CYBORGS AND STIGMA: TECHNOLOGY, DISABILITY, SUBJECTIVITY

[p.95]
"The world is being transformed, but it is being transformed in the direction demanded by forced labour - which is why it is being transformed so badly." (**Vaneigem, 1967: 53)**

This chapter explores some of the potentials, problems and dilemmas which cyberspace, virtual environments and associated new technologies create for people with disabilities. We begin by discussing the cyberpsychology initiative and outlining some meanings associated with the term "cyborg", to inform our discussion of the effects of technology upon bodies and subjectivities. Then we introduce German Critical Psychology and Holzkamp's notion of *subjective possibility spaces*, which we use to conceptualise how new technologies might effect the subjectivities of people with disabilities. We then review the new technologies being used by or adapted for people with disabilities, looking both at generic computer use and specialised devices or aids. We go on to describe the potential impact of some of these applications in more detail, highlighting four issues which are likely to be relevant when assessing the value of *any* new technology for people with disabilities: access, surveillance, control and dependency.
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CYBERPSYCHOLOGY AND CYBORGS
Today, talk of cyborgs and cyberspace is widespread, perhaps because it provides an apposite focus for tensions concerning technology, identity, culture and the body. Cyberpsychology meshes neatly with this *zeitgeist* whilst simultaneously highlighting a pre-existing, practical deconstruction of some of mainstream psychology's most treasured beliefs. Specifically, it emphasises a realm where postmodern concepts of identity as shifting, multiple, groundless, variable and discontinuous are not only viable but widespread. In this way it challenges the practices of regulation and subjection which mainstream psychology legitimates by reference to traditional notions of identity. Cyberpsychology also draws on Haraway's (1985) use of the cyborg as metaphor to question the dualisms (between mind and body, "representation" and "reality", culture and nature) which hierarchically structure the Western notion of self that is central to both patriarchy and capitalism.

Yet, as researchers using virtual environment technologies with people with disabilities who wish to take a critical stance to our own work and that of others, we must add some caveats and cautions. First, despite the apparent novelty of the cyborg metaphor, we should remember that people with disabilities first encountered many of the issues posed by the cyborging of humanity some time ago, in practice rather than in debate, when the first spectacles, hearing aids and wooden legs were used. Second, cyberpsychology is partially predicated on a belief that postmodern notions of identity are inherently radical and liberatory, when in fact they may be so only within limits (see Eagleton, 1995). We suspect that the multiple subjectivities of the postmodern era will prove to be at least as useful to post-Fordist, niche-marketing capitalism as the ideology of liberal humanism was to its mass-producing predecessor. Third, our status as "hands-on" researchers and our work with people with disabilities gives us an inevitable emphasis on materiality, and leads us to question some of the more extravagant claims made for the electronic realm. Many of the features of cyberspace as it currently exists flow from its nature as a predominantly textual communication medium, and depend upon its novel combination of real-time interaction coupled with a limited and malleable representation of body and environment. As profit drives technology onward, these features may disappear as broad-band fibre-optic technologies make live video streaming commonplace. Finally, although [p.97] cyberpsychology places a useful emphasis on the linguistic and discursive aspects of human subjectivity, striking global inequalities mean that it is, and for the near future at least is likely to remain, a local concern. Hobsbawm (1993) points out that there are more phone lines in

Manhattan alone than in the entire continent of Africa, and that two thirds of the world's population have still never even used a telephone, never mind a computer.

