.2) it is clear that any educational strategy aimed at *

equality should begin by challenging attitudes towards

technology, as well as the social relations from which it

springs. Keeping this in mind, in chapter three educational

approaches are discussed, and in chapter four, techniques which

can be used to encourage inquiry of the sort outlined above,

will be considered.

CHAPTER III

REALLY USEFUL KNOWLEDGE: EDUCATION FOR EMPOWERMENT

In the same way that popular attitudes towards technology leave unquestioned the role of technology in perpetuating gender and class hierarchies, popular approaches to education leave unquestioned the role of education in capitalist societies. We have seen thus far that dominant ideologies about technology fail to provide women with any hope of escaping cultural subordination. In considering educational strategies which will empower women in relation to technological change, it is crucial to understand how the educational system contributes to the ideology of capitalism.

There are several approaches to adult education, which are reviewed in this chapter. While the various approaches appear to be quite different, evaluating the approaches in light of the goal of developing an empowering workshop for women about technological change illuminates many shortcomings. It will become clearly evident that among the shortcomings of several of the models is the failure to account for the instructor/learner relationship, the gender relations which characterize education, and the failure to critically consider the content of education.

Education and the Reproduction of Capitalist Ideology

The Random House Dictionary defines power as the "ability to do or act" (1978, p.700). Empower is defined as "to give power or authority to; to enable or permit" (1978, p.295). Any educational program designed to empower women in relation to technological change should encourage women workers to act in relation to technological change in a manner which will help bring their status in western capitalist societies on a par with men's status. No single educational approach is well suited to this task, and many approaches to education subtly reproduce gender and class relations.

Material concerned with adult education typically takes one of three forms. Philosophical approaches to education focus on the educational potential. The second or program planning approach is concerned with the principles and practices of planning educational programs. The third or sociological approach which will comprise the bulk of this chapter, focuses on key social processes such as the instructors' role in selecting material to teach to students. The relation of these processes to the dominant ideology of capitalism is the focal point of sociological analyses.

Elais and Merriam (1980) outline several philosophical approaches to adult education in their work <u>The</u> <u>Philosophical</u> <u>Foundations</u> <u>of</u> <u>Adult</u> <u>Education</u>. Among the approaches they describe are the liberal, progressive, behaviourist and humanistic philosophies of adult education. While on the surface each of these views appears to be quite different from the others,[1] none of the philosophical approaches to education are concerned with social relations, and in particular, power relations.

Each of these approaches is discussed below. It will become clear that all of these approaches fail to explain women's position in the labour market in terms of the power relations which characterize capitalism in western culture, and all of these approaches view a person's position in the labour force as somewhat fixed. The failure of these approaches to explain the gender stratification prevalent in our culture in general and in the workplace in particular renders them useless in terms of developing strategies to empower women in relation to technological change.

The liberal philosophy of education, assumes potential varies with innate characteristics. This would suggest that non-white and female populations are absent from high skill high wage positions because they lack the innate potential that a

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[1] See Elias and Merriam, 1980 for a thorough articulation of each of the philosophical approaches to education.

liberal education and a high paying high skill job demands. If we turn to the progressive or humanistic philosophies of education, both of which focus on the unlimited potential of the person, we could only explain the absence of non-white and female populations from positions of status and power by blaming the victim; since humans have unlimited potential, if they fail, it is because that potential has not been exercised. If we try to explain this phenomenon in light of behaviouralist philosophies of education which assume learning results from reinforcement, we can only conclude that most women and non-white men have not been in properly controlled environments where appropriate behaviours could be rewarded, and so they lacked the skills and knowledge to fill positions of status and power. This explanation implies that additional education would remedy the situation, and avoids the issue of why women and most non-white men haven't benefited from earlier education to the extent that most white men have.

The program planning approach to adult education organizes the "how-to" of education in a manner which detracts attention from consideration of content selection in education and the social relations of education. Along with the philosophical approaches to education, the program planning approach is part of an ideology which supports stratification of the labour force necessary to capitalism. The nine programming models compared by Boone (1985) in his recent book Developing Programs in Adult Education vary in the emphasis each places on the roles of

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administrators, teachers, counsellors and policy makers who are involved in the programming process (Boone, 1985). In addition, each model suggests its own set of unique relationships between the three subprocesses of educational programming; planning, design and implementation, evaluation and accountability (Boone, 1985).

Despite the appearance of diversity, the program planning approach to education assumes that the content of education is public knowledge which is mediated through teaching and instructional functions. Yet, it does not explain how this occurs. In other words, the role of the teacher is seen as more important than the content of knowledge, which revolves around it (Griffin, 1983). Consequently, the content of education escapes critical scrutiny, along with the social relations which characterize the educational activities. This failure to question either the social relations of education or social significance of content leads to educational programs which reproduce the social relations of capitalism through content selection and teaching style.

Sociological Approaches to Education

The failure of the philosophical approaches to education to question the social relations of education and the social significance of the curriculum led sociologists of education to these issues as a starting point in their examination of the

relationship of education to culture. While the philosophical and program planning approaches to education contribute to an ideology which supports capitalism, a great deal of the material which takes a sociological approach attempts to demystify capitalist ideology (Griffin, 1983). Central to this is a class analysis; sociological analyses of education begin by analysing schooling in terms of the way in which it reproduces capitalist relations of production (Griffin 1983); it is assumed that the school system serves capitalist society (Elias and Merriam, 1980).

For example, Bowles and Gintis (1976) depict schooling as a kind of training ground for capitalism, in which a new generation of workers are equipped with skills, attitudes, expectations and relationships to authority and control which are conducive to the smooth running of capitalist society. They suggest that that the function of the educational -system is to anticipate and produce conditions and relationships that exist between employers and workers in relationship to production (Thompson, 1983). The presence of structural equivalents to the social relations of production in school environments (e.g. relation of instructor to statement) socializes future workers for similar conditions in the labour force (MacDonald 1980).

Educational structures are understood as selective, allocating devices which reproduce the class structure, and determine educational success (MacDonald, 1980). Variations of the organization of schools and different forms of education

prepare children for different levels of the occupational structure. Lower levels of education emphasize rule following and close supervision, while middle and upper levels of education allow more space for initiative, in the direction of more independant activity (MacDonald, 1980). In this way, the social relations of education correspond with the stratified social relations of the workforce, which the educational system ensures is skilled, passive and competent (Thompson, 1980).

As Westwood (1983) points out, the sociology of education can make three major contributions to an analysis of adult education. An emphasis on locating education in relation to the wider socioeconomic structure, a recognition that children become adults whose views of adult education are formulated in relation to their earlier school experiences, and the consideration of education in relation to cultural transmission are essential to an understanding of how to radicalize adult education and create forms of socially transforming education. This is important to keep in mind in terms of determining an approach and criteria for content selection appropriate to educating women workers about technological change.

Griffin (1983) considers Bowles and Gintis' (1976) analysis somewhat deterministic, assuming a fairly uncomplicated relationship between the economy and the value structure or culture of a society. Along with Macdonald (1980) and Westwood (1983) he makes a distinction between cultural and social reproduction. Griffin maintains that the only way to understand

the selective functions of education is to explain how an elite culture takes on a reality as a common culture in society. This process is one of social and cultural reproduction, where the material interests of a dominant class are served by an educational system which imposes universal meaning and legitimacy upon a so-called common culture. Cultural reproduction, the transmission of values in the entire context of socialisation, is an element of the wider process of social reproduction which describes how material conditions, technology and manpower are themselves the object of the educational system (Griffin, 1983).

While the distinction between cultural and social reproduction may seem abstract, it allows us to see how the content of the curriculum is culturally significant. Public forms of knowledge and experience which are selected from the culture for transmission to students via the curriculum (Griffin, 1983; Thompson, 1983) can be seen as cultural capital, playing a role in cultural reproduction. O'Brien (1983) points out that the notion of education as the objective uncovering of truth and the subjective passing on of knowledge obscures the fact that truth and knowledge are socially defined and legitimated.(See chapter four on cognitive authority.)

Consideration of public or socially legitimated knowledge about technology clarifies this point. Despite the role of technology in history, and its relationship to labour studies (often a branch of sociology), courses on technology from a

social science standpoint are seldom taught in school. Most people go through life without knowledge of the Luddites,[2] and their struggle to have some control over how technology was used on their jobs.

Treatment of technological change in grade school and high school usually consists of acclaim for marvelous new devices. Though we are encouraged to think critically about literature, we are not encouraged to think critically about the social impacts of technology. While information exists which suggests that workers and other non-experts can control technology, it is not made public by the school system: that is, it has not been selected for inclusion in the legitimated curriculum. The exclusion of this type of information from the legitimated curriculum results in the reproduction of other kinds of ideas about technology; for example that technology is neutral and value free, that technology is inevitable progress, etc.

In the absence of a distinction between social and cultural reproduction, the curriculum is considered an instrument of social reproduction, which has led in England to an emphasis on the problem of education as one of recruitment (Griffin, 1983). And, as Thompson (1983) points out, to focus on access to education is to fail to recognize that only certain forms of education exist. Consequently, focusing on access will not alter

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[2]Though often mis-represented as ignorant anti-technology "machine smashers," the Luddites protested the introduction of new machines because they were opposed to the organization of work which accompanied the new machines. They merely wanted to have input in the design of technology.

the position of women in relation to men.

Griffin (1983) goes beyond the simple economic determinism of Bowles and Gintis (1976). He sees the cultural sphere as something which is mediated by forms of human action in the context of specific activities, contradictions and relationships among people as we go through life, not as a mere reflection of economic practices. Control is inherent to the processes of education; control occurs within the social relations of education, as well as through and within the curriculum (Griffin, 1983). Recent discussions about curricula have been concerned with a need to politicize issues and consider knowledge and culture in terms of social class and social control. While this has been important, it has in some senses divorced curriculum theory from the more practical or technical concerns of teachers and policy makers. (Griffin, 1983).

Theories of adult learning and discussions about the organization of provision, or why more adults don't participate in formal or structured education, give rise to theories about adult education, rather than of it(Griffin, 1983). Griffin further argues that the issue of whether adult education reproduces or transforms the curriculum categories of schooling must be a central concern of theory. Given that any theory of education must be a theory of practice, a theory of adult education is one of curriculum practice whose object it must be to explore the ways in which its aims, content and methods transform or reproduce the knowledge categories of schooling

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(Griffin, 1983).

While one might expect Griffin to turn to consideration of curriculum content and practice, in an important sense he fails to do so. By discussing the knowledge content of education in theoretical rather than practical terms, he contributes to the divorce of curriculum theory from the more practical concerns of teachers. However, he does introduce the reader to Johnson (1979) as well as Gelpi (1979), Freire (1972) and others who address in greater depth the content, methods and pedagogy of a transforming education. Before turning to a discussion about contents and methods of education, it is important to consider whether the sociological analyses of education outlined above will lend themselves to the development of an analysis of education and practices which will empower women. Any error or omission in an analysis of education will replicate itself in the practice of education which it implies.

While the sociological approach to education allows us to recognize the class nature of western capitalist society and how power relations necessary to capitalism are reproduced through the educational system, it largely fails to account for the different experiences of men and women who work in occupationally segregated jobs stratified along gender lines and experience different impacts of technological change according to gender. Unless gender is considered more centrally in the sociological analysis of education, the experiences of women in the labour force and in relation to technological change remain

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both hidden and unexplained.

As O'Brien points out, authors have either omitted women in their discussion of the sociology of education (e.g. Karabel and Hasley, 1977) or like Bowles and Gintis, have lumped gender issues together with race and ethnicity, which are considered external to capitalism. In its efforts to smoothly control the work process, capitalists must respect the wider prejudices of society (Bowles and Gintis, 1976). While Bowles and Gintis recognize that capitalism has adapted pre-existing 'social prejudices,' they fail to provide any reasons for why these exogenous variables exist.

Through omission and assumption, much of the work in the sociology of education fails to see that labour market segmentation is one of the most significant features resulting from the integration of the sexual division of labour, and in particular, patriarchical[3] power structures, into the capitalist, formation. Though Bowles and Gintis have suggested that the labour market is characterized by a dual labour force, their analysis masks the presence of sex-segregation within the labour market (MacDonald, 1980). Little recognized in this analysis of schooling is the potential correspondence between patriarchal authority structures, and the hierarchy of men over women which occur within the social relations of school and work processes (MacDonald, 1980).

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[3]Patriarchy is used in this paper to mean the power of men over women.

Bowles and Gintis' analysis rests on the assumption that girls and boys, and later men and women experience similar conditioning within the differential forms of schooling catering to different sectors of the wage labour force (MacDonald, 1980). Feminist scholarship concerned with the sociology of education questions this assumption, and in doing so, explains why women are taught from a different curriculum than men. Ample evidence (Gaskell, 1981; Macdonald, 1980; Thompson, 1983; Sells, 1980) demonstrates that men and women are taught different subjects, which helps ensure that the conditioning each group receives varies from the other.

Women are absent in higher level math and science courses in university streamed high school programs (Sells, 1980) and in vocational high schools, men and women are concentrated in trade and secretarial or domestic education, respectively (Gaskell, 1981). In discussing high school education, Macdonald (1980:17) points out that working class girls are often allocated to curriculum streams for the 'less able,' where they take classes in everyday life, citizenship and receive basic skills training. Courses include household crafts; cooking and sewing. She maintains that the concept of 'education for life' takes on a specific meaning within the ideological climate of patriarchy- education for domesticity, encouraging marital and maternal roles as primary goals in life. Clearly, this is an example of social reproduction. It also may be a basis for gender differences in attitudes towards technology.

Thompson (1983) points out that adult educational institutions prepetuate this trend. Women, who outnumber men as participants in adult education in England by roughly two to one, are both visible and invisible in adult education. Visible in numbers, they remain invisible as subjects of study in the curriculum, which displays the usual commitment to the social and cultural values of dominant groups, and to the dissemination of male centered knowledge. Thompson (1983) argues that the type of educational transmission characteristic of institutionalized adult education in England leaves unquestioned the social conditions which accord men value and prestige.

Many working class women do work in the paid labour force, which may seem to contradict MacDonald's and Thompson's argument that women are educated for domesticity. MacDonald however points out that the focus on domestic life for personal fulfillment which the educational system encourages, may partially explain why women are prepared to accept employment in the worst, lowest paid jobs within the secondary labour market. By both ensuring the continued existence of a reserve army of labour, and at the same time providing women with skills which will aid them in caring for adult male workers and transmitting culture to future workers in their family, the reproduction of capitalism is facilitated (MacDonald, 1980; Westwood, 1980).

Along similar lines, Thompson (1983) points out that the education system, which reflects the same interests and attitudes of the wider society, does little to challenge gender

discrimination and sexism. Like MacDonald, she argues that the main purpose of education is to replicate the division of labour required by capitalism, and to dispense definitions and attitudes which legitimise the propriety and apparent justice of an otherwise unequal society. And, like MacDonald, Thompson (1983) is critical of reproduction theories which fail to explain how girls are trained for domestic roles, and what this has to do with the reproduction of capitalism (Thompson, 1983). While reproduction arguments consider how education teaches us the role of worker, Thompson (1983) argues that unless women consider strategies for redefining their relationships with men in ways which redefine the distribution of power and oppression, that learning new roles will continue to be a poor substitute for the practice of liberation and freedom. To this extent, a sociological critique of education which fails to recognize the reproduction of gender roles and their importance to capitalism contributes to the ideology which supports capitalism, and women's oppression.

Before turning to a discussion of transforming content and methods of education, it is important to return briefly to Griffin's comment (1983) regarding the separation of theoretical discussions from discussions of content and methods of education. While Thompson (1983) does integrate discussions of pedagogy and content in her efforts to contribute to an almost non-existent body of information about how to understand and create socially transforming and empowering educational

experiences, she is in a minority. Some material which includes women in a sociological analysis of education criticizes the current content and pedagogy of education, and fails to propose alternatives (MacDonald, 1980; Westwood, 1980). Other work, largely written by activists, though valuable in its contribution to the practical aspects of education, often lacks a theoretical basis which prohibits us from demystifying the relationship of education to the oppression of women (Bunch, 1983).

Wertheimer's Labor Education for Women, probably the only volume which considers the special needs of women workers, sadly lacks any mention of capitalism or how women are oppressed in western capitalist culture. However, it is an important book in other ways. It is unique in its consideration of labour education as a legitimate form of adult education. As evidenced thus far in this discussion labour education is absent from most discussion about adult education. While some authors do discuss labour education (e.g. Gelpi, 1979), they fail to consider women as workers. While other authors (e.g. Freire, 1972) discuss how content and pedagogy can contribute to social transformation, in addition to omitting women from their discussions, they tend to be context specific, and hence somewhat inappropriate in terms of empowering women workers in relation to technological change.

Content and Pedagogy of Socially Transforming Education

Griffin (1983) and Thompson (1983) introduce the reader to a concept developed by Johnson (1979); really useful knowledge. Within the radical tradition of education, 'really useful knowledge' referred to real knowledge which served practical ends (Thompson, 1983). With this concept Johnson, a historian, makes a valuable contribution to the notion of a transforming curriculum for workers. Along with Harrison (1961) he constructs the social history of adult education within England in a class context. Johnson identifies the middle years of the nineteenth century as an important period in the development of working class education. Central concerns of this period were the struggles for socially relevant education, and a curriculum related to social change.

Johnson (1979) found evidence of the term really useful knowledge in the radical press of the early nineteenth century, Really useful knowledge was the best kind because it was practical. It consisted of "the acquirement of ideas concerning our conditions in life," (Johnson, 1979, p. 84)[4] Workers wanted to be informed about how to get out of their present troubles, and a monopoly of either capital or knowledge was seen as impeding this process (Johnson, 1979). In short, the concept of really useful knowledge embraced a theory of exploitation in the

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[4]Johnson's sources include the Co-operator (an early Owenite journal) The Pioneer (an Owenite/trade union journal) and the Poor Man's Guardian.

economic realm, a theory of state power and cultural domination (Johnson, 1979).

Johnson (1979) points out that radical working class educational movements developed a varied educational practice, which appeared to emphasize education for a more just social order, (by altering the knowledge content of learning), but was also concerned with men and women as educators of their own children. The teaching of one's children, which was improvised, made less of a distinction between children and adults in education than contemporary education. Griffin (1983) argues that the child-adult dichotomy is an institutional invention, which reflects the appropriation of childhood by the state; hence it is a political, rather than educational distinction. The knowledge content of education must be transformed in conditions which deinstitutionalize the child-adult dichotomy, if it is to achieve the visions of radical educators (Griffin, 1983). While Griffin provides us with a context within which to locate discussions of social relations, he fails to recognize the importance of the sexual division of labour in both the teaching of one's children, and the historical meaning of really useful knowledge.

Thompson (1983) relying on historical material demonstrates that it was male knowledge around which debates about really useful knowledge revolved. Culturally dominant assumptions about femininity were based on a domestic ideology which located women (who were excluded from early trade union activity except within

their own organizations and were forced back into the home whenever possible) in the home. By the second half of the 1800's, patriarchal family relations were being supported by the trade union movement in its struggle to protect men's jobs from female infiltration, and gain a family wage. Women were defined in relation to men as mothers and wives rather than as workers or political activists. This was reflected in the institutional provision of adult education, which addressed the perceived problem of cultural and moral deficiency of women through the provision of courses which stressed domestic training. Regardless of their aspirations, working class women were offered a curriculum which was limited to their domestic roles and their role in the reproduction of capitalism (Thompson, 1983).

Women's cooperative guilds were an important exception to this general rule. Flourishing in the late 1800's and early 1900's, the guild was not only an opportunity for education, but also an initiation into socialism and women's rights. The curriculum, organised at a local level by working class women included domestic management as a part of a broad provision which placed great emphasis on politics, economics and trade union rights (Thompson, 1983). Thompson points out that for the first time, a separatist working class organization provided an opportunity no patriarchal or philanthropic provision of education had intended or succeeded in offering; it gave working women a voice, free from male intimidation (Thompson, 1983).

An important feature of the guilds was their link with appropriate action; useful knowledge which was practical. The success of the guilds lay in the relevance to the material and cultural concerns of women (Thompson, 1983). While Thompson, like Freire, (1972) Gelpi (1979) and Griffin (1983), sees the importance of developing a popular education free from institutional pedagogy, she highlights the importance of relying on women's experiences to escape the trap of recreating pedagogy which reinforces patriarchal domination of women. So, while really useful knowledge can be a useful concept, it will only be useful to women when both the knowledge content of learning and the patriarchal relations of education are challenged and transformed.

Along with Griffin and Thompson, Gelpi addresses content and pedagogy of socially transforming education. Gelpi (1979 v.2) locates the sources of cultural development and educational change in social, cultural and economic struggles which take place at work and at home, and which can be found in the creativity of workers. He begins his rethinking of the educational system with these events. Similar to Johnson, he points out that workers are interested in education which would help diminish the gap between managers and workers, and which would not lead to new forms of domination in society (Gelpi, 1979 v.2). Reflecting on Marx's observations on the division of labour, Gelpi (1979 v.2) notes that social relationships tend to coincide with technical relationships in the process of

production In addition, the division of labour fragments workers into sub-groups. Thus, the reconstitution of the working class becomes one of the tasks of political and cultural action.

In efforts to fight the hierarchical division of labour and reject the cultural determinism it implies, Gelpi (1979) calls for the creation of conditions for the enlargement of educational and cultural practices. For Gelpi a forward view of education will begin with an examination of the contradictions of the exploiting and exploited classes and the haves and havenots. The search for alternative forms of education must take as its starting point new relations of production. It must consider the framework within which educational experiments are carried out, and their struggle to reverse the tendency of education to increase individual and groups' dependencies (Gelpi, 1979). With the transformation of work and the relations of production as the basis for worker education, information which reflects on the economic system such as political economy, economics and the organization of management structures of production should be considered from the beginning when educating workers. Work influences the lives of workers, and one must begin with existing conditions if an educational program is to be put into context (Gelpi, 1979). Within this context, discussion of workers' contradictory attitudes towards technology seems an appropriate place to begin discussing the effects of technology on work and workers.

With regard to pedagogy, the relationship of the instructor to learner, Gelpi (1979) argues for a pedagogy of choice. The active and creative status of the learner are stimulated in the educational process. In aiding workers in their analysis of the concrete situations in which they live, the trainer should not intervene except to help them to demystify the unknown (Gelpi, 1979). Theoretical instruction should take into account the fact that workers have acquired a practical experience in the class struggle and the production process of their work. Realizing that each person comes to an adult educational experience with negative attitudes and experiences from the past, an instructor should allow each person to discover their own possibilities and limitations, and offer them types of study which are adapted to their real needs (Gelpi, 1979).

While Gelpi stresses the importance of investigating the contradictions of the exploited and exploiting classes, he identifies the importance of mending the division of labour which divides workers into sub-groups, and advocates a pedagogy which begins with the workers' analysis of the concrete situations of their lives. Like Griffin, he fails to recognize the significance of the sexual division of labour to capitalism, and consequently its significance in explaining women's oppression. While he stresses adapting education to learners' real needs, he fails to recognize the significance of the sexual division of labour to capitalism, and consequently its significance in explaining women's oppression. While he stresses

adapting education to learners' real needs, he fails to question the patriarchal assumptions which lead to the definition of women's needs in relation to men. Were we to create educational materials and methods from the analysis posed by either Gelpi or Griffin, we would quite probably contribute to the reproduction of a class and gender stratified workforce, which differentially experiences the impacts of technological change. Within the context of creating educational materials and methods appropriate to empowering women in relation to technological change, such an approach would fail.

Freire (1972) like Gelpi has made an important contribution to concerns about content and pedagogy of transforming education. However, like Gelpi and Griffin, his pedagogical methods do not ensure that women's voice will be heard. Freire's pedagogy of the oppressed is based on an analysis of banking education which confines student's scope of action to one of receiving, filing and storing educational deposits. While allowing students to become collectors of education, it is alienating as it does not encourage inquiry or reflection on one's conditions. Within the banking concept of education, teachers project an absolute ignorance onto others which is characteristic of the ideology of oppression (Freire, 1972).

Teachers and students are opposed; teachers teach but do not learn while students learn from the teacher but do not encourage learning in the latter. In response to the problems inherent in the banking concept of education, Freire (1972) advocates the

problem-posing method of education, which he claims does not dichotomize the activites of teachers and students. Through a dialogue with students, the teacher moves knowledge from the realm of private property to that of the public domain, shared by all students. The role of the problem-posing educator is to create, along with students, an environment which accommodates the discovery of true knowledge, through the demystification of ideology. While the banking form of education attempts to submerge consciousness, problem-posing education strives for the emergence of consciousness and the critical intervention in reality.

