# 6
# Women and Wider Values

## Contrasting sets of values

In the ancient world, the achievements of those who today we would call technologists were sometimes celebrated in legends that described marvellous feats by mythical metal-smiths and the drama of their flaming furnaces. The Greeks' artisan-god, Hephaistos (known to the Romans as Vulcan), was often portrayed like this in stories that date from the bronze age. When he made a great shield for Achilles, he had twenty bellows working:

> and twenty Forges catch at once the Fires;
> . . . In hissing Flames huge silver Bars are roll'd
> And stubborn Brass, and Tin and solid Gold.[1]

Hephaistos was widely renowned for his 'craftsmanship and cunning', and legend had it that technology among humankind began when Prometheus stole fire from Hephaistos and gave it to man. But one other deity the Greeks linked with technical skill was the goddess Pallas Athene (or, to the Romans, Minerva). She stands for the intellectual and moral qualities required in practical work, and for meticulous craft skill. Homer wrote of a carpenter who was 'well versed in all his craft's subtlety' through Athene's inspiration, and mentioned a goldsmith who was taught his trade jointly by Athene and Hephaistos. In other passages, Homer wrote about the practical skills of real women such as the aristocratic Penelope, known for her weaving and her wisdom, and others who collected and prepared medicinal herbs.

There was real admiration for the skills of women, though it was always made clear that these were of a different order from those of men. On one of the Greek islands there was a community where the

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men's 'extraordinary skill in handling ships at sea is rivalled by the dexterity of their women-folk at the loom, so expert has Athene made them in the finer crafts'.

Denied the right 'to a heroic way of life, to feats of prowess, competitive games, and leadership of organized activity of any kind',[2] women excelled in painstaking craft work and socially useful skills – spinning yarn and grinding corn in the handmill. While Homer shows great appreciation for what they did, the contrast with the spectacular achievements of men using furnances and forges, weapons and ships, is very striking. Here, perhaps, we may see two parallel sets of values concerning practical skill and 'technology': one seems rather like the set of values concerning adventure and virtuosity we examined in the previous chapter, while the other is more closely attuned to basic needs and human welfare.

Parallels have been drawn between Homer's world and the life portrayed in roughly contemporary parts of the Bible. The book of Proverbs ends with a poem in praise of the good woman, who rises early, 'while it is yet night' to prepare food for her family. 'She layeth her hands to the spindle, and her hands hold the distaff... She openeth her mouth with wisdom; and in her tongue is the law of kindness ... Beauty is vain but ... let her own works praise her.'

However, while the work done by women was widely appreciated, other types of work were despised. In Homer's world this included trade and the routine manual work done by men. This attitude was shown by the ambivalent way Hephaistos was portrayed. Surrounded by the flames of his furnaces, his virtuosity and skill are heroic. In other contexts, though, he is a clumsy, inarticulate working man. Similarly, while Penelope's husband Odysseus captained his ship on a voyage of exploration and adventure, he was a heroic figure. But when somebody mistook him for the skipper of a merchant ship, that was an insult. In other words, distinctions were actually made between three kinds of practical skill, carried out by three kinds of people – women; merchants and working men; and adventurers, armourers and warriors.

Homer described aspects of the human character that go very deep, and three thousand years later, we may wonder whether similar attitudes are not still widespread. It is certainly significant that feminist writers, concerned with women's work roles in the modern world, have taken considerable interest in historical and anthropological evidence from traditional societies. Susan Walker, an archaeologist, points out that with regard to ancient Greece, we have 'few references to the way

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in which women spent their lives, [but] more accounts of how men wished their lives to be spent'. That must be taken as warning that the comments made in previous paragraphs may reflect men's values and aristocratic men at that. What Homer does not describe is how most women 'worked the fields as they have done throughout history',[3] and for an appreciation of what is involved in this, we can most usefully turn to studies of the role of women in modern developing countries.

A statement often quoted is that, in much of Africa, women are responsible for growing three-quarters of the food that is eaten in rural homes. Some such estimate is relevant to much of Zaire, for example,[4] and the figure quoted for Tanzania is that women grow between 60 and 80 per cent of food. Reviewing conditions in the 1960s, Ester Boserup found that in sub-Sahara Africa, more women than men were undertaking agricultural work, and the women were usually working in the fields for longer hours than the men.[5] She also stressed that farming in Africa is not a family enterprise: men and women work independently of one another, growing different crops. Women usually grow the basic food crops for family consumption, while men who are farmers grow crops for sale.

For example, Margaret Haswell[6] has described a village in the small West African state of Gambia where, in the 1940s, the staple food crop, rice, was grown on natural swamp land by the women, while the men cultivated higher fields to grow groundnuts for market. The women had to work very much harder than the men, but received little help from them. During the growing season, women would have to fit in extra work in the fields by cutting down on the time spent on other tasks such as preparing meals and fetching firewood and water. Thus families were less well fed during the growing season than at other times.

Margaret Haswell followed up her study with subsequent visits and found that by 1974, men were tending to concentrate even more on cash crops (mainly groundnuts), and some were leaving the land for paid work elsewhere. Thus women were even more on their own as producers of food, and where there was ill-health, families were short of labour and were going into debt to buy food.

