DOCUMENT RESUME

ED 329 208 IR 013 683

AUTHOR Bruce, Margaret; Kirkup, Gill
TITLE An Analysis of Women's Roles under the Impact of New Technology in the Home and Office.
INSTITUTION Open Univ., Walton, Bletchley, Bucks (England). Inst. of Educational Technology.
PUB DATE 86
NOTE 21p.; Chapter 18 of Computers and Democracy: A Scandinavian Challenge, edited by Gro Bjerknes and others.
PUB TYPE Information Analyses (070) -- Viewpoints (Opinion/Position Papers, Essays, etc.) (120)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Computers; Democracy; *Females; Foreign Countries; Labor Force; *Office Automation; Office Practice; *Sex Role; *Social Influences; *Technological Advancement
IDENTIFIERS *Division of Labor (Household)

ABSTRACT

Focusing on the ideology of the sexual division of labor with emphasis on women's roles and their work, this paper argues that social ideology dominates both the domestic and the office environment, and is perhaps the most powerful force determining the rate and direction of technological change. The argument set forth is illustrated by two case studies that examine the effects of new technology on women's life in two areas--the private, unwaged domestic sphere, and the public, waged environment of the office--both of which are considered parts of a larger technological and social system in which changes in one are related to, and have effects on, the other. The paper discusses why some forecasts suggest that new office technology may actually contract the market for clerical/secretarial work and what the repercussions will be. It is concluded that unless the ideological foundations of technological development are uncovered and examined, rather than ignored and unchallenged, technology will continue to function as a conservative force. (33 references) (CGD)

18 An Analysis of Women's Roles Under the Impact of New Technology in the Home and Office

MARGARET BRUCE
Management Sciences
UMIST
UK

GILL KIRKUP
Institute of Educational Technology
The Open University
UK

in

Computers and Democracy

A Scandinavian Challenge

Edited by
GRO BJERKNES
Institute of Informatics
University of Oslo
Norway

PELLE EHN
Swedish Center for Working Life
Stockholm
Sweden

MORTEN KYNG
Computer Science Department
Aarhus University
Denmark

Avebury

Aldershot · Brookfield USA · Hong Kong · Singapore · Sydney

Introduction

Predictions about the impacts of microelectronics and information technology (IT) in both the domestic and office environment have tended to focus on the "gee-whiz" aspects of the technology, and on its beneficial effects, for example, A Day at Xanadu (The Futurist, February 1984), At Home with the Computer (Vocational Ed, 1982). The scenarios tend to ignore and neglect the effects of these technologies on women. They do not usually discuss house cleaning or clothes cleaning nor child cleaning! Childcare becomes a job for the machine. Children sit obediently in front of their computer-tutor for hours! The paperless office of the future whirrs away without a female touch!

These predictions focus on the technology and treast it as a self-directing and politically neutral force, impacting on society. They typically have no analysis of the structural nature of the sexual division of labour in either the domestic or waged work environments and such scenarios often have little understanding of what the work, especially housework, actually entails. This omission leads to unrealistic suggestions for change and images of the future which are cameos of the present, writ large.

In this paper we focus on the ideology of the sexual division of labour, in particular, women's roles and their work and argue that this ideology is perhaps the most powerful force determining the rate and direction of technological change. We illustrate our argument by examining the effects of new technology on women's life in two areas: the private, unwaged domestic sphere and the public, waged environment of the office. Both the private and public areas are considered, as far as women are concerned, as parts of a larger technological and social system, in which changes in one area are related to and have effects on the other.

We argue that the applications of new technology to the domestic and office environment will not significantly change the sexual division of labour. Although it will change the quality of the work experience, perhaps detrimentally, for many women, and in unexpected and unrecognised ways. For example, in our case study on domestic technology we suggest that new technology while changing the nature of some domestic work is likely to create additional new work and will not necessarily reduce the overall time that women are engaged in work defined as 'housework'. We will illustrate our argument with recent historical research which indicates that the application of technology and the development of new appliances, while reducing the time and effort needed for some household tasks has increased the time needed for others. The unexpected effect of the increase in the use of domestic technology has been to collapse differences between working class and middle class women, and between rural and urban women, while on average leaving women working roughly the same number of hours on domestic tasks as their mothers.

In our case study on office work, we again use historical evidence to suggest that the new technology, if it is developed with the same ideological framework as

the old, will have the effect of reinforcing and reproducing the personalised and masculine forms of control without necessarily increasing productivity, a prime incentive for introducing the electronic machines. And while doing so is likely to decrease the job satisfaction of some female office staff as well as increasing female unemployment in this sector of business.