Freire's concept of conscientization takes the solution of the teacher-student dichotomy as its starting point, and utilizes problem-posing education as a mechanism to encourage the emergence of consciousness. Conscientization is a process through which the learners learn to perceive the social, political and economic contradictions of their culture, and to take action against the oppressive elements which constitute the contradictions. This is accomplished through dialogue, which revolves around the codification and decodification tion of cultural images. Pointing out that an educational program which fails to respect the particular view of the world held by the people constitutes cultural invasion, Freire looks to the thoughts and language of the culture as a source of themes for the generation of dialogue. Codes, or images from the culture are viewed by students, who "split" or decode the whole, which

entails describing the situation, and discovering how the parts of the disjoined whole interact (Freire, 1972).

Data can also be used in a manner similar to Freire's (1972) codification and decodification. Data reporting on workers attitudes towards technology and experiences with technology on the job can be presented to workers, who in discussing it can "decode" the data. This approach also ensures that facilitators will have a resonable understanding of the world view held by the learners.

While Freire's methods are tremendously useful, and have been adapted by feminists, (e.g. Mies, 1983; Thompson, 1983) it is important to realize that strict adherence to Freire's methods, as well as proving impractical in western capitalist culture, can potentially reproduce women's oppression through the omission of coded images of women's experiences, and through a failure to provide women with a learning environment which is free from male intimidation and patriarchal domination. In western capitalist culture, if voluntary assistance is sought in coding cultural images, women are apt to be excluded as a result of their role in the home. If paid teams were used, unless the study were conducted by feminists with a class consciousness, it would be all too easy to omit women's concerns in selecting images from the culture to be used for codification.

Conclusion

In reviewing material on adult education, philosophical approaches to adult education are rejected on the grounds that they fail to take into account power relations, and in doing so, suggest an approach to education which reproduces the dominant ideology of western capitalist society which denies women equal status with men. Sociological approaches to education consider curriculum a social and political issue, rather than a concept related only to education. Curriculum is analysed in terms of class, status and power, and of central concern is how knowledge is defined, distributed and legitimated (Griffin, 1983). This approach allowed us to see how education reproduces worker's consciousness in ways which are profitable to capitalism (Bowles and Gintis, 1976).

While the sociological approach to education allowed us to see how the educational system reproduces worker's consciousness to meet the demands of capitalism, a great deal of the literature (Bowles and Gintis, 1976; Gelphi, 1979; Griffin, 1983; Johnson, 1979) fails to consider how gender roles are reproduced through education, and what, if any effect this has on the socialization of men and women for different roles in both the labour force and the home in western capitalist society.

While other literature focuses on women in the educational system, (Macdonald, 1980; Hughes and Kennedy, 1983; O'Brien,

1983; Westwood, 1980) for the most part this literature fails to provide information about how to educate women in an empowering way so that women question both the role of education in their oppression and the role of technology in their oppression. Material which does address the practical aspects of women's education stresses technique and educational process, but does not indicate why the suggested approach is adapted (Bunch, 1983; Werthiemer, 1981), and tends to say little about what the content should be. While Thompson's (1983) work does begin with a sociological analysis of women's education, and does consider process and content, this material does not mention technological change, and so proves to be inadequate when attempting to educate women workers for empowerment in relation to technological change.

Freire's (1972) problem-posing education, while providing no guarantee its use would result in adequate consideration of and inclusion of women, is none the less the basis for a workable model for an empowering education for women. Data which reflect women's experiences with technological change can be used in lieu of Freire's coded images. Discussion can be used as a vehicle for sharing experiences among participants and encouraging a common experience. The application of a problem-posing approach to the workshop developed in this study, along with other approaches which have been discussed here are discussed in chapter five.

The work of Gelpi (1979), Griffin (1983), Freire (1972) and Johnson (1979) while providing valuable insight into the content and methods whose goal it is to transform culture, prove to be inadequate for teaching women workers about technological change in an empowering way. Only by beginning an educational activity with an investigation of women's experiences and expectations in reference to their own needs and interests, which considers strategies for redefining women's relationships with men, can education be empowering for women (Thompson, 1983).

CHAPTER IV

TECHNOLOGY ASSESSMENT AS AN EDUCATIONAL TOOL

Technology assessment, as it was originally conceived, is a unique form of policy analysis. Recognizing that the social impacts of technological change had become so great that national policy and life were being affected, the United States Congress in 1972 authorized the establishment of The Office of Technology Assessment, which functions as a Congressional source of information. In addition, it was designed to provide analysis of problems related to technology which is nonpartisan, expert, objective, and anticipatory" (OTA, 1984).

Since the concept of technology assessment was introduced in 1967 (Porter, Rossini, Carpenter and Roper, 1980), there has been continual debate concerning many aspects of technology assessment; what it is, what it should be, how it differs from other forms of policy analysis, what components should characterize the assessment process, what methodologies should be used in conducting assessments, and whether or not current assessment activities meet the original goals outlined by Congress.

Although the discussions which have surrounded the evolution of technology assessment have been insightful and have contributed a great deal to the theory and practice of assessing technology, one issue has been consistently left out; whether or not technology assessment studies adequately consider how women

will experience the social and economic impacts of technological change. Though a few articles on this topic exist, (see Bush 1981 and 1983,) their focus has been to make women aware of the practice of technology assessment, rather than to evaluate how well technology assessment method and practice address women's concerns. Consequently, little is known about whether technology assessment holds any potential as a useful tool in changing women's relationships to technology.

In considering whether or not technology assessment holds any promise as a tool for empowerment, several issues must be considered. Technology assessment must be defined, its limitations identified and the treatment of women in technology assessment studies must be considered. In addressing these issues it is useful to consider cognitive authority, which affects all aspects of the technology assessment process. Once all of these issues are considered, it becomes possible to envision some of the ways technology assessment might be used to accomplish feminist ends, particularly its use as an educational tool.

Overview of Technology Assessment

Several authors (Coates, 1973a; Arnstien, 1977; Bereano, 1971) have pointed out that technology assessment has eluded easy definition. Arnstien (1977) however maintains that the definition which has achieved the widest currency is the one

articulated by the former manager of the technology assessment
program at the National Science Foundation:

> Technology Assessment is a class of policy studies which
> systematically examines the effects on society that may
> occur when a technology is introduced, extended or
> modified with special emphasis on those consequences
> which are unintended, indirect or
> delayed....Comprehensive impact or assessment studies
> are a class of holistic studies which attempt in some
> sense to embrace everything that is important with
> regard to a technology....One characteristic of holistic
> thinking is that we do not know how to do it routinely;
> secondly, it almost certainly cannot be done routinely;
> and thirdly, it is not a scientific or an engineering or
> a disciplinary enterprise. It is essentially an art form
> (Coates 1974, in Arnstien, 19xx p. xx).

*Characteristics Which Distinguish Technology Assessment From
Other Forms Of Policy Analysis*

Most efforts to distinguish technology assessment from other
forms of policy analysis begin with a list of what technology
assessment is not. For example, technology assessment is not
simply forecasting or futures research, or social impact
analysis or purely systems analysis (Lee and Bereano 1981).
Significant differences exist between technology assessments and
more conventional technology studies such as technical
feasibility studies, market research, clinical trials, cost
effectiveness, economic and environmental impact studies
(Arnstien, 1977).

The central differences between technology assessment
studies and other forms of technology studies are threefold. The
differences are 1) in the range of questions asked, 2) in the
depth of analysis accorded to the various analytic parameters,

and 3) in the comprehensiveness of the study's focus or scope (Arnstien, 1977). Technology assessment claims to go beyond identifying impacts and their causation, and looks as well at whether impacts are direct or indirect, i.e. first- second- or third-order. Technology assessments attempt to describe both the beneficial and adverse consequences of technological change (Lee and Bereano, 1981).

In theory this reflects the assumption that technological change alters the social distribution of costs and benefits. We will see later in the paper that this assumption may be held but not taken to fruition; in practice technology assessments do not always address the differential distribution of costs and benefits experienced by all parties at interest.

Technology Assessment Methodology

Lee and Bereano (1981) point out that the term methodology applied to technology assessment, is virtually a misnomer. Because technology assessments are essentially social impact studies that deal with value-oriented and institutional issues which are nonquantifiable, technology assessments cannot adequately be performed by relying solely on formal statistical, survey or operations research methods. In a general sense, technology assessment consists of an overall framework or research strategy, and a carefully considered use of specialized techniques for portions of the overall analysis, along with processes for integrating these disparate elements (Lee and

Bereano, 1981).

One popular research strategy is a ten component strategy.[1] The steps, or components are: problem definition, technological description, technological forecast, social description, social forecast, impact identification of direct and higher order impacts,[2] impact analysis, impact evaluation, policy analysis, and finally communication of results (Porter et.al.,1980).

While research strategies such as the one listed above may offer helpful guidelines for determining the sequence of the principal concerns of a technology assessment, such lists are not literally a method or procedure for conducting technology assessments. Lee and Bereano (1981) conclude that there is no validated, universally accepted methodology for technology assessment. Coates (1973b) points out that every assesssment will have a unique organization and structure, as well as a selection of methodological tools and techniques appropriate to the specific subject.

In spite of this uniqueness, technology assessments can be characterized into four types, which are recognized by technology assessment practitioners. The four types of

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[1]This ten component strategy is Coates' (1975) modification of the now classic seven component strategy developed by Jones for the Mitre Corporation (1971).

[2]In identifying and analysing impacts, impacts of an environmental, psychological, institutional/political, social, technological, legal and economic nature are considered.

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assessments are 1) problem oriented assessments, 2) technology initiated assessments, 3) objective oriented assessments, and 4) group interest oriented assessments. In problem oriented assessments, the search is for technological ways to alleviate social problems. For example, a problem oriented assessment might attempt to find a technological solution to air pollution resulting from car emissions. Technology initiated assessments, on the other hand, focus on the technology as a central element. The future applications of an innovation are studied, and analysed for future impacts and possible consequences. Within this type of assessment, the potential impacts of an innovative air pollution control technology might be studied. The third form of assessment, an objective oriented assessment, begins with a stated objective, and examines alternative social and physical technologies which might meet the objective. For example, the stated objective might be the reduction of air pollution from cars. Among the potential means of meeting the objective might be carpooling and electric cars. Group interest oriented technology assessments, or adversarial assessments are designed to meet the needs of particular institutions or constituencies. A group interest oriented assessment might focus on how to reduce the effects of car emissions on elderly people.

While these four approaches to assessing technology have been identified, only three have received widespread use. Problem oriented and technology initiated assessments are the most widely recognized approaches to the technology assessment

task. Objective oriented assessments have gained popularity in the last few years. Several technology assessment practitioners (Arnstien, 1977; Arnstien and Christakis, 1975: Bereano, 1971; Green, 1970: Tribe, 1972) have suggested that adversary technology assessments should be tried as a promising technique for reconciling social value issues inherent in any technology assessment. However, despite the recognition by technology assessment practitioners that group interest oriented assessments are a viable form of assessment, group interest or adversarial technology assessments are virtually never conducted, though they were conceived of early in the evolution of technology assessment studies.[3]

By examining some of the assumptions which underlie technology assessment activities, we can begin to determine whether or not technology assessment can be used as an educational tool and, if it can, how it must be altered to conform to the educational approach outlined in chapter three. In particular, in the issues related to the absence of group interest oriented assessments, we can begin to see some of the flaws in present technology assessment practices. These issues are addressed in the following section.

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[3] Anstien writing in 1977 stated that strictly speaking, there had been no adversary technology assessments conducted to date.

Limitations Inherent In Technology Assessment Research Strategy

As Olsen (1983) points out, technology assessment is based
on the assumption that technology can, and should be,
controlled. Further the assumption is made that all of the
consequences of the technology under consideration can be
identified, and thorough examination of technology will reduce
negative consequences associated with its use. This in turn
requires that technology assessment practitioners assume that
they can acquire a useful degree of accuracy in forecasting
social, environmental and economic events. Although the tools
and strategies borrowed from the social and physical sciences
for use in technology assessments are employed with a different
purpose, scope and outcome in mind, their use within the
framework of traditional technology assessment encourages
commitment to a rational, political decision making process.

This is in part because, as Olsen (1983) points out, in all
jurisdictions carrying out technology assessments, the agencies
involved represent a mixture of governmental, extra-governmental
and private institutions and firms, whose active members
comprise an elite. Ordinary people do not conduct technology
assessments, and neither are they involved in them, in any
significant way. This has particular implications for women
(which will be discussed later). This also means that a decision
making process is adapted in relation to technology assessment
studies which has been widely termed "disjointed

incrementalism." Disjointed incrementalism refers to the decision making process which occurs in the real world where governments are subject to the pressures of special interest groups and other interests, which do not allow the forthright acceptance or rejection of a given technology. This form of decision making fails to encompass long term or abstract elements such as social values or social features, and it also limits the practical range of alternative projections and policy options suggested.

In addition, the assumption that the future will be a logical continuation of the past which can be modelled and or simulated fails to account for the fact that current knowledge in the physical sciences reveals a number of natural phenomenon where radical dysjunctions occur. Similar turnover points, where future behaviours cannot be predicted on past behaviour are also found in the biological and social sciences. Hence, the assumption that the future will be a logical extension of the past is faulty, at best (Olsen, 1983).

Lee and Bereano (1981) also formulate two additional aspects of traditional technology assessment studies that affect their outcome. These elements are: first, the normative elements inherent to the technology assessment process, and second, the kinds of 'bounding' constraints which the assessment teams are faced with. Both of these areas are discussed below, and are followed by a discussion of cognitive authority and its role in ensuring that the normative decisions and bounding

considerations required in technology assessment studies are congruent with the status quo.

Although it is generally recognized by technology assessment practitioners that bias should be suppressed, the assessment process contains several elements that are normative, judgemental, creative and subjective. These elements are 1) the choice of the area to be studied, 2) the nature of the questions to be investigated in detail, 3) the choice of impacts, actors, receptors, which will be examined, 4) the evaluation of impacts as adverse or beneficial (including the identification of societal groups that will experience these consequences), 5) the "decision criteria" employed in aggregating these findings, expressing the group's judgements as to uncertainty of risk; and 6) the policy issues which are reflected in the recommendations made, if any (Lee and Bereano, 1981 p.xx).

Examples can be used to illustrate how these normative elements typically affect or bias the content of technology assessments with respect to women's concerns. A corporate executive in the airline industry studying the effects of new technology on that industry would probably choose to study how new technology can be used to maximize profits in the company. A union representative studying the effects of new technology on the airline industry would probably choose to study the relationship of new technology to job loss or acquisition, as well as how the new technology is affecting workers' personal well being on the job. If the union representative is a woman,

she may choose to use data in her analysis which are disaggregated along gender lines.

These two hypothetical studies have a common characteristic. Each study reflects its sponsor's interest, and reflects the sponsor's experience of the world. The processes of choosing an area to study and defining a problem within that area are both virtually impossible to separate from an individual's unconscious efforts to shape the world according to his or her world views. Keeping in mind this point, if we recall Olsen's (1983) point about technology assessment being an activity of the elite, the problematic nature of an elite technology assessment takes on a greater significance. (This is addressed in greater detail later in the chapter.) Because the world views held by elite members of technology assessment teams show little variation, assessment approaches and results also show great similarity in their adherence to dominant norms. .

The definition of a problem developed by an assessment team reflects the composite values of technology assessment team members. This is ensured early in the study, when the scope of the assessment project is "bounded" or limited. Bounding consists of making trade-offs with regard to what is covered in the assessment and to what extent. It consists of defining the limits of the topic being studied. Lee and Bereano (1981) mention criteria which several technology assessment practitioners have found helpful in bounding. These criteria are described below.

The first bounding constraint, system centrality, refers to how central the problem under question is to larger systems. Resource limitations, the second type of bounding constraint refers to limitations on funds, time and personnel. Where an assessment team may want to enlarge the scope of their investigation to include less central elements, financial resources and time budgets often lead to restrictions here. Cognitive limitations refer to those limits which are imposed on the study due to a lack of information, knowledge, understanding or proven methods of study. Political factors which may bound a study fall into two basic categories. First, to the degree that technology assessment is intended to affect policy, it has political content. Certain variables, perspectives and impacts will be more relevant than others, and hence ought to be emphasized more. Second, as some boundries are expanded, and others contracted, some social, political and economic factors will be emphasized, while others will be downplayed. Value judgements of the assessors are expressed, sometimes explicitly.

In considering each of these criteria, the assessment team must make a multitude of value laden decisions, which reflect the normative elements mentioned earlier. First, the assessment team must define the assessment task. The broadly defined subject of a TA might be how new technology affects banking. After considering the bounding criteria the assessment team might decide to conduct a technology-initiated study; the roles of technology as both a motivator and facilitator of change

would be investigated (as was the case in <u>Effects</u> <u>of</u> <u>Information</u> <u>Technology</u> <u>On</u> <u>Financial</u> <u>Services</u> Systems (OTA 1984a)).

Although women fill over ninety-three percent of all bank teller jobs (Gregory, 1983), which will clearly be influenced by the effects of information technology on financial service systems, there was no mention of displacement of women workers from these jobs in the summary of the technology assessment mentioned above. This reflects normative decisions about the nature of the questions posed, and the choice of impacts, actors and receptors studied. Under other circumstances, an objective oriented or group interest oriented technology assessment might be conducted. The problem and scope of the study could be defined in a manner which would include coverage of the displacement of women workers from banking jobs.

Frequently bias creeps into the problem definition of a technology assessment because the assessment team is homogeneous, along class and/or gender lines, rather than heterogeneous. For example, if a technology assessment team is composed either entirely or largely of men and nonfeminist women,[4] women's concerns will not be raised during problem definition, or if they are raised, thay will not be considered significant enough to warrant consideration as part of the

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[4] In this paper "feminist" is defined as a woman who has feminist consciousness and class consciousness and makes links between the sometimes conflicting value sets associated with each type of awareness. A woman can have a feminist awareness, and at the same time have a stake in the patriarchy, causing her to act first in the interest of her class, and then in the interest of women.

problem.

Evidence suggests that bounding considerations more often than not mean that issues of particular concern to women are bounded out. Only two of two hundred and fifteen abstracts of current and completed assessment projects conducted through the Office of Technology Assessment mention women (OTA 1984b, 1984c). The titles of these TAs are Reproductive Hazards in the Workplace and Information and Commmunication Technologies and the Office, and they are not yet available. Clearly, unless it is virtually impossible to exclude women from consideration in a technology assessment, women are excluded.

The nature of questions which are investigated in detail in technology assessments, as well as the impacts, actors and receptors which are examined, all reflect the interest and values of the assessment team and the sponsor. The team members will most likely hold the popular attitudes towards technology discussed in chapter two, and these will be supported by cognitive authority (discussed in depth in the following section), which assures that the researcher's interests and values match those of the sponsor. In addition, the assumptions on which technology assessment is built, combined with popular attitudes towards technology ensure that a commitment to technology, rather than to social goals, remains.

When we describe systems we describe relationships. In assessing technologies, the questions we investigate in detail,

and the impacts, actors and receptors examined, all refer back to the relationships we identify in our efforts to describe technology and society. Our descriptions of systems reflect our assumptions about those systems, particularly when the systems are complex. Addelson (1983) points out that "the scientific enterprise is based on the metaphysical premises that because there is one reality, there must be one, correctly described truth." (Addelson, 1983, p. 169). This commonly held assumption rules out or limits discussion of the validity of other assumptions assessors make about relationships which exist in complex systems.

In addition, this premise challenges the validity of group interest oriented assessments. The notion of one truth, one reality suggests that there is only one correct answer, while it would seem that the assumption that group interest oriented assessments are built on is that there are as many "answers" as there are constituencies. This, along with the potential of group interest oriented assessments to be conducted in the absence of specialists works against the possibility of group oriented assessments. Unlike other types of assessments, group oriented assessments can move technology assessment out of the domain of the expert, and into the domain of the ordinary person. While this makes this·type of assessment attractive in light of our purpose here, it makes group interest oriented assessments unattractive to businesses and government.

Many relationships which are assumed to be simple and straightforward are in fact more complex than they are assumed to be. For example, prior to the publication of "Time Spent On Housework" (Vanek 1974), it was generally assumed that household technologies had reduced the amount of time women spent doing housework, freeing them for employment outside of the home. As a result of Vanek's work (which proved that women spend as much or more time doing housework than they did early in the century) people are beginning to reframe their understanding of the relationship of household technology to time savings and women's paid employment.

While the importance of including alternative value sets in technology assessments is given lip service (Porter et.al., 1980), the unexamined premise of one reality, one truth allows assessment practitioners to confuse their understanding of reality with fact. Commonly held assumptions (e.g. household technology has freed women to work for pay outside the home) remain unquestioned.

Additionally, Addelson (1983) suggests that we cannot simply accept without test the empirical assumption that a specialist's social experience has no significant effect on his or her scientific understanding of the world. It follows from this that even if an assessment team did study and include alternative value sets in the technology assessment, that the teams' social experiences may have a significant effect on their scientific understanding of the world; of those alternative values and

their significance.

The choice of impacts, actors and receptors which will be examined in an assessment, and the evaluation of those impacts as adverse or beneficial, is closely tied to the assessment team's description of relationships in the technological and social systems which as we saw above are apt to be based on unquestioned, dominant beliefs. If an assessment team studying the effects of computers on the home held the belief that the entrance of technology into the home saved women time and made their jobs easier, they might assume that the introduction of computers into the home will lead to computer shopping, which will increase women's leisure time, because travel time to stores will be reduced. Labeling these impacts as non-problematic, the assessment team might focus impact identification on another area, such as how computers in the home might generate increases in electronic mail, which in turn would affect the postal system.

The assumption that the introduction of technology into the home has increased the time women spend on housework and related activities might result in an assessment team's identification of women as the primary recipients of negative impacts resulting from shopping at home via computer. The team might speculate that shopping at home will increase the time women spend as consumers, which would further limit women's leisure time. In addition, shopping at home would reduce the amount of contact women have with other people outside of the home. Clearly, not

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only the identification of impacts, but also the evaluation of impacts as adverse or beneficial reflects the assumptions a person maintains about the world.

A technology assessment team, having described the present and future states of technology and society and having identified, analysed and evaluated impacts, must produce a report of their work, which may or may not include policy recommendations. During this component, as in all the other components of a technology assessment, the assessment team must make decisions. Because the very nature of technology assessments stresses the inclusion of many variables and relationships, one of the major tasks an assessment team faces at this point is what to include in their report to the assessment sponsor.

In considering what material to include in a final report, and to what extent to include it, the assessment team will most likely "target" the content of the project report to the sponsor and/or parties identified as having a significant interest in the technology under assessment. Berg et.al (1978) found that over ninety percent of the technology assessment practitioners they interviewed indicated some attempt at targeting, while sixty percent indicated targeting to a considerable extent.

From this we can only conclude that if in the process of conducting a technology assessment, the technology assessment team did pursue a line of questioning which deviated

substantially from dominant assumptions and world views, in the interest of targeting the content of the assessment, this material would be either left out or briefly mentioned in the project report. The end result is that decision makers receive expert opinion which varies little in its class and gender bias from information generated from other forms of technology studies.

In addition to the problems inherent to the technology assessment research strategy which I have already mentioned, another aspect of technology assessment research is worth mentioning: the dynamics of the interdisciplinary team conducting research. Coates (1977) notes that this is one of the continuing problems which plagues technology assessment projects. When a large contract is carried out by an interdisciplinary team, a number of issues emerge, including how to allocate time, effort and resources among the team members, and how to structure interactions of the team members, who, coming from different disciplines, speak different languages.

Unfourtunately, the technology assessments I have read have contained no information about the type of interactions among technology assessment team members, and other than Coates' comment, information on this subject is scarce. One can speculate that any forms of dominance (such as gender relations and ageism) which are evident in our culture, will be evident in the assessment team's dynamics, which will in turn affect the content of the assessment.

In addition to these normative elements and bounding constraints which help determine the content of technology assessments, three additional factors restrict the range of material addressed in technology assessments. First, the 'invisibility' of women's activities as separate and distinct from the activities of men often results in the omission of women as subjects of study in technology assessment studies. Second, a related issue is the absence of data which describes women's lives. If data have not been disaggregated along gender lines, as a great deal of data have not been, than little can be determined about women's lives. Third, exclusion of women, especially feminist women from technology assessment teams helps ensure that women's activities will remain invisible, and that women will not be included as participants or subjects of study. Cognitive authority, the process through which expert status is awarded, ensures that the factors above will continue to support the status quo.

Cognitive Authority

Specialists have cognitive authority; we take their understanding of factual matters within their sphere of expertise as knowledge, or as the definitive understanding (Addelson, 1983). Science is distinguished from other forms of enquiry because its methods require criticism, test and falsifiability. Addelson points out that a crucial area of criticism of the sciences has been ruled out: the social arrangements through which scientific understanding is developed

and through which the cognitive authority of specialists is exercised (Addelson, 1983).

Cognitive authority can be understood as a process which perpetuates a set of metaphysical beliefs, that is, beliefs about the nature of things and their relation to one another and us. Although there are many people in a given discipline, those who stray from the dominant paradigm may never have their perspective adapted, and may never serve as expert advisors (Addelson, 1983). This is assured by the social arrangements through which scientific understanding is developed. Addelson maintains that prestige hierarchies, power within and outside of scientific professions, and the social positions of researchers themselves all will affect which group can exercise cognitive authority (Addelson, 1983). Cognitive authority determines, in part, the educational content of curricula.