This is the human context of the declining per capita food output in much of Africa that was noted in a previous chapter. The irony is that where agricultural development is planned by governments, this is usually with the aim of directing more farm produce into the market economy. Such policies result in a degree of economic growth, but achieve this by encouraging male farmers with their cash crops –

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groundnuts, coffee, cotton – while usually offering no support at all to the female farmers who grow their families' food. The work of these women is dismissed as 'subsistence activity' or 'gardening'. Even in some African countries where most farmers are women, agricultural policies may be based on the assumption that all farming is done by men. One consequence is that in communities such as the Gambian village mentioned, nutritional standards fall as economic growth proceeds. What makes sense in terms of economics does not always make sense in the context of family welfare.

This represents more than the tunnel vision of specialist economic planners. It also demonstrates a conflict of values between economically-oriented development and nutrition-oriented agriculture.[7] One might even argue that agriculture is an instance of technology which takes different forms according to the values built into it.

It is of further significance that, when an agricultural task is mechanized, responsibility for it will often pass from women to men. For example, the milling of grain by hand was not only a women's job in Homer's time, but also in 95 per cent of all communities throughout the world where the technique has been recorded.[8] But where power-driven mills are introduced, the work is usually taken over by men.

In Lesotho, where numerous men are regularly absent from home, working in the South African mines, women may drive tractors and do the ploughing, but elsewhere in Africa, this is exceedingly unusual. In Asia, women are less often farmers as such, and work in the fields mainly as labourers, but are equally affected by mechanization. In Java, harvesting has 'switched from being a female task', and where rotary weeders have been introduced, or rice hulling machines, large numbers of women have been displaced by 'smaller gangs of hired males'. Very often, then, women may simply be left with tasks not affected by technological innovation.[9]

In some circumstances, improvements in hand-tools or water supplies can be identified which do not involve machinery, and which lighten the burden on women without handing the task over to men. Such innovations are particularly welcome, because although women are often over-burdened, Judy Bryson argues, they 'take considerable pride in their agricultural work', and lose independence if all jobs outside the home disappear through mechanization.[10]

The reason men are attracted to mechanized jobs may be to do with the higher productivity and earnings associated with them, but seems also to be partly due to the way machines convey prestige. The modern

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male takes pride in being mechanically minded. Furthermore, as with the ancient Greeks whose men worked forges or steered ships while the women worked at the loom or hand-mill, there seem to be very particular values involved in controlling inanimate force – even in the undramatic setting of a ploughed field – and these recall the virtuosity values discussed in the previous chapter. So in modern Africa, as in ancient Greece, there appear to be three kinds of values involved in the practice of technology – firstly, those stressing virtuosity; secondly, economic values; and thirdly, values reflecting the work traditionally done by women.

## Users and the management of process

In previous chapters, values and world views have been discussed mainly in terms of the attitudes of economists and more technically-minded commentators. Now we find that women's work roles imply a third point of view, and one which may come closer to the basic needs approach encountered in the Kerala case-study of chapter 4 than to anything else so far discussed.

In order to see how these three viewpoints are inter-related, it is useful to turn back to the 'map' of technology-practice presented as figure 6. This illustrates how we commonly think about technology in terms of an 'expert sphere' of interest, forgetting the activities and experience of 'users'. The expert sphere includes research, design, all industrial activity, and also the professional interests of engineers and medical men. Even though many user-related factors are neglected, this is still too large a field for a comprehensive view to be easy. Most discussion therefore tends to be biased either toward economics and the management of technology (i.e. topics on the right-hand side of figure 6), or alternatively toward scientific knowledge, innovation and technique (i.e. the left-hand part of the figure).

Thus views on the practice of technology tend to be polarized between economic and technical views, and in chapter 4 we see how this leads to very different beliefs about resources; similarly, in chapter 5, we noted two viewpoints about imperatives and goals in technological development. Table 5 summarizes and amplifies these contrasts, and introduces a third viewpoint representing the attitudes and needs of users. This is associated with what I shall refer to as 'user' or 'need values', and 'need-oriented' goals.

It is notable that the traditional division of labour between men and

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TABLE 5 Three sets of values involved in the practice of technology

| | Virtuosity values | Economic values | User or need values |
|---|---|---|---|
| *Exemplars* | adventurers (Odysseus), smiths, warriors | merchants, working men | women (Athene, Penelope) |
| *Applications* | tractor driving | cash cropping | gardening |
| | high technology (aerospace, weapons) | production engineering | craft work, appropriate technology |
| | ——— | food technology | cooking, handmilling |
| | heart transplant surgery | drug manufacture | childcare, primary health work, nursing |
| *Priorities* | pursuit of the technically sweet | pursuit of profit | maintenance, subsistence |
| | mastering natural forces | managing a workforce | care for people, care for nature |
| | extending frontiers | economic growth | stability |
| *View of technology* | construction for prestige value | construction, production for exchange value | management of process: use value |
| *Typical evidence of 'progress'* | improving performance (figures 3 and 5) | increasing GNP | falling infant mortality (figure 7) |
| *Attitude to risk* | risk as challenge; offset by fixes | risk balanced by potential gain | risk avoidance and prevention |
| *Views of creativity* | innovative, adventuring, unrestrained | equated with enterprise | tempered by responsibility |
| **Cross references:** | | | |
| Table 3 | technical fix | economics | bio-economics |
| Figure 6 | expert sphere | expert sphere | user sphere |

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women casts men as the makers of tools and equipment, thereby giving them a great interest in the 'expert sphere' of technology, while women are often most directly concerned with the end-use of equipment or energy, and with meeting basic needs. Thus women tend to experience technology less as making things and more in terms of the 'management of process' (p. 68), leading to a very distinctive outlook. The importance of this is not usually recognized because of the habit of regarding women's traditional roles as service activity, subsidiary to the more serious business of wealth creation.