The two themes converge when we examine the recent concept of the home/workstation. This has been seen by a number of authors as one of the benefits of the changing nature of work, especially for women, in that they can incorporate unpaid domestic and childcare work with paid employment. We question what benefits, if any, there might be in such a scenario.

We conclude by speculating about possible interventions in the process of technological change in order to open up the socio-technological options available for women. We make suggestions of ways to incorporate women's needs and values into the design process and the effect of including women as designers and as critical users and buyers. However, we argue that such developments do not represent *the* solution unless they constitute an integral part of a systems approach which is incorporated into a political and industrial initiative to provide radical challenge to the ideology underpinning the current rate and direction of technological change.

The sexual division of labour

By the term 'sexual division of labour' we mean that system whereby certain types of work are classified as being more appropriately done by one sex rather than another. In its grossest form all domestic and caring work within the 'private' sphere of the family is classified as women's work, and all economically productive, waged work in the 'public' sphere as belonging to men. In present day Western Europe few cultures or individual families would subscribe to such a rigid division. However, a sexual division of labour exists in the workplace, with certain types and jobs seen as male and others as female, and the environment within which the work is done is also seen as sex specific. There are frequently aspects of 'female' paid jobs which mirror aspects of women's unpaid domestic work such as subservience to men, a servicing/supporting role to a man, repetitive light semi-skilled tasks. Such common factors reinforce the notion of women's work. The office is a female environment, particular types of office work for example, secretarial, clerical, receptionist, etc., are typically women's work. Whereas, management work is predominantly men's work. The feminisation of secretarial, shorthand and typing employment is clearly demonstrated by the Census figures presented in Table 1. From Table 1, it can be seen that in 1951 97% of secretarial, shorthand and typing jobs were done by women. By 1971 (the last available Census figures) 98.6% of these jobs were women's jobs, cited by

SPRU (1982). This indicates that during a period of technological and social change the sex stereotyping of jobs has in fact increased.

In this paper we examine technological change in two contexts in which women predominantly work in particular 'female roles'.

	Total	Number of Males	% of Total	Number of Females	% of Total
1951	510,337	15,346	3.0	494,991	97
1961	663,960	13,940	2.1	650,020	97.9
1966	803,520	14,620	1.8	788,900	98.2
1971	747,400	10,100	1.4	737,800	98.6

Table 1. *Secretarial, shorthand and typing employment.*
Source: Census, England and Wales, Occupational Tables, 1985, 1961, 1971.
Sample Census, Great Britain, Economic Activity Tables, 1986.
Office of Population Censuses and Surveys, HMSO.

Domestic technology

Ideologies are not static, but develop and evolve, and this is certainly true of the ideology of women's domestic role during the last hundred years, almost everywhere in the world. However, ideological change may, in reality, be slight and disguise the fact that lived experience remains very much the same.

In Britain for example, there has been much post-1945 social commentary analysing what is seen to be a more flexible sexual division in society where women play a greater role as waged workers, and are helped more by other members of the family carrying out domestic tasks. Myrdal and Klein, for example, in the 1950s argued that women were able to take their place as waged workers because many of their domestic caring tasks were being carried out by te agencies outside the family, and many of their domestic labouring roles were

being replaced by labour saving devices. Later writers such as Young and Willmot (1973) have argued that this change in women's role has been complemented by an involvement of male family members with domestic tasks; which has produced the companionate marriage. However, work which has examined in detail the actual domestic tasks performed and how long they take has questioned this notion of equitable sharing. Tasks are still found to be sex stereotyped (Blood and Wolfe 1960), with men doing the infrequent jobs such as lawnmowing and household repairs — jobs which are more likely to be seen as skilled — whereas routine 'unskilled' tasks such as getting breakfast, washing up and tidying are women's jobs. Studies have shown that although women employed outside the home spend less time on housework the reduction of hours of housework does not equal that spent in paid employment. Thrall (1982) for example, found that when women worked on average twenty-four hours in paid work, they reduced their housework by ten hours, which still gave them an *extra* fourteen hours in their work week. However the husbands and children of employed women only increased their share of housework by four hours a week. It would appear then that the sexual division of housework continues during a period when new developments in household technology have been much heralded. In fact critics such as Thrall (1982) and Cowan (1983) argue that the development of household technology has had a conservative effect in so far as it has "facilitated the maintenance of family patterns which might otherwise have been threatened by other changes outside the family." (Thrall 1983 page 193).

In particular it is now possible for a woman to take paid employment while still being expected to perform the major domestic service role. A historical analysis suggests that this conservative role is visible in the effects of the first Industrial Revolution on domestic technology. And, it leads us to believe that the effects of a second industrial revolution in the home will be similarly conservative.

