1

TECHNOLOGY

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Introduction

Perhaps it is because of the its ubiquity and taken-for-grantedness in everyday life that Organization Studies (OS hereafter) has never really quite got to grips with the world of machines and technology. Whatever the reasons for this hesitancy, the historical trend in OS reveals from the technological, and the pursuit of an understanding of how these two re a tendency to insist on a distinct epistemological separation of the social/cultural alms interact at the organizational and societal level. For well over 100 years, the same mantra has been chanted: culture is concerned with people, agency and desire whilst technology is to do with all things non-human and mechanical. Thus, in the early twentieth century, the Futurists and capitalists enthusiastically embraced technology, believing it would change the social world for the betterment of all. On the other hand, the Romantics feared that new industrial technologies were alienating people and forever changing human values. As the twentieth century 'progressed,' this debate between the technophiles and the technophobes was re-problematized within a debate cast in terms of technological determinism versus strategic choice. As far as OS was concerned, technology did not really exist as a subject of serious empirical enquiry until about the 1960s and within 25 years technology disappeared once again as it became wrapped up within newly formulated approaches based on social constructivism. Today, technology has all but disappeared from the OS curriculum (although it has been readily embraced by technophiles allied to other Business and Management School disciplines). Technology, it would seem, is nothing, and does nothing, unless human agents make it so. Nevertheless, the efforts of a small band of social constructivists notwithstanding, the epistemological dualism remains intact.

The first part of this essay will review these debates in which technology is seen as a prosthetic *extension* of social capabilities and agency. For example, a

microscope extends the capability of the eye to see objects too small for the unaided human eye to register. Whilst this is a useful way of conceptualizing technology, and enables researchers to examine the important political aspects of technology, it overlooks the way in which technology can act as an aesthetic *intension* within the human (for elaboration, see Danius, 2002). In other words, as technologies change the way we make sense of, and perceive, the world, the world also changes. Returning to the example of the microscope; once microscopic things became visible to scientists, the very way these things are represented and theorized by scientists also tends to change. 'It is said that modern technology is something incomparably different from all earlier technologies because it is based on modern physics as an exact science', suggests the philosopher Martin Heidegger. 'Meanwhile, we have come to understand more clearly that the reverse holds true as well: modern physics, as experimental, is dependent upon technical apparatus and upon progress in the building of apparatus' (1977: 295–6).

Like Heidegger, McLuhan (1962) argues that we interiorize technologized ways of perceiving ourselves and the world. It is for this reason that the epistemological dualism of technology–human is unsustainable. This perspective heralds a new mantra: we are all cyborgs (and have been for at least a millennium). Whilst mainstream OS research has tended to align itself with a technology-as-prosthetic epistemology and the analysis of the production of technological effects on people, the second part of this essay examines how research based on an epistemology of technology-as–aesthetic reveals how the technological and the social are mutually implicated and inextricably interlinked in organizational and everyday life. Rather than viewing technology as an object which only becomes knowable once it is placed in front of an ontologically distinct subject, we should regard it as an *object* (Macho, 2000) – something that is not in front of us but completely surrounds us in everyday life. The essay ends with a consideration of the implications of such a reconceptualization for OS research.

'Prosthetic' Theories of Technology and Organization

One of the first problems to be faced in exploring the role of technology in everyday corporate life is deciding what we mean by 'technology'. After all, most aspects of the organizing process involve extending the abilities, competences and actions of individual actors. In this sense, a business organization is a technology for producing objects and services that 'society' demands. Job design, organizational structure, payment systems, rules and regulations, and decision-making procedures are essential technological elements of this process. The sociologist Alan Fox (1974) argues that this broad definition of technology encompasses what he calls 'social technology' – the organizational

methods and structures which order and shape the behaviour of people. The problem with such a broad definition of technology for OS researchers is that it becomes to difficult to think of any organizational process that is *not* a social technology.

Fox suggests an alternative conceptualization of technology as a 'material technology', by which he means the physical tools, equipment and machines used within an organization to achieve its objectives. The main bulk of empirical OS research on technology has employed this more restricted definition as it enables the relationship between material technology and other aspects of organizational behaviour to be analysed in a more systematic way. In such research material technology becomes the key independent variable – the factor that is controlled or changed by the researcher to discover the effect it has on another factor or variable (such as job design, skill or communciation).