Members of each specialty certify and criticize their opinions in their own journals and at their own conferences. Excellence is marked by ascent up the prestige ladder. During the ascent researchers judge excellence in terms of their own understandings of a field. Researchers judge which competing theories to encourage others to pursue, and they often decide which of several competing projects will be funded. Researchers in positions of power are able to spread their understandings and metaphysical commitments.

Metaphysical understandings are embedded in scientific specialties, so in teaching us their scientific specialties, researchers simultaneously teach us these broader understandings (Addelson, 1983). Metaphysical understandings also reflect our social position. Keller (1982) argues that the impulse toward domination finds expression in the goals, theories and practices of science. Addelson describes this process:

> The leading physicists, biologists, and philosophers of science are also persons with tenure and right of pension. They live in societies marked by dominance of group over group. As specialists, they compete for positions at the top of their professional hierarchies which allow them to exercise cognitive authority more widely. (Addelson, 1983, p.181

Addelson goes on to make the point that out of such cultural understandings and social orderings, it is no wonder that we get an emphasis on predictive law (which maintains the dominant metaphysics) and an insistence that the currently popular theories within a specialty represent the one true description of the world. Consequently, the institution of cognitive authority plays a major role in determining which metaphysical paradigm , or even which specific scientific/social theories will dominate.

If we look at cognitive authority as a social institution rooted in or reflecting social position, whose function is to maintain metaphysical conformity, we can begin to see how other elements such as the exclusion of feminist women, the invisibility of women's activities and the collection and use of data, affect and/or are affected by cognitive authority.

Cognitive authority also ensures that certain views of technology will be popularized, while others will not.

Cognitive authority is the authority to have your beliefs accepted and perpetuated. In our society, the dominant ideology adhered to by most cognitive authorities is one of capitalist, patriarchal relations. Capitalists and male workers both accrue benefits from having women work in the home for no pay. The institution of the family wage can be understood as a resolution of the conflict over women's labor power, which was occurring between patriarchal and capitalist interests (Hartmann, 1981).

It is important to both capitalism and patriarchy that women's activities remain obscured and unvalued. Men enjoy authority over women which would be threatened if women's activities in the home were awarded greater value. Capitalists externalize the costs of reproducing workers by paying a family wage and institutionalizing lower wages for women's work. If women's roles were seen in this light, women might demand renumeration for the services they provide in the home, or equal wages in the paid labour force. Either of these demands would threaten the capitalist's profits. Cognitive authority serves this end, by defining social relations in a manner which hides women's activities.

Cognitive authority dictates what data is collected, how it should be used, and how it is interpreted. Because the services women provide in the home such as childcare and housework have

not been subject to quantification (i.e. they are not counted in the GNP), they do not easily lend themselves to scientific analysis. Historically, by excluding women from science, it has been ensured that data about women will not be collected or analysed. Although there are now legal mandates which encourage the entry of women into the sciences, the study of women is still curtailed. Women scholars whose ideas are too threatening can still be denied the status of "significant communicator" within their specialities. Without this stamp of approval, one's ideas cannot become certified, and without certification, one cannot advance new paradigms.

Because women's activities are unvalued women become invisible. When something is invisible, it becomes more difficult to understand. The invisibility of women in our culture in general results in failures to provide services such as day care at public forums, which would encourage the inclusion of women participants in technology assessment studies. One can only speculate about the extent to which women's inclusion on technology assessment teams and as participants would alter the current state of affairs. If women are included who identify more with the men (a potential consequence of becoming significant communicators), the treatment of women's concerns in technology assessment would probably not change at all.

The limitations inherent to cognitive authority are generalizable to all methodologies, and permeate every aspect of

the technology assessment process as it is now practiced. While
it would be tempting to conclude that technology assessment is
so riddled with flaws that it's worthless, this would do little
to rectify the damage caused by technology assessments. Instead,
I now turn to how technology assessment can be practiced in a
way which challenges class and gender relations.

Technology Assessment From a Feminist Perspective

Bush (1983) points out:

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. (Bush, 1983, 151).Bush

One of the first sources of oppression we must unthink in our
efforts to conduct feminist technology assessments is that
reality can be fully described from a single point of view.
Reality, including the reality of technology can't be fully
described until it has been looked at from the points of view of
women who are concerned with women's interests, working class
interests etc., because there are aspects of reality that it is
very hard or impossible to procure from a single point of view.
In attempting to understand technology, we should always keep in
mind that it can be described and understood in a number of
different ways.

Bush's four contexts in which technology operates[5] are
helpful in challenging the notion that a traditional technology

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[5]See chapter 2 for a discussion of the four contexts.

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assessment team can capture equitable views of technology, by encouraging us to consider a range of impacts from a variety of perspectives.

At any given time, technology is creating changes in several contexts. A person who has been involved with the design context of a technology will understand it very differently than a user. The user context of technology has been the least studied. This point warrants further attention.

While scientists may be experts with regard to analytic skills required to study something, users are clearly the experts when it comes to describing how the technology under study is affecting them. Because virtually all method incorporates the bias of the investigator, there is in a sense no point in even attempting to conduct a value free analysis. In their eleven step "Methodology for a Policy-Oriented Futures Technology Assessment" Arnstien and Christakis (1975) encourage technology assessment practitioners to identify a set of futures which are important in the sense that they include a desirability criterion. This is done after interaction with parties-at-interest. This has potential as a technique which might address the interests of women workers, by building on the bias of the investigators. However, this method can fail to meet women workers' needs if the parties-at-interest consulted do not represent that group's interests. To ensure that a group's interests are being addressed, the futures creative technique could be conducted by special interest groups.

Olsen (1983) has pointed out that merely employing ordinary people as part of technology assessment teams has not brought about change. Recognizing the extensive limitations of citizen participation in technology assessmnet studies, he advocates a reversal in the relationship of ordinary people to experts in technology assessment studies. In an effort to combat the lack of public consciousness in relation to technology, Olsen also recommends that non specialists be inserted into the technology assessment core function. Expertise would be assigned an advisory role, replacing the cognitive authorities.

Along with other critics of technology assessment, Olsen argues that the public should be involved more in the technology assessment process. However, rather than recommending specific techniques or methods to accomplish this end (as is most often done), Olsen's view, that the structure of assessing technology be fundamentally changed, seems more concise. Rather than hiring experts, who then solicit participation from other experts, people who use technology should solicit participation from persons who have a critical eye for methodology. While funding may be difficult to obtain, it is not essential to the success of using technology assessment as an organizing tool. Assessments should be conducted by the people who experience technological change, rather than by teams of experts who solicit input from subjects.

Conclusion

In conducting a feminist assessment of technology our
approach to technology should be defined by our knowledge of how
traditional technology assessment disallows a feminist analysis
of technology. While it might be possible under extraordinary
circumstances[6] to conduct a feminist assessment of technology
which utilizes a problem oriented, technology initiated or
objective oriented approach, clearly, a more expedient route to
this end would be to conduct a group interest oriented
technology assessment.

In addition, group interest oriented assessments would
easily accommodate the framing of technology assessments around
'desirable futures,' an approach advocated here, as well as by
Olsen (1983) and Arnstien and Christakis (1975), with their
'futures creative' approach to technology assessment.

Bush's (1981) approach to technology assessment can be
utilized in a way which locates each of the points raised above
at the centre of an analysis. The assessment technique she
proposes is easily adapted to both a group interest oriented
assessment, and an assessment which is conducted by non-experts.
By framing the questions one might ask in addressing each of the
contexts of technology, in the future tense, Bush's strategy for
technology assessment can be used to outline desirable futures.

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[6]For example, a radical value shift which ensured that feminist
and equalitarian concerns were incorporated fully into every
aspect of life.

Technology assessment can be used as an education tool to the extent that it allows discussion of technology-related problems in a problem-posing fashion. By implicitly attempting to conduct group interest oriented technology assessments, dominant world views, often taken for granted, can be made explicit. By employing technology assessment techniques for feminist ends, feminist values can be featured as an important aspect of the study, rather than left uninvestigated, as is most often the case. In addition, techniques such as Bush's (1981) effects wheel are easily used by groups of non-experts.

CHAPTER V

DEVELOPMENT OF RESEARCH TOOLS

In chapter two, the relationship between attitudes about technology and models of the technology/society relationship were explored. It was argued that widely held views of technology and models of the technology/society relationship accommodate only a limited understanding of technology – one which leaves people ill-equipped to confront the contradictions inherent in their views about technological change. Having identified this situation, helping people understand the shortcomings of these views became a basis for education. In chapter three educational approaches were discussed, and in this context, the importance of a problem-posing education became clear. In the Freire model, the process of coding and decoding people's experiences is an essential step in the problem-posing .process. In the context of technology, this means that peoples' experiences with technology as well as the attitudes they hold towards technology must be described and discussed.

The development of an educational approach and educational materials to teach women workers about technological change required that two kinds of data be collected. First, data about workers' attitudes towards technology and technological change were collected to verify the theoretical arguments made in the first part of chapter two about how people think about technology. Second, data describing workers' experiences with

technology and perceptions about technology were collected. Both types of data were collected through questionnaires. This data was used to both develop a better understanding of the research setting, as well as to create "coded" situations which could then be "decoded" and discussed by workshop participants.

This chapter is divided into two parts. In the first part, the development of the questionnaire which was used to collect the data described above is discussed.[1] In addition, the implementation of the questionnaire and the data analysis process are described. In the second part of the chapter the development of the workshop curriculum and its implementation are described. In chapter six, the results of the questionnaire are reported, and in chapter seven, the results of the pilot study of the implementation of the workshop are reported.

Development of Questionnaire

In developing suitable questions about workers' attitudes towards technology, earlier work, particularly that of Mesthene (1970) and Bush (1983) was used. Both Mesthene and Bush have summarized in simple terms a range of attitudes towards technological change. (See chapter two.) In addition, previous research conducted by me and others through Labour Canada's Technological Impact Research Fund resulted in several questionnaires which included questions on this topic.

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[1] In doing so, reference is made to the questionnaire, which can be found in the appendix.

Variations of some of these questions were adapted as well. Questions 1 through 4-7 reflect the work of Bush and Mesthene. Questions 5-1 through 5-3, on the same subject, were written when the same or similar questions, which had been used in an earlier study involving another group of unionized workers (BRAC, 1986) did not yield the range of results anticipated. It was hoped that inclusion of this set of questions might shed further insight into this matter. Questions six through eighteen attempt to capture an individual's general understanding of and perceptions about technology, as well as how it affects work.

The theme of how new technology will affect work continues in questions 19 and 20. In question 19-1 through 19-14, respondents are asked to indicate the likelihood that a variety of potential changes will occur. The fourteen items included reflected areas of concern which have been extensively addressed in literature about women and technological change. For example, several articles in Zimmerman (1983) suggest that the introduction of new technology will result in more part-time work for women, an increase in split-shifts, work which is more specialized, increased layoffs and fewer new job vacancies for women. Question twenty-one, like earlier questions, was included as a general indicator of how people understand technology. Questions twenty-three and twenty-four were included to provide a sense of what people value in a job environment.

Question twenty-five acted as a screen, instructing people who had not used computers to skip questions only relative to

those who had used computers. Questions 28-1 through 28-17 ask respondents to answer a series of questions concerning how their jobs have changed as a result of the introduction of computers. Questions 45-1 through 45-17 are a parallel set of questions, which were designed to elicit non-computer users' perceptions about and expectations of how their jobs will change in the future if new technology is introduced. Both sets of questions reflect the research approach developed by Feldberg and Glenn, (1983) in their study of the effects of technology on clerical workers at three levels; the occupational level, the organization, and the work process. Some pertinent aspects of their work are discussed briefly below.

Working with a model of technology similar to that of Noble (1979 & 1984), Feldberg and Glenn (1983) emphasize the way social relations affect the development and use of technology. Unlike some previous researchers, (e.g. Braverman, 1974, Richards, 1979) they do not assume that changes in the technology/ work relationship will be uniformly experienced. Instead they investigate changes within each of the three levels.

Changes in the occupational level are reflected in changes in the number and types of jobs, and the ratio of one job category to another. In addition, occupational level changes are reflected in changes in the content and/or scope of activities which constitute a job. Among the characteristics which Feldberg and Glenn cite as indicative of change on the occupational level

are greater job specialization and standarization, (which result from a reorganization of the work,) shifts in the number and type of jobs, and elimination of some occupations through labour savings.

Changes in the organizational level refer to changes in the ratio of workers in different job categories within a workplace, or organization. In addition the workforce of an organization often becomes increasingly more gender stratified. And, opportunities for upward mobility are reduced through compression of the occupational hierarchy, which restricts occupational mobility. Jobs are reorganized, and while some evidence shows the trend is not uniform,[2], reorganization often results in deskilled jobs (Feldberg and Glenn, 1983).

Changes in the work process refer to changes in the content and organization of jobs. Among the characteristics which reflect changes in the work process are changes in the level of autonomy associated with a job, changes in the extent to which jobs are specialized, varied or routine, and changes in the amount and type of skill associated with a job, in the context of an organization (Feldberg and Glenn, 1983).

The two series of questions, 28-1 to 28-17 and 45-1 to 45-17 were included in the questionnaire to reflect, workers' perceptions of the type of changes described by Feldberg and

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[2] See Working Women Enter the Computer Age (Women's Skills Development Society, 1986) for an example of job reorganization resulting in job integration.

Glenn (1983). Among the job characteristics the series of questions addresses are changes in skill requirements, changes in level of monotony associated with the job, extent to which the job has become or might become specialized, extent to which management and worker control of the work has increased or decreased, whether or not how varied the job is has changed or might change, and, whether levels of efficiency, amount of contact with co-workers and amount of work done per worker have changed.

Questions 29 and 30 ask computer-using respondents whether or not they are using two applications of computers; communication between two or more computers, and electronic mail. Questions 31 through 38 inquire about the respondents' experiences with and feelings about how computers were introduced into their jobs. Questions 39 through 46 (excluding 45, which has already been dicussed) are all related to training associated with the introduction of new technology. Questions 47 through 61 address demographics; gender of respondents, age, marital status, educational background, etc. Question 62, which asks if the respondent uses a bank machine, is included so it can be compared with the respondent's answer to the question about whether or not they have ever used a computer. Question 63 was included as an indicator of whether or not the respondent held a feminist analysis of women's work. The final question asked respondents to enter a combination of numbers for coding purposes.

Implementation of the Questionnaire

All continuing full time staff members in the Association of University and College Employees' (AUCE2) bargaining unit (representing Simon Fraser University clerical workers) were sent a mail survey. AUCE was selected for study for three reasons. First, technological change is occurring and altering union jobs. Second, the union was willing to cooperate with the study, and third, working with AUCE allowed participant observation. The survey was designed as closely as possible to the specifications outlined in Mail and Telephone Surveys: The Total Design Method, by Dillman (1978). Included in Dillman's extensive and rigorous treatment of mail surveys are points related to question structure, layout, pretesting, follow-ups to ensure high response rates, and formats for letters accompanying the mailed questionnaire.

While Dillman's (1978) total design method often yields seventy percent response rates when followed completely, response rates between fifty and sixty percent are common when Dillman's methods are only partially adhered to. The AUCE questionnaire netted a response rate of about fifty-four percent.[3] This response rate reflects some departure from the

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[3] The exact response rate is hard to assign. Three mailings plus a postcard reminder were conducted, separated in time. The mailing labels generated for each mailing varied, reflecting changes in staffing levels as well as movement between positions within the university. The first and second mailing list had four hundred seventy names, the third had four hundred fifty three, and the forth had four-hundred sixty-one names. Two hundred and fifty-four questionnaires were returned. Averaging

total design method which was necessitated by circumstances

beyond the control of the researcher, as described below.

While Dillman advocates the use of personalized letters

accompanying questionnaires, several constraints prohibited

this. First, AUCE mailing labels bearing a first initial and

last name were available. While first names may have been

available to the extent that they might have been recorded in

the data base, the use of personalized letters would have

required substantial additional time to produce, tying up the

union's computer. Hence computer generated first name

correspondences with members were impractical. In addition, the

union addresses its correspondences "Dear Member," and departure

from this format might have called into question the legitimacy

of the study.

Another departure from the total design method was in the

area of coding. The total design method achieves a high response.

rate, in part because multiple follow-ups which supply

replacement questionnaires to non-respondents are used to

increase the response rate. These follow-ups require that

researchers know who has and who has not returned their

questionnaires. While Dillman's approach to coding seems

perfectly reasonable, prior experience with union groups

suggested that a technique which guarantees anonymity should be

used. For example, when Dillman's method was used with airline

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[3](cont'd) the number of names on the lists and taking the
percentage of that results in just under fifty-five percent.

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employees, several people tore the corner with the code off of the questionnaire, while others refused to answer some questions they felt would allow someone to determine who they were.

Consequently, rather than coding each questionnaire and matching each number to a name, participants were asked to code their own questionnaires. They were instructed to separately return a form they received with the questionnaire, indicating they had returned the questionnaire. While this may have reduced anxiety among respondents with regard to anonymity, it was not without consequence. Several respondents either returned incomplete forms, where the name was left off or there was no indication that the questionnaire had been returned. Some respondents initally failed to return the form, though they had returned their questionnaire, and some names written on the returned forms were illegible. In all of these cases, a person's name was not removed from the follow-up list, which in turn meant that in some cases where questionnaires had been returned, follow-up questionnaires were also sent. Some respondents found this irritating.

Finally, another departure from the total design method was in the area of mailing. Financial constraints, restricted use of intercampus mail,[a] and the presence of the shop steward system suggested the use of the latter for delivery of questionnaires to AUCE members. This method is somewhat less dependable than

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[a]The AUCE collective agreement specifies that mass mailings can not go through campus mail.

the postal service. Despite these departures, the response rate achieved was similar to that achieved in an earlier study (BRAC, 1986) of the airline union discussed throughout this thesis.

Procedures for Data Analysis

A scheme for coding the questionnaires was determined prior to the mail out. Data were entered directly from the questionnaires into a microcomputer by experienced data entry workers at Simon Fraser University's Computing Centre. Entries were screened electronically and verified against error during the data entry process.[5] The data were then uploaded from the microcomputer to the University's mainframe computer system, with the aid of an error-checking data-transmission protocol.

Once data were transferred to the mainframe computer, they were analysed with the aid of the SPSSx statistical software package. Frequencies were computed for all variables. Questions which allowed for more than one response were analysed both as individual frequencies and multiple response or multiple dichotomy groups, depending on the type of data. A variety of cross-tabulations were then conducted, and the χ^2 statistic was computed for all cross-tabulations. While data sampling requires that the sample be validated against the population being studied, working with a census, or complete population as was the case here, makes this step unnecessary. As a precaution,

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[5]Each questionnaire was keyed in twice, the second time for error verification.

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however, early responses can be compared to later responses, which can provide some indication as to whether or not late respondents, (and in theory non-respondents) differ from early respondents. This was done, and no significant differences were apparent.

Development and Implementation of the Curriculum

In chapter three, where educational approaches were considered, several aspects of education were identified, which must be considered in developing empowering educational materials and workshops. Among these were the teacher-student relationship, the gender relations which characterize education (the social relations of education), and the content of education. In light of the limitations I earlier identified in the material about education, it is useful to develop criteria which can be followed in designing a workshop and selecting material to include in a curriculum.

In the following section, the criteria, i.e. content and methodological considerations which informed the design of the workshop on technological change are described, followed by a general description of how the criteria were put into practice in the curriculum and workshop.

Criteria for an Empowering Workshop on Technological Change

1. In general, a 'problem-posing approach' should be employed
    to encourage critical thinking and avoid alienation of
    learners. An instructor can both facilitate discussions and
    act as a resource person, providing information if desired
    by learners.

2. Women should be encouraged to examine their own experiences,
    exercise their imagination and explore the dynamics of
    gender relations. This suggests that, among other things, an
    empowering workshop for women about technological change
    should be gender segregated. Also, day care should be
    provided to encourage women with children to participate.

3. Workshop content should include discussions of popular
    attitudes towards technology and resource materials
    appropriate to their own workplace. Existing empirical
    research on both topics can be utilized or new data can be
    collected from the group participating in the workshop. The
    latter would be a superior alternative as it would help to
    locate the discussion about these topics within the context
    of the women participating in the workshop.

4. Working with the model developed in chapter two,
    contradictory information can be presented to stimulate
    conversation and to encourage learners to locate technology
    in a conflict framework which assumes conflict exists
    between various parties at interest. An example of
    contradictory information is the information presented
    earlier in tables 2.1 and 2.2. In addition, this type of

format can accommodate discussion of how gender relations are mediated in relation to technology. To introduce this topic, one question which might be posed is "how is women's paid labour similar to their unpaid labour in the home?" Traditionally, in both settings women serve men, and are subject to their control, their skills are valued less than men's, their work is often unrecognized and uncredited, etc.

5. Content should include the role of education in reproducing the ideology of capitalism. Discussion about learners' experiences in school, especially in "male" classes (e.g. math and science), can be used to uncover the phenomenon of class and gender streaming. Attention should be paid to both the role of different curricula for men and women, and the role of instructors in encouraging gender appropriate behaviour (the social relations of education).

6. Political economy and economic theories can be used to tie what may seem like unrelated concepts and experiences together. This can be conceived of as similar to Freire's (1972) step of codification.

7. Historical and contemporary information about workers' efforts to mitigate the negative impacts of technological change and/or share in its control can be used to stimulate discussion of possible actions and activities participants can engage in in their efforts to have technology encourage equality. This can be tied in with a discussion of the concept of social choice in machine design.

The curriculum consists of a) written resource materials, and b) a workshop. The resource material, to be given to workshop participants at the beginning of the workshop, was conceived of as an in depth summary of main points to be covered in the workshop, plus some additional references. This in depth review consists of three parts. Part one is called Overview of Technology and Culture, part two is Discussion Topics - Technology and Work, and part three is titled Technology Assessment.[6] The front page of each section lists in outline form the major points covered in the pages that follow. Though it was not necessary, participants could browse through materials as informal presentations and discussions progressed.

The workshop itself was divided into three corresponding sections, which followed introductions. During introductions participants would be asked to comment briefly about why they had come to the workshop, and what office or department they worked in. In section one technology is considered somewhat theoretically. Section two begins with the slide-tape presentation Who's In Control (produced by Partipatory Research Group, 1985) which is followed by participants' comments on the the slide show, and a discussion. Part three is practically oriented; technology assessment techniques are introduced and then practiced by the group. A break is easily taken between any of the sections, or in the middle of section two, between the

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[6]Appendix 2 contains a copy of the workshop materials.

slide presentation and the discussion.

The first part of the curriculum addresses the issues discussed earlier in chapter two, however, in considerably less detail. (With the exception of definitions of technology, specific individuals' perspectives were omitted.) The section opens with a presentation of words commonly used to describe technology.[7] Next, information from tables 2.1 and 2.2 is presented, along with a summary of what the data might mean. During the workshop, the data are discussed, the summary is made, and a discussion about popular views of technology occurs. Having discussed the simplistic nature of the popular views of technology, an exercise called Naming the Complexity of Technology is done by the group. During the exercise, a technology is selected for discussion, and participants discuss what the technology was designed for, what besides its initial purpose it is used for, and what some of the positive and negative things about the technology and its use are.

While this exercise is simple enough, it is in a very general sense a form of technology assessment. As is the case in technology assessment studies, use of the exercise is an attempt to identify a wide range of impacts resulting from technological change. While earlier portions of the section reflect the criteria in 1, 3, and 4 above, this exercise reflects the goal

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[7]The words included were selected from a list of frequently used words obtained in response to the following question which appeared in the AUCE questionnaire: When you hear the words "technology" or "technological change," do any words pop into your head? ...What words?

outlined in 2 above, of encouraging women to examine their own experiences. Throughout the workshop, technology assessment exercises are used to stimulate group interation while exploring issues relating to technology. By focusing on learners' knowledge of technological change and speculation, it was hoped that learners will begin to feel more knowledgeable about technology and hopefully more confident of their ability to alter the direction of technological change.

Following the exercise described above, two alternative definitions of technology which complement one another, are presented. Given the suggestion which is implicit in the definitions of technology that technology operates in or exists within several contexts, five[8] contexts of technology are presented, and a discussion occurs. The section ends with a summary of major points covered, and in particular stresses the point that in redefining technology it is possible for people to see that they have a great deal of information about technology.

The second part of the workshop begins with the presentation of Who's In Control (Participatory Research Group, 1985). The twenty-three minute long slide show, presents background information about the use of technology in each of three different clerical workplaces,[9] along with interviews with

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[8]Similar to the earlier model developed by Hanny and McGinn, I include a "political" context in which technology operates, along with Bush's four contexts of technology. For elaboration, see the curriculum, in appendix b.

[9] These are the phone company, a public library, and a bank.

workers from those workplaces. After an introductory section, the presentation opens with historical material about women workers. The section shows that the sectors of the labour market in which women are concentrated have been the fastest growing sectors of the economy. This is followed by a brief history of the computer, and its impact on office production.