Despite its widespread use the term "cyborg" is rarely defined, a situation which promotes conceptual confusion. For our purposes, we can distinguish three ways in which the term is employed. First, as described above, the term "cyborg" is used as a metaphor in order to gain political and conceptual leverage in debate, a usage which flows from Haraway's (1985) paper on socialist feminism. Second, the term "cyborg" can refer to the transformation of subjectivity by the array of communication technologies currently available. The interpenetration of media and everyday life is now so complete that the media have a hegemonic grip on points of cultural reference and topics of casual conversation, so that our lives and relationships are informed and occupied by tropes and narratives drawn from soap operas, advertising, political soundbites, high-profile tragedies. This transformation has coincided with, and been facilitated by, the weakening of previously existing bonds of labour and community as the era of mass capitalist production and consumption has been superseded by an age of "flexible" production and "identity consumption" (Hall & Jacques, 1989). Third, the term "cyborg" can refer to the physical augmentation of the bodies of people with and without disabilities. Dery (1995, p.231) says that "In cyberculture the body is a permeable membrane, its integrity violated and its sanctity challenged by titanium alloy knee joints, myoelectric arms, synthetic bones and blood vessels, breast and penile prostheses, cochlear implants and artificial hips".

These last two uses of the term "cyborg" reflect a useful classification of technologies for people with disabilities, since these can be said to fall into two broad classes: physical prosthetics which augment their bodies, and communication devices which extend their subjectivities. However, we must emphasise that this is an analytical strategy since these meanings do not remain separate. Most obviously, the cyborg metaphor is vitally shaped and informed by accounts of the body's amenability to technological intervention. [p.98] Moreover, some technologies address both subjectivity and physicality simultaneously - for example, any device which corrects a sensory impairment. Most importantly, in the subjectivity of individuals the cyborging of subjectivity and body typically co-occur. Collagen injections and penis extensions function below the level of consciousness, but those who have them typically assert that their effects upon self image are as important as their aesthetic or functional aspects. The aids and devices used by people with disabilities may also raise this issue: for example, independent movement is extremely valuable, but the subjective awareness that independent movement is easily possible is also hugely significant. We will draw upon German Critical Psychology for a framework within which to understand this phenomenon; we now provide a very brief introduction to this work.

GERMAN CRITICAL PSYCHOLOGY: SUBJECTIVITY AND POSSIBILITY

German Critical Psychology (GCP) offers a means of conceptualising the effects of the cyborging of both subjectivity and the body, through its description of how subjectivity is structured by possibilities. Tolman (1994) provides an accessible introduction to GCP, setting out a "functional-historical" account of the emergence of subjectivity in human society. GCP grounds subjectivity in the material and social conditions which made its evolutionary emergence possible. It does this by examining the prehistory of our species, drawing together evidence from biology, archaeology, anthropology and history to detail the development of pre-human and early human social groupings. Amongst many other factors, GCP highlights bipedality, the move from trees and forests to open grasslands, increasingly complex social relationships, the availability of language for communication, and the division of labour which made early humans more efficient at meeting their own needs for survival. Together, over

evolutionary periods of time, these developments produced a material organisation of society which for the first time offered individuals a complex of possibilities way beyond the immediate necessities of survival. Although each social group had to produce on average enough food for its own sustenance, not everyone had to be engaged in this activity all of the time. Societal necessities (someone has to hunt the bison!) became individual possibilities (it doesn't have to be me!).
[p.99]
This distinction between societal necessities and individual possibilities is crucial to GCP, since it provides "the fundamental material, economic prerequisite for the knowing, epistemic relation of the person to the world .. the possibility relationship creates a kind of epistemic distance between individuals and their world that allows them to assess the relations among events (as opposed to being constantly concerned with the relations of events to themselves .. It is in this epistemic distance that we become fully conscious of the world and our relation to it." (Tolman 1994, p.102). Simply put, the need to deliberate and make choices was the evolutionary basis of human subjectivity; this need itself arose as a consequence of a social organisation which meant that individuals no longer had to be exclusively preoccupied with the immediate demands of survival. For GCP subjectivity is simultaneously biological/organic and societal, since the (largely societally determined) nature of the possibilities available will strongly condition the subjectivity which emerges. Ideological and material circumstances combine to offer each individual a more or less restricted range of choices, so that "The life world of the mine owner is literally different to that of the miner .. they perform different functions in the division of labour .. they occupy different positions in society and thus experience different life situations. This is bound to have significant effects upon subjectivity .. [the real, objective, quantitative differences in their situations] are experienced subjectively in their respective life situations as distinctly larger or smaller subjective possibility spaces" (Tolman 1994, p.113).