Research into domestic work in pre-industrial Britain suggests that a sexual division of labour existed long before the Industrial Revolution (Davidson 1982). Jobs categorised as 'housework' were primarily done by women, for example food preparation, cooking and cleaning as well as carrying fuel and water to and from the house. This work was unpleasant and dangerous, and the lack of basic services increased the labour of associated tasks such as laundry or cleaning. However, in pre-industrial Britain the organisation of this work was different. It was unlikely to have been carried out by a woman working alone. Households would have contained a number of unmarried or widowed female relatives, who did domestic work and it was common for all but the poorest households to employ women or children to help with particular arduous tasks such as laundry or cooking.

Domestic work has also always been waged work and one of the first indirect effects of the Industrial Revolution was an increase in the number of women servants. By 1881 roughly one in eight of all women above the age of ten were domestic servants, (Hugget 1977). This was partly due to the fact that many women had been displaced from their pre-industrial productive work, such as, in

textiles and agriculture, and could therefore be employed at extremely low wages. The servant market in Britain was bigger than in the USA, where progress in the application of technology to domestic work, for example central heating, was much faster. Developments in domestic technology demonstrate a strong link between availability of cheap labour, women as servants, and slow development. A link which is important when speculating about women's potential in the changing job market of the future, especially in relationship to a contraction of 'female' jobs in areas such as office work.

The first Industrial Revolution produced the services to households that we take for granted today: the provision of clean water, sewage and refuse systems to remove waste and gas and electricity as energy supplies and fuels for heating, cooking and lighting. The effects of all these have been dramatic. For example, without piped water, jobs such as laundry and food preparation were done outside, at the water source. The technology of laundry work, that is, the development of washing machines and washing preparations has depended on this infra-structure of services. However we usually take for granted the individualised way in which the work has developed. Laundry work is now seen as one of the unpaid tasks of housework, with households aiming to own their own washing machine. In 1958 only 29% of households owned a machine, in 1980 77%. Had not women's labour been treated as free, this same infra-structure and its technical developments could have produced a service system of laundries which would have removed the task from the load of individual women.

The application of these services and the technical developments based on them has produced for women the situation represented by Vanek's graph (1974) in Figure 1. This, based on data about women in the USA, indicates that there has been no significant reduction in the overall number of hours per week women spent in housework between the 1920s and the 1960s.