An additional problem associated with the study of technology and organization relates to the different levels of analysis employed by researchers. At the macro level of analysis, one can conceptualize technology as the process undertaken by an entire organization. For example, a university is a social and material technology which produces knowledge and provides education. However, at an organisational level of analysis it is possible to see that different technologies are used by different departments and functions within the same university. A micro-level analysis of technology would involve the study of a particular technology in a specific university department or work setting. In practice, of course, research is conducted at all three of these analytical levels. However, as Hatch (1997) contends, researchers inspired by a prosthetic approach to technology and organization 'typically simplify the organisation-level conception by downplaying the diversity of technologies within a given organisation and emphasising the core technology for producing the organisation's primary output' (1997: 129).

An exploration of the philosophical, theoretical and empirical studies of the social impact of technology at all levels of analysis is well beyond the reach of one short essay (see McLoughlin, 1999, for an overview). For this reason, we will restrict our embrace to studies explicitly concerned with the impact of core technology – technologies used in the production of goods and services within an organization – on everyday life in organizations. We begin by considering the provenance of prosthetic theories of core technology and organization as this has an important bearing on the ideational development of such theories within OS.

A surprisingly large number of scientific disciplines, whether ostensibly 'natural' or 'social', seem to develop by a working through of oppositional theoretical formulations – nature versus nurture, wave versus particle, mind versus matter, universalism versus relativism – and the study of technology within OS is no exception. The development of the vast majority of prosthetic theories of technology can be traced through debates centred around two dualisms which have

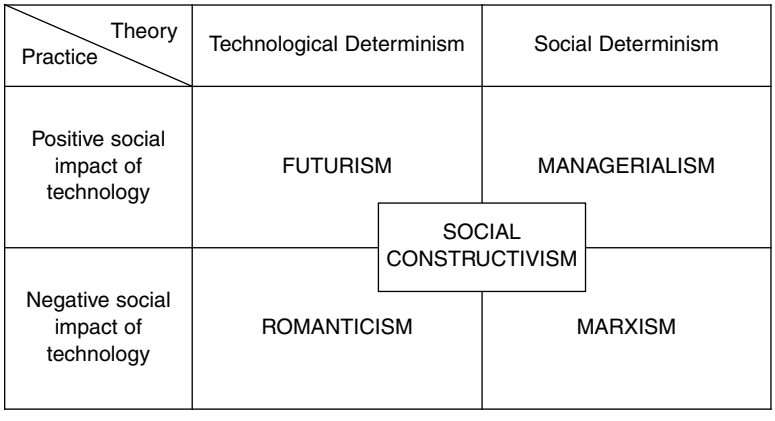

Figure 1.1 Prosthetic theories of technology and organization

been occupying philosophers and social theorists for over 2,000 years. Firstly, there is the dualism of determinism and voluntarism (free will): is the impact of technology on organization determined by characteristics of the technological apparatus itself or by choices made by the adopting social organization? Secondly, we have the dualism of good and evil: is technology a 'good thing' or a 'bad thing' for members of the adopting social organization? Although theorizing about these dualisms has become more sophisticated within the social sciences, prosthetic theories tend to locate themselves close to one of the two poles that make up such dualisms. As we shall see a little later, one notable exception is actor network theory which tries to attend to both poles of both dualism simultaneously without inhabiting either. Nevertheless, in the time-honoured tradition of scientific 'typologizing', it is possible to locate a number of theoretical traditions around the intersections of the two dualisms (see Figure 1.1). Although such typologies are inevitably an over-simplification, they at least enable us to tease out the assumptions, themes and findings within OS theorizing about technology. The reader will find a more extensive guide to the research findings which underpin this typology in Table 1.1.

Futurism

The label 'Futurism' is most commonly associated with the early twentieth-century European art movement which saw a huge potential in the new technologies of cinematography, radio, phonography, telegraphy, transport and manufacturing machinery for the improvement of society in general and artistic expression and culture in particular. For the Futurists, the characteristics of the technological apparatus itself heralded fundamental changes to everyday life. Crucially, they saw these changes as bringing almost uniformly positive benefits for all – freedom from the drudgery of work and labour,

better communication, material wealth, freedom of expression, and a better understanding, and mastery, of the world. Within OS, there are numerous researchers who share Futurist leanings (although they rarely, if ever, make this connection explicit).