The slide-tape presentation addresses many of the pertinent issues related to women and microtechnology, including changes in the content and organization of work, how reorganization of work affects control of workers, how technology affects workers' health, changes in the quality of service provided, as well as the tendency of technology to displace and deskill labour. The slide-tape show fits nicely with the model developed in chapter two, and used throughout the workshop. While many other issues are addressed, most noteworthy among them is the topic of workers' responses to technology. These issues, along with additional issues provide the basis for the discussion questions which make up the curriculum portion of the second section of the workshop.

The questions reflect a wide range of concerns that would (one hopes) be routinely addressed during the course of a technology assessment study. The questions also reflect the assertion that technological change occurs in many contexts. Rather than providing workshop participants with materials to read about other workplaces, this section was conceived as it was to encourage participants to describe and analyse their

experiences. During the workshop data which address the issues described in the slide-tape presentation can be presented again to bring the context of the discussion onto a personal level. Using data in this way can provide the basis for coding and decoding cultural experiences, in the sense that Freire (1972) describes this process.

The last section of the workshop begins with a brief presentation about technology assessment, during which the assumptions on which technology assessment is built are presented, along with four approaches to or types of technology assessments. From this point, the workshop consists primarily of exercises and discussion. The first exercise in this section is called Exercise in Problem Definition. Participants are asked to define problems which reflect the distinctions made between the four approaches to technology assessment studies.[10] In doing this exercise participants become aware of how the exact way in which a problem is defined has an impact on the overall emphasis of a problem as well as the emphasis placed on each of the problem's components. During the exercise, participants are asked to describe problems in the workplace they might want to solve.

A brief portion of this section in the written materials describes brainstoring. It was included so that if the materials were used by others, they would have more of a script or outline

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[10]See appendix two, section three of the curriculum for an example of the four approaches to conducting technology assessments.

to follow, in the event that this were necessary. In reality, during the actual workshop, discussion of brainstorming would probably be omitted if participantsknew the technique. The next topic, the effects of technology, is introduced. A brief brainstormingsession is to lead to a discussion about how consequences of technology combine and create other, new consequences. This pattern is referred to as first-order effects, second-order effets, and so on. Next, the effects wheel, developed by Bush (1981) for use by women to assess technology, is presented. Four circles, one inside the other are used to illustrate primary, secondary and third level effects resulting from a change. The change is written in the center circle. The remaining circles are divided into pie- shaped pieces, where second and third level impacts are recorded.

After looking at an example, and discussing how impacts can be rated in terms of their desirability and their likelihood, the participants, working as a group decide on a technology to assess. Then, an effects wheel is filled in for that technology. During the workshop, having compiled a list of impacts, and assigned them either a (+) for being positive, or a (-) because they are preceived as negative, participants can then go through the negative effects on the list and generate a list of ideas (both technological and social) about how to mitigate the negative impacts which were identified.

Finally, section three of the workshop ends with two pages of additional exercises, designed to encourage a comprehensive

action-oriented assessment of technology in the workplace. The exercises on the first page reflect what Arnstien and Christakis (1975) refer to as a "futures- creative approach" to technology assessment. Arnstien argues that assessing technology should be action oriented to the extent that it proposes creative alternative scenarios for the future which have been deemed desirable. The second page of exercises directs the reader to an information section which accompanies the curriculum. The reader is then presented with questions which will encourage critical reading of materials related to technological change.

While the format selected for the workshop, and the materials designed for it are both flexible enough to incorporate all of the criteria discussed earlier, in reality, some were somewhat neglected. While a problem- posing approach was designed into the workshop, and women were encouraged to examine their own experiences (the workshop was gender segregated), it proved impossible to ensure the participation of women with children through the availability of day care, as had been hoped. One woman did mention this as the constraint that prohibited her from attending the workshop. While daycare is available near the workplace for younger children, older children are "off the hill," and a parent would have to leave the geographically isolated workplace, get the child, and return to the geographically isolated workplace to take advantage of daycare. In addition, licensing procedures make the provision of even temporary day care very difficult.

In addition, discussion about the role of education in the human/technology drama, as well as the role of education in reproducing attitudes towards technology, were difficult to cover in depth in the time allotted for the workshops; two four hour sessions. However, these issues were addressed somewhat in the context of discussing training people had received or would have liked to receive in relation to the new technology. Also, due to time constraints, political economy and economic theories were not used as suggested in the sixth point of the criteria section.

In the next chapter, results of the questionnaire are discussed. In Chapter 7 pilot evaluation of the curriculum is reported. In discussing questionnaire results, comparisons will be made to similar data collected from airline workers (BRAC, 1986).

CHAPTER VI

STUDY RESULTS

In chapter two, it was argued that gender relations are mediated through technology. While theoretical arguments have been made about this (both about women and the general population), there is a relative scarcity of work which attempts to determine whether or not there are sex differences in attitudes toward technology and technological change.[1]

As described above, data were collected for several reasons. First, data were collected to determine popular attitudes towards technological change. Second, data describing workers' experiences with technology were collected, for presentation back to workers. Third, data were collected to determine whether or not gender differences in attitudes towards technology exist, and if differences do exist, to describe them. Fourth, data collection reflected Felberg's and Glenn's (1983) analytical approach to the workplace.[2] Consideration of some of the same elements previously addressed by Feldberg and Glenn provides an

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[1]More recent work, such as Collis' "Psychosocial Implications of Sex Differences in Attitudes Toward Computers: Results of a Survey" (International Journal of Women's Studies vol.8 #3) and Lucking's (1984) Gender Differences in Attitudes Toward Computing, (Voice of Youth Advocate, 7 (2), 80-82), have addressed sex differences in relation to computers.

[2]This approach considers three aspects of the impact of technology on work (effects on the organization, the work process, and the occupational structure), and takes as its starting point the assumption that technological change on one level will not necessarily lead to parallel change on another level.

opportunity to evaluate the validity of their approach, as well as to identify similar trends, if they exist. This and other results from other questionnaires (work includes for example, BRAC material, see chapter two) were collected to be used in a workshop context, where they would be presented to workers who are members of the group which provided the data. Having discovered contradictions in workers' attitudes towards technology (see chapter two) during preliminary analysis of the data, data were further analysed in an effort to clarify these contradictions.

In chapter two, tables 2.1 and 2.2 show popular attitudes towards technology. In this chapter, results of each aspect of this inquiry will be considered. It will become clear that gender differences in attitudes towards technology exist. It will also become clear that while approaches to the study of technology and the workplace, such as that of Feldberg and Glenn, are useful, they can be constraining as well. Models fail to account for the diversity of experiences which occur even within a given workplace.

Gender Differences in Workers' Attitudes Towards Technology and Technological Change

Respondents were given a series of questions concerning their attitudes towards technology and were asked to specify whether they agreed or disagreed with each statement. While in

most cases for clerical workers, men's and women's responses were quite similar, data illustrate that among clerical workers, a significantly greater percentage of women than men feel technological change is inevitable. Table 6.1 includes results from the series of questions about clerical workers' attitudes towards technology.

While the assertions that technology is progress, and that how it is used determines if it is good or bad are held almost equally by women and men, women more than men feel that technological change will occur whether they want it to or not. ($\chi^2(1,\underline{n}=244)=6.88$, $\underline{p}=.0087$). While some of the other differences are not statistically significant, they remain interesting. A slightly greater percentage of women than men indicate that it is important for businesses to introduce new technology to remain competitive. A larger percentage of men, however view technological change as neutral and value free.

While there are not significant differences for most of these questions, other data are consistent with the data, in table 6.1. For example, when airline workers in the study cited in chapter two were asked similar questions, gender differences were statistically significant for three questions. Table 6.2 illustrates these findings.

While the wording was somewhat different in the questions posed to the two populations regarding whether or not technological change is worth paying attention to, the airline

Table 6.1

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Workers' Specific Views of Technology

_____

| | % Agree [1] | | | | | |
Specific View of Technology	Women	Men	DF	$\underline{n}$	x^2	$\underline{p}$
Technological change means progress	87	88	1	244	0.00	1.00
Technology itself is neutral and value free	46	55	1	14	2.72	.39
The way technology is used determines if it is good or bad	91	90	1	243	0.00	1.00
It is important for business to be able to introduce the latest technology so that they can become more efficient and compete	83	79	1	246	.27	.60
Technological change isn't worth paying attention to	2	5	1	249	1.09	.77
Technological change will occur whether we want it to or not	92	76	1	244	6.88	.0087
Technology is inevitable doom	17	17	1	237	0.00	1.00

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Note: Percentages are rounded.
[1] Collapsed from 'agree strongly' and 'agree somewhat'.

Table 6.2

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Airline Workers' Views of Technology

_____

| | % Agree | | | | | |
View of Technology	Women	Men	DF	$\underline{n}$	x^2	$\underline{p}$

_____

Technological change means

progress	76	71	1	685	2.38	.12
Technology itself is neutral and value free, how technology is used determines if it is good or bad	88	88	1	697	0.00	1.00
Technological change will cause more problems than it solves	26	30	1	668	1.09	.30
Technological change is unworthy of any special attention	1	5	1	697	5.65	.02
Technology is inevitable progress	94	89	1	708	5.37	.02
Technological change is inevitable doom	19	26	1	688	4.07	.04

Note: Percentages are rounded.

workers' data (which represent a much larger number of

responents) in table 6.2 reveal a significant difference in male

and female opinion about the inevitability of technology. A

significantly higher percentage of male respondents agreed that

technological change is unworthy of any special attention. In

contrast, a significantly higher percentage of women agreed that

technological change is unworthy of any special attention.

Although the specific questions were different in the two

surveys, in both groups of workers a significicntly greater

percentage of women than men agreed with statements suggesting

that technological change is inevitable. This may reflect a

greater sense of powerlessness on the part of women, in relation

to their work, and in particular, to technology.

Similarly, while agreement with the statement that
technological change is inevitable doom is the same between male
and female clerical workers, a significantly larger percentage
of male airline workers, agree with this statement ($\chi^2(1$, $\underline{n}$
=688)=4.07 $\underline{p}$=.04). One possible explanation is that gender
differences in response patterns are linked to the length of
time jobs have been automated. While attempts could be made to
explain the gender differences in airline workers' responses
based on an assumption that men and women fill different jobs,
and hence have different experiences with technology, in the
case of airline workers, this is not true. Men and women occupy
the same jobs, which suggests that men may be more critical of
technology than women.

A comparison of data from tables 6.1 and 6.2 brings some
additional interesting points to light. Both men and women
clerical workers agreed to a greater extent than the airline
workers that technological change means progress. Among other
things, this may reflect the two groups' different experiences
with technological change. While the airline jobs were automated
overnight in 1975, and have continued to become more
technologically sophisticated, the university clerical workers'
jobs have been automated much more recently, and in most cases,
gradually. As has been suggested by an airline worker (BRAC
1986), during the early stages of automation, the new
computerized systems parallel old forms of work. In most cases,
the reorganization of work often associated with computers does

not occur at the same time as the introduction of new technology, but rather lags behind the introduction of the new machines.

Two additional questions asked clerical workers their opinions about the extent to which workers should be involved with the process of technological change in the workplace. While responses to question 6 regarding changes to the office shows no gender difference in response patterns, responses to the second question, (question 7) which addresses who should be involved with the introduction of technology into the workplace, indicate that gender has a significant impact on response. Table 6.3 shows these findings.

The majority of men feel workers should to a great extent or entirely be responsible for deciding if the proposed technology is appropriate or not. While this is also true for women, the percentage of women who concur that they should be entirely responsible for evaluating new technologies is considerably smaller than men expressing this view. This finding is congruent with the finding reported earlier, which indicates that women more than men feel technological change is inevitable.

Women appear to be influenced by past socialization in relation to technology, which probably did not provide ample opportunities to learn about or control technology. In addition, women and men clerical workers in the population studied fill

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Table 6.3

Workers' Views About Involvement With Technological
Change

	% Agree	
	Women	Men

In your opinion, to what
extent should you, as an
employee be involved in the
introduction of new tech-nologies to your job?[1]

	Women	Men
Not at all	0	0
Minimally - they should be notified	2	0
To some extent; they should be asked to comment on management's plans	32	28
To a great extent; they should be asked to determine what machines would best meet their needs	60	51
Entirely; they should be responsible for deciding if the proposed technology is appropriate or not	6	21

Note: Percentages are rounded.
[1]Significance is for entire table. $\chi^2(3,\underline{n}=231)=10.02,\underline{p}=.02>$

different jobs, resulting in different experiences in relation

to technology, which could result in the gender differene

reported above. Also, comments made by women during the

workshop, as well as on questionnaires, suggest that often when

women expressed interest in learning more about the technology

used in their jobs, they were discouraged. Women's greater

acceptance of technology may be a reflection of past

socialization and present experiences with technology on the job.

When asked if employers should be allowed to monitor workers, men and women responded differently. Table 6.4 illustrates this difference.

A significantly greater percentage of women than men feel that employers should not be allowed to monitor work. This finding suggests that while women more than men feel that technological change is inevitable, and that fewer women than men feel workers should be entirely responsible for introducing technology into the workplace, women are very strongly opposed to monitoring of their work - an issue which directly affects them.

Workers' Experiences With Technological Change on the Job

Having discussed gender differences in workers' attitudes towards technological change, and workers' opinions about worker involvement with the introduction of new technology as well as other issues, we can now begin to look at workers' actual experiences with technological change in the workplace. Before doing that, background information will be presented.

Eighty-two percent of survey respondents have used computers while working for their current employer. The greatest

Table 6.4

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Workers' Views About Monitoring of Work

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	% Agree	
	Women	Men

_____

	Women	Men
In your opinion, should employers be allowed to monitor work?[1]		
Yes	28	53
No	72	47

_____

Note: Percentages are rounded.
[1] $\chi^2(1, \underline{n}=231)=7.78, \underline{p}=.005>$

percentage of AUCE clerical workers (49%) began using computers

during a three month period prior to the survey discussed here.

Another 17% have been using computers between three months and

two years, while 34% have been using computers on their jobs for

two years or longer. Although most people using computers have

only begun to do so recently, data indicate that computers have

been present in all types of offices for quite some time. Most

workers heard of the introduction of new technologies from a

supervisor. Only 8% of the workers instigated the introduction

of new technology into their offices, while 6% were never

informed about the introduction of new technology. Of those who

were given notice about the introduction of new technology into

the office (69%),[3] the amount of notice received prior to the

introduction of computers varied from no notice to several

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[3] This may be a misleading figure, as some workers may have begun
work or moved into already computerized offices.

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years. Most workers (79%), however, received three months notice or less about the introduction of new technologies to their jobs.

In the last section workers' opinions regarding the extent to which workers' should be involved with the introduction of new technologies and other changes to the office, were reviewed. In looking at workers' experiences with technological change, it is informative to begin by looking at the extent to which workers' experiences match their perceptions of how new technology should be introduced. Table 6.5 summarizes workers' experiences with the introduction of new technologies to their jobs.

While a majority of workers feel that workers should be involved to a great extent or entirely with the introduction of new technology into the workplace (see table 6.3) data in table 6.5 indicate that the opposite has been true. Eighty-seven percent of women respondents were either not at all, minimally or to some extent involved in the introduction of new technology into their offices, as compared to 60% of male respondents. Greater proportions of male respondents were either to a great extent involved with the introduction of new technology into their offices, or entirely responsible. Almost two thirds of workers have had opportunities to make suggestions about how the new technology is used on their jobs. In line with findings discussed earlier, it appears that women weren't given the opportunity to be active and involved with technological change.

Table 6.5

"Workers' Experiences With the Introduction of New":-
"Technologies"

	% Agree	
Experience	Women	Men
Extent to which workers have been involved with the introduction of new technology into the work environment[1]		
Not at all	20	13
Minimally; I was notified	42	20
To some extent; I was asked to comment on management's plans	25	27
To a great extent; I was asked to determine what machines would best meet my needs and/or the demands of my job	8	23
Entirely; I was responsible deciding if the proposed computer or technology was appropriate	0	10
Other	5	7

Note: Percentages are rounded.
[1] $\chi^2(5, n=187)=25.15$, $p=0.018$.

Of those who were consulted about some aspect of new technology in the office, workers were most frequently consulted about furniture (28%), and workspace design (27%).

Workers' Experiences With Technology On The Job

Feldberg and Glenn (1983) have developed an analytic approach to studying the effects of technology on workers, which

rests on the distinction between three different types of effects of technology. Technology affects the occupational structure (the kinds of jobs available), the organizational structure (the ratio of one type of job in a firm to another), and the work process (how the work is actually done).They argue that the failure to differentiate between these three levels of effects of technology on work and workers has resulted in some faulty assumptions about these effects.

This failure to differentiate between these levels has led people to assume that change on one level will result in parallel change on another level. For example, an increase in new technical jobs in the occupational structure is assumed to lead to an upgrading of work done at all levels. Reliance on models criticized by Feldberg and Glenn (1983) which fail to make the distinction between types of effects would lead to the assumption that women and men similarly experience. technological change in the workplace, and that women are just as likely to benefit as men.

Through case study research Feldberg and Glenn (1983) find that there is no necessary connection between change on one level and change on another level. Some jobs are as likely to remain unchanged or be simplified, as they are to be upgraded. Through the use of a model which does differentiate between the occupational structure, the overall organization of work and the work process, Feldberg and Glenn found that women have been differently and more negatively affected by technology than men.

Data collection about workers' experiences with technology was informed by Feldberg's and Glenn's (1983) model. Questions were developed to elicit information primarily about the effects of technology on the work process. Changes in the occupational structure which include variations in the ratio of occupational categories in relation to one another, changes in the content of jobs within an occupational category, etc., could not be collected through a survey. In looking at the organizational level, Feldberg and Glenn look at changes in how work is organized within an organization. While the questionnairre addresses this issue to some extent, again, informal interviews and exchanges during the workshop proved valuable here. Changes in the work process, that is, how work is experienced by individual workers, proved easiest to collect data on through a survey format. These results of these questions are reported below, in table 6.6.

For a majority of this group of workers, several aspects of the work process have remained unchanged as a result of technology. Given that elsewhere (BRAC, 1986) workers have reported that initially the introduction of technology merely parallels the old work process, rather than transforms it these findings are not surprising. In the words of one AUCE worker, "computers lead to high level of stress and frustration till they are mastered. The worker has increased sense of accomplishment." This may explain why for half of respondents the level of challenge associated with their jobs has increased,

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Table 6.6

Clerical Workers' Experiences With the Initial Introduction
of New Technology

Experience	% Agree		
	Increased	Not Changed	Decreased
Level of monotony in job has	15	59	26
Job security has	10	81	9
Level of challenge has	50	41	8
How interesting job is has	41	49	10
Amount of skill involved in job	68	27	5
Extent to which job is specialized	50	48	2
Managements control over workers	13	82	5
The amount of control I have over work has	23	68	9
My job satisfaction has	36	51	12
Amount I need to know about the overall work process has	55	41	5
Extent to which tasks are varied	35	52	12
Amount of positive contact with co-workers has	15	73	12
The ease with which job is done	38	48	14
Amount of work done has	45	49	6
Level of efficiency has	53	42	6
Level of stress in job has	37	60	3
Quality of service provided has	50	42	7

Note: Percentages are rounded.

and why the amount of skill associated with jobs has increased. Similar questions, posed to airline workers reveal that the work environment may change substantially after the initial introduction of technology, even in situations when the initial introduction of technology may not have substantially altered how jobs were done etc. Table 6.7 describes airline workers' experiences with technological change on the job. Note that this industry pioneers in automation, having almost entirely computerized services in 1975.

While the response categories provided for the two sets of workers vary (airline workers were not given the option of responding with "no change"), the roots of this difference are perhaps indicative of a larger pattern. When the survey given to airline workers was pre-tested, airline workers accepted the question in the form which appears above - with two response categories. When the same questions were given to university clerical workers for pre-testing, the number of people who indicated a desire for a "no change" category necessitated that such a category be added. This suggests that the effects of computerization on airline workers is more pronounced or extreme than what university clerical workers are experiencing. In addition, the data also indicate that for many of the questions posed, this is true.

While only 15% of university clerical workers felt that the level of monotony associated with their jobs has increased, over half of the airline workers felt monotony had increased as a

Table 6.7

Workers' Airline Experiences With the Initial Introduction
of New Technology

	% Agree	
Experience	Increased	Decreased
Level of monotony in job has	57	43
Job security has	18	82
Level of challenge has	55	45
How interesting job is has	55	45
Number of steps required to do job has	33	67
Amount of skill involved in job	73	27
Extent to which job is specialized	80	20
Management's control over workers	73	27
The amount of control I have over work has	53	47
My job satisfaction has	47	53
Amount I need to know about the overall work process has	70	30
Amount of positive contact with co-workers has	29	71
The ease with which job is done	80	20
Amount of work done has	70	30
Level of efficiency has	89	11
Level of stress in job has	62	38
Quality of service provided has	62	38

Note: Percentages are rounded.

result of the introduction of computers into the workplace. Similarly, while half of the university clerical workers report that their job has become more specialized, 80% of airline workers report increased job specialized. While only 13% of university clerical workers indicated that management's control over workers has increased, 73% of airline workers indicated that management control over workers had increased as a result of the introduction of computers. While only 53% of university clerical workers indicate their level of efficiency has increased, 89% of airline workers indicated their efficiency has increased as a result of technological change. While 37% of university clerical workers indicated the level of stress associated with the job had gone up, for 76% of airline workers this was the case.

Gender Differences

When responses to the above questions are considered in relation to gender, a few significant relationships are suggested by the data. Among university clerical workers, response to the question concerning level of control over work appears to be related to gender. While the majority of women (73%) feel their control over work has not changed as a result of new technology, only 45% of men felt this aspect of their work had remained unchanged ($\chi^2(2,\underline{n}=191)=9.53$, $\underline{p}=0.01$). Forty-two percent of men felt that as workers, their control over the work process had increased as a result of the

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introduction of computers on the job.

Given earlier findings which suggest that women feel more
accepting of technology, this is not surprising. It may be that
for men, the introduction of new machines encourages interaction
with the machines which they feel allows them greater control
over work. For women, interacting with new machines does not
lead to an increased sense of control. The cause of this gender
difference lies beyond the scope of the data collected. Two
possible explanations of this difference include 1) that men and
women have different perceptions of similar experiences, or, 2)
that men are encouraged or allowed to use computers in ways
which encourage a greater sense of control.

The other question in which gender proved significant was a
question regarding the quality of service provided as a result
of the introduction of new technology. While women responded in
roughly equal proportions that the quality of service provided
had decreased as had increased, almost two-thirds of male
respondents felt service had increased. Sixteen percent of male
respondents, compared to only 6% of women respondents felt that
the quality of service provided had decreased in relation to the
introduction of computers into the office $\chi^2(2,\underline{n}=189)=9.07$,
$\underline{p}=0.01$. Again, the explanation of this difference lies beyond
the scope of what the data suggest; however, one possible
explanation is the occurrence of different perceptions of
similar experiences. Another possible explanation is that women
and men work in different jobs, where computers have a different

effect on the quality of service provided. Data from airline workers, whose jobs are largely not sex segregated, demonstrated gender differences, suggesting that women and men may perceive similar situations differently.

The analytic approach developed by Feldberg and Glenn (1983) proved to be useful in developing questions to be posed to groups of workers about technological change. While the questions here focused primarily on the work process, this approach did allow us to see that some gender differences do exist in how workers experience the effects of new technology on their job. The model, however useful, does have some limitations. Among them, the model does not describe the changes in the work process which accompany the early stages of computerization of a firm. To this extent, the model can not be used predictively, as changes which occur during the early stages of computerization are ill explained by the model. In addition, the model does not account for the potential of ideology or belief systems to affect responses. In some instances, this may not be a problem. However, when working with subjective data, one must consider the possibility that responses to questions posed by the researcher will reflect the respondent's belief systems about technology, which can have an impact on how a respondent reports experiences.

Contradictions in Workers' Views of Technology

In chapter two it was argued that there are contradictions in workers' views about technology. That discussion focuses on establishing the contradiction and looking at its implications. It was also suggested that to dismiss these views as unchangeable is to obscure the potential for different gender and class relations. Additional cross-tabulations of data presented in chapter two yielded some contradictions similar to those presented earlier. Some examples follow.

Eighty-three percent of respondents of the clerical workers' survey agreed that it is important for businesses to introduce the latest technology, so they can remain competitive. Of that group, 97% also agreed with the statement that criteria besides business criteria should be used to determine how technology is introduced. For most respondents, a potential conflict arises. People believe that criteria besides business criteria should determine how technology is introduced. However, at the same time they believe that business must introduce the latest technologies to remain competitive. While the belief about how technology should be introduced implies an active role on the part of workers in shaping technology, the belief about how essential technological change is to business implies passivity in relation to technology on the part of workers.