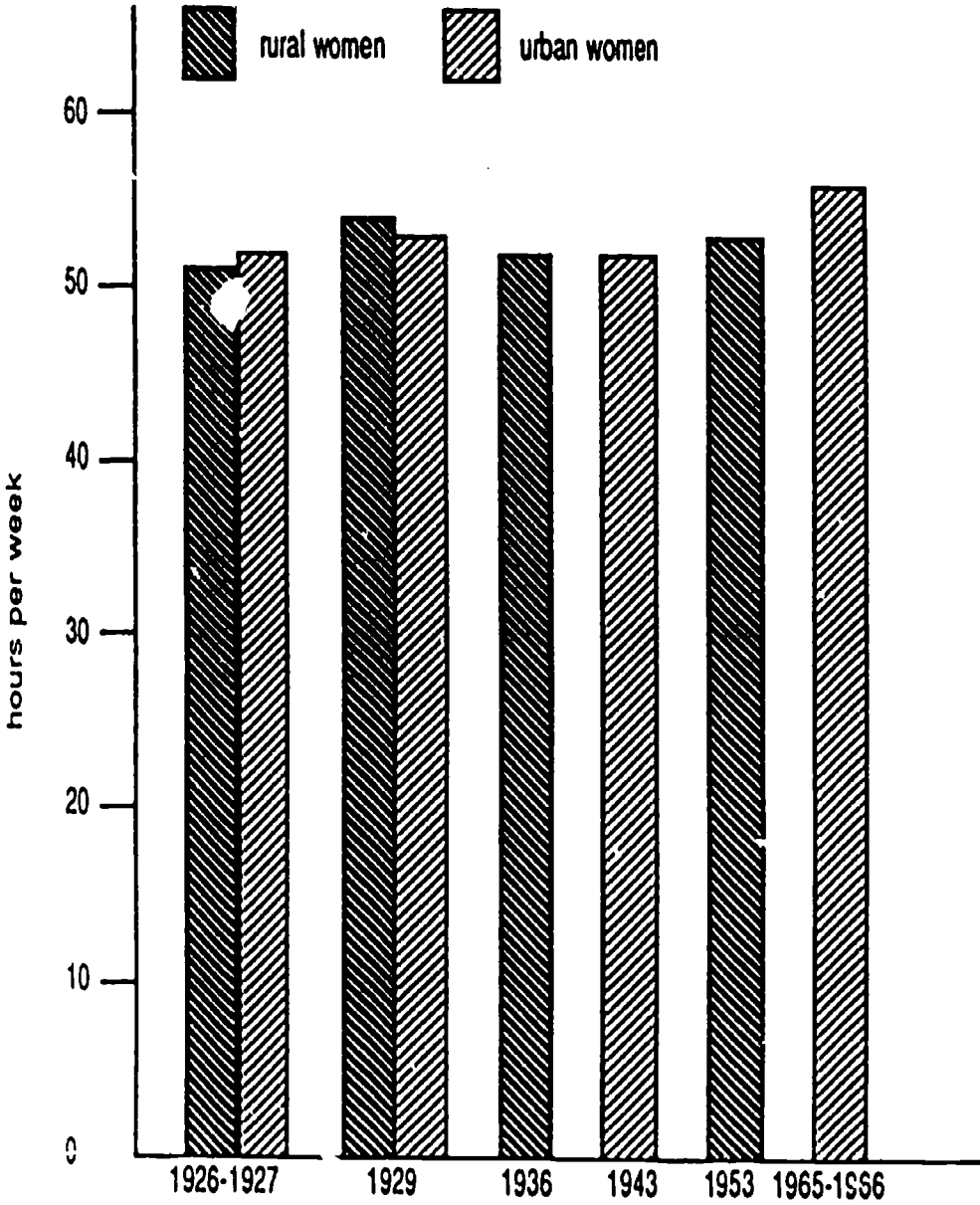

Figure 1. *Time spent in housework. Source: Vanek 1974.*

Cowan (1983) and others have suggested that this is because along with the benefits of the provision of services has come a flood of domestic gadgets, which while increasing the scope of product that an individual woman can produce, for example food processors for food production, steam irons for laundry, have increased the expectations of other family members about the nature of her product.

Some tasks, like washing up, only came into existence as the quantity of utensils and table-ware increased. The scullery was a Victorian invention necessary to deal with the boom in china table-ware and the dishwasher appears to follow a similar trend. Other tasks which are now an important part of the housewife's role were previously performed by agencies outside the home, or by other individuals within it. For example one task which was not previously part of a woman's domestic work and has become so is the transport of goods and of other members of the family. In Western motorised culture this is an important part of domestic work. Retailers now only deliver large items like furniture, and women travel to shops increasingly under their own steam, as public transport systems concentrate on commuters and long distance travel. Giuliano (1984) has demonstrated that although women have less access to the family car than men, the trips they do are more often for servicing reasons, such as chauffeuring others or shopping. All this begins to provide an explanation of Vanek's graph.

So far we have concentrated on services and gadgets that have effected the physical labour of domestic work, but the information technology (IT) of the last fifty years, telephone, radio and television has also affected the nature of domestic work. Radio, for example, is these days seen as a way of decreasing the isolation of the housewife by providing entertainment and the change to be heard in "phone-in" programmes. Television provides both entertainment and the most important advertising medium in the West. If anything it increases the tasks of the housewife by raising the expectations of the other members of the family about what she should be doing, such as how white her laundry should be, what sort of meals she should be serving and how. Both these media are then providing extremely conservative reinforcements of the ideology of women's role. Finally the telephone, which has the potential to reduce the amount of work a housewife needs to do, by providing direct ordering facilities etc., has done no such thing. Instead it has become a means by which organisations and professionals control the housewife to fit in with their own schedules[1], for example, she must phone to make an appointment for any family member to see doctors, solicitors or any professionals, she must leave her number with her children's school so that she can be contacted if needed. However, in situations where it could be to the housewife's benefit, such as for delivery or repair men to contact her by phone to make an appointment to visit she is usually told such scheduling is not possible, and the best that can be done is to tell her which day such a person will arrive, so that she can spend the day at home waiting for them.

The phone is an excellent illustration of the issue of the focus of control of domestic work, and the effect that technology has on this. Although on the surface it would appear that a housewife is "her own boss", it is obvious that much of her work is determined by other members of the family, their needs and expectations and the amount of domestic work they do. The present day housewife is also

1 and a way in which other members of her family especially her husband can direct work and check on her from a distance.

involved in a complex social and technological infra-structure over which she has no control, and in which she is controlled and organised for the convenience of state agencies and industry. Most high technology domestic appliances are impossible for her to maintain or repair, so she is dependent on a network of service engineers, who may be willing to call, or may demand she takes the appliance to them during her working hours. The development of supermarkets has forced housewives to travel further to shop, during those hours specified as shop opening hours. Not all of this is due to the demands of big business, much of it is the result of union agreements to improve the working lives of employees, frequently as is the case with women, it ignores any roles performed outside those of paid workers. For example working women with 9.00 am to 5.00 pm working days find difficulty in doing the family shopping since shopping hours mirror their working hours. The older forms of IT have done nothing but *decrease* the amount of control a housewife has over her work, while at the same time reinforcing its privatised nature, certainly not reducing the time or labour involved.