The notion of subjective possibility spaces provides a way of assessing the impact of cyberspace and related technologies upon the subjectivity of people with disabilities. Each technology brings a range of opportunities, access to which transforms the subjectivity of users. These opportunities may be immediate and material: improved mobility makes it possible for a person to independently take part in more activities. Other opportunities may be a provisional consequence of these immediate, material gains; for example, better mobility might make it easier for someone to go out unaided, so creating new opportunities to meet people and form relationships.
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Since subjective possibility spaces are structured by both ideology and materiality they can include the effects of factors such as gender. Lonsdale (1990) interviewed a woman in her early twenties who had begun using a wheelchair, instead of the callipers and crutch she had previously used and which gave her valuable exercise, because she hated the effect they had on her appearance and body shape. By contrast, in the wheelchair "she felt she could glide quietly and gracefully into a room and look less distorted" (p.4). More so than men, women in our society are expected to comply with standards of appearance based on sexual, physical and behavioural stereotypes. For this woman, the subjective possibilities associated with conforming more closely to these expectations outweighed the problems which lack of exercise was likely to bring. In addition, the subjective possibilities which result from using a technology may well be contradictory, simultaneously containing both positive and negative aspects. For example, the improved mobility which results from using a wheelchair may provide subjective possibilities which have a positive character, because it makes more activities and places accessible. However, someone who is aware of prevalent stereotypes of disability may know that using a wheelchair could lead others to perceive her as being permanently and globally disabled; in this

way, subjective possibilities which have a negative character would also arise.

These examples illustrates the value of using the concept of subjective possibility spaces to critically assess new technologies for people with disabilities. Not only does it capture the contradictory potentials of new technologies, allowing us to acknowledge their benefits at the same time as it draws attention to their shortcomings, it does this through a focus on the subjectivity of the user, so highlighting the experiential realm wherein new technologies are actually used and evaluated in everyday life. Subjectivity and lived experience are thus given primacy over other evaluative criteria (e.g. social, orthopaedic, medical). Although the focus is on subjectivity, material and social factors are neither excluded nor added in later as "context", but instead are treated as necessary and integral components by which subjectivity is structured.

TECHNOLOGIES FOR PEOPLE WITH DISABILITIES

Rather than attempt to provide a comprehensive review of technologies for people with disabilities, a brief overview of applications of [p.101] new technology is followed by a more detailed discussion of the subjective impact upon people with disabilities of a small number of these applications. This discussion is organised around themes which we believe are relevant when critically assessing *any* new technologies for people with disabilities.

Computer use is rapidly becoming more widespread, yet commonly used computer peripherals make it difficult for many people with disabilities to use ordinary desktop computers. In response to these and other problems, both software and hardware have been developed. The most basic software solutions are the options built in to operating systems such as "Windows 95" to make them more usable by people with disabilities by reconfiguring the keyboard to remove the need to use a mouse, or adjusting the sensitivity of keys to repeat pressing (Microsoft, 1995). Specialised software has been developed which aims to predict the "intended" mouse movement of users with fine motor difficulties - such difficulties result in hand tremors which make it tedious for the person to use graphical user interfaces. The software "learns" the users' typical patterns of computer interaction and so with repeated use becomes successively better at assisting with control of the computer (Craven et al., 1997). Similar prediction algorithms have already been used with some success to help students with cerebral palsy to learn physics in a "virtual science laboratory" (Nemire & Crane, 1995). On the hardware side there are specially adapted keyboards, touch sensitive screens, and devices which use "suck and blow" tubes, light beams and pneumatics to control computer peripherals. One device even enables people with motor impairments to control a graphical user interface using only eye movements (Istance, Spinner & Howarth, 1996).