Seventy-nine percent of those who agree that ordinary people should have veto power over technological change also agree that

technological change is essential to business competition
($x^2(1,\underline{n}=244)=6.58$, $\underline{p}=0.01$). This indicates a conflict similar to
the conflict described above. On the one hand people believe
they should have a say in the shape of technology, implying an
active stance in relation to technology. On the other hand,
agreement with the statement that technologial change is
essential to business competition implies an acquiesence to
business in shaping technology.

These data further substantiate the general claim made in
chapter two regarding the prevalence of limiting beliefs about
technology, riddled with contradictions. The prerogatives of
business are used to determine what progress is; discrepancies
between how people think technology should be managed and how it
is managed do not disturb the cultural sense that technology is
progress. These legitimating notions of progress can be
challenged, and the basis for this challenge can be found within
the same contradictions.

When one looks at how workers feel they should relate to
technology versus how workers do relate to technology, we can
more clearly see that there is some consistency in how workers
would like to interact with technology, despite all of the
contradictions inherent to the views themselves. Data suggest
there is a general agreement in the workplace that criteria
other than business criteria should guide the introduction of
new technology (96%), that non-experts should play a significant
role in technological change (76%), and that ordinary people

(workers) should have some form of veto power over technological change (80%).

Having argued that these contradictions in attitudes toward technological change can be one source for challenging gender and class relations in relation to technological change, gender differences take on an enlarged significance. While there are similarities in how men and women view technology, there are also important differences which must be considered in working with groups of workers in relation to technological change. For example, data about the inevitibility of technology suggest that men would be more willing to challenge technology than women. This in turn suggests that discussing this topic with women might require an approach unique to women.

Discussion of three additional questions supports the point made earlier about contradictions inherent to cultural attitudes about technological change. Bernard (1985) has made the point that workers' attitudes towards unemployment are similar to young soldiers' attitudes toward the potential of death during a war. Soldiers all recognize that there is the potential to die during combat. However, this doesn't stop them from fighting. Many think that death will not touch them. Similarly, workers, recognizing the labour displacing potential of technology assume that while layoffs might occur, they will not affect their industry, or their firm.

Respondents to the questionnaire were asked if the application of computers to their jobs could result in any form of self- service.[4] They were also asked if computers in the workplace might make their job obsolete. Of the respondents who felt computers could result in some aspect of their job becoming self- serve, 62% felt computers could not result in their jobs becoming obsolete ($\chi^2(1,\underline{n}=230)=23.94$, $\underline{p}=<.001$).

While other cross-tabulations did not yield statistically significant relationships, the patterns displayed are similar. Respondents who use computers on the job were asked if they connected with other computers, and if they used an electronic mail or message system. Of those respondents who connect with other computers, 65% feel that computers will not make their jobs self-serve. Of those who connect with other computers at work, 78% feel computers won't make their jobs obsolete. Of those using a message system, 81% feel their job cannot be made obsolete by computers.

These findings are particularly interesting in light of the history of computerization of the airline industry, which provides ample examples of computer telecommunications resulting in redundancies, as well as computers being used directly by customers, by-passing an airline employee. New developments allow customers to use a magnetic-strip card to reserve seats on

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[4]Self-service occurs when a person who is not paid to provide a service can obtain the service without involving, or involving to a much lesser degree, a person who is paid to provide the service. Bank machines and self-serve gas stations are two examples of self- service.

planes and issue tickets, from a self service machine.
Individuals and businesses can now book airline reservations
through off-premise computers, just as travel agents have for
years, further eliminating the need for (paid) airline
employees. This suggests that clerical workers have barely begun
to experience the range of impacts possible in relation to
technological change.

Conclusion

Gender differences discussed in the first section of the
chapter indicate that among survey respondents, women are more
passive in relation to technology than men. In addition, they
are somewhat less critical of technology than men, and to a
lesser degree than men feel that as workers, they should be
extremely involved in the introduction of new technology into
their jobs. However, they are also significantly more opposed to
monitoring of work than men, which suggests women do have strong
opinions which suggest an oposition to how technology is a part
of their lives, when the issue is one which diretly affects
women. Women also report being less involved in the actual
setting up of technology in their own workplace. This may
reflect their own acceptance of the technology resulting from
socialization, or may reflect limitations on experiences with
technology imposed by supervisors.

Data also suggest that in some instances, women and men do have different experiences with technology. The exact cause of these differences requires further research. While Feldberg's and Glenn's model of how workers are affected by technological change is useful in locating gender differences in workers' experiences of technology, it is somewhat limited in its ability to predict differences which might occur only during the early stages of automation.

Data also indicate that there are contradictions in workers' attitudes towards technology. Most notably, there is a large discrepancy between what workers would like to have happen in relation to technological change, and what does happen. This can provide a basis for challenging how technological change is shaped and controlled.

CHAPTER VII

RESULTS OF THE PILOT EVALUATION OF THE WORKSHOP AND CURRICULUM

Cook and Campbell (1979) point out that pilot work, designed to anticipate and detect the unexpected, reduces the likelihood of unfruitful experimentation. Pilot tests play a particular role in field settings where, unlike laboratories, conditions can not be rigidly controlled. It is also important, Cook and Campbell point out, to detect unexpected reactions at an early date, so the research can be redesigned to maximize their effect.

In conducting workshops using the curriculum described above, it was hoped that insight would be gained generally about the merits of a particular educational approach, and specifically about the content of the curriculum. Besides information about the curriculum, some insights have been gained about problems in the educational environment of union education[*] in general. In this section, results of the pilot evaluation of the workshop will be discussed. In this context, implementation of the workshop will be discussed in greater detail.

As initially conceived, a technological change workshop would be delivered, through the union, along the same lines as other union workshops. Hence, the workshop was scheduled for two consecutive weekdays, partially on work time, and partially after the work day. Because of the relationship of the questionnaire to the workshop, (it was administered to the same

group who would have an opportunity to attend the workshop,) the workshop was scheduled further in advance than similar union-sponsored workshops.[1]

The workshop was advertised in several ways. Beginning with the first questionnaire mailout, union members were told there would be a workshop on technological change which they could attend. On the same form that members were asked to return to indicate that they had returned their questionnaire, they were given the option of indicating whether they would like to attend the workshop on technological change. In addition, announcements were made at union meetings, and posters advertising the workshop were posted throughout the university on union bulletin boards. These notices made it clear that wage reimbursement was available for the time union members would miss work to attend the workshop. The workshop was scheduled like previous AUCE workshops had been scheduled; on two consecutive afternoons, half on work time and half off of work time. It had been hoped that interest in the workshop would be great enough to accommodate randomly assigning potential participants into two groups, allowing comparison between them after one group

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[1]Data collection through survey requires a minimum of eight weeks, to ensure a high response rate. Because data were collected in part to be used in the workshop, data collection had to occur prior to the workshop. Because the distribution of work in most areas of the university parallels that of the academic term, care also had to be taken to schedule the workshop during a time when it would be likely that workers would be able to attend. Consequently, the workshop, which occurred late in July, was scheduled in early May. Dates were first publicised in a letter accompanying the initial questionnaire, in mid-May.

attended the workshop, appropriate to a pilot study. Other factors intervened, however, somewhat altering the initial research plan. The process of conducting the workshop is explained below.

One of the factors beyond the control of the research was the attempted automation of the university's undergraduate preregistration system, which was announced after the dates for the workshop had been publicised. Prior to the attempted automation of the undergraduate pre-registration system, undergraduate pre-registration occurred during a six-week period. While the beginning of this period was often busy, as the pre-registration period continued, the work load associated with this task leveled out. While talk of the new system had been occurring for some time, it was finally decided to change the pre-registration process, by automating it beginning in July 1986.

Rather than scheduling pre-registration for a six week period, as had previously been done, the pre-registration period was shortened to three weeks, the first two of which overlapped the previously scheduled dates for the union workshop on technological change. When the pre-registration period began, many offices had not yet received the proper computer equipment. In some instances, where the proper equipment had been installed, little or inadequate training prior to the pre-registration period made it impossible to use the newly-automated system. Consequently, a task which had

previously been conducted over a six-week period, was now being conducted during a three week period. This, along with other factors discussed below, seems to have had a negative impact on workshop participation.

Between two weeks and ten days prior to the scheduled date for the workshop, flyers were posted about the workshop. Among other things, the flyers encouraged potential participants to phone the union office to sign up for the workshop. At the same time the flyers were posted, letters were sent to the forty-two questionnaire respondents who had returned forms and indicating an interest in attending the workshop on technological change. Though previous flyers for similar union events had also encouraged union members to phone the office to sign up, experience had proven that most people would wait until two or three days before the workshop, and that a handfull of people might show up, unannounced for the workshop.

Given the knowledge of past experiences with workshops, a decision was reached with the union to not intensify recruitment for the workshop, until just a few days prior to the workshop. The workshop was scheduled for Tuesday and Wednesday afternoons, in the same week. On the Thursday prior to the workshop, when only a few people had indicated an interest in attending the workshop, a telephone campaign was undertaken, to encourage participation. (The same forty-two people who had earlier expressed an interest in the workshop, were contacted by phone.) By the time the workshop occurred the following Tuesday, nine

were on holidays,[2] one had moved out of the union, one expressed

a desire for a more hands-on course (in light of comments

reported earlier concerning the lack of training, this is not at

all surprising), one was on long term medical leave from her

job, three specifically mentioned an inability to leave work

(either because of other people in the office out on holidays,

with no replacement, or too much work in general), and two

additional members mentioned library reorganization specifically

as the reason they were unable to attend. One potential

participant from the downtown campus became a non-participant

because of day-care problems.

As a result of the telephone work, and distribution of

additional flyers, twenty participants were recruited. Next,

these twenty participants were randomly assigned to one of two

groups. One group would attend a workshop on technological

change immediately, the other would wait until the. fall. The

situation was explained to participants, and they were notified

about which group they had been assigned to. Although nine

people were assigned to the group which would participate in the

workshop immediately, only five appeared when the workshop was

to begin. [3]

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[2]While the summer is not the best time to conduct union
educational programs, given that the workshop had to occur
during one of the summer months for research reasons, a date in
July was specifically selected to maximize on availibility of
potential participants, in light of holidays. While AUCE members
indicated that in the past most people took time off in the
middle of August, July also proved to be a busy month for
holidays.

[3]One was sick, one had become confused about the dates, and one

The workshop was carried out as had been planned, with the exception that participants could not all come for the full time the second day. One participant was unable to attend at all the second day, due to workload. (This was unknown ahead of time.) Another participant had to leave early the second day, and a third, who had only been able to take time away from work by agreeing to return to work after the workshop, came after the workday on the second day. The workshop was repeated a second time, as will be explained below, and a similar problem ocurred.

Because participation rates had not been as high as had been hoped for, and because several people who had been contacted by phone about the workshop had been very positive and enthusiastic, despite pressures that prevented them from attending at that time, a second workshop was scheduled two weeks after the first. Potential participants from the initial group who had expressed an interest in the workshop, but had been on holidays or otherwise unable to attend, were contacted by phone and informed about the workshop. Many people were very positive about the workshop, two asking that workshop materials be sent to them, though they couldn't attend. Three people indicated that they would like to attend the second workshop, and all three did so.

Because some participants had been unable to attend the second day of the first workshop, at the beginning of the second workshop, participants were asked if they would be able to

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[3](cont'd) had been unable to leave work at the last minute.

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attend both days. Because only one of three participants could attend the second day, a condensed (one day) version of the workshop was offered. Since the workshop was set up to accommodate a lot of discussion and sharing of experiences, during the second workshop, all of the information could be presented, while still leaving some, though not as much time for discussion.

Participants responded very positively to the workshop. One comment that came up both during the workshop and which appeared in written comments of those participants who wrote comments about the workshop, was that it was unfortunate that more AUCE members had not attended. In the words of two of the respondents,

> Would have liked to seen a bigger turn out - which would have been more useful and got a wider range of ideas and opinions on technological change.

> I hope that more SFU employees take advantage of the courses on tech change. I feel I have a better understanding, and a different outlook. Technological change can happen in a positive way and it can work for you and not against you.

The value of discussing technological change with other union members is expressed by one workshop participant:

> Listening to other AUCE members from other areas, I can relate what happens in their departments to what can happen in ours...

This participant went on to make the point that this type of discussion (about technological change in different departments) does not always occur in other union meetings, and that these seminars are the only time such matters are talked about.

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Participants too, were concerned not just that others had not attended the workshop, but about why they had not attended it. During a discussion of cultural views of technology and definitions of technology, one participant in the first workshop asked if it might be possible that others had not attended the workshop because they felt technology was inevitable, so it was unnecessary to find out more about it. This question was also posed after results from the questionnaire (about attitudes towards technology), which had been administered to AUCE members, had been presented. This provides some indication that utilizing data in this way is a useful educational technique.

The number of participants who indicated they would, but then did not attend the workshop, was somewhat surprising. In an attempt to understand whether or not this was a normal occurrence, informal interviews were conducted with union leaders and educators in the Vancouver area. Marcy Cohen, (personal communication, M. Cohen, July 26, 1986) of Women's Skills Development Society pointed out that at a recent workshop on health and safety in the workplace related to technological change, although 38 people had registered, only 28 attended. When the same workshop was held a second time, while 27 had signed up, 16 or 17 attended. Marion Pollack, (personal communication, August 3, 1986) vice-president of the Vancouver local of Canadian Union of Postal Workers (CUPW) indicated that despite the size of the Vancouver local of CUPW, union educational programs often have to be cancelled due to low (i.e.

under seven) participation rates.

Christine Micklewright, (personal communication, August 3, 1986) President of the Brotherhood of Airline and Railway Clerks, (BRAC) Airline Division reported that at a recent day-long seminar conducted by the national office of her union (which has 12,000 members) only 80 people attended, representing a participation rate of less than one percent. In addition, an AUCE union meeting scheduled just prior to the workshop on technological change failed to draw a quorum, which resulted in cancellation of the meeting. While the focus of this study concerning union education was primarily content related, the area of recruitment for and participation in union workshops warrants further attention. While intensification of work within the AUCE bargaining unit may contribute to low attendance at union workshops, interview data show that under 'normal' circumstances recruitment for and participation in union eductional activities is low, suggesting this may be a global problem, warranting further study.

In discussing the low turnout for the workshop, those who had managed to attend had experiences to share about the process each had gone through to become a participant. One participant, upon asking her supervisor permission to attend the workshop, was referred by this supervisor to the most senior person in that office, for permission to attend. This occurred despite the fact that it is within the mandate of the supervisor to grant permission for time off for union business.

In addition, another workshop participant, upon requesting permission for time off, took the flyer about the workshop to her supervisor. Despite the clearly presented information on the flyer, which stated that the workshop was being offered by AUCE local #2, and that wage reimbursement was available, the supervisor persisted in telling the participant that the workshop was being offered by AUCE local #6, not local #2, that wage reimbursement was not being offered, and that the workshop had not been cleared with personnel. In addition, this person could only get the time off from work by taking it as holiday time, rather than union time off.

In another instance, a workshop participant had returned from vacation to find that her co-worker had obtained another job, which she had already been moved to. The co-worker's position had not yet been filled, and yet the workshop participant was expected to keep the work (done previously by herself and her coworker) up to date. This participant was only able to take time off from work by agreeing to return in the evening and make up missed work time.

All three of these cases could be considered to be intervention, on the part of supervisors, intending to prohibit people from attending. In the first case, the referal for permission to the most senior person in the office is a form of intimidation; in the second case, it was blatant interference. In the third case, intensification of work can be used to increase demands on active union members' time, prohibiting

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further involvement with the union. [4] In light of these findings, there is cause to speculate that at least some potential participants become non-participants after the occurrence of events like those described above.

While participants enjoyed the exercises, it appeared they were more involved with the discussions which occur as a part of the exercises, than with learning the techniques, such as how to use an effects wheel.[5] Given this finding, it seems appropriate that participants received material at the beginning of the workshop, which provided an approximate transcript of material presented during the workshop. While evidence is available for only one participant in terms of use of the materials, after the workshop, in her words, the "materials were great."

Given the positive response to discussions which occurred during the workshop, it was not surprising that participants liked the slide presentation, and found it useful. In commenting about it, one participant wrote,

> I really enjoyed the slide presentation. I like the fact that everyone exchanged their own feeling about their working environment and how they felt that not enough training was involved when the computers were introduced.

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[4]The same person to whom this happened observed that one of the impacts of use of computers was that, unlike the system prior to automation, where a person might momentarily interrupt their work to join in a discussion going on around them, computers somehow encouraged people to pay attention to them. The result she has observed is that there is less grass roots organizing and interaction in her department, as people are less inclined to "leave" the computer, to participate in a discussion.

[5]See the curriculum, part three in the appendix for a discussion of this technique.

Training was a popular topic for comment on the questionnaires, as data presented earlier in the chapter indicate. It was also a popular topic of discussion during the workshops. First, participants in some departments had received no training at all to use computer equipment, though they were expected to complete their work on the computer. One questionnaire respondent echoed this point made during the workshop:

> I find I am 'expected' and encouraged to keep up with it [technological change] but neither compensated or provided with proper training or opportunity to 'practice' what I have learned.

Another questionnaire respondent had a slightly different experience which she reported.

> I have actually been discouraged from attending training courses, yet I am expected to operate these machines at a high level of efficiency.

In addition, training came up during the workshop, in the context of job mobility within the the university, as well as job reclassification. One workshop participant pointed out that many job postings now required specific experience with particular software. Because of this new requirement, even switching jobs laterally was difficult. Because most other jobs in her classification require experience with different word processing software, she could not easily compete for the other jobs. While she had tried to take training courses which would give her some experience with other software, her supervisor would not grant her time off to attend training for software which she was not required to use in her present job.

Consequently, her mobility, even laterally, is restricted.

Because workers felt so strongly about training, training surfaced during the workshop as a good opening for coding and decoding of workers' experiences. Many workers, both in workshops and in comments on the questionnaire expressed concern about gaining and using new skills on the job, and not being properly remunerated for the new skills. In response to an open-ended question on the questionnaire about how the union could increase its activities concerning technological change, one respondent wrote "encourage proper training and compensation for skills acquired." While several people in the union have attempted to have jobs reclassified (and have in some cases succeeded), reclassifications often do not adequately reflect the new skill acquired.

It is not surprising that employers would fail to provide adequate training for workers on computers. In failing to provide training employers challenge the assertion so frequently made by workers, that the use of computers to do a job involves additional skill, which ought to be remunerated. This echoes Zuboff, (1982) who argues that computer-mediated jobs are marked by a combination of abstraction and routinization. Of the abstraction she writes "one aspect involves the invisibility of many features of work when it becomes computer-mediated" and what goes on 'behind the screen' is lost to view (Zuboff, p.55, 1982).

It can be argued as well, that one of the effects of neglecting to properly train workers is that workers are weakened, both physically and as a group. In the words of one AUCE member, "a lot of us go through many frustrating days (months) because of no proper training and we do it all by trial and error." Another AUCE member talked about being constantly uncomfortable because she had not yet received proper training. Another worker commented that she and her co-workers are "illtrained, frustrated and uneasy." The pressure which results from the lack of training makes it more difficult to work towards change.

Conclusion

The curriculum and workshop developed appeared to have benefitted workers, and provided them with a point from which to begin evaluating how technology affects them at work. Beginning discussions about technology with a review of cultural attitudes towards it appeared to be useful, and the utilisation of technology assessment exercises valuable, in particular because it allowed participants to share work experiences with one another.

The collection of data from the workers who attended the workshop also proved valuable, both in preparing the workshop curriculum, and in acting as a focal point for conversations with workers about their experiences on the job. In addition, it

allowed easy comparison with other workplaces, which was useful in developing a larger perspective of how technological change is affecting work and workers.

CHAPTER VIII

CONCLUSION

In chapter two attitudes towards technological change and models of the human technology/relationship were discussed. That discussion was undertaken to make explicit the approach that was adapted in developing educational materials about technological change, and to explore workers' attitudes towards technological change. After discussing several commonly held attitudes towards technological change and considering models of the human/technology relationship they imply, it was argued that a model which considers contexts of technology, while at the same time encouraging an analysis of the human technology/relationship which restores people to their role as subjects, would be most useful in educating women workers to challenge the gender relations mediated through technological change. Other types of models do not encourage us to view technology in a way which suggests that ordinary people can have an effect on how technology is used in our lives.

Contradictions were discovered in workers' attitudes towards technological change, which suggest that it is difficult for workers to develop their own analysis of technology. One explanation for these contradictions is that technology simultaneously serves as the vehicle and mask of domination, trapping us in a complex web of beliefs which legitimate a lack of freedom. This suggests that the starting point for an

educational strategy aimed at challenging gender relations should be by challenging commonly held views of technology, and the social relations from which they spring.

In chapter three, approaches to education were discussed. A review of mainstream and less popular approaches to education revealed that no single educational approach was well suited to the task of developing an educational approach to teaching women workers about technological change in an empowering way. Philosophical approaches to education fail to account for power relations, and as a result, reproduce the dominant cultural ideology, which denies women equal status with men. Other material which focuses on women in the education system fails to provide information about how to educate women in an empowering way. One consequence is that as a result of this omission, women are not encouraged to explore at all the possibilities that both education and technology play roles in women's oppression. Thompson's (1983) work avoids many of the pitfalls of other material, yet she does not consider educating about technology.

Though far from perfect, Freire's (1972) model for a problem posing education proves to be the basis for a workable educational model for an empowering workshop on technological change for women. The strength of this model is that it builds on learners' experiences, as well as encouraging learners to participate in learning, rather than simply trying to receive information passed on to them.

In chapter four, technology assessment is first described and then critically reviewed in the context of its value as an educational tool for empowerment. It was argued that traditionally performed technology assessment studies do not adequately challenge gender relations. Instead, cognitive authority, the process through which one becomes a 'certifiable' expert, ensures that technology assessment practitioners will conduct their analyses of technology within the confines of the acceptable and dominant ideology. In addition, traditional technology assessments assume a commitment to technology as a starting point, rather than a commitment to social goals.

It was argued that group interest oriented technology assessments can go beyond the limitations of traditional technology assessments in several important ways. First, group interest oriented assessments can be conducted by public groups, in their own interest, which is likely to challenge constraints resulting from cognitive authority. Second, this type of assessment also easily accommodates the framing of problems around 'desirable futures.' Assessment techniques, such as Bush's (1981) effects wheel can be used in a variety of settings in a variety of ways. It can be used in a manner which is analogous to Freire's (1972) codification of learners' experiences.

Chapter five described the methods employed in data collection, in addition to providing an overview of the workshop curriculum which was developed in light of arguments made

throughout this thesis. Questionnaire results, which were presented in chapter six verify the existence of gender differences in attitudes towards technological change, as well as experiences with technological change. Women tend to act more accepting/less critical of technology than men. However, data also demonstrated that women have strong opinions about matters such as monitoring of work, which directly affect them. In addition, data revealed additional contradictions in workers' attitudes towards technology which can be used as a tool in a workshop setting, to explore the role of ideology in supporting workers attitudes towards technological change.

In chapter seven, results of the pilot evaluation of the workshop and curriculum were reported. It appears that technology assessment techniques were an effective educational tool, in part because they provide a focal point for discussions which allow and encourage participants to share their experiences of technological change with other workers. Participants also found the slide presentation useful, for some of the same reasons. The use of data collected from workers who participated in the workshop proved extremely useful in directing conversation and exercises towards workplace issues.

The pilot study was also successful in identifying other significant issues which will warrant further study. First, while the workers' experiences suggest that the use of original data for each group worked with is valuable in providing a starting point for discussions about technological change in the

workplace, this fails at times to be practical. This does not
however render the curriculum useless in the absence of original
data, since there are ways of obtaining the same or similar
effects.

This suggests that original data is not always necessary;
data from similar workplaces can be used, along with data from
workplaces experiencing different levels of technological
change. For example, the different responses to similar
questions reflecting airline and clerical workers' different
experiences of technological change proved to be very useful in
creating a broader picture than data from just one workplace
could illustrate. Finally, given the wealth of data available
from unions as a result of Labour Canada funded research, in the
absence of specific data, a combination of library work and
interviews would probably provide data which could be
appropriately used in labour education workshops on
technological change.

Given the positive response to utilizing a group oriented
technology assessment approach in educating workers about
technological change, additional studies might attempt to
identify other ways to use this approach to heighten awareness
of technological change in the workplace, and to organize
additional activities in relation to technological change.

Gender differences in workers' attitudes towards
technological change indicate that in particular, women's

current perceptions of technological change should be challenged, as these views limit the extent to which workers see themselves as able to alter how technological change alters their jobs. Given these findings, several different approaches to challenging women's current perceptions about technological change should be developed and tested. For example, the model used in the Vancouver Municipal and Regional Employees Study, where workers attend a training session, and then return to their workplaces to develop the concept of social choice in machine design with co-workers, deserves further attention (M.L. Benston, personal communication, August 17, 1985).

The area of workers' participation in union educational programs must be investigated in greater detail. A study should be undertaken to determine the extent to which social relations of the workplace discourage employees from attending educational programs. Second, efforts should be directed at developing strategies to ensure that workers have opportunities to participate in educational activities sponsored by the union.