Writers such as Davidow and Malone (1992), Woodward (1980) and Forester (1985) argue that organizations must change the way they function on a day-to-day basis in order to reap the benefits of technology. We are told that new technologies enable organizations to achieve higher quality, higher productivity, faster communication, flexibility, happier customers and lower costs. In the 1970s the normative prescription to 'automate or liquidate' pervaded the Western manufacturing world, and 30 years later we were told that computer-based Enterprise Resource Planning (ERP) systems will enable a complete 're-engineering' of organizations through adherence to the 'best practice' encapsulated within them. Futurist OS does not deny that we have some choice in how we use technology, but they make it clear that the only truly rational choice is to embrace it and take full advantage of its benefits. Here is a typical example.

> The tangible benefits that accrue due to ERP include: reduction of lead time by 60 per cent, 99 per cent on-time shipments, increased business, increase of inventory turns to over 30 per cent, cycle time cut to 80 per cent and work in progress reduced to 70 per cent. The intangible benefits include: better customer satisfaction, improved vendor performance, increased flexibility, reduced quality costs, improved resource utility, improved information accuracy and improved decision making capability. (Siriginidi, 2000: 381)

Here, Fox's distinction between material and social technologies collapses as it is assumed that the business corporation itself is, or should be, perceived as a technology. More efficient or flexible machines mean a more efficient or flexible organization. As we will see shortly, Futurist OS offers little empirical evidence to support such optimism, and its position is seen by many as both untestable and untenable. Nevertheless, as Grant et al. (2006) point out, the discourse of technological determinism continues unabashed in the prescriptive writings of management consultants and technology providers. Perhaps it is the development of the internet that has added the freshest impetus to the Futurist project, with many writers arguing that all traditional forms of organization are rapidly becoming obsolete to make way for the 'virtual' organisation (e.g. Davidow and Malone, 1992; Grenier and Mates, 1995).

The Futurist perspective represents what Jaques (2002) terms a *cypto-utopia* in that it contains utopian ideals which are concealed within the language its supporters use. While crypto-utopianism purports to communicate the truth about the future, Milojevic (2003) argues that such realistic futures also subtley promote implicit assumptions about the nature of future society – for example, that it should exploit all the benefits of high technology – and impose these views on other perspectives.

Romanticism

The term Romanticism usually refers to a secular and intellectual movement in the history of ideas that originated in Western Europe during the late eighteenth century. It stressed the importance of nature and human emotion, and the individual imagination as a critical authority. Inevitably, as technology was culturally coded as 'artificial' and 'unnatural', Romantics were strongly technophobic, and, within OS, a discernible anti-technology Romanticism is evident among some researchers. Whilst sharing the technological determinism of the Futurists, the Romanticists have a far more pessimistic outlook.

The Romanticist critique of technology stems from a perception that modern technology undermines certain core 'natural' human values and abilities – particularly the ability to act autonomously in the making of life choices. Technology, Jaques Ellul argues,

> itself, *ipso facto*, and without indulgence or possible discussion, selects the means to be employed. The human being is no longer in any sense the agent of choice. He [sic] is a device for recording effects and results obtained by various techniques. He does not make a choice of complex and, in some ways, human motives. He can decide only in favour of the technique that gives maximum efficiency. But this is not a choice. (1964: 84)

This negation of human choice is made possible, according to Marcuse, because political interests are 'not foisted upon technology "subsequently" and from the outside; they enter the very construction of the technological apparatus' (1968: 223). In other words, ideological choices are made by designers and these decisions overly constrain (determine) choices available to organizational members, and these choices inevitably 'dehumanize' everyday life (see Noble, 1984).

Managerialism

This approach, like the term itself, has a briefer history than the previous two theoretical positions. Managerialism is less a theory than a framework of values and beliefs about organizations which emphasize behaviour oriented to efficiency and economy, market responsiveness, and the control of employee behaviour towards these ends by senior and executive managers (Trowler, 2001). As far as the technology–organization relation is concerned, managerialism stresses the key role played by management's strategic choices of how best to employ core technologies to achieve the desired economic ends (Child, 1997). From this perspective, 'technology has no impact on people or performance in an organisation independent of the purposes of those who would use it and the responses of those who have to operate it' (Jones, 1982: 199).

In enthusiastic terms similar to those used by Futurists, managerialists talk of technology as 'enabling' organizational change and improvements (e.g. Bessant,

1991; Buchanan and Boddy, 1983; Matthews, 1989). To be sure, there may be employee resistance to any perceived abuses of managerial power such that technological 'choice' may be the outcome of localized bargaining and negotiation, but technology itself remains a pawn in such power games. The rules of the game are managerialist nonetheless.