Computers are also being used to assist with mobility, navigation and the control of wheelchairs and artificial limbs. Scott & Parker (1988) describe how computerised artificial upper limbs can use myoelectric signals to control the movement of prostheses. Computers can also be used to assist users with the control and navigation of electric wheelchairs, both by providing onboard assistance to users and by using "virtual presence" technologies which permit remote operation. Joint research by the universities of Birmingham and Gothenburg has developed an aid for people with visual impairments, integrating portable computers with speech synthesis and navigation devices using the Global Positioning Satellite (GPS) system so as to guide the user to a chosen destination. Taking this a step further, Vanderheiden & Cress (1992) propose a device called [p.102] "The Companion", a pocket computer incorporating a real-time clock, speech synthesis and a GPS link, which people with intellectual disabilities could use to help them live more independently. As well as navigation this device could provide help with schedules and

appointments, sequencing of everyday chores, reminders about medication, and even task specific help which would make people with intellectual disabilities capable of performing adequately in jobs which would otherwise be beyond them.

Virtual environment (VE) technologies are also being adapted for use by people with disabilities. VE are three-dimensional computer generated worlds which respond in real time to the activity of users, and so generate a sense of "presence" (Steuer, 1992) in the virtual world. They can be run on ordinary desktop computers using standard input devices, or with dedicated graphics machines and peripherals such as head-mounted displays, gaze tracking and position sensors (Biocca, 1992). In both cases they are extremely flexible and have many applications in the field of disability. In assessment, Andrews et al (1995) show how VE can be used with people with acquired brain damage. VE make possible rigorously controlled test situations which nevertheless retain ecological validity and could help to differentiate between (for example) sensory and motor damage. In rehabilitation, VE could be used to deliver therapeutic stimulation to people in comas (Wilson & Macmillan, 1993), whilst people with brain damage could use VE to repeatedly practice movements which need to be re-learned with no need for supervision, no risk, and minimal cost (Rose, 1996). Cromby, Standen & Brown (1996) describe how VE can be used for education and skill acquisition by people with intellectual disabilities. VE systems foreground the learner's self-directed activity, need not use language or symbols, and provide a safe environment where skills can be practiced without harm or humiliation - a novel combination of features which make VE an ideal teaching medium for this group. Similarly, Stanton, Wilson & Foreman (1996) describe how VE can be used by children with physical disabilities to learn their way around novel environments. VE technologies have even been adapted for use by people with visual impairments, using multi-channel 3D audio systems to generate interactive acoustic environments (e.g. Lumbreras, Barcia & Sanchez, 1996).

In the UK application of new technologies to disability is in its infancy, hindered by limited and discontinuous research funding and a poorly developed infrastructure. In America provision is primarily funded by Medicare health insurance, which pays up to 80% [p.103] of "approved charges" to rent or buy assistive devices but does not supply or develop equipment. Beneficiaries must depend on the market and their own ability to "top up" the Medicare payments to get the technologies they need. Proponents of the free market argue that this arrangement is effective, equitable and results in the continual, innovative development of new technologies for people with disabilities (Galasko & Lipkin, 1989). However, this ignores the hidden agenda driving research which utilises military or NASA technologies, and which may gain precedence over the needs of people with disabilities (we provide an example of this later). Additionally, the prominence of market forces means that those with less money are unlikely to have their needs addressed, and some potentials of new technologies may therefore be ignored. This may be why VE technologies (which have been pioneered in America) are hardly used there with people with intellectual disabilities (Salem-Darrow, 1995), despite their obvious suitability for this group.

This concludes our brief overview of applications of new technology to disability. We now consider four issues which these technologies raise, using specific examples to show their relevance and using the notion of subjective possibility spaces to understand how they might affect people with disabilities. These issues are: the availability of the technology to those who need it; the potential of the technology to allow others to observe or track the movements of its users; the potential of the technology to allow others to direct or constrain the user's activity; and the extent to which the everyday lives of users become interwoven with and reliant upon the functioning of the technology.