The newer forms of IT are at the moment most usually used in the domestic environments for leisure activities. If home computing magazines are taken to be an accurate representation of the market, the majority of software packages are games packages, and the content of the games suggest that the typical player is seen to be male. Also, at all levels from primary school to adult students, the interest shown by girls and women in learning to use computers is significantly lower than boys and men, while research with children (Clarke 1984) suggests that experience with computers in schools *reinforces* the negative attitude of girls. This is to be expected since it follows a trend where expensive leisure technology is usually bought for the adult male in the house, for example, hi-fi equipment, photography equipment, and before home computers, hobby electronics.

Overall, appliances and gadgets in the home appear to have reinforced the sexual division of labour in such a way that male family members do a smaller proportion of domestic work than their wives, and women are being increasingly expected to incorporate paid employment with domestic work. Thrall notices two important effects of the availability of new gadgets; first, families with gadgets do more work so that if you have a floor polisher or sewing machine, you are more likely to polish floors and make curtains; second, new equipment increases stereotyping tasks, for example, when a family owns a dishwasher the women do all the washing up. In fact Bose and Bereano (1984) argue that appliances are used as a way of *not* sharing housework. And unfortunately women do not find housework satisfying in the way makers of domestic appliances and other members of the family would like to believe they do (Oakley 1974). Women increasingly want paid work outside the home.

In terms of our analysis, what presumptions can we make about future changes in the nature of women's work? First, what new services or tasks is IT bringing to housework? Viewdata systems are always quoted as a potential bonus to housewives since they could in theory order goods via this system. We suggest

that for many years the range of goods available in this way is likely to be small, and restricted to large expensive items. Until the housewife can order her regular weekly purchases and have them delivered, the advantage of being able to order the infrequent luxury item like a piece of furniture, does little to help ease her work. Such services are also being heralded as ways of budgeting and bill paying. An unfortunate new task for many women when previously many families used banks to pay standing orders and only budgeting gross costs themselves.

Advocates of IT presume that there are real advantages in home computers as control devices for micro-wave ovens, dishwashers and washing machines, while ignoring the fact that this facility has been available for many years through simple electronic time clocks, either built into the equipment as in cookers or attached to the power supply. Such advocates do not recognise that cookers can only cook prepared food, dishwashers wash the dirty dishes someone has stacked inside them and washing machines wash the dirty clothes someone has collected and sorted. At present domestic robots, such as "Omnibot" by Tomy are really no more than toys — at best a preambulating teatray. Women would be right to suspect that what is being put onto the domestic market in this field is directed at no *real* need, but simply a profitable outlet for the micro technology industry.

However there is an aspect to these new developments which is not trivial and that is the suggestion that a combination of new technology applications to housework with the potential for people to work from workstations at home, will benefit women so that they can carry out domestic and employment tasks in the same room, such as take care of an aged relative while doing secretarial work from a terminal. We will explore this possibility further in the case study on office technology. But, such a situation would be the logical outcome of further developments in domestic technology which support the ideology of the working wife/mother and collapse the two roles into one person.

Office work and technological change

Offices provide a large proportion of all jobs in Western industrialised countries. In the UK, 20% of employed people work in offices (Turney 1984). Offices and information related work are increasingly important to the economies of such countries. Various social commentators like Daniel Bell (1974) and Toffler (1984) argue that these societies have shifted from an industrial to a post-industrial society or information based society.

There is an increasing trend to install information technology, for example, wordprocessors, electronic exchanges, local area networks, personal computers, electronic mail systems, etc. in offices. Some forecasts predict a rapid and steady growth in the demand for information technology. Figures produced by Pactel (1981) estimate that there will be a total world market worth £150 billion by 1990. At the same time, other forecasts predict a dramatic decrease in the number

of clerical and secretarial jobs. (Turney (1984) summarises the current forecasts.) One set of predictions made by Bird in 1980, estimates that in Britain by 1990, 170,000 jobs will have been lost with the installation of wordprocessors.

Whatever the numbers prove to be, the forecasters all agree that there will be a reduction in these areas of office work, areas typically classified as women's work. Certainly too, if there is a widespread adoption of electronic office equipment, the nature and organisation of office work will change with the move towards electronic based and more capital-intensive offices.

In this section, we consider what the office is and show its complexity. Then, we discuss how women's work in the office has been affected by technological change within the context of the ideology of sexual division of labour, both historically and contemporarily, before speculating about some future possibilities.