One way of illustrating a distinctive basic-needs approach could be to refer back to the Kerala case-study, because in Kerala (and Sri Lanka), the openness of politics, and the tendency of governments to be prisoners of the popular will, means that economists and economic values are less dominant in policy-making than elsewhere, and user values and basic needs carry more weight. For example, it has been said of both states that agricultural development during the last two decades has been nutrition-oriented rather than economically-oriented; output of basic food crops has certainly increased impressively. However, we may also understand user values better by giving further attention to the traditional roles of women, and that is what will be done here.

Although economic values are dominant in many aspects of modern life, they are not as comprehensive as some people think. Economists can certainly tell us what it cost to land a man on the moon in 1969, but they cannot say whether this was worth it. That is judged on a different basis, and according to virtuosity values. Economists are equally at a loss when assessing the unpaid work of women in the home, again because different values are involved – need or user values. Thus a proportion of women's work is usually entirely omitted from overall estimates of output, such as gross national product (GNP); 'domestic work is not considered as "real" work because it has only private use value but no exchange value'.[11]

The contradictions implied by this become particularly striking when an activity like grain milling is considered. If wages are paid to operatives in a mechanized mill, the economist counts milling as productive work. When it is done by hand in the home to meet family needs, however, he relegates it to subordinate status as housework. Similarly, the washing and cooking done by housewives may not count as production, though the comparable output of commercial laundries and bakeries does.

Even more remarkable anomalies arise when economists study the

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division of labour between men and women, and conclude that 'labour is rationally allocated in terms of maximizing income'. As Ingrid Palmer points out,[12] such judgements invariably ignore a wide range of factors, including the special problems of pregnancy and breast-feeding. They ignore the fact that 'bodily resources and . . . bodily needs' of individuals may be sacrificed to maintain production. Thus farm work in some African countries may be kept going at the expense of babies, who are born under-weight and are inadequately breast-fed because of the time and energy mothers are devoting to work in the fields. In such instances, if economic values suggest that the division of labour between the sexes is appropriate and right, then they are in clear conflict with all values that have to do with human need.

'Technology' like 'economics' is a term conventionally defined by men to indicate a range of activities in which they happen to be interested. One academic course on technology that I teach but do not control has a section entitled 'food' which deals with mechanized agriculture and fertilizer manufacture in great detail, but says nothing about cooking. Yet any rational definition of technology such as the one given in chapter 1 would encompass cooking just as readily as it encompasses engineering. After all, cooking involves the application of 'organized knowledge to practical tasks', and it involves 'people and machines', even if the latter amount only to stoves, mixers and kitchen scales.

Nearly all women's work, indeed, falls within the usual definition of technology. What excludes it from recognition is not only the simplicity of the equipment used, but the fact that it implies a different concept of what technology is about. Construction and the conquest of nature are not glorified, and there is little to notice in the way of technological virtuosity. Instead, technique is applied to the management of natural processes of both growth and decay. Child-care, vegetable-growing, bread-making and dairy work all depend on the fostering of growth; other work done by women, ranging from cleaning, hygiene and home maintenance to nursing and the care of the elderly, concerns the management of inevitable processes of decay, and relates to the broader concepts of conservation and prevention discussed in chapter 3.

Appreciation of process in this sense partly depends on accepting and working with nature rather than trying to conquer it, and is a neglected concept in conventional technology. Thus Joan Rothschild has every reason to claim that a 'feminist perspective' can help create a 'soft technology future' where such values as 'harmony with nature . . .

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and non-exploitation become integral to technological development'. She is right to stress a feminist view as countering the male interest in dominating nature, and in 'pursuit of . . . "rational efficiency" to the point of irrationality'.[13] What is still lacking, though, is the solid framework for analysis that could come from the concept of technology as the management of process if this were developed using appropriate scientific ideas (e.g. from thermodynamics – chapter 4).

If a modified concept of technology were developed in this way, we could perhaps put the case for recruiting more women into, say, engineering in a very different light. It is a strong case, not only for reasons of equality and (as is also argued) to make up the shortfall in male recruitment, but also because it could force us to recognize that engineering may itself be in need of reform: its practice may incorporate values that alienate men as well as women. In the United States in 1978, only one engineer in 100 was a woman, though there were many more women coming through the engineering schools.[14] In Britain, the figure is only one engineer in 300. It is possible to point to all sorts of barriers in social attitudes, girls' education and the employment policies of firms to account for this imbalance, but it is rare for anybody to identify the problems that also exist in the way engineering is conceived and taught. However, one group of engineers at Warwick University has suggested that part of the problem may be that 'engineering is taught by men and for men'; there is a neglect of 'working and living experience'.[15] Technology-practice not only includes innovation, design and construction, but operation, maintenance and use. When, as so often, engineers under-emphasize the latter, one of the positive contributions of a feminist viewpoint might be in stimulating interest in this aspect.

It may be, however, that if we want to understand women's achievements in technology, we ought not to be content with counting the pitifully small number of women engineers, but we should also recall what was said earlier about declining infant mortality in England and in Kerala. This was partly due to advances in education that gave mothers an increased ability to use simple information about nutrition, hygiene and household medicines. On however basic a level, this is the 'application of scientific and other organized knowledge to practical tasks'. It may therefore be regarded as 'progress' in technology just as much as the improvements in engines represented in figure 5. It is, moreover, very largely the achievement of women: mothers, health educators, nurses and teachers.