ACCESS

The issue of access can be illustrated by a discussion of the potentials and problems of computer mediated communication (CMC). CMC occurs most often through email, but also via Internet Relay Chat (IRC) and live video streaming. Systems are also being developed to facilitate "virtual conferencing" using computer graphic representations of faces to simultaneously convey the emotions and reactions of participants alongside their verbal or textual communication (e.g. Benford *et al*, 1995). CMC has been the subject of much discussion, both in the popular press (e.g. Rheingold 1993) and in academia. Participation in CMC leads to the formation and [p.104] cultivation of interpersonal relationships and the emergence of "community" and "identity" in the electronic realm, processes which have been compared with those that typically occur in face-to-face communication (e.g. Frederick, 1993; Jones 1997; Ross, 1991; Shields, 1996).

Access to CMC by people with disabilities raises a number of issues, the first of which is sheer physical access to the computer which, as we have already suggested, is likely to be unsuitable for many disabled users. Second, the cost of buying a computer and having it networked may be beyond people on lower incomes; this is especially important since disability and poverty are closely associated (e.g. Beresford, 1996). Third, the widely held perception that computers are the province of the young and the well-educated may further discourage many people with disabilities from even considering them. The notion that "such things are not for us" still constitutes part of the subjective possibility space experienced by many people in our culture, and may be especially prevalent in the oldest sector of the population where disability is concentrated. The male domination of discussion groups, and the bias towards male interests evident on the Internet, may provide women with disabilities with a further disincentive to use computers. Fourth, the emphasis on textual communication, privileging a mode which many will associate with experiences of failure at school, may further contribute to a reluctance to engage with new technology.

But assuming that people with disabilities do access CMC, it creates many possibilities. One effect may be the creation of new employment opportunities, since the transformation of many office jobs into an electronic form means that people with physical disabilities could work from home and so avoid the disabling separation of home and employment which industrialisation imposed (Gleeson, 1997). Within the workplace computers reduce the physical effort involved in filing and fetching work documents, reducing the need to walk around or climb stairs, whilst networks facilitate access to databanks, allow communication via email, and permit a variety of different tasks to be performed at the same workstation (Roulstone, 1993). CMC might also allow people with disabilities to create or join "communities of interest" which would otherwise be inaccessible to them because of either mobility problems or sheer geographical distance. For example, in the Internet "newsgroup" hierarchy, support groups exist where people with various disabling conditions can [p.105] exchange information and ideas, discuss medical matters and seek information about sympathetic doctors, diagnoses and treatments. People may also build friendships, and in so doing gain solidarity and support from others who are grappling with similar problems. Ultimately, this might help people with disabilities to both undermine some of the authority of medical "experts" and be more vocal in demanding appropriate interventions, a possibility of which the medical profession is already aware - Coiera (1996) notes that "widespread use of the Internet is likely to aggravate existing conflicts between patient's expectations and the provision of health care".

Because CMC reduces all participants to the same level of representation, which currently is

almost exclusively textual, it also raises unique possibilities for identity construction. Through CMC, people with disabilities can interact with others without their impairments being either immediately obvious to others or relevant - even by omission - to the interaction. People with disabilities can be as similar to non-disabled people as they wish, since in CMC their disability is not only not an issue but is and will remain invisible unless they choose to disclose it. Whilst other forms of written communication offer the same opportunities for anonymity, no other medium does so and permits real-time interaction. Uniquely, then, CMC can create (albeit temporarily and artificially) a subjective possibility space within which people are effectively no longer disabled in their interactions with others.

SURVEILLANCE

New technologies create many new opportunities for surveillance: witness the spread of closed-circuit TV cameras, of which there are now more than a million in this country. But surveillance can also be more subtle and insidious, as with "smart cards" for cashless financial transactions and supermarket "loyalty cards", which all allow user's purchasing habits to be centrally monitored and individually recorded. Similarly, the electronic toll systems being piloted on some motorways use overhead scanners to read barcodes on vehicles' windscreens, incidentally allowing the computer system to track individual vehicle movements in real time.