Offices vary in location, size, purpose and organisation, for example, offices exist in shops, factories, hospitals, schools, etc. They can be small, employing one or two people like the offices attached to the doctor's surgery or very large like the head office of a multinational corporation. The purpose of the office is to collect, store, process and communicate information, for example, about the doctor's patients or about the financial operation and corporate strategy of a global company.

Offices have financial and accountancy staff, sales and marketing staff, designers, production engineers, electronic dataprocessing staff, etc. Most of the management office staff are relatively highly paid and are predominantly male. Offices also have secretaries, typists, switchboard operators, wordprocessor operators, receptionists, filing clerks, photocopier operators, dataprocessing operators, etc. Most of these jobs are relatively low paid and are typically done by female employees. Yet all office workers thrive on information: collecting and storing information, manipulating and communicating information. Sales staff, for example, collect sales figures, file the figures and manipulate these to find the actual sales for a given week, month and year and then they communicate the figures in the form of a table and written report. Secretaries, for example, will receive information from her boss, type out reports, letters, make copies, file a copy and send the finished work to her boss or to the final recipient. Some secretaries act as 'gatekeepers', not letting people interrupt the boss when he's in a meeting, dealing with some issues herself, and so on. In this way, Vinnicombe (1980) suggests that secretaries also have a personal assistant's role. Nonetheless they along with most of the other women in the office, primarily have a servicing role.

Stereotypes of secretaries bying presents for the boss and his family and so on actually reflect a male dominated form of office control. The situation mirrors the ideology of women servicing men in the home and reproduces this in the workplace. Female office staff are expected to have qualities of obedience, loyalty, patience and so on. Also, female secretaries are status symbols for bosses.

Vinnicombe (1980) represents the structure of offices in terms of the numbers of secretaries employed by directors, senior managers and managers.

Figure 2 shows this. The higher up the management hierarchy the manager is, then the more likely he is to have his own personal secretary.

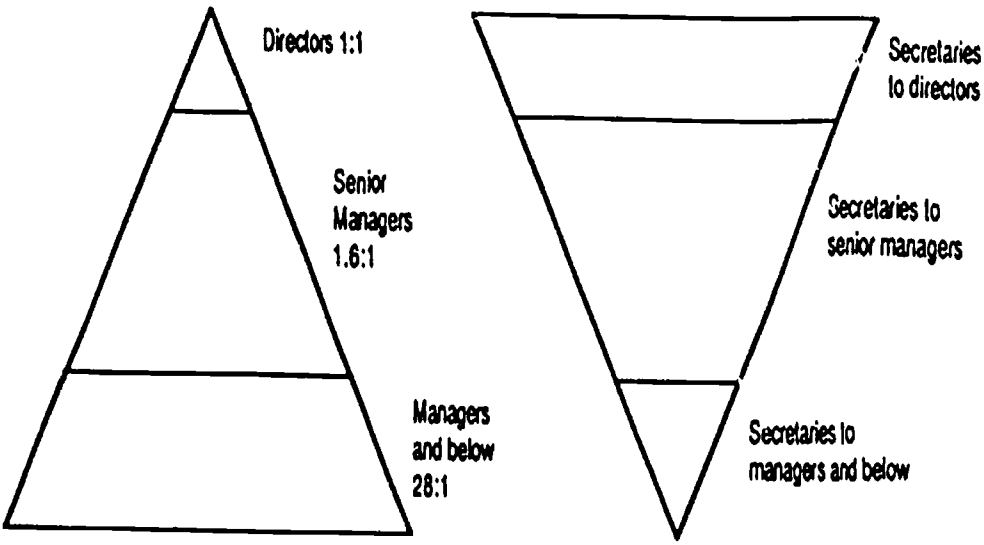

Figure 2. *Structure of secretaries and managers. Source: Vinnicombe (1981).*

The feminisation of certain categories of office work is deeply-rooted historically. Delgado (1979) shows that office work employed a relatively small proportion of the working population until the late nineteenth century. Office employment was typically a male preserve and enjoyed a relatively high status. Office work expanded from about the 1870s in the UK with the growth in trade and commerce. The introduction of mechanical machines, such as the telephone, telegraph and particularly the typewriter effected how information was handled, mainly replacing verbal messages by written messages. This in itself resulted in an expansion of office work. Women were recruited in large numbers to fill the demand for office work. Delgado (1979) estimates that the employment of women in offices grew from 7000 in 1881 to 146,000 in 1911. Women moved from domestic work to office work. Women no longer had to live and work in their employer's homes. However, women were typically recruited into certain kinds of office work, such as clerks, typists, secretaries, receptionists, telephone and telegraph operators jobs and rarely as accountants, general managers, etc. There was a clear sexual division of labour. Indeed, women moved almost directly from servicing jobs in the private and domestic sphere to servicing jobs in the public and office sphere. Often, Morgall (1982) stresses, for low wages and very hard work. The qualities of obedience, loyalty and patience were regarded as virtuous attributes for the female office worker.