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Another contribution to technological progress in the area of maintenance and use is illustrated by the Electrical Association for Women, founded in 1924 by Caroline Haslett, herself an engineer. At a time when her male counterparts in the electricity industry were neglecting sales and service, Haslett encouraged women to take a lead in buying, using and maintaining household electrical appliances. She wrote an *Electrical Handbook for Women,* and her association organized courses for domestic science teachers emphasizing the potential role of electricity in aiding emancipation.[16] The use of electric irons and vacuum cleaners, in particular, expanded rapidly, and domestic use of electricity in Britain during the 1920s and 1930s grew much faster than any other sector of the market. Through this and other consumer organizations, women have contributed more to technical progress than we generally recognize. However, research by Ruth Cowan and others is now showing that 'labour-saving' electrical appliances in the home did not emancipate women in the way that has often been assumed.[17] In America, women still spent 60 or more hours per week on domestic tasks, partly because higher standards of comfort and cleanliness were sought.

What emerges, then, is that women already have important roles in technology – in child-care, in management of process, and in consumer work – and there is need to recognize these as well as to encourage more women to move into the expert sphere of practice by taking jobs in engineering. There is danger, though, in stressing what is valuable in women's traditional roles: some employers will discover in this new reasons for confining women to low-paid work in the maintenance and service departments of industry. Mike Cooley, the trade unionist, has described how his experience of computerization has convinced him that new technology, 'is frequently used to consolidate the unequal pay and opportunities for women . . .'.

Thus women need to fight, 'not only the traditional forms of discrimination, but much more sophisticated and scientifically structured ones. There is little indication, even in 1980, that the unions catering for such workers have really understood the nature and scale of this problem.'

Working with union colleagues, Mike Cooley went over some past issues of the principal computer magazines examining advertisements. Of those that illustrated a person with the equipment being publicized, some 82 per cent,

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showed a woman in some kind of absurd posture which was in no way related to the use of the equipment. There is a continual projection of the view, even in the most serious of journals, that women are to be regarded as ridiculous playthings, just draped around the place for decoration. Not only that, but those who read these journals often do not notice the built-in assumption unless it is pointed out to them. They are conditioned to accept the presence of women in the servicing role . . .

A profound contribution that could be made toward creativity in science and technology would be to encourage the involvement of women in this field at all levels. Not, I must add, as imitation men, copying all the absurdness of men, but to challenge and counteract the male values built into the technology.[18]

## Tempered creativity

To talk about the new insights that women might bring to technology could be merely a pious hope unless we appreciate how experience and values interact. Sociologists have sometimes noted that many people divide up experience between separate compartments, and apply different values to each. Thus an individual may operate with one set of values when at work, and quite a different set when at home with the family. There is the danger, then, that a woman engineer would adopt the conventional engineer's mixture of virtuosity and economic values in her professional role, and apply a more need-oriented approach only at home. Stephen Cotgrove suggests that it is as if people leaf through a 'gazetteer' of values when they move into a new area of experience.[19] The challenge to both men and women, therefore, is not just to take on new roles, but to break down some of the compartments that divide up attitudes and life, and add more cross-references to the gazetteer.

What is at issue when Cooley and others speak about 'female values' is not that women and men are inherently tied to opposed ethical perceptions. We are all of us human beings first and foremost, capable of sharing perceptions and experiences to a very high degree. In the last resort, there are only human values, not separate male and female ones. But the traditional division of labour between men and women has restricted many women to a rather narrow range of experience concerned with home and family. It has therefore kept their perceptions focused on only one or two pages in Cotgrove's gazetteer – and these are pages which men have tended to neglect.

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We can see what may be involved by referring again to agriculture in Africa. One of the few agricultural experts who has advocated that more technical assistance should be given to women farmers added to his recommendation a comment that: 'The women do seem to have a greater sense of responsibility generally.'[20] In charge of children, the sick, the old and of providing food for all, how can a woman but be responsible in her view of technical innovations relevant to meeting human needs?

At an opposite extreme from rural Africa, we may consider the thirty-one women who were working as research scientists at Cambridge University in 1934, and who included a future winner of the Nobel Prize for Chemistry (Dorothy Crowfoot Hodgkin, in 1964). A brief account of their activities notes that while many male colleagues devoted themselves to 'pure' science, the women were much more willing to concern themselves with social issues related to science, such as malnutrition among the unemployed in Britain, and opposition to the militarization of science. Two also stood as Labour Party candidates in local elections. And one of their husbands, C. H. Waddington,[21] remarked that the women did much to awaken a whole group at Cambridge to the question of social responsibility in science about which he later wrote.

These women may well be untypical – they were certainly uniquely situated. But there are some issues, such as peace and disarmament, where women are fairly frequently seen to be giving a lead. What lies behind this, I suggest, is a particular sense of responsibility arising from the immediacy with which they experience human need. Values are rooted in experience.

Men sometimes do work which gives them similar experience, but many professional jobs, and much wage labour, has the effect of detaching them to some degree from family life without offering any other such close contacts with people. In many of the African countries mentioned, some men have paid jobs in distant towns which take them away from their homes for long periods. In Cambridge, the idea of pure science as an abstract, detached pursuit, distanced some of the men from responsibility.