Some new technologies designed for people with disabilities encounter similar issues. Professor Heinz Wolff at Brunel University has proposed a "caring house" for people with disabilities (Wolff, 1996). The house is fitted with a variety [p.107] of sound and motion sensors, tripswitches and pressure pads, all connected to a networked computer. The computer uses these devices to monitor movement and activity within the building, and the network link to alert care staff and call for assistance if a potential problem is detected.

The subjective possibility space this creates has two principal aspects. First, occupants of the house would be aware that their movements were constantly monitored, and would structure their activity to take account of this continual, passive surveillance. Second, they would also know that they had a high level of protection from the consequences of accidents and crises - not just medical emergencies, but incidents such as fires and burglaries. For some, the knowledge that their every movement was recorded by an all-seeing machine would be a small price to pay for the safety and security of knowing that they were protected from accident or injury. For others such a level of surveillance in their private lives would be simply unacceptable, whatever its benefits. Whilst a range of living options are available for those who are unable to live wholly independently, people with disabilities will be able to exercise choice. However, as the costs of such technology continue to fall in real terms, it is likely that more and more "caring" will be provided in this way as the cost of doing so (compared to paying workers) declines. A situation may ensue where the choice facing all but the very wealthiest people with disabilities is between no assistance at all, or assistance accompanied by and predicated upon continual surveillance.

CONTROL

Beyond mere surveillance, researchers at Utah State University in America have developed a wheelchair incorporating "remote presence" technologies which enable the chair's movement to be controlled by an operator at a base station (Smith, Gunderson, Abbott & Joshi, 1995). If a user feels an epileptic seizure beginning whilst she is out in the chair, she can press a button which sounds an alarm at a control centre. A trained operator then puts on a head-mounted stereoscopic display and uses video cameras mounted on the chair to assess the situation (real-time information about the chair's angle, orientation and movement are also measured by sensors and

transmitted back to base). In the best "Thunderbirds" tradition, the operator then uses the joystick to drive the wheelchair and its occupant home again.

This wheelchair incorporates elements of surveillance and also of total control, since for the system to function the remote operator must be able to completely over-ride any attempts by the chair's user to control its movement. The subjective possibility space this creates would include the dual aspects of surveillance and safety which the "caring house" created, with the additional possibility that journeys could be constrained or re-directed at any time. Opportunities for spontaneous intimacy, anonymity, aimless wandering and quiet reflection would all be compromised, since this technology excises solitude and seclusion from the lives of its users.

This wheelchair's design reflects unspoken assumptions about people with disabilities, whose dependency and perceived vulnerability may legitimate levels of supervision and surveillance which would otherwise be unacceptable. The bodies of people with disabilities can become highly public due to factors such as the ongoing requirement to explain to others their differential functioning, the relatively high levels of medical intervention they may receive, and the assistance sometimes needed to fulfil everyday bodily functions. In day care and residential settings this assistance is typically institutionalised; for example, toiletting will be assisted by staff on duty, and who this is depends on shifts and rotas not preferences and relationships.

The wheelchair's design not only naturalises this lack of privacy, it also demands an idealised technological Utopia which simply does not exist: would onlookers really stand by and watch a wheelchair-bound person in the throes of a seizure careering at high speed, oblivious and apparently out of control, through streets and across roads? The failure to consider this issue implies that other concerns are primary, and (we would suggest) is explicable only if the issue of funding is examined. In fact, this wheelchair uses technologies developed for NASA to remotely operate robot vehicles, and was essential to secure Federal funding for this work. The benevolent aspects of these technologies were highlighted by the Mars Pathfinder mission and its use of a remotely-controlled roving vehicle to explore the planet's surface. Its more sinister uses (to maintain, repair and re-align spy satellites and weapons-targetting systems) gain less publicity but still receive primacy over the needs of people with disabilities, which are used here to justify the allocation of public money to this research.