In relation to gender based differences in workers' experiences of technological change, additional work might attempt to identify the extent to which different perceptions of similar situations are the cause of the gender differences identified, as opposed to differences resulting from gender segregation of the labour force, or other factors. A related line of inquiry might attempt to determine whether workers' perceptions of gender differences related to technology, or

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perceptions held by workers, have a greater impact on how workers actually experience technological change.

The inability of Feldberg's and Glenn's model of the technology/work relationship to describe subtle changes which accompany the introduction of new technology suggests that additional work might attempt to develop a model which can place changes occurring during the early stages of computerization into a broader context. Such a model might be used as an early warning system, aiding workers in identifying subtle changes which might be indicative of changes which will grow to a larger magnitude with time.

Finally, the wealth of comments about the lack of training and inadequate training suggests that a fruitful area for research might be the relationship between lack of training and stress, sense of control on the job, etc. In addition, it would be interesting to conduct multi-workplace research about the relationship between amount of training provided and levels of pay and recognized levels of skill. One possible explanation for the resistance to the provision of training is that providing training would imply new skills are required to perform a job. This in turn raises the issue of job reclassification. One possible motive behind the failure to provide adequate training for workers on new machines is that the amount of skill required to do the job is somewhat obscured during the process of self-training.

All of the research directions suggested above are easily suited to group interest oriented technology assessments, and all of these issues can be addressed by lay people - the workers themselves. Given that workers have expressed interest in how technology alters their worklives, and given that there are many discrepancies in how workers would like technology to be in their worklives as opposed to how technology is in their worklives, the task of making the job of assessing technology a coffee-break conversation piece should occupy a high place on the list of current union priorities. and should continue to be a priority for scholarly research.

APPENDIX A

<u>Questionnaire Administered to Clerical Workers</u>

First we would like to know what you think about technology.

1. Which of the following phrases best expresses your general view of new technologies? (Circle number)

    1 IT'S PROGRESS; I SUPPORT IT
    2 I'M NOT AGAINST IT, BUT I'D LIKE IT DONE DIFFERENTLY
    3 IT DOSEN'T MATTER WHAT WE THINK; IT'S INEVITABLE
    4 I'M TOTALLY AGAINST IT, BECAUSE OF HOW IT AFFECTS PEOPLE .

2. When you hear the words "technology" or "technological change" do any words pop into your head? (Circle number)

    1 YES...What words? _____
    2 NO

3. Which of the following best describes what you think technological change in the workplace mean? (Circle all numbers that apply)

1 NEW MACHINES	9 MORE RESPONSIBILITY ON THE JOB
2 BETTER RESOURCES TO DO A JOB	10 LESS RESPONSIBILITY ON THE JOB
3 NEW SOLUTIONS TO PROBLEMS	11 MONITORING OF WORK
4 THE REORGANIZATION OF WORK	12 INCREASED PRODUCTIVITY
5 GREATER EFFICIENCY	13 CONTRACTING OUT
6 GREATER INEFFIECENCY	14 LOWER WAGES
7 MORE SPECIALIZATION	15 INCREASED ACCESS TO INFORMATION
8 OTHER (Please specify) _____	

4. Do you agree or disagree with the following statements? (Circle answers)

1 Technological change means progress..AGREE   AGREE   DISAGREE DISAGREE
                                        STRONGLY SOMEWHAT SOMEWHAT STRONGLY

2 Technology itself is neutral and
  value free..........................AGREE   AGREE   DISAGREE DISAGREE
                                        STRONGLY SOMEWHAT SOMEWHAT STRONGLY

3 The way technology is used determines
  if its good or bad..................AGREE   AGREE   DISAGREEDISAGREE
                                        STRONGLY SOMEWHAT SOMEWHAT STRONGLY

4 It is important for businesses to be
  able to introduce the latest tech-
  nology so that they can bemore more
  efficient and compete...............AGREE   AGREE   DISAGREE DISAGREE
                                        STRONGLY SOMEWHAT SOMEWHAT STRONGLY

5 Technological change isn't worth
  paying attention to.................AGREE   AGREE   DISAGREE DISAGREE
                                        STRONGLY SOMEWHAT SOMEWHAT STRONGLY

6 Technological change will occur
  whether we want it to or not........AGREE   AGREE   DISAGREE DISAGREE
                                        STRONGLY SOMEWHAT SOMEWHAT STRONGLY

7 Technology is inevitable doom.......AGREE   AGREE   DISAGREE DISAGREE
                                        STRONGLY SOMEWHAT SOMEWHAT STRONGLY

Next we would like to know who you think should be involved in the process of technological change.

5. Do you agree or disagree with the following statements? (circle answers)

    1 Non-experts should play a signifcant
      role in technological change.........AGREE   AGREE   DISAGREE DISAGREE
                                           STRONGLY SOMEWHAT   SOMEWHAT STRONGLY

    2 Other criterea besides business or
      government criterea should be used
      to determine what kind of technology
      is introduced and how it is used.....AGREE   AGREE   DISAGREE DISAGREE
                                           STRONGLY SOMEWHAT   SOMEWHAT STRONGLY

    3 Ordinary people should have some form
      of veto over technological change....AGREE   AGREE   DISAGREE DISAGREE
                                           STRONGLY SOMEWHAT   SOMEWHAT STRONGLY

6. Do you believe that workers and/or their unions should be consulted about changes to office equipment or office layout? (Circle number)

    1 EMPLOYEES SHOULD BE INDIVIDUALLY CONSULTED
    2 THE UNION AND EMPLOYEES SHOULD BE CONSULTED
    3 OUTSIDE EXPERTS SHOULD TAKE CARE OF THESE CONCERNS
    4 EQUIPMENT AND OFFICE LAYOUT ARE MANAGEMENT'S BUSINESS- THE
      UNION AND EMPLOYEES NEED NOT BE CONSULTED AT ALL

7. In your opinion, to what extent should you, as an employee be involved in the introduction of new technologies to your job? (Circle number)

    1 NOT AT ALL
    2 MINIMALLY; I SHOULD BE NOTIFIED
    3 TO SOME EXTENT; I SHOULD BE ASKED TO COMMENT ON MANAGEMENTS
      PLANS
    4 TO A GREAT EXTENT; I SHOULD BE ASKED TO DETERMINE WHAT
      MACHINES WOULD BEST MEET MY NEEDS
    5 ENTIRELY; I SHOULD BE RESPONSIBLE FOR DECIDING IF THE PROPOSED
      TECHNOLOGY IS APPROPRIATE OR NOT

8. If it were proven that technological change created unemployment, then on whom should the social responsibility of unemployment fall? (Circle all that apply)

    1 GOVERNMENTS
    2 FREE ENTERPRISE
    3 UNIONS
    4 ALL THREE JOINTLY
    5 THE INDIVIDUALS AFFECTED
    6 OTHER (please specify) _____

9. Do you think there is a link between working with computers or terminals and health problems? (Circle number)

    1 YES
    2 NO
    3 UNDECIDED

10. How do you think working with computers or terminals effects peoples' health? (Circle number)

    1 POSITIVELY
    2 NEGATIVELY
    3 NOT AT ALL

11. Do you think there is a link between working with computers or terminals and birth defects? (Circle number)

    1 YES
    2 NO
    3 UNDECIDED

12. Do you think that computers can keep track of how fast a person works or how many mistakes they make? (Circle number)

    1 YES
    2 NO

13. In your opinion, should employers be allowed to monitor workers? (Circle number)

    1 YES
    2 NO

14. What would your attitude be towards electronic monitoring of your work or your time at work if it existed? (Circle number)

    1 I THINK IT IS A GOOD IDEA; IT HELPS US KNOW HOW WELL WE ARE
      DOING
    2 I DON'T APPROVE BUT I DON'T OBJECT EITHER; I DON'T CARE
    3 I WOULD WANT IT REMOVED

15. Do you think your employer currently monitors your work or your co-workers' work? (Circle number)

    1 YES....How? _____
    2 NO

Next, a few questions about how you think computers could effect your work.

16. In your opinion, does or will the use of computers or terminals on your job change how the work in your office is organized? (Circle number)

    1 YES
    2 NO

17. Could the use of computers or terminals in your workplace make your job obsolete? (Circle number)

    1 YES....If yes, how? _____
    2 NO

18. Could the application of computers and other new technologies to your job result in any form of self service, where people who require the service you provide obtain it without someone doing what you do?

    1 YES....If yes, how? _____
    2 NO

Next we would like to know what you think about how computers and other new technologies will affect work and workers in the future.

19. The increasing use of computers and other new technologies in the future could lead to: (Circle answer)

    1 More part time work...........VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

    2 Increase in split shifts.......VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

    3 More temporary work...........VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

    4 An increase in contracting out
      of work......................VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

    5 Increase in working at home....VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

    6 More layoffs..................VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

    7 Fewer job vacancies...........VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

    8 New jobs.....................VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

    9 Increased job security........VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

   10 More skilled jobs.............VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

   11 More specialized jobs.........VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

   12 More routinized jobs..........VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

   13 More interesting jobs for
      women........................VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

   14 Increasing unemployment.......VERY   SOMEWHAT   NO   SOMEWHAT   VERY
                                  LIKELY   LIKELY   CHANGE   UNLIKELY UNLIKELY

20. How will computers and terminals in your workplace affect your union?

    Computers and terminals will lead to: (Circle number)
        1 MORE UNION JOBS
        2 FEWER UNION JOBS
        3 NO CHANGE IN THE NUMBER OF UNION JOBS

21. In your opinion, why are computers introduced? (Circle all numbers that apply)

      1 TO IMPROVE SERVICE
      2 TO DECREASE THE AMOUNT OF TIME REQUIRED FOR CERTAIN TASKS
      3 TO IMPROVE MANAGEMENT OF EMPLOYEES
      4 TO REDUCE COSTS OF PROVIDING SERVICES
      5 TO IMPROVE WORKING CONDITIONS
      6 TO ALLOW THE SAME AMOUNT OF WORK TO BE DONE BY FEWER PEOPLE
      7 OTHER(please explain) _____

22. How concerned are you about technological change? (Circle number)

      1 VERY CONCERNED
      2 SOMEWHAT CONCERNED
      3 NOT AT ALL CONCERNED

   Before moving on to questions about how computers have affected or could in the future affect your work, we'd like to know what you like about your work.

23. What characteristics do you find desirable in a job? (please circle all letters that apply)

A VARIETY OF TASKS	I EASY TASKS, NOT DEMANDING
B MENTAL STIMULATION	J WORKING ALONE
C GOOD PAY	K NO DECESION MAKING
D HEALTHY ENVIRONMENT	L SIMPLISTIC
E ABILITY TO MAKE DECISIONS	M SHIFT WORK
F CONTACT WITH CO-WORKERS	N UNION JOB
G REGULAR HOURS	O NON UNION JOB
H OTHER (please specify) _____	

24. Which of the above job characteristics is most, second most and third most important to you? (Place letter in appropriate box)

MOST	SECOND	THIRD
IMPORTANT	MOST	MOST
	IMPORTANT	IMPORTANT

   Next, some questions about how computers are affecting your job, or how you think they will affect your job in the future.

25. Have you ever used a computer or terminal? (Circle number)

      1 YES
      2 NO.....If no, please skip to question 45.

26. Have you become more interested in computers since they began appearing all around your workplace? (Circle number)

      1 YES
      2 NO

27. Where have you used computers or terminals? (Circle all numbers that apply)

I use or have used a computer or terminal:

1 AT HOME
2 AT A PREVIOUS WORKPLACE
3 AT MY CURRENT WORKPLACE
4 OTHER _____

If you are not currently using a computer or terminal at work, please skip to question 44 on p. 8.

28. As a result of the initial introduction of computers into my workplace: (Circle answer)

1 The level of monotony in my job has...........INCREASED   NOT CHANGED   DECREASED

2 My job security has.........................INCREASED   NOT CHANGED   DECREASED

3 The level of challange in my job has..........INCREASED   NOT CHANGED   DECREASED

4 How interesting my job is has.................INCREASED   NOT CHANGED   DECREASED

5 The amount of skill involved in my job has.....INCREASED   NOT CHANGED   DECREASED

6 The extent to which my job is specialized has..INCREASED   NOT CHANGED   DECREASED

7 Management's control over workers has.........INCREASED   NOT CHANGED   DECREASED

8 The amount of control I have over my work has..INCREASED   NOT CHANGED   DECREASED

9 My job satisfaction has.......................INCREASED   NOT CHANGED   DECREASED

10 The amount I need to know about the overall
   work process has..............................INCREASED   NOT CHANGED   DECREASED

11 The extent to which the tasks in my job are
   varied has....................................INCREASED   NOT CHANGED   DECREASED

12 The amount of positive contact I have with
   fellow workers has............................INCREASED   NOT CHANGED   DECREASED

13 The ease with which I do my job has...........INCREASED   NOT CHANGED   DECREASED

14 The amount of work I do has...................INCREASED   NOT CHANGED   DECREASED

15 My level of efficiency has....................INCREASED   NOT CHANGED   DECREASED

16 The level of stress in my job has.............INCREASED   NOT CHANGED   DECREASED

17 The quality of service I provide in my job has.INCREASED   NOT CHANGED   DECREASED

29. Do you use the computer or terminal in your office to connect to other computers?

1 YES....Which ones? _____
2 NO

30. Do you use electronic mail or message systems?

1 YES....Which system? _____

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Next, some questions about how computers and other new technologies were introduced into your work environment.

31. About how long ago were computers or terminals introduced into your job? (Fill in blanks or put an x to indicate "don't know")

_____ YEARS
_____ MONTHS
_____ WEEKS
_____ DON'T KNOW; I BEGAN WORKING IN MY JOB AFTER COMPUTERS WERE INTRODUCED

32. How did you first hear of the introduction of computers or other new technology into your work environment? (Circle number)

1 I INSTIGATED IT.............skip to question 37, bottom of page.
2 I WAS TOLD BY A CO-WORKER
3 I WAS TOLD BY A SUPERVISOR
4 I WAS NOT TOLD
5 OTHER _____

33. Were you given any notice about the introduction of computers or other technologies into your office? (Circle number)

1 YES
2 NO------skip to question 36, this page.

34. How much notice were you given prior to the introduction of computers or other new technology into your office? (Circle number)
_____ months _____ weeks

35. Do you feel that the amount of notice was: (Circle number)

1 JUST RIGHT
2 NOT ENOUGH NOTICE
3 TOO FAR IN ADVANCE OF CHANGES
4 DON'T KNOW

36. Have you been consulted about any of the following things, in connection with computers or other new technology? (Circle all that apply)

I have been consulted about:
1 TYPE OF COMPUTER
2 WORKSPACE DESIGN
3 FURNITURE
4 OTHER CHANGES IN EQUIPMENT
5 OTHER CHANGES IN OFFICE DESIGN

37. To what extent have you been involved with the introduction of new technologies into your work environment? (Circle number)

1 NOT AT ALL
2 MINIMALLY; I WAS NOTIFIED
3 TO SOME EXTENT; I WAS ASKED TO COMMENT ON MANAGEMENTS PLANS
4 TO A GREAT EXTENT; I WAS ASKED TO DETERMINE WHAT MACHINES WOULD BEST MEET MY NEEDS AND/OR THE DEMANDS OF MY JOB
5 ENTIRELY; I WAS RESPONSIBLE FOR DECIDING IF THE PROPOSED COMPUTER OR TECHNOLOGY WAS APPROPRIATE
6 OTHER (please specify) _____

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38. Since computers or other new technologies have been introduced into your work environment, have you had any oppourtunities to make suggestions about how the new technologies are used on your job? (Circle number)

       1 YES
       2 NO

Next we would like to know about how you have learned to use computers and other new technologies.

39. What types of computer training have you received? (Circle all numbers that apply)

       1 ON THE JOB, SELF TAUGHT
       2 ON THE JOB, TAUGHT BY A CO-WORKER
       3 ON THE JOB, TAUGHT BY A SUPERVISOR
       4 TRAINING PROVIDED BY SFU COMPUTER CENTRE
       5 TRAINING PROVIDED BY AN EQUIPMENT MANUFACTURER
       6 A NON-SFU COMPUTER COURSE
       7 OTHER(please explain) _____

40. Which of the above forms of training did you find most, second most and third most helpfull? (Put number from above in appropriate box)

MOST IMPORTANT	SECOND MOST IMPORTANT	THIRD MOST IMPORTANT

41. Did you or your employer pay for the training (Circle number)

       1 I PAID FOR THE TRAINING
       2 MY EMPLOYER PAID FOR THE TRAINING
       3 OTHER _____

42. Did you attend the training on your own time or during work time? (Circle all numbers that apply)

       1 I ATTENDED TRAINING ON MY OWN TIME
       2 I ATTENDED TRAINING DURING WORK TIME
       3 I WAS GIVEN TIME OFF FOR TRAINING

43. In general, has the computer training you have received allowed you to do your job in a confident and professional manner? (Circle number)

       1 YES
       2 NO

44. When you use computers or terminals, how do you feel? (Circle number)

       1 IN CONTROL OF THE PROCESS
       2 CONTROLLED BY THE COMPUTER
       3 OTHER (please specify) _____

45. As a result of the initial introduction of computers into my workplace I expect: (circle answer)

    1 The level of monotony in my job will...........INCREASE   DECREASE

    2 My job security will............................INCREASE   DECREASE

    3 The level of challange in my job will.........INCREASE   DECREASE

    4 How interesting my job is will................INCREASE   DECREASE

    5 The amount of skill involved in my job will....INCREASE   DECREASE

    6 The extent to which my job is specialized will.INCREASE   DECREASE

    7 Management's control over workers will........INCREASE   DECREASE

    8 The amount of control I have over my work will.INCREASE   DECREASE

    9 My job satisfaction will......................INCREASE   DECREASE

   10 The amount I need to know about the overall
      work process will.............................INCREASE   DECREASE

   11 The extent to which the tasks in my job are
      varied will...................................INCREASE   DECREASE

   12 The amount of positive contact I have with
      fellow workers will...........................INCREASE   DECREASE

   13 The ease with which I do my job will..........INCREASE   DECREASE

   14 The amount of work I do will..................INCREASE   DECREASE

   15 My level of efficiency will...................INCREASE   DECREASE

   16 The level of stress in my job will............INCREASE   DECREASE

   17 The quality of service I provide will.........INCREASE   DECREASE

46. In your opinion, will participating in training courses potentially lead to any of the following? (Circle all numbers that apply)

      1 SALARY INCREASES
      2 INCREASED JOB SATISFACTION
      3 A BETTER JOB
      4 OTHER(please specify) _____

  Finally we would like to ask some questions about you for statistical purposes.

47. Your sex: (Circle number)

      1 FEMALE
      2 MALE

48. Do you have children? (circle number)

     1 YES
     2 NO

49. Your present marital status: (circle number)

     1 NEVER MARRIED
     2 MARRIED
     3 DIVORCED/SEPARATED
     4 COMMON LAW
     5 WIDOWED

50. Your present age: _____YEARS

51. How long have you worked for your present employer?

     ___YEARS

     ___MONTHS

52. In the past have you worked at a different job for the same employer? (circle number)

     1 YES
     2 NO

53. In what type of office are you currently working? (circle number)

     1 DEPARTMENTAL OR FACULTY OFFICE
     2 REGISTRARS
     3 LIBRARY
     4 COMPUTING CENTRE
     5 LAB
     6 FINANCE
     7 OTHER (please specify) _____

54. Do you work:

     1 FULL TIME
     2 PART TIME

55. Which is the highest level of education you have completed? (Circle number)

     1 SOME HIGH SCHOOL
     2 HIGH SCHOOL DIPLOMA
     3 SOME COLLEGE OR UNIVERSITY
     4 COMPLETED COLLEGE OR UNIVERSITY
     5 SOME GRADUATE WORK
     6 COMPLETED GRADUATE WORK

56. If you had some college or university, in what area was your study?

     Area of study (please specify) _____

57. Have you upgraded your education since you began working for your present employer? (circle number)

     1 YES
     2 NO

58.
Do you feel the technological change clause in your collective agreement is adequate? (circle number)

    1 YES
    2 I'M NOT FAMILIAR WITH IT
    3 NO....Why not? (please specify) _____

59. Would you like your union to increase its activities concerning technological change? (circle number)

    1 YES....How? (please specify) _____
    2 NO

60. Are you a union member? (Circle number)

    1 YES
    2 NO

61. Is this your first union job? (Circle number)

    1 YES
    2 NO

62. Do you use an automated bank machine? (Circle number)

    1 YES
    2 NO

63. Which of the statements below best charaterizes your level of activity in relation to technological change and technology? (Circle number)

    1 I READ ABOUT TECHNOLOGY AND TECHNOLOGICAL CHANGE OR TALK ABOUT
      IT WITH FRIENDS AND CO-WORKERS FREQUENTLY AND INTENTIONALLY

    2 IF I SEE AN ARTICLE IN THE PAPER ABOUT TECHNOLOGY OR TECHNO-
      LOGICAL CHANGE I USUALLY READ IT- BUT I DON'T GO OUT OF MY
      WAY TO FIND THINGS TO READ

    3 I RARELY READ OR TALK ABOUT TECHNOLOGICAL CHANGE

    4 I NEVER READ OR TALK ABOUT TECHNOLOGY OR TECHNOLOGICAL CHANGE

64. Do you think what you do at work is similar to work you do at home? (Circle number)

    1 YES....How? _____
    2 NO

65. For coding purposes, please write the following letters and numbers below.

    1 FIRST THREE LETTERS OF MOTHER'S MAIDEN NAME _____
    2 FIRST THREE NUMBERS OF YOUR SOCIAL INSURANCE NUMBER _____
    3 LAST TWO NUMBERS OF YEAR YOU WERE BORN _____

Is there anything else you would like to tell us about your relationship to technology, how it is effecting your work or how you expect it to effect your work in the future? If so, please use this space for that purpose. Also, any comments that you wish to make that you think may be helpfull to us in our future efforts to look at these issues will be appreciated, either here or in a separate letter.

_____
_____
_____
_____
_____
_____
_____
_____

Technological Change Curriculum Given to Clerical Workers

INTRODUCTION

HOW TO USE THESE MATERIALS:

These materials have been developed as reference materials - to be used in conducting a technological change workshop, in a unionized or non-unionized work environment.

The goals of the workshop are:

1) To familiarize participants with cultural attitudes towards technology and technological change;

2) To explore the relationship of technology to work and workers;

3) To assess the impacts of technology on our worklives and to develop worker-oriented strategies for its further introduction.

The workshop materials roughly correspond to each of the goals listed above.

* Section I summarizes information about how our culture thinks about technology and presents an alternate definition of technology.

* Section II provides some information about several aspects of how technology has affected a few aspects of work and worklives.

* Section III summarizes some methods for assessing the impacts of technology on the on the job.

The colored pages at the beginning of each section serve as an outline or overview of information that follows in the section. White pages summarize materials that ought to be covered, and include exercises.

The appendix contains a variety of information related to technological change which participants may want to refer to during the latter portion of the workshop. Finally, a bibliography will aid participants in further learning about technological change.

Part 1 Overview of Technology and Culture

1. Introductions

2. Cultural Views of Technology

> Technology as Tool
> Technology as Threat
> Technology as Triumph

3. Excercise: Naming the Complexity of Technology

4. Definitions of Technology

> Dictionary definition
> Bernard's Definition
> Bush's Definition

5. Contexts in Which Technology Operates

> Design or Development Context
> User Context
> Environmental Context
> Cultural Context
> Political Context

TECHNOLOGY

WHAT IS TECHNOLOGY?

If you were to ask a number of people to write down their definitions of
technology, a quick comparison would show some similarities. Among the
words commonly used to describe technology are:

> -computers
> -progress
> -advancement
> -the future
>
> (Street Sample, Van. B.C. 1986)

Similarly, our attitudes towards technology are easily grouped. As a group,
we seem to show some unity in how we think of technology and
technological change.

In a recent survey of Canadian Airline workers,

> -89% agreed that technology is neutral and value-free;
> -74% agreed that technological change means progress;
> -72% don't believe that technology will cause more problems than it solves.

And, not surprisingly given our views of technological change,

> -92% felt that technological change will occur whether we want it to or not.

Despite the overwhelming sense that technology itself is neutral, that it
means progress, and that it solves more problems than it creates, the same
workers felt that as a result of the introduction of technology into their
workplaces,

> -their jobs have become more specialized (80%)
> -the amount of positive contact they have with co-workers has decreased (71%)

-their jobs have become more stressfull (76%)
-they felt their job security has decreased (82%).

Among the characteristics these workers find desirable in a job are
-a variety of tasks (85%)
-contact with co-workers (73%)
-a healthy environment (86%)

What do these facts indicate? The information above can be summarized like this:

> *we think that technology is positive, even though, when questioned about how it changes our jobs, it appears to change our jobs in ways we don't view as desirable.*

The information above seems to indicate that this is true. When we stop to think about it though, it seems contradictory: why would we think something is positive when it effects us adversely?