An opposite situation can be seen in the situation of many craftsmen as they once existed in Britain. Such men lived in the villages they served, and the people for whom they built or repaired farm implements or household goods were often immediate neighbours with whom they had close relationships. Thus they saw the products they

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made in use, discussed them with the users, and repaired them as necessary. Any impulse to be inventive would always have to take second place to neighbours' needs, and any faults in workmanship would be immediately apparent.

The work of housewives and craftsmen is comparable in this respect, and has other similarities. Cooking and dressmaking are practised mainly as craft technologies. They depend on knowledge gained by experience and on personal judgement more than on theoretical formulations. Accounts of village craftsmen stress that much of their work was routine maintenance and repair, and the same is true of housewives, who spend much time cleaning, washing, altering clothes, and keeping the larder stocked.

The importance of the concept of maintenance has already been amply stressed, along with the fact that it is to engineering construction and the technical-fix approach that prestige accrues. Attention to maintenance work involves values of a different order – care and responsibility, discernment and personal involvement. In maintaining a water supply, we have seen, an engineer may have to forget about status and promotion, for the work often goes unnoticed. In maintaining a motorcycle, you must 'have some feeling for the quality of the work', and a 'sense of what's good. *That* is what carries you forward.'[22]

These caring attitudes will be stronger when affection or personal concern is also involved. One thinks of a mother cooking for her family – a nurse giving an injection to a patient – or, indeed, a craftsman repairing a wagon for a close neighbour. In every instance of this sort, care for the quality of the work is reinforced by care for the person who will benefit. Other values might be involved as well. Child-care involves protectiveness and love as well as the practicalities of hygiene and nutrition. How much more than a craftsman's care may be brought to these activities if they are carried out with love?

Part of the modern problem with technology may simply be that many people have become detached from direct responsibilities of these kinds; but there are also historical changes which may have reinforced this alienating trend. The ideal of pure science and its influence on technology is one factor. Another, going further back, was the displacement of craftsmen by professionals in technology. A parallel development was the emergence of a way of looking at the world in terms of mechanical models. The solar system was regarded as being somewhat like a clock, and living bodies were thought of as assemblies of levers, springs and pumps. Such analogies encouraged a rather

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insensitive view of the world in which men of science focused on those parts that would fit their models and could be tinkered with.

During the scientific revolution of the seventeenth century, this mechanical philosophy becomes quite explicit. It was promoted by people who took a relatively hard-headed, mathematical approach to engineering, and opposed by those who understood craft methods better, and who were more concerned about the use of knowledge and skill for human welfare.[23] Significantly, one historian has also argued that the scientific revolution was, in some respects, a setback for women, and that the mechanical philosophy was hostile to women's values.[24] Looking back on these and other historical developments, one may conclude with René Dubos that 'the dangers of technology' do not come from complexities that make it incapable of social control, but rather from our values and world view, and 'from man's acceptance that he must conform to technological imperatives' instead of striving for 'true human values'.[25]

Conforming to technological imperatives, we have seen, means pursuing virtuosity and innovative creativity. In some respects, these seem admirable aims, but speaking of what they actually mean for product design in technology, Victor Papanek describes a 'cancerous growth' which has spread from the arts and can be seen most clearly as 'the creative individual expressing himself egocentrically at the expense of . . . the consumer'.[26] In other respects, conforming to technological imperatives means following innovative paths wherever they lead, almost without restraint.

Women in their traditional roles and craftsmen with their social obligations always had to show their creativity in less egotistical ways; and their achievements are given rather limited recognition because, in technical and artistic terms, they were restrained in their originality by responsibility. Rachel Maines says that 'female culture is documented almost exclusively in creative forms', but these are 'rationalized' as the production of rather mundane, useful goods.[27] Such things as the crochet work on a child's bonnet, the cable stitch in a knitted pullover, or the icing on a son's birthday cake are, in conventional terms, of little artistic or technical interest, and are regarded merely as decoration. Yet when men paint pictures to hang in art galleries or the houses of the rich, these are claimed to have great significance as art.

Just as I have found it necessary to point out that cooking falls within the definition of technology, and that declining infant mortality can be seen as 'technological progress', so others have found it necessary to

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assert the validity of women's art forms. Miriam Schapiro has done this by taking elements from work done by women in dressmaking, embroidery, and table decorations, and building them into pictures of a sort that art galleries will hang.[28]

Lack of recognition seems to be a general problem wherever creativity is so tempered by responsibility that innovation is unobtrusive or design does not conform to accepted 'professional' standards. Not only has craft technology often been under-valued, but reform movements in technology, which assert user values rather than innovative creativity or economic growth have faced the same problems. One thinks particularly of the nineteenth century movements for sanitary reform or for the recovery of craft skills, and of the modern movement for appropriate technology. In the early years of the latter, professionals regularly commented that its methods were inconsistent with doing a proper engineering job, and Third World governments said that they did not want second best technology.