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DEPENDENCY

Oliver (1990) identifies dependency as a central issue in disability, showing how the rise of capitalism and associated changes in social relations increased the dependency of people with disabilities, making them more marginal and less economically self-sufficient (see also Ryan & Thomas, 1987). The new technologies discussed here are at the cutting edge of capitalism, and our society is crucially dependent upon them for the production and distribution of goods and services, the organisation of travel, health and welfare, and the operation of the financial and money markets. But the dependency of people with disabilities upon new technologies may be even more thorough, because their reliance is likely to be more sustained, extensive and intimate. We all depend on computer systems to keep our shops full and our trains running (roughly) on schedule; people with disabilities may also depend on them to get out of bed, get dressed, prepare meals, open doors, and operate prosthetic devices and artificial limbs. In this context computer failures can cause more than inconvenience, posing a serious challenge to the quality of everyday life. Moreover, once dependency exists failures are not the only possible source of problems: the combination of built in obsolescence and the exercise of monopoly power by large

companies, upon whose products people with disabilities may have to rely, could create financial hardship for those with money and exclusion for those without it.

The subjective possibilities which dependency raises flow from the awareness that the quality of everyday life, or the ability to carry out simple tasks independently, cannot be maintained if the technology fails: in a sense, people with disabilities would become hostages to the machines that help them. For applications such as the caring house and the remote presence wheelchair described above, additional subjective possibilities would arise from the users' dependency on the benevolence of system operators not to abuse their opportunities for surveillance and control, since both of these devices would position their users in the unremitting gaze of an invisible "carer" whose continued good will could become a continual source of concern.

The idealised abstract notions of "independence" embedded in ideologies of care such as "normalisation" (Brown & Smith, 1993) demarcate and individualise disability by concealing the social interdependence which is already the norm for everyone, disabled or not [p.109] (Oliver, 1993). Nevertheless, the extent and nature of the dependencies which new technology creates must always be considered when their suitability is assessed.

DISCUSSION

New technologies for people with disabilities create opportunities and problems which typically arise simultaneously, so creating difficult dilemmas for users. Prosthetic aids which enhance bodily function inevitably reduce the user's ability to manage without them, as underuse causes muscles to atrophy and joints to weaken. There are other dilemmas, too: for example, the anonymity of CMC which enables people with disabilities to interact with others without their disability being an issue simultaneously undermines the potentials for political action which CMC provides. Invisibility and deception, however justifiable and well-intentioned, make a poor foundation for the trust and solidarity that determined political action demands (Breslow, 1997). Attention has been drawn to the possible drawbacks for women of leaving their bodies behind when they enter cyberspace, so shedding the fundamental basis upon which their gendered identity is founded (Dietrich, 1997): it seems likely that people with disabilities will also have to consider this issue.

Such dilemmas suggest that improvements in the quality of life of people with disabilities will not flow automatically from technology. Boal (1995: 12) observes that "Artifacts are congealed ideology": given that there is already widespread discrimination against people with disabilities, this implies that they are unlikely to get the devices best suited to their needs without a struggle. Technology is always already social - which in our culture means that it is shaped and informed by market forces and the requirements of powerful vested interests. The "remote presence" wheelchair described above shows how such influences can lead to inappropriate devices being foisted on people with disabilities, and illustrates again (if further illustration were necessary) the need to involve end users throughout the design and evaluation process (e.g. Newell & Cairns, 1993). However, even ideologically contaminated technologies can be subverted and used for other purposes.Whilst for some devices this is difficult to imagine (guns have relatively few uses apart from shooting), for computer and communications technologies the devel-[p.110] opment of alternative applications is greatly facilitated by the sheer power and flexibility of microprocessor-based devices.

Some decades ago, predictions were commonplace that by the millennium computers and robots

would greatly shorten the working week and free humanity from drudgery and mindless labour. That these predictions have proved false is obvious; the more interesting question may be why this is so. In this context, the efforts of people with disabilities to get the applications of technology they most need may parallel, if not actually prefigure, the attempts of us all to acquire innovative new technologies shaped by the needs and aspirations of users rather than the profits of manufacturers. We hope that the issues and discussions outlined here might serve as a modest contribution to these struggles.

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