We may never come up with a correct explanation for why we believe what appear to be contradictory explanations about technology. But, we can learn a great deal by keeping contradictions like this in mind while discussing popular attitudes towards technology. Discussing popular attitudes towards technology is also a good place to begin investigating how our worklives are effected by technology and technological change.

POPULAR ATTITUDES TOWARDS TECHNOLOGY

TECHNOLOGY IS SEEN AS:

* A TRIUMPH;
* A THREAT:
* A TOOL.

As one observer (Bush, 1983) points out, each of the popular attitudes about technology supports a line of argument which leads to legislation, public policy, and ironically , powerlessness. We will be concerned with determining to what extent a similar process occurs in relation to new technology in the workplace.

DISCUSSION MATERIAL

POPULAR ATTITUDES TOWARDS TECHNOLOGY AND TECHNOLOGICAL CHANGE

ASSUMPTIONS:

Popular attitudes towards technology fall into one of three categories: technology is seen as either a triumph, a threat or a tool.

TECHNOLOGY AS TRIUMPH

The belief that bigger is better, coupled with the assumption that technology is beneficial, is the ideology of progress. That view holds that since it is the job of technology to solve problems, there are no problems that technology cannot solve. Technology itself is seen as the key to a better and more prosperous future.; all problems are only temporary "glitches" in a perfectable system. Belief in progress and the "tech fix" approach is appealing because it allows people to ignore the negative consequences of technology. "The problems will soon be solved; everything will be all right; no need to worry or change." (AAUW, 1981)

For workers, the technology as triumph argument encourages an unquestioned acquiescence to technological change. They may assume that they will benefit as a result of the new technologies, which will increase their employers productivity and lead to higher wages while replacing boring, dangerous jobs with more interesting and safe work.

TECHNOLOGY AS THREAT

An opposing assumption underlies much of the current rhetoric against technology. In this view, technology is seen as a source of evil and the cause of every contemporary ill from pollution and urban sprawl to tasteless tomatoes. According to those who assume the threat of technology, the

solution to the problems of modern life is a retreat from technology and a return to simpler times and ways. This assumption is appealing because it provides an enemy to serve as a focus for frustration and discontent. It also provides one simplistic solution to many extremely difficult problems: "Get rid of machines; return to the land; everything will be all right." (AAUW, 1981).

While some anti technology /workers have fled to the hills in search of a return to nature, others have remained in cities and attempted to create alternative work structures. While cooperatives and collectives have lowered worker alienation, they are often faced with a decision to keep wages low or adapt mainstream technologies such as memory cash registers to remain competitive with the capitalist economies within which they function. Anti-technologists tend not to effect a change in how technology effects employment in larger society.

TECHNOLOGY AS TOOL

Those who look upon technology as a tool see it as neutral and value-free. Neither good nor evil, tools have function but not innate content or purpose. A hammer, for example, is neutral; it can be used to good purpose — to pound nails and build a house - or to bad purpose - to beat someone over the head. But the purpose is determined only by the user. "Tools don't hurt people, only people hurt people." That is an appealing assumption because it focuses on the human factor in technology and implies that technological problems are only social problems. All one has to do to ameliorate the negative effects of technology is to change the people who control it. The old saw, "if you don't like it, you can always pull the plug," is an example of that kind of thinking. (AAUW, 1981)

Workers who view technology as neutral and value-free may view it as neutral but subject to the motives of its user. The impacts resulting from technological change are viewed as the result of the actions of an individual, rather than the actions of a culture. While this assumption can lead to recognition of a conflict between a particular manager and particular workers, the significance of managers and workers in a wider cultural context is missed. In this case, workers are left with no information about either how management uses technology in opposition to workers' interests, or how technology can be used in a manner which is congruent with workers' interests.

THE WHOLE TRUTH

All of the above assumptions are correct; they are also contradictory and simplistic. Together they obscure rather than explain the complex nature and interrelationships of technology and society. (AAUW, 1981)

Not even the most simple tool- a hammer or a carrying bag- is value-free. One tool may lead to the invention of others. All tools and machines increase the ability to work and thereby affect the environment beyond the innate capacity of the individual. (AAUW, 1981)

When something is gained, something else is always lost. Any action, no matter how trivial, using any tool, no matter how simple, ripples through society producing both desired and undesired consequences. The more complex the tool or machine, the more involved the changes that result. The automobile is a complex machine that utilizes the internal combustion engine to move people from place to place rapidly and conveniently. The products of the internal combustion engine are power, motion, heat, noise, and fumes. The two former, desired products cannot be achieved without the three latter, undesirable ones. The internal combustion engine is *not*

neutral or value-free. Its effects on the environment are the same whether you drag race down a crowded street or speed someone to a hospital. Technology is always used for a purpose in an environment. It is, therefore, never possible for tools to be neutral. (AAUW, 1981)

The "Technology as Triumph" and "Technology as Threat" arguments are equally false, because each assumption concentrates on only one set of consequences. The automobile has caused more deaths and disabilities than all US wars combined, has created a national imbalance of payments, has made the US subservient to oil-rich countries, and is responsible for most of the air pollution in US cities. Yet cars have positive as well as negative consequences: thousands of lives are saved each year by improved access to major medical centres. Public nutrition is vastly improved because fruits and vegtables are available all year throughout the country.(AAUW, 1981)

It oversimplifies the truth to claim that technology is either boon or bain. It is always both. (AAUW, 1981)

WE CAN UNTHINK THE MYTHS OF TECHNOLOGY BY DESCRIBING THE COMPLEXITY OF TECHNOLOGY

A critique of technology should unthink the myths that see technology in simple categories as tool, triumph or threat. In unthinking the myths of technology, we can simplify it by naming its complexity. As Bush (1983) points out,

* 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 valance 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. (Bush, 1983)

Simplifying how we think about technology has proven to be an excellent technique for maintaining social control. The assertion that technology is beneficial lulls us into believing that there is nothing wrong that can't be fixed, so we do nothing. Similarly, the technophobia that sees technology as evil frightens us into passivity, so, again, we do nothing. "The argument that technology is value-free either focuses on the human factor in technology in order to obscure its valance, or else concentrates on the autonomy of technology in order to obscure its human control." In all cases, what results is a sense of helplessness- people feel they can do nothing. Also, by encouraging people to argue with and blame each other, our public attention is drawn away from more important questions such as who is making technological decisions?, on what basis?, what will the effects be? (Bush, 1983)

EXCERCISE: NAMING THE COMPLEXITY OF TECHNOLOGY

For the technology of your choice, answer the following questions:
1) What was the technology designed for?
2) What besides what it was designed for, is it used for?
3) List a few positive things about the technology and/or its use.
4) List a few negative things about this technology and /or its use

However, many workers have very little say, if any in how technology is used in their workplace. For example, in the airline industry, reservation agents using computers to book flight reservations are forced, by machine design to show availability of their airline's flights before competitor's flights. Since the time required by the agent to secure the customer's reservation is monitored, along with the dollars generated by the sale, it is difficult for a reservations agent to book a seat on another airline, even though this might prove to be less costly and more convenient for the customer. If reservations agents had say in how the technology they use at work was designed and used, they might opt for introducing the technology in a way which optimized for customer satisfaction.

Redefining technology will help us have a say in how technology is used in our work.

First, the dictionary definition.....

Technology is "applied science" or "practical arts in total".

A better definition is "the means and processes through which we as a society produce the substance of our existence." Technology consists of five items;

- tools (hammer, typewriter, shovel)
- energy forms (steam, electricity)
- materials (plastics, metals, fibre optics)
- techniques (weaving, annealing metals)
- organization of work (assembly line, craft production etc. (Bernard, 1985)

Another way to think of technology is as a cultural process:

"Technology is a form of 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 particular personal or competitive advantage in a given ecological, economic, and /or social context. (AAUW, 1981)

"This definition locates technology in a spectrum of other cultural endeavors such as art, religion, and science; it also sets technology in a specific operative context. In other words, a technology always operates within and through a particular set of environmental, economic or social circumstances. Second, this definition intentionally includes all of the separate parts of technological systems (resources, tools etc.) while indicating that the function of those systems is to perform tasks and mediate problems. Finally, the concept of advantage is the reason for inventing and adopting the technology to begin with. "(Bush, 1981)

"People accept and adopt a technology to the extent that they see it creating advantage for themselves and, in competitive situations, disadvantage for others. Thus, an equity analysis of any technological innovation must focus on advantage and disadvantage with the four contexts in which the technology operates." A description of each of the four contexts follows.

1. The Development or Design Context includes all the materials, processes, personnel and systems necessary to create a tool or technique from raw materials. An analysis of the developmental context answers the questions:
   * what principles of science and mechanics are applied by the tool?
   * what resources, tools and processes are used to manufacture it?
   * what tasks are performed?
   * what problems are solved?
   * what competitive advantage accrues to developer in marketing the tool?

2. The <u>User Context</u> includes the motives, intentions, advantages and adjustments called into play by the use of the tool or technique. Among the questions answered when examining this context are:

* what is the current technology that will be displaced by the innovative tool or technique?
* how is the current technology used and who uses it?
* how is the innovation used and who is to use it?
* what patterns of behaviour and organization of work surround the current technology? how will these change?
* how congruent or incongruent to other existing technologies is the innovation?
* what personal advantage is created by use of the innovation? what competitive advantage?

3. The <u>Environmental Context</u> describes the physical, physiological and ecological consequences of development and use of a particular tool or technique by examining the following:

* what are the energy requirements of manufacture and use?
* how does the technology affect energy flow and materials cycling in the ecosystem?
* how does the technology affect the stability, diversity and rebound capacity of the ecosystem at all points of contact?
* what effects do manufacture and use of the technology have on the physiology and health of developers, manufacturers and users?
* the physiological and ecological impact of the innovation <u>vis a vis</u> the effect of continuing existing techniques.

4. The <u>Cultural Context</u> describes the effects of technology on the norms, values, aspirations, organizations and laws of the culture in which it is employed. An analysis of the cultural context would examine:

* how will the innovation affect sex roles and the division of labor within the family? in the economy?
* how will the distribution of goods and services within the economy be affected?
* which classes or groups of people will be advantaged by the new technology? which disadvantaged?
* how congruent are these patterns of advantage with existing norms and values of the cultures?
* what will the effect of this technology be on equity for women, minorities, handicapped? (AAUW, 198?)

While the author of the four contexts of technology intended the cultural context of technology to be broad enough to include any legal and/or political changes that might occur in relation to a technology, it is useful when considering the impact of technology on work to specifically consider technology's impact on legal and political structures. For this reason, I have outlined a fifth context in which technology operates- the political context.

The <u>Political Context</u> describes the effects of the technology on organization and mandates of decision making bodies whose function it is to directly or indirectly regulate one or more aspects of the technology. An analysis of the political context would examine :

* how will the innovation affect the structure of decision making bodies?
* will the organization governing decision making in relation to the technology change?
* will the innovation require new rules or laws to come into affect?
* will the distribution of decision making power change in relation to the technology?

Viewing technology as a process which occurs simultaneously in several contexts allows us to understand how we, as a culture think about technology. We know more about the design or developmental context than about all the other contexts put together. As Bush (1983a) points out, our 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). 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).

"If we accept 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 invisability that is 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. "(Bush, 1983a)

"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 very little change since the nineteenth century" (Bush, 1983a)
Ironically, until recently most women did not realize they possessed any information about technology which was of any great significance. With all the cultural attention focused on the activity surrounding the development of technology it is hard to see the answers to questions such as, how am I spending my time at work? How is my work different than it was before computers were used? Am I better off

Redefining technology as we have allows us to see that we have a great deal of information about technology.

Balka, E. (1986) <u>Technological Change in the Airline Industry</u>: Data Collected for the Brotherhood of Railway and Airline Clerks, Airline Division, under contract to Labour Canada. Unpublished raw data.

Balka, E. (1986) <u>Technological Change in the University</u>: Data Collected for the Association of University and College Employees Local #2. Unpublished raw data.

Bush, C.G. (1983a) "Women and the Assessment of Technology; To Think, To Be, To Unthink, To Free " in Rothschild, Joan ed., <u>Machina Ex Dea</u> Pergamon Press, New York.

Mesthene, E..G. (1970) <u>Technological Change: It's Impact on Man and Society</u> New American Library, New York.

Part 2   Discussion Topics- Technology and Work

1. Slide Show <u>Who's In Control?</u>

2. Discussion

<u>Possible Topics</u>
How Work Is Organized
Organization of Work and Effects on Control
Changes in Content of Work
Health Effects
Changes in Quality of Service
Changes in Employment Levels
Changes in Organizational Hierarchies
Work at Home and Work for Pay
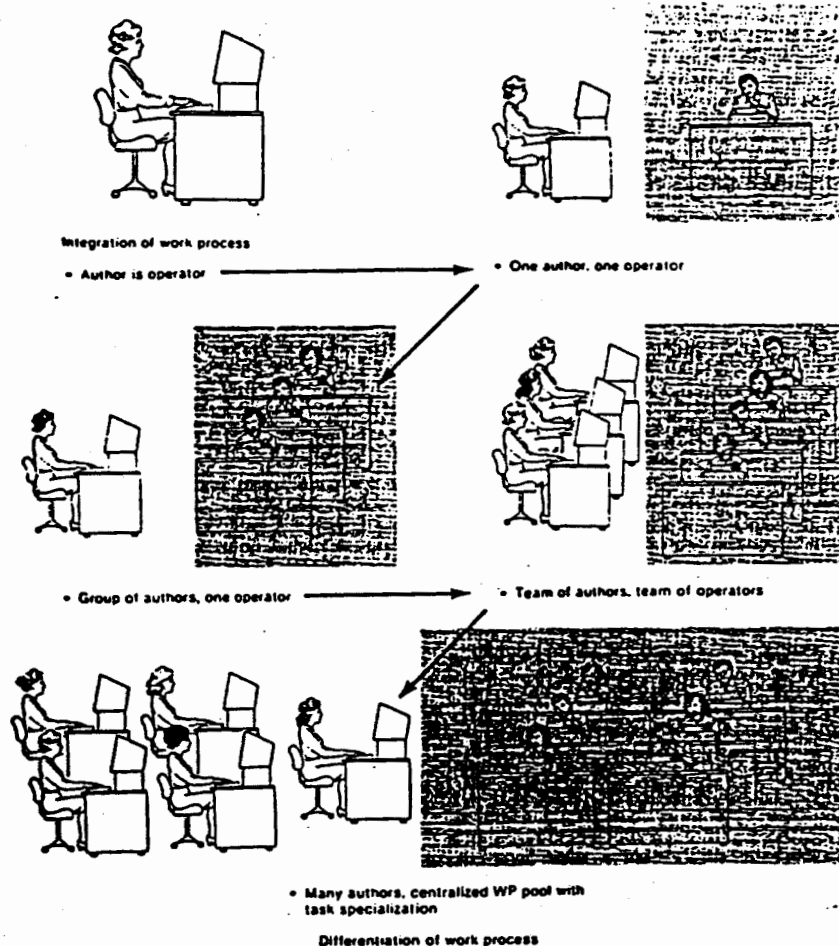Training
Workers' Responses to New Technology

Skill

Does using a computer make your job more or less skilled?
Why or why not?

How Work Is Organized

Glance at the diagram below. Then keeping in mind a part of your job involving a machine, answer the following questions:

- How is the job organized in relation to the machine?
- Can the same machine be used to organize the work differently? If so, how?
- What do you like about how the job is organized in relation to the machine?
- What don't you like?
- How could it be changed for the better?

Figure 4-1.—Possible Variations of Work Process for Word Processing

Integration of work process
- Author is operator
- One author, one operator

- Group of authors, one operator
- Team of authors, team of operators

- Many authors, centralized WP pool with task specialization

Differentiation of work process

SOURCE Adapted from S M Pombert C W Olphert, and K D Eason "Work Organization Implications of Word Processing. Proceedings of the 1st IFIP Conference on Human Computer Interaction INTERACT '84, vol 2, 1984 pp 357-363

Organization of Work and Effects on Control

In what ways does the way your job is organized effect how much ?
control you have over your work?

In what ways does the organization of your job effect the extent ?
to which you are supervised or monitored?

Changes in Content of Work

Is your job becoming more or less varied?
more or less monotonous?
more or less specialized?
more or less interesting?

Health Effects

Have you noticed any changes in your health as a result of using new technology?

Changes in Quality of Service

How is the service you provide changing?
Is the quality of the service you provide improving, staying the same or declining as a
result of new technology?

Changes in Employment Levels

Are some job classifications experiencing growth or decline?
Is the content of jobs changing while the classifications remain the same?

Changes in Organizational Hierarchies

Is the structure of the organization you work within chnaging? If so, how?

Are changes uniform along gender lines?

Work at Home and Work for Pay

How is women's work at home similar to women's work for pay?

Read the quote below. Explain it.

> " The Mechanization of Women's Work: When it began two centuries ago, it was characterized by low pay and occupational segregation. The same holds true today, although women are entering the labour force in larger numbers. "

Training

> " We are paid according to our skills and experience. Doctors make more than nurses because they have more training and responsibility."

Is this myth or fact?

Do men and women get the same training?

<u>Small group excercise:</u>

In small groups, present a one minute work and training histories. During a person's presentation, no questions are to be asked and no dialogue should occurr. Consider issues such as:
- subjects you liked in school;
- what courses you took in high school, and after high school if you continued;
- the relationship of your education to what you now do;
- how your education did and didn't prepare you for your job.

After each person has had a turn, summarize any similarities that ? occurred.

Workers' Responses to New Technology

Discuss:

- How technology has been or might in the future be introduced into your job;

- What you liked about how technology was introduced into your job;

- What you disliked about how technology has been introduced into your job;

- What was your role in choosing the equiptment you work with?

- If you were involved in the purchase of your equiptment, in retrospect, were you adequeately prepared for the decesions you made?

Part 3 Technology Assessment

1. Background of Technology Assessment

      Assumptions on Which Technology Assessment is Built
      Technology Assessment Methodology

2. Four Approaches to Technology Assessment

      Problem Oriented Assessments
      Technology initiated Assessment
      Objective Oriented Assessment
      Group Interest Oriented Assessment

3. Excercise in Problem Definition

4. Constructing an Effects Wheel

      Overview
      Accounting for Desirability of Effects
      Accounting for Likelihood of Effects

5. Excercise in Constructing Effects Wheels

6. Assessing Technology in the Workplace

      Excercises

TECHNOLOGY ASSESSMENT

Technology assessment is the attempt to predict the consequences of technology and to ascertain the costs, benefits, and risks associated with the introduction and diffusion of a specific technology or set of technologies. In other words, it is a way of guessing what is likely to happen and of estimating how these results might be good or bad. Of course, people are involved in assessment and evaluation activities every day. Generally, people do not call it "technology assesment" when they debate whether or not to buy a new car, nor do they call it "impact analysis" when they try to decide whether or not to take a new job. Nonetheless, those types of activities are similar to the processes used in technology assessment, except that corporations and governmental agencies use sophisticated computer models, refer to enormous pools of data, and can call on national and international experts for advice.

The purpose of this section is two-fold: first, to acquaint readers with the development and assumptions of technology assessment; second, to demonstrate two basic tools or models for technology assessment -- the consequence wheel and the cross-impact matrix.

BACKGROUND

Technology assessment grows out of the realization that, where technology is concerned, "We haven't always known what we were doing." One hundred years or even 30 years ago, no one thought it necessary to assess technology because everyone believed in progress. American ingenuity and technology

could solve all problems; technology itself was the key to increased productivity and the good life. In that atmosphere, technology was seen as an unquestioned benefit to humankind. There was no need to assess the consequences of technology because there *were* no negative consequences, or at least none that couldn't be remedied with the application of yet more technology.

Today, public and professional opinion is divided into three distinct camps: the technological optimists who welcome new technologies as the only feasible solutions to major social and environmental problems; the technological pessimists who see technology itself as the problem; and the bewildered who fall along a continuum between the two extremes and who think of technology as both problem and solution. The latter group recognizes the difficulty of making intelligent, informed decisions, yet finds truth in the adage, "Not to decide is to decide."

Whatever one's personal views, it is fair to say that technology itself has never before been so thoroughly scrutinized. The techniques in this section are designed to provide you and your group with a means to assess and evaluate technology. Each of the techniques can be used to analyze not only technological innovations but personal and social changes as well. Use of these tools rarely will provide an answer that is either clearly for or against the change studies; it will organize the information about possible consequences so that you can evaluate them yourself, according to your own value system. When done properly, technology assessment raises hard questions and demands hard choices.

ASSUMPTIONS

Every science and every field of study builds upon certain fundamental assumptions about itself and the world. The field of technology assessment is founded on the assumptions that everything is connected to everything else, that technology is rational and knowable, that the future can be anticipated, and that technology is under human control.

* <u>Everything is connected to everything else,</u> the prime tenet of environmentalists and ecologists, was first articulated by Barry Commoner in *The Closing Circle.* Technology assessment depends on the belief that each technological innovation and every set of technologies is linked to the natural ecosystem and to the vast complex phenomena, norms, and values called human society. Thus, technology affects and is affected by everything in the natural and human world. The strands of that connection may be thick or thin, complex or simple, direct or indirect, but they link technology into the web of interactions that make up the world.

The assumption is revolutionary, as much for its humility as its radicalism. Despite 25 years of public awareness of ecology, despite air pollution, urbanization, and unemployment, many engineers and technologists still do not believe that technological change causes social or environmental change. They see themselves as problem solvers, not problem makers. One of the inherent tensions between the technocratic establishment and the proponents of technology assessment is a conflict over technology's connectedness to and responsibility for social and environmental change.

* <u>Technology is rational and knowable</u>. While the analysts of technology understand that it is a vast and complex subject, they also believe that it is susceptible to rational analysis. They assume that its causes and effects, however hidden in social and ecological systems, are discernable and understandable. They share that assumption with scientists, mathematicians, and logicians who also believe in the order and rationality of the universe. However, unlike "pure" scientists who assert natural laws, and engineers who tend to believe in the integrity of physical properties, technology analysts tend more to faith, hoping that because "man [sic] created it, man can understand it."

The past problems with technology and forecasting are seen as sins of ommission: people were so busy inventing and implementing new technologies that no one took time to study or assess them. With present assessment techniques, such oversights can be remedied.

* <u>The future can be predicted</u>. This assumption posits that humans can anticipate the future, identify potential problems, and take steps to eliminate them or lessen their severity. This assumption is far from humble since it ignores the roles of chance and self-interest in human affairs.

* <u>Technology is under human control</u>. This belief is actually an invalid conclusion derived from the two preceding assumptions: if technology is rational and the future predictable, then technology is controllable.

In its way, it is a rewording of the old homily that "If you don't like it, you can always pull the plug." What the argument ignores is the difficulty of ascertaining who controls technology. How many people would willingly

give up the freedom and mobility of their cars despite traffic deaths, air
pollution, and energy shortages? Who has the right to tell them to? When
most offices have computers and files are kept on silicon chips, who will
pull the plug on the computer that violates a citizen's privacy or the
military computer that declares war?

Whatever its failures of logic, technology assessment represents an
attempt to see technology

> ... *in terms of benefits and disbenefits, in other words, of
> social accounting of technological change. The attacks on
> technology on the one side and the whole-hearted defense of it
> on the other should not blur the real issue, namely "how are we
> to assure ourselves that technological forces are harnessed for
> the common good and that mere technological change is not
> pawned off on us as 'technological progress?"* (Myron Tribus
> quoted in Hetman, *Society and the Assessment of Technology*,
> page 25)

TECHNOLOGY ASSESSMENT METHODLOGY

The term "methodology" as applied to technology assessment is virtually
a misnomer. "Because technology assessments (TA's) are essentially
social impact studies that deal with value-oriented and institutional
issues which are nonquantifiable, TAs cannot adequately be performed "by
relying solely on formal statistical, survey or operations research
methods."

COMPONENTS OF A TA RESEARCH STRATEGY

1. Problem Definition
2. Technological Description

3. Technology Forecast
4. Social Description
5. Social Forecast
6. Impact Identification
   direct and higher order impacts of an environmental, psychological, institutional/political, social, technological, legal and economic nature are considered.
7. Impact Analysis
8. Impact Evaluation
9. Policy Analysis
10. Communication of Results

(source: Porter et. al. 1980)

* for elaboration of each of these, see appendix.

While research strategies such as the ones listed above may offer helpful guidelines for determining the sequence of the principle concerns of a technology assessment, such lists are not literally a method or procedure for conducting TAs. There is no validated, universally accepted methodology for technology assessment.

There is not a single approach which characterizes the execution of TAs. One of four approaches to the assessment task generally dominates the execution and focus of the technology assessment study.

FOUR APPROACHES TO TECHNOLOGY ASSESSMENT STUDIES

1. **Problem-oriented TAs** emphasize the search for technological ways to alleviate a societal problem, such as air polution resulting from car emmissions.