When the sanitary reforms of the last century made careful tests on the design of sewers and began to install improved drainage in London, the established engineers of the time refused to recognize that improvements had been made. One historian who describes the obstacles they put in the way of the reformers notes that some of the engineers involved became folk heroes in their own lifetimes through their exploits in railroad building, but 'showed a swashbuckling disdain for the social evils around them'.[29] Significantly, where such engineers were in charge of sanitation schemes, these became yet another opportunity for displays of technological virtuosity. London's main sewage pumping station at Crossness had a vast engine house with cathedral-like gothic arcading. The engineer of Glasgow waterworks described its structures as surpassing 'the greatest of the Nine Famous Aqueducts which fed the City of Rome'. It would 'remain perfect for ages . . . indestructable as the hills through which it has been carried'.[30]

Similar attitudes, transferred to developing countries a century later, produced many over-elaborate schemes for water and power supply. As Michael Ionides put it, 'civil engineers regarded a river as a sort of challenge: how many dams could they build on it, how great a command area could be created, and so on'. But where needs were greatest, which was often 'outside big river systems', the engineers 'had virtually nothing to offer'.[31]

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## Ethical disciplines

Awareness of such attitudes, and their effect in diverting technology away from the service of human need led Michael Ionides to join E. F. Schumacher in the effort to develop intermediate technologies that were more appropriate to meeting needs. One early project dealt with rainwater catchment systems that could be used in places where big dams were inapplicable. But two points arise that go far beyond individual inventions such as that. One is the nature of the organizations which control technology and which may prevent appropriate forms of technology being used. This is discussed in chapters 7 and 8. The other point is a question of ethics and the individual technologist. One suggestion is that there should be a Hippocratic oath in engineering like that in medicine. There is a difficulty about this, however, in that if such an oath were to have meaning, it would need to take an attitude to the armaments and related industries in which perhaps a third of all British and American engineers are employed.

Another problem is that the Hippocratic oath in medicine does little to make doctors prefer the humbler branches of community medicine to prestigious hospital jobs or work of high technical interest in, say, transplant surgery. For the individual, the effort to seek a balance between virtuosity values and user or need values involves more than giving assent to an ethical principle; it requires also a discipline and a process of personal ethical development. Meredith Thring attempts to provoke thought about this by linking his proposal for an engineering Hippocratic oath with a 'moral spectrum of engineering' which accords low value to weapons development and 'cosmetic machines', and high value to technologies that enhance possibilities for the fulfilment of human potential.[32]

Others refer to the discipline that is required in any individual realignment of values by using words such as 'dialectic' or 'reversal', both of which imply an interaction between different sets of values. For example, Joan Rothschild talks about a 'dialectical vision of . . . technology' in which the conventional values of male and female interact in a new creativity.

Robert Chambers uses the idea of reversal in discussing the attitude required of all professionals – not just technologists – whose work is concerned with basic needs in rural developing communities. He points out that if one operates with conventional values, many aspects

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of life in such communities will be overlooked. One will see irrigation as canal systems watering hundreds of hectares, and forget the majority of farmers who may be irrigating from wells on their own land. One will think of research institutes or government departments in terms of the well-known men administering recognized activities, forgetting the 'few departments where women are numerous and sometimes predominant'. But it will be the latter, despite their low status, which deal with the most vital, need-oriented subjects: 'nutrition, home or domestic science, childcare, handicrafts, and women themselves'.[33]

The kind of reversal required is summarized for Chambers by a Biblical quotation: 'the last shall be first'. Its application here is that need-oriented work must systematically give first place to those things that convention leaves until last: maintenance rather than construction, nutrition and child care rather than engineering, and the question of what people need, not what professionals can supply (compare chapter 3). Above all, putting the last first means a new professionalism, more aware that 'the technical and neutral appearance of many decisions and actions is deceptive', and that some people gain and some lose by almost every project.

A reversal is also entailed in the new ending that Goethe gave to the old story of Faust, the man of learning who bargained with the Devil. No amount of knowledge, worldly experience or magical power could give Faust satisfaction; but in the end, by devoting himself 'to a socially useful purpose' – land drainage and reclamation – Faust did find contentment. Goethe's play is complex, and for some commentators, its ending is unconvincing.[34] What matters here, though, is not the meaning Goethe intended, but new meanings the story has gained for participants in modern high technology. For one of them, the legendary Faust and the great engineer I. K. Brunel stand together as symbols of what we most admire as well as fear about technology. For another, thinking of comradeship experienced during intensive design work for a nuclear reactor, it is the co-operative aspect of Faust's drainage scheme which is significant.[35] For a third writer, an engineer, it is sufficient to point out that Faust only found satisfaction when he turned from the pursuit of knowledge and magical power to more ordinary work of immediate social benefit. Where such human purpose is lacking, these men indicate that technical endeavour can lead to a sense of emptiness; they then speak of work in high technology as 'playing with toys'.[36]

Few professionals would admit to this, but in other circumstances,

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and for other men, one may see how vital links with social purpose are broken. In one of the African communities mentioned previously where women do the most essential work in agriculture, somebody openly said: 'a man is a worthless thing . . . what work can a man do? A woman bears a child, then takes a hoe, goes to the field, and . . . feeds the child [through her work] . . . Men only build houses.'[37]

Perhaps in western man, though lack of social purpose and of need-oriented work is not recognized as a problem, there may still be a feeling of emptiness. Division of labour may have gone so far that many people – men especially – feel disconnected and alienated from the ultimate goals of their work. And that may partly be what leads individuals to seek satisfaction in exaggerated expressions of virtuosity, like Faust with magical power or the adventuring Odysseus. Much professional culture may be a disguise for this sense of emptiness, devoted as so much of it is to building up a notion of the social importance of the profession. But as in Faust's final fulfilment, there is still an opportunity to find peace of mind in practical tasks, 'as simple as sharpening a kitchen knife or sewing a dress or mending a broken chair'.[38]

In the technologists' version of the Faust story one may pick out three stages of ethical development. Firstly, the reversal: Faust's turning away from playing with magical power to accept the discipline of ordinary work; secondly, his work of direct service to the community, almost a work of charity; and finally, the fulfilment he ultimately reaches – innocent contentment.