Marxism

Although some Romanticist OS theorists share a certain affinity with the early writings of Karl Marx (which, some have argued betray a romantic view of pre-capitalist society), theorists who share a Marxist approach to technology and organization explicitly take their starting point from Marx's major work, *Capital*. In this later work, Marx argued that the economic conflict inherent in capitalism produces social relationships which are unstable. Capitalist organizations are built upon the economic contradiction between the use value of labour (what owners must pay to procure labour) and its exchange value (the revenue received for the goods or services produced by that labour). Marx reveals how capitalist society relies upon the former always being lower than the latter so that surplus value (profit) can be extracted. Class conflict is played out between the owners of capital who control the means of production and who desire to maximize profits, and the workers who rely on them for employment and who seek higher wages in exchange for their labour. But, because higher wages threaten to reduce surplus value, owners must use their power to minimize labour's use value.

Marxist OS theorists see a key role for core technology in this class conflict. From this perspective, exemplified by the work of Braverman (1974) and the labour process theorists he inspired (e.g. Knights and Wilmott, 1988; Thompson, 1989), capitalists will employ core technologies in such a way as to control and deskill labour. This strategy enables capitalists to reduce both labour's bargaining power (as skilled knowledge can be displaced into intelligent machines) and its use value (lower skilled work reduces training costs and commands lower wages), and thus increase profits. In other words, technology is employed as an extension of capitalist's power to exploit and degrade workers. The deskilling hypothesis is not without its detractors (e.g. Beechey, 1982; Zimbalist, 1979) but continues to generate a wealth of empirical research highlighting the deeply political nature of technological change (see below).

Social Constructivism

A constructivist approach insists that we longer talk about technological apparatus as if it were distinct from the social realm. Rather than making an *a priori* distinction between the technical and the social, Bijker suggests the use of

the term 'socio-technical ensemble' to stress how 'the technical is socially constructed and the social is technically constructed' (1995: 273). Technology is 'society made durable' (Latour, 1991) although any distinction made between the technical and the social is contingent upon economic, social, historical, cultural and political circumstances. For this reason, social constructivists are relativists who do not regard 'socio-technical ensembles' as necessarily either good or bad. Their interests lie in how networks of people, materials and practices become stabilized over time, and numerous studies of technology have explored these processes. However, a majority of these studies examine the social dynamics involved in the design of technologies (e.g. Bijker, 1995; Callon, 1986), with far fewer studies exploring the everyday use of technologies in production (e.g. Bloomfield et al., 1992; Saetnan, 1991).

The constructivist position attempts to overcome the dualisms underpinning the other four sets of theories, and to offer a corrective to their one-sided technology-as-prosthetic epistemologies. However, in some accounts (e.g. Grint and Woolgar, 1997) technology loses all materiality to become an exclusively social and semiotic phenomenon. In this way social constructivists, whilst claiming to be epistemological relativists, often follow a strong social determinist line in their insistence on the interpretative flexibility associated with any given technology. The notion that technology may have certain social impacts is replaced by the notion that social discourse determines what is commonly defined as technology. Because organisations are rarely semiotic democracies, this approach allows the political dimensions of technology to be examined through the ways meaning is managed and contested (see Brigham and Corbett, 1997).

Prosthetic Theory: Research Findings

So what and where is the evidence to help us make sense of the differing claims put forward by these OS theories? As with other scientific disciplines grounded in dualisms, the 'truth' seems to lie somewhere in-between the poles. Much of the research on the impact of technology and organization falls quite neatly into three areas of corporate life; namely, job design, organization structure and organization culture. Unfortunately, the results are frustratingly inconclusive (see Table 1.1).

Technology and Job Design

Research on technology and job design received a huge impetus from the publication of *Labour and Monopoly Capital* (Braverman, 1974), and a flurry of case studies were published subsequently in response to Braverman's deskilling hypothesis. Some researchers, whilst closely aligned with the Marxist

Table 1.1 Research findings on the relationship between technology and organization

Job Design	*Organization Structure*	*Organization Culture*
Enskilling (Currie and Procter, 2005)	Decentralization (Matthews, 1989)	Faster work rate (Collins, 2005)
Empowerment (Womack et al., 1990)	Flexibility (Piore and Sabel, 1984)	Workflow efficiency gains (Kidd, 1994; Siriginidi, 2000)
Deskilling (Braverman, 1974)	Increased centralisation (Bain et al., 2002; Ritzer, 1996)	Increased stress (Montreuil and Lippel, 2003)
Empowered machines, disempowered users