2. **Technology-initiated TAs** focus on the technology as a central element, studying the future applications of an innovation and analyzing the impacts and possible consequences.

3. **Objective-oriented TAs** are similar. They start with a stated objective and examine alternative social and physical technologies which might achieve the stated purpose.

4. **Group interest-oriented TAs** (sometimes referred to as "advesarial TAS") are designed to meet the particular needs of institutions or consituencies. (Lee and Bereano 1980).

Example:

1. Problem-oriented:
   TA will look at extent to which technologies can be used to minimize physical discomfort of work.

2. Technology-Initiated:
   TA will focus on future applications and impacts on University clerical workers of electronic mail.

3. Objective Oriented:
   The objective is to outline a range of options to reduce job-related stress.

4. Group Interest:
   TA will focus on how older workers are effected by introduction of computers.

EXCERCISE IN PROBLEM DEFINITION:

Can be done individually or in group(s).

For each of the approaches to technology assessment listed above, write a separate statement indicating what you would conduct a technology assessment on. Draw on experiences you've had in your job.

Some of the best information that results from technology assessments comes out of fun, informal excercises. Many are built on 'brainstorming' which is described below.

BRAINSTORMING

Brainstorming is an idea-generation technique (Osborn 1957). In essence, it is nothing more than an effort to stimulate creative thinking on a topic by explicitly removing censorship of ideas. The "cameo" entitled "brainstorming rules" presents the ground rules.

Brainstorming can be conducted either in groups or by individuals who then pool their ideas. The literature indicates no clear relationship between group size or group interaction pattern and the number and richness of ideas generated (Lewis et al. 1975).

BRAINSTORMING RULES

1. Criticism of any sort is barred, both of one's own ideas and those of others. Avoid "killer phrases" such as "that's ridiculous" and "it won't sell."

2. Quantity of ideas is a primary objective.

3. Unusual, remote or wild ideas are sought -- freewheeling is welcome.

4. Combinations, modifications, and improvements on ideas are encouraged. It is therefore important that every idea offered is kept visible to the participants (e.g., on a blackboard) to generate additional ideas.

EXCERCISE:

* Using the brainstorming technique, generate a list of some of the ways technology is affecting the occupational structure, the organizational structure and the work process.

Be sure to include 1st, 2nd & 3rd order effects, of the type illustrated in the example to the right.

THE EFFECTS OF TECHNOLOGY

[Excerpted from J. Coates (1971: 228-229)]
At times, technologies can have unintended consequences that combine to have a serious impact undreamed of by the creators of the technology. The following table suggests how television may have helped to break down community life.

Consequences of Television

First-order	People have a new source of entertainment and enlightenment in their homes.
Second-order	People stay home more, rather than going out to local clubs and bars where they would meet their fellows.
Third-order	Residents of a community do not meet so often and therefore do not know each other so well. (Also, people become less dependent on other people for entertainment.)
Fourth-order	Strangers to each other, community members find it difficult to unite to deal with common problems. Individuals find themselves increasingly isolated and alienated from their neighbors.
Fifth-order	Isolated from their neighbors, members of a family depend more on each other for satisfaction of most of their psychological needs.
Sixth-order	When spouses are unable to meet heavy psychological demands that each makes on each other, frustration occurs. This may lead to divorce.

CONSTRUCTING AN EFFECTS WHEEL

It is always difficult to think beyond the limits of habit and experience and to focus on secondary and tertiary effects of a technological change. Trapped in old patterns of thought and beguiled by promises, people often cannot think beyond immediate gains and individual solutions. The following techniques -- the effects wheel and the cross-impact matrix -- are

methods for thinking beyond the obvious and extrapolating a specific change to its less apparent but far more telling consequences.

The effects wheel is an assessment technique that enables people to examine a specific technological innovation -- word processors, conversion to synthetic fuels, or even car-pooling -- and project its effects into the future. The effects wheel is a particularly useful tool because it is easy to learn and adapts readily to group situations. It also stimulates divergent rather than linear thinking, a mode of thought at which women seem particularly adept. Further, everyone who participates in an assessment using the effects wheel is equal because knowledge and expertise are pooled; what one person doesn't know, another will, but no one will know and understand everything.

Divergent thinking occurs when you contemplate several different variables or relationships at the same time -- when your ideas spread out like ripples in a pond. In fact, as the following model shows, the effects wheel resembles the pattern of rings that flows from the center when a stone is dropped into still water. Each innovation is like a stone cast into the waters of society; no matter how small, it sets in motion cycles of change and consequence that eventually reach the farthest shore. The effects wheel allows people to represent that process graphically, demonstrating the truth of Edward Cornish's statement: *"We can never do just one thing. Every action radiates forward in time and outward in space, affecting everything everywhere."* (Cornish, *The Study of the Future,* page 8)

MODEL

The model of an effects wheel is presented below.
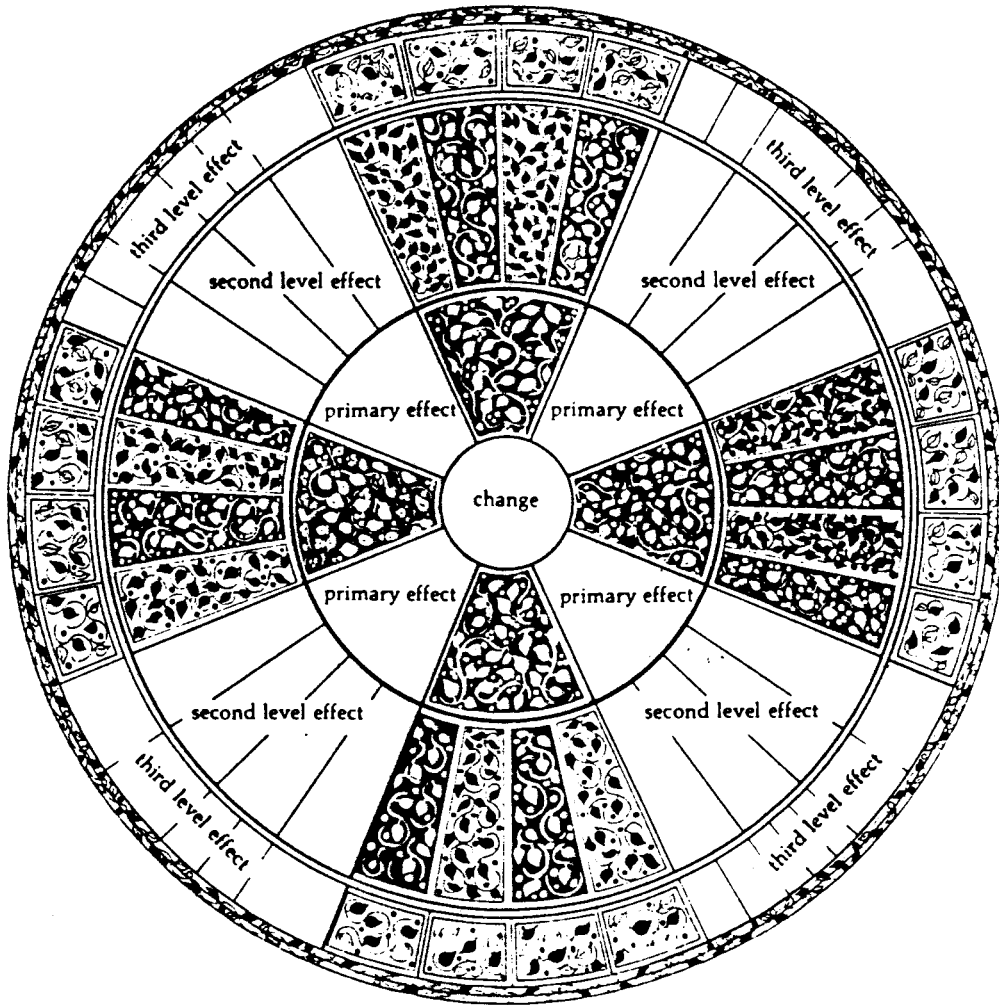
*Reprinted with permission of Corlann Gee Bush.

To construct an effects wheel, draw four concentric circles as illustrated. Within the smallest circle write the change or technological innovation you wish to assess. Now, think about what will happen immediately if that innovation is accepted. Those immediate consequences are called the primary or first order consequences. As you identify immediate or primary consequence, write it in the next circle and draw lines to separate from other primary effects. (If there are four first-level effects, there will be four pie-shaped wedges; if you identify five, the wheel will have five wedges and five spokes.) Next, examine each primary effect separately, asking, "If this effect happens, what will happen next?" Write your responses in the next circle. Because those consequences can occur only if the primary effect occurs, they are called secondary or second-level consequences.

Secondary consequences also have consequences; focus on each second-level effect and think, "If this happens, what happens next?" Third-level effects are written in the outermost circle next to the secondary effect that produced them.

EXAMPLE

An example will help to illustrate this process. Imagine that you want to assess the effects of buying a microwave oven before you decide to buy. Write microwave oven in the center circle. If you buy a microwave oven, you will 1) spend $475-$650. That is a primary effect and is written in the second circle along with the other primary effects of 2) cooking food faster, 3) using microwave energy instead of convection heat, and 4) being more convenient.

To determine the secondary effects, you may reason: "If food cooks faster, then I will a) save time in meal preparation and b) be less rushed to get home in time to cook dinner; but I will have to c) learn new recipes and d) unlearn old cooking habits." Each of those effects should be written in the third circle.

In assessing third-level effects, your thoughts might proceed as follows: "If I save time in meal preparation, then I can spend more time with my family," or "I might need to buy new cookbooks and attend microwave cooking classes." These are third level effects; they are written in the outermost circle, as illustrated by the example below:
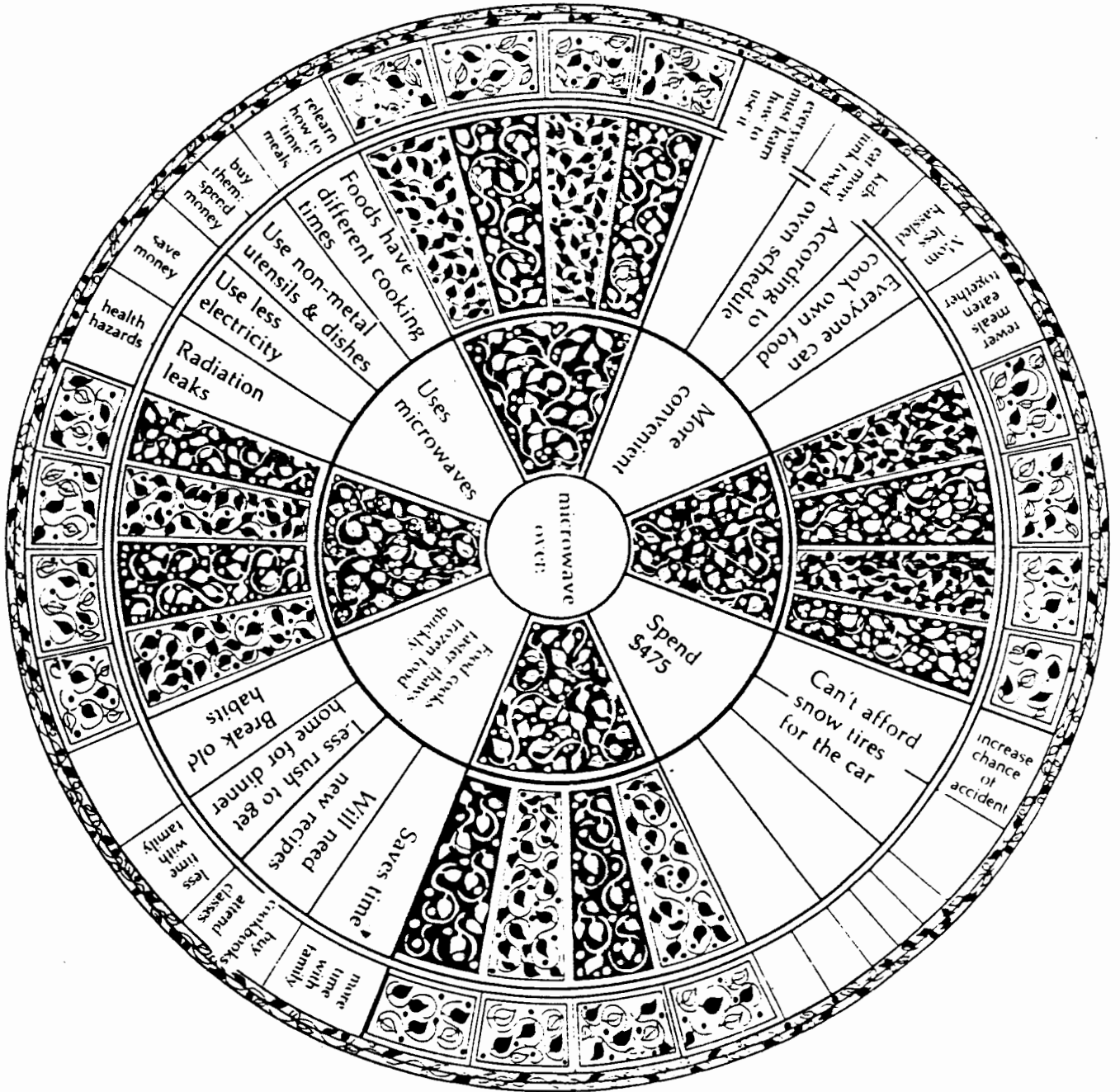
Reprinted from <u>Taking Hold of Technology</u> published by the American
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20037. This publication not for sale.

As you examine the effects wheel, note that not all second-level effects have third-level consequences; that is, breaking old habits may simply be breaking old habits, nothing more. On the other hand, some effects contradict each other. For example, one result of saving time is being able to spend more time with the family, but one consequence of not rushing home to fix dinner is spending less time with the family. The number of subsequent effects varies greatly: spending $475 has only one secondary effect, while the use of microwaves has several second-level effects.

One of the advantages of the effects wheel is that it allows a variety of responses; another advantage is the ease with which it can be evaluated. Since all effects are different and because some are more important than others, an assessment technique is effective only if it allows you to compare one consequence with another. For example saving time is very important to an employed mother and may outweigh the disadvantage of breaking her old cooking habits. Unless some way is found to give more weight to the former effect than to the latter, all effects will seem the same. In other words, the effects of a technological innovation will have been predicted but not assessed or evaluated.

Evaluation of the effects wheel can be accomplished most simply by putting a plus (+) or minus (-) sign in each box and counting them up. This can give you a rough idea of whether the change will be more positive than negative. Unfortunately, this method has a major disadvantage: every + and - has the same weight. You know that an effect is good but not how good it is. The solution is that dilemma lies in assigning values or points according to a fixed scale -- a process similar to measuring weight on a scale with pounds and ounces marked off.

Since change is assessed in terms of its desirability, it is possible to define a scale in which desirability is identified by a + or - sign and a numerical value determined as follows:

DESIRABILITY

If an effect is highly desirable, score it   +10
       desirable   +5
       acceptable   0
       not desirable   -5
       very undesirable   -10

Using this desirability scale, you can evaluate each section of the effects wheel. Say, for example, that you are busy with a job, a husband and three children. Saving time is very important and very desirable to you, so you

score that effect a +10, writing that number in the appropriate section. On the other hand, breaking old habits doesn't concern you at all, so you rate that effect 0. However, needing new recipes, buying new cook books, and attending cooking classes are not desirable so you rate each effect a -5. The process is illustrated below:
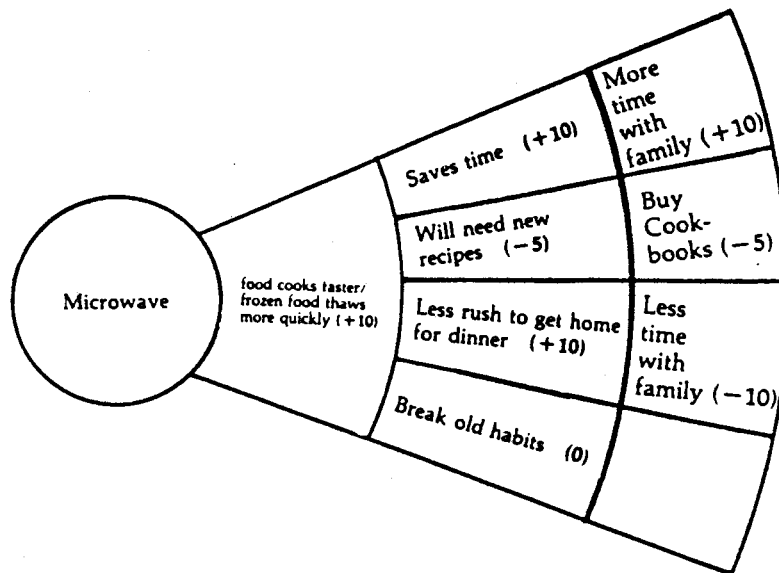

Assigning a value to each effect is a major improvement over simple + or -, but there is still a problem. Some effects are more likely or more probable than others. For example, it is certain that you will spend at least $475 for the microwave, somewhat less certain that you will be unable to afford snow tires, and not certain at all that the chance of an accident will increase. There must be a way to estimate probability. Again, a scale provides the solution:
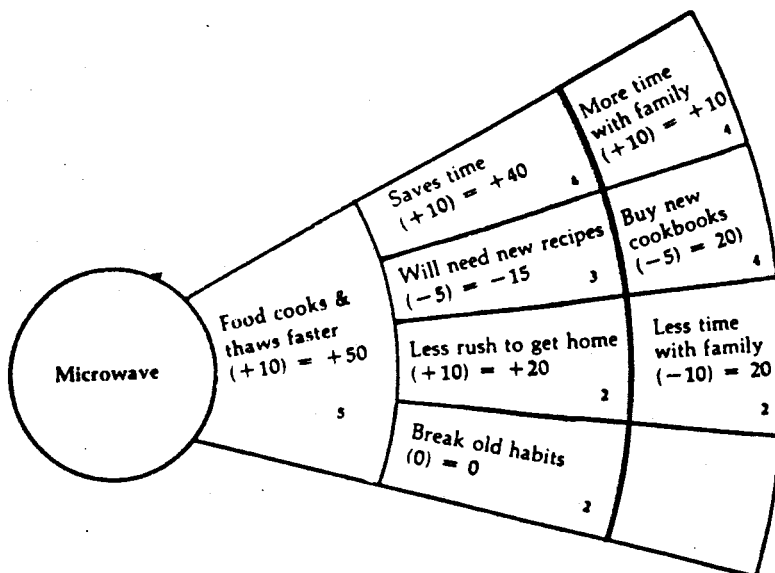
LIKELIHOOD

If an effect is:		rate it	
	certain,		5
	very likely,		4
	probable,		3
	possible,		2
	unlikely,		1
	unknown,		0

To use the probability scale, evaluate each effect according to its likelihood or probability and write the number on the line (arc) that separates it from its causal effect, as illustrated.
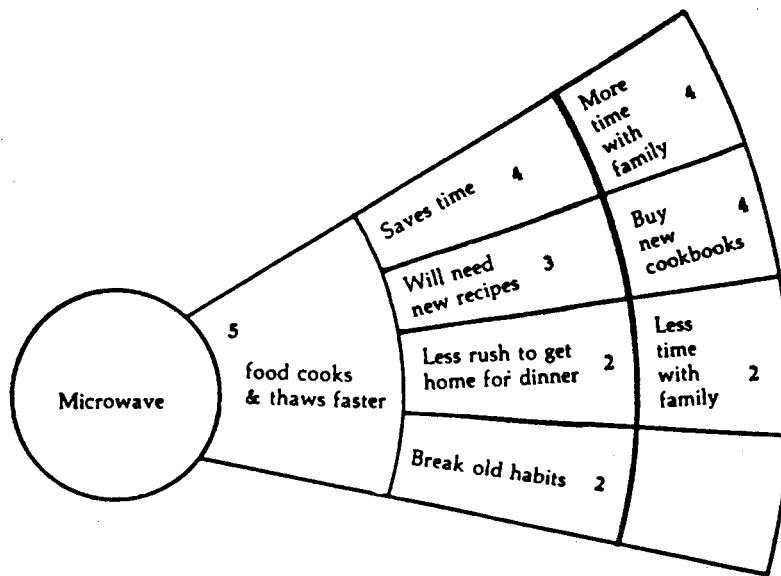
It is now possible to express the value of each effect in terms that relate to both desirability and probability. In other words, one can judge whether a highly desirable consequence (more time with the family) is more likely than an undesirable consequence (less time with the family). Such relationships can be determined by multiplying the score for desirability (i.e., +10) by the index for likelihood (3) to give a net value (+30) for each effect. The following example illustrates how net values are determined for the "food cooks faster" prime effect of a microwave oven.

Note that the likelihood index is written on the lines or arcs separating the levels of effects while the desirability value is written within the section and enclosed in parentheses. The net value is written in each section as a + or − number (5 X (+5) = +25).

The net values for each set of effects (each complete wedge of the pie) can be added together to evaluate the innovation. Totals may be summarized as follows:

        total number of + values
        <u>total</u> number of − values
        total for wedge

For the above example the net value is:

$$+ = 150$$
$$- = \underline{-40}$$
$$\text{Total} = +110$$

You are now ready to summarize your analysis:

* Do any of the consequences cancel each other out?

* Are there unknown factors? other options to explore? Does more research need to be done?

* Can you generalize about the overall benefits of the change? About costs or risks? What steps can be taken to minimize risks? Is the change worth it?

* What values are in conflict? How will women, families, minorities be affected? What will be the effects of the change on cultural interests, community development, education, international relations?

SUMMARY

Once you have used an effects wheel to assess a particular change in technology, you will see how it helps you to focus on general questions of values. As the example shows, buying a microwave oven has a profound effect on how a woman spends her time and on her role in relationship to other members of the family. At the level of tertiary effects one can assess the amount of time family members spend together and their individual responsibilities as well as their safety and nutrition. None of these are trifling concerns, even though the purchase of a microwave oven may seem an essentially trivial innovation, merely a way of cooking food faster.

Technology assessment, like every intellectual enterprise, tends to be bounded by contemporary assumptions, habitual patterns of thought, and the difficulty of making more than first-order extrapolations. Particularly when an emerging technology appears to represent a merely incremental advance over its antecedents, as was the case when the automobile was still perceived as a "horseless carriage," old habits of thought are projected into areas in which they may prove dangerously misleading. Paradoxically, the demands on creative imagination may be least severe when the technology in question poses an obviously radical departure from precedent. (National Academy of Science, *Technology: Processes of Assessment and Choice*, House of Representatives, Committee on Science and Astronautics, page 44)

EXCERCISE:

Read the section describing how to construct an Effects Wheel.

Next, using the impacts you identified in the last excercise, complete an effects wheel.

You will need to begin by first determining if each impact is a first, second or third order effect, and so on.

ASSESSING TECHNOLOGY IN THE WORKPLACE

Listed on this page are additional excercises which, along with information
generated in the effects wheel excercise, will lead to a comprehensive,
action-oriented assessment of the workplace.

1) Conduct a technology assessment which examines ways to use new
   technology in your work environment. Your objective is to maximize
   worker satisfaction, minimize stress, and maintain service levels.
   Don't be constrained by what you think is possible; instead, focus on
   what is a desirable future.

2. Training & Work Excercise:
   Design a training program to meet your needs.

3. Draw a rough diagram of the institutional and organizational structures
   that control how technology is introduced into your job. (A portion of
   this can be found in the information section.)

   Based on the desirable future you have already outlined, how would the
   organizational/institutional structures have to change? After
   answering this question, generate a list of steps to take to meet this
   end. Don't worry yet about what is realistic.. Assume some ideas will
   seem heavenly, perhaps unrealistic; then think of what is possible.

   Next, from the list above, identify realistic strategies for change.
   Determine which are short term as opposed to long term tactics.
   Discuss how the union would go about meeting these ends, and how they
   would have to relate to management. What have the past successes
   been?

   Finally, develop a plan for change based on information generated above.

Additional Excercises

These excercises can be used to generate some of the information which the excercises in the previous section require. All articles referred to can be found in the INFORMATION SECTION.

Refer to <u>President's Advisory Committee on Computer Services</u> Report.

1) Based on the information on pages 1-2, if this plan is adopted, what departments will be effected? What AUCE jobs will change?

2) Refer to the bottom half of page 4. On which popular attitudes towards technology is this statement based?

3) Refer to p. 6. If this statement becomes practice, how will AUCE jobs change?

4) Refer to pages 9-10. For each paragraph, (beginning bottom p. 9) list the assumptions about technology which form the logic of the paragraph.

5) Refer to p. 21, <u>Equipment</u> section. How does this situation effect AUCE? Also see pgs. 25-27 on <u>Administrative Computing</u>. Outline the changes that will result if this recommendation is met.

6) Refer to pgs. 35-37 <u>Organization & Resources For Computing</u>. From your position as a staff member, what do you think is good about this structure? What is bad?

7) Refer to pages 40-43, <u>SFU's Computing Environment In 1990</u>. Generate a list of all the department's and AUCE jobs that will be effected if these plans become practice.

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