Francis Bacon, a central figure in the scientific revolution, referred to an earlier version of the Faust legend in warning that dangers as well as benefits could come from the growing knowledge and skill he saw around him. He proposed ethical ideals concerning the proper use of science, which successive generations have reinterpreted to meet the needs of their own times. For the 1980s, one cannot do better than use an interpretation due to Jerry Ravetz, in which the same three stages of ethical development are distinguished: 'discipline is the preparation, charity the way, innocence the end'.[39]

The emphasis on discipline came for Bacon as a reaction to vanity in intellectual pursuits. The term 'charity' is from the same root as 'caring', but also reflects Bacon's deep reading of the Bible, where it means 'love'. For Bacon, it is a 'positive ethical teaching . . . charity as practical action for relieving the suffering of individuals'. Men should seek knowledge and practical skill, Bacon said, not 'for pleasure of mind, or for contention, or for superiority to others, or for profit, or

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fame, or power, or any of these inferior things; but for the benefit and use of life'. As for the future of knowledge-based skill, he prayed that men would 'perfect and govern it in charity'.[40]

The third stage of ethical development, corresponding to Faust's final contentment, is seen as innocence by Ravetz because Bacon was thinking about the 'kingdom of heaven, where-into none may enter except as a little child'. As Bacon well knew, there is a consistent biblical view that this kingdom of the spirit may be found through humble, practical tasks, especially acts of mercy and healing, and through the sharing of bread which 'earth has given and human hands have made'. Bacon's contemporary, George Herbert, wrote about making 'drudgery divine' in sweeping a room. But the peace of mind achieved this way is not just passive contentment; it also involves enhanced awareness of the significance of what is done – one 'sweeps a room as for [God's] laws'. Such work leads to 'awakening', and significantly, when men talk about it they seem most often to have women's work in mind.[41]

Similar ideas may be found within other cultural traditions also. In Sri Lanka, a strikingly similar ethical system has been incorporated into technology-practice by a voluntary organization, the Sarvodaya Shramadana Movement. This organization is engaged in education and health work (including some malaria control)[42] in 1,900 villages throughout the country. Much of its work centres on mothers' groups and farmers' groups; it promotes village technology units and has a training workshop in which youths learn welding and the use of basic machine tools.

Though inspired by some of Gandhi's ideas, the Sarvodaya movement is predominantly Buddhist in outlook, and has monks among its activists. The aim of its work in technology is related to the Buddhist concept of 'Right Action', and the idea of *dana* or giving which this involves. But while to most Buddhists, *dana* means gifts of money to religious causes – food for monks or gifts toward building pagodas[43] – in Sri Lanka, the Sarvodaya Movement stresses *dana* as sharing. This means sharing knowledge through teaching, through health education and in medical work. Most important, though, is the sharing of labour (*Shramadana*), stressed in the movement's name. This takes practical form in work camps where students and villagers together undertake pick-and-shovel soil conservation tasks, or road-building or latrine construction, and join in discussion, education and some meditation also.

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The philosophy of all this is formulated in complicated Buddhist terminology and by an elaborate table (much simplified in table 6). What is striking, however, is that the broad outline covers the same general points as Ravetz's interpretation of Bacon. The central concept in both is charity or sharing or *dana* as the motivation for technology. In the Baconian scheme, 'charity' is 'practical action to relieve suffering'. In the Sarvodaya Movement, it is 'compassionate action to remove causes that bring about suffering, fear and grief'.[44] It involves tasks related to irrigation and agriculture, nutrition and health care (table 6).

Many objections can be made to ethical schemes such as this. They can degenerate into empty formality or sentimentality, and like much thinking about social responsibility in science, failure to consider

TABLE 6 A scheme of right action based on giving (*dana*) or sharing, and applicable in the practice of technology

| Compassionate action to remove causes that bring about suffering, fear and grief |
|---|
| *Shramadana* – sharing labour:<br>*a* to repair and build reservoirs, irrigation canals and wells<br>*b* for soil conservation work and clearing land for agriculture<br>*c* for building roads to villages<br>*d* for building schools, houses and latrines |
| *Buddhidana* – sharing knowledge:<br>*a* in education and literacy training<br>*b* to provide a library service<br>*c* in development education and technical training |
| *Bhoodana* – sharing land: for cooperative cultivation |
| *Gramadana* – community ownership of land:<br>*a* to eliminate landlessness<br>*b* to increase productivity |
| *Waidyadana* – sharing health care:<br>*a* through medical aid<br>*b* through health education and work to improve nutrition<br>*c* through primary health care<br>*d* by improving pure water supplies |
| *Dharmadana* – sharing self-knowledge – spiritual development |

*Source*: Sarvodaya Movement *Ethos and Work Plan*, Moratuwa, Sarvodaya Press, 1976, part of Annexure 18.