Office work has undergone organisational and technological changes over the past 100 years and particularly with the introduction of computers and microelectronics-based office equipment since the 1960s. Yet, we maintain, the sexual ideology of the division of labour and which roles are appropriate to women has not disappeared. Rather the technological changes have occurred within this basic structure of office work and have reinforced and reproduced it.

Some researchers looking at the changing nature of office work, notably Baker and Downing (1980) argue that the introduction of new technology and particularly wordprocessors has and will deskill secretarial work. They point out that the skills and knowledge of layout and judgements that secretaries make to produce high quality work are incorporated into the machine. The machine can automatically do layouts and the workprocessor provides different typefaces at the 'touch of a button'.

Baker and Downing (1980) also suggest that new office technology means more management control over the work process. They write

> "Wordprocessors are also designed to subordinate the workers to the machine and to develop more formal forms of control than those we have described. In conjunction with developments such as electronic mail and facsimile transmission, the wordprocessor aids deskilling and hence the cheapening of office labour and offers management the means by which they can increase their control over the office work process."

No doubt, this tendency is occurring but it is also true that some secretaries like using a wordprocessor, many wordprocessor operators can receive higher wages than copy typists and so on. The nature of the office work and organisation effect women's experiences of technological change. This can be demonstrated by taking two of Giuliano's (1982) types of office organisation, the 'pre-industrial' and 'industrial'.

The 'pre-industrial' office, he writes, dates back to the mid-nineteenth century and is typical of most small business, professional offices. In this office, male employees do their work fairly independently, moving around to retrieve a file, attend a meeting, see a client. There is no systematic organisation of workflow. The female office workers, the secretaries, receptionists, have to answer the telephone, type and file. There is no formal job sharing of sex specific work. In this type of office organisation, there is a mixture of old and new technologies: the telephone, the telex machine, electric typewriters and perhaps a wordprocessor, and microcomputer. The equipment is not installed in a systematic way to raise output, to deskill or to make the work more machine-paced. Rather in many situations, the new equipment is seen as improving the work and status of the secretary and the receptionist and can mean wage increases for such staff. Whereas, the 'industrial office' Giuliano explains, is essentially a production line with a systematically organised workflow intended to maximise efficiency and output. In this type of office, each person's job is quite specific and separate from the next person's work, for example, in a large mail order company a typist produces lists

of addresses, a checker takes these to look for errors, clerks find the correct addresses for typing, etc. Typically wordprocessors, in the above example, have been installed for typing addresses and have reduced the number of women employed as typists, checkers and clerks. The typist has been "upgraded" to a wordprocessor operator, after having had some training. She is no longer located in a typing pool but in a wordprocessor centre. Her work flow and pace of work is still monitored by the supervisor of the centre. The supervisor is now a 'wordprocessor supervisor'. In this situation, the workpace is often increased, the pace of work is automatically monitored and the female worker is still deskilled.

The rate of development of this type of central wordprocessor pool is slowing down. It is mainly appropriate to offices with very high volumes of work and so can justify the high capital cost of investing in the equipment. Also Reinecke (1984) claims productivity has not increased significantly. He goes on to suggest that there is a lot of conservatism amongst office staff, in particular, male bosses like the status of having female secretaries and still tend not to use keyboards for text entry. Indeed, voice based information technology equipment is being designed for male office managers, for example, audio cassettes for wordprocessors, voice operated wordprocessors, etc. Also, special non-QWERTY keyboards are creeping in, such as the Microwriter chord typewriter/wordprocessor. Using a QWERTY keyboards is associated with low-status, women's work.

The present direction of innovation of information technology in offices is towards decentralised workstations. The machines are designed for female users as 70% of electronic office equipment is used by women for the collection, filing, manipulation and communication of text. Also, they are typically designed and sold to male purchasers. The sales literature produced by the suppliers often has male managers using a telephone to give a message to one or more female secretaries using wordprocessors. The sales literature has the messages of 'male control', 'there's status for you and your secretary with a workstation', and 'improve efficiency with a workstation'. The advertising reinforces the sexual division of labour that exists in offices and the current designs of workstations do not challenge this. We agree with the cover story in Business Week (1983) that there is an emphasis on automating secretarial and clerical work rather than on automating the office. However, the changing technology means that smaller, more powerful and cheaper business machines and better telecommunications facilities are being designed. Workstations are becoming available which enable text, data and colour graphics work to be done at one terminal. The workstations connect to a centralised database for information retrieval and processing and are also linked into high capacity local area networks for electronic mail.

Some of these workstations are being used by secretaries but are designed primarily for male office work, such as financial modelling. In electronic based information offices, where men and women use keyboards and sit at workstations they are doing different work. The ideology of the sexual division of labour and which roles are appropriate to women continues.

Another form of decentralised office working is teleworking or the convergence of the home and office. Nilles (1982) points out that most experiments of teleworking are with female typists working at home. As mentioned earlier in our discussion of domestic technology, women home workers are still responsible for childcare, household duties, etc. The remarks by one female home worker (cited by Reifro 1982) that she can 'work and nurse' are relevant here.

Some larger organisations are experimenting with executives working at home using terminals to communicate with a central office. In these experiments, the secretary still travels to and from the office to deal with telephone enquiries, to act as a gatekeeper to stop the manager being interrupted by certain enquiries and people and to produce and print good quality letters. The female secretary is still servicing the male boss but her personal contact with him is reduced.

In general, the changes in office technology and office organisation have not altered the ideology of the sexual division of labour and the roles which are appropriate to women. The technology has been developed and implemented in a way which reinforces the status quo. Future changes with decentralised workstation and teleworking take place within this context and serve to reproduce this.

Conclusions

In the two case studies we have emphasised that the most powerful force determining the future direction of technological change is social ideology, for women the ideology of the sexual division of labour. We have described how this ideology dominates both the domestic as well as the office work environment of women, and does so in such a way that changes in one have effects in the other. This has been true in the past in the way that domestic technology has made it possible for more women to join the labour market while their domestic gadgets and services have enabled them to retain high standards of housework, and so not caused their families to 'suffer'. The applications of technology in the workplace have at different times expanded or contracted the market for cheap female labour. Some forecasts suggest that new office technology will in fact contract the market for clerical and secretarial workers as discussed in the paper. This has repercussions on the domestic environment both in limiting opportunities for housewives to take paid work, as well as increasing the numbers of women willing to do domestic and childcare work in other people's houses often as part of the black or informal economy. The effect of this is then to slow down the development of more useful domestic technology, such as self-cleaning houses and to reduce the possible options available for women. We argue that the ideological foundations of technological development have to be uncovered and examined, as we have done in this paper, otherwise if they are ignored and remain unchallenged, then the technology will continue to function as a conservative social force.

There are points of intervention in the process of technological change where the ideology supporting the sexual division of labour could be challenged.

One of these is to increase the number of female technologists, designers, planners, etc. through extending training and education and employment opportunities to women. However, such initiatives need to be handled carefully in order to avoid tokenism or acceptance of the idea that more female technologists automatically leads to changes in values, strategies and the quality of the technology produced. Our evaluation of post-experience courses during the British Women Into Science and Engineering (WISE) initiative in 1984 elaborates on this criticism (Bruce and Kirkup 1984).

Another solution is to find ways of developing the confidence and skills of the female user so that she can have a stronger effect on the product market. As Zimmerman and Horwitz (1983) write when examining the potential of the home/office:

> "To avoid typing the annual report while jiggling crying babies on their laps, women will need to define clearly for themselves what needs they want home information services to fill, and to what extent they will allow video services into their homes."

This demands a much more critical consumer market than we have at present. Again, this has implications for education, as well as trade unions, consumer action groups, local authorities, etc. to play a part in democratising the design process for women, for example, via supporting networks of women designers and users of technology, organising positive action campaigns, and assessing products in terms of their ability to meet women's needs and provide childcare.

Some critical scholarship in technology and design has begun to address these issues. It is interesting that women scholars and technologists who are involved in analysing the problem of technology and women's lives often see it systemically, in terms of changing social structures, and are concerned to redesign large scale environments such as cities (Markusen 1983, Matrix 1984) or 'self-cleaning' houses (Gebe 1984).

There are also instances where large numbers of women are working together collaboratively and separately from men, to challenge the social relations underpinning the development of technology. The Women's Peace Movement in Britain, through the establishment of Peace camps, has challenged the deployment of military technology, created public awareness about the likely effects of nuclear war and wakened many people to the possibilities of using the resources for alternative forms of technologies.

However, we feel that unless these initiatives become an integral part of a political and industrial strategy supported by the leading edges of new technology, they will remain largely in the domain of abstract ideas or be seen as peripheral or 'alternative'. We need those at present determining the direction, and meaning, of technology to be aware of the ways in which this direction and meaning underprivileges and exploits particular social groups. These groups cannot simply

become privileged by offers to "join in", or escape their exploitation by the construction of small scale alternatives. Instead technology must be re-examined for the basic structural ways in which it continues to reproduce unequalities, such as a sexual division of labour. If those involved in promoting the new information technologies wish to turn statements about the democratic nature of these technologies into action rather than being simply rhetoric, they must put more time, effort and money into a critical examination of the impacts of what they are producing.

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