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political and institutional factors can be fatal. The Sarvodaya Movement attempts to avoid a party-political stance, but at the same time has evidently helped to reinforce the values of a basic needs economy in Sri Lanka. We have noted a western commentator describing Sri Lankan governments as subjected to a 'tyranny of public opinion' when it comes to need-related policies in agriculture and health care.[45] But since 1977, there has been a degree of economic liberalization, with the establishment of a free trade manufacturing zone. Advocates of this approach aspire to rapid growth on the Singapore model, and as one of the Sarvodaya leaders says, they have sometimes 'outsmithed Adam Smith himself', and have attacked the Sarvodaya Movement as an attempt to 'revert back to a primitive subsistence and feudal economic system'. At the opposite extreme, critics 'who outmarxed Marx . . . saw nothing but capitalism and imperialism in Sarvodaya'.[46]

Opposition of this sort was such that in 1974, the Movement was in danger of being proscribed; however, its achievements are now widely recognized. Tributes are paid by prime ministers, and there is even a proposal 'to humanize and dynamize the bureaucracy' by sending senior officials from government ministries to stay in Sarvodaya work camps. The philosophy may certainly seem vague and even reactionary in its stress on 'traditional values', but critics can be shown 'quantifiable physical results . . . Buses and motor cars drive on the roads we have built . . . Farmers irrigate their paddy fields through channels we have cut . . . Thousands of unskilled hands have been trained to earn a decent living . . . Children study in schools which we have built'.[47] Statistics such as those given earlier in table 4, p. 71 confirm that somebody, if not just Sarvodaya workers, has been very active about such things.

But there remains the difficulty for western readers that spiritual disciplines seem out of keeping with hard, practical technology, even where it has a user or need orientation. When writers on technology seek inspiration in Buddhism – as Pirsig, Schumacher and Touraine have done[48] – they are attacked by those who see this as mere trendiness which seeks to replace rational thinking by a woolly and eclectic mysticism. But for anybody who thinks that sensitivity in the use of technology is important, even within a rationalist frame of reference, Buddhism can present some refreshingly challenging views. It does not demand belief in any god, but rather adds to humanism by offering a philosophy of life on earth in which there is a sense of continuity and natural process. There is also a tendency to think about human cre-

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ativity more modestly, with less stress on virtuosity. 'Buddhists walk lightly on the earth; westerners feel they must make their mark.'

For me, as for most other westerners with materialist values and an atheistic style of thinking, mystical language is extremely discomforting. However, there are two points in all this which might well be demythologized and applied, and one further point we should at least think about.

First, we may need an ethical, if not a spiritual discipline in technology, not just a Hippocratic precept. This discipline needs to be capable of dealing with conflicts between virtuosity values and need, between expert and user values. There may be clues to such a discipline not only in the Sarvodaya talk of mental 'preparation' for Right Action and material development, but also in the ideas about dialectic and reversal mentioned earlier.

Secondly, there is the suggestion that ideas such as charity, sharing and the meeting of basic needs should be taken much more seriously as goals in technology. One industrial designer notes that there is a difference between design for human need and design for the market, reflecting the conflicts we need to face between user values and economic demand. Designers may have to work mostly for the market, but may still occasionally practice a 'reversal'; and the suggestion is that they might commit a proportion of their thinking to need-related work, 'tithing' a fraction of their ideas 'to the 75 per cent of mankind in need'.[49] Not everybody has the opportunity to do this constructively, but one British industrialist whose firm makes expensive medical equipment spends a few months each year in Africa, training hospital technicians to maintain much more basic equipment.

The final point, which needs thinking about, but which is not for me to pursue, concerns the origins of these values that are applied in technology. Are they, as Marxists tend to say, merely derivative from social structures, employing religious language as a rhetorical disguise for attitudes that reinforce the established bases of political power? Are they, as many other people, including some sociologists, would argue, developed in response to experience, especially during adolescence, as young women and men work out what roles they are to play in life? Or are there in addition, deeper, perhaps instinctive drives to explain the constant building of cathedrals and Eiffel Towers that reach out toward space, and rockets that actually travel there? Even Buddhists share this impulse, as their enthusiasm for pagoda building shows. And why, even in the atheist West, do advocates of high technology feel a reaching out

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towards an undeified transcendance in this, and speak about spacecraft or civil engineering as 'aspiration to higher things' and 'diagrams of prayer'? We would perhaps be more successful in controlling and coming to terms with modern technology if we better understood the power of these irrational urges, and the failure of most teachings that stress humbler works of service – Buddhist, Christian or humanist – to curb them.

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# 7
# Value-conflicts and Institutions

## Babels of confusion

Modern man, it often seems, is divided man. There are no universally agreed goals, no wholly comprehensive systems of values: 'the modern mind is divided – in tension'. Again and again there are attempts to resolve the tension by suggesting a rejection of high technology and reversion to a simpler, more rural way of living. But many of the finest achievements of western culture are the products either of high technology or of the virtuosity values that have impelled it. One thinks of the idealistic engineering of medieval cathedrals, the work of Renaissance artist-engineers, the constructions of Brunel and Eiffel, and the marvels of microelectronics or of space exploration. To disown all that would be both Luddite and Philistine. But to assert the importance of meeting basic human needs, and using technology to that end, is an inescapable obligation. To recognize the necessity for an environmental consciousness and concern for conservation is almost equally vital. But those who advocate a rural lifestyle and rejection of modern technology do not have the answer. Neither, at the opposite extreme, do those who advocate 'total (and implicitly totalitarian) materialism... Each of these simple choices has failed'.[1]

One of the most sensitive of all writers on engineering, L. T. C. Rolt,[2] has described how conflicts of this sort developed for him during an apprenticeship with a firm of locomotive builders and in a diesel-engine factory. His enjoyment of the work and his interest in things mechanical was wholehearted. His account amply illustrates many facets of what I have called virtuosity values – especially the aesthetic appeal of machines, craftsmen's 'feel' for their work, and the enjoyment of an elemental mobility in the still novel automobiles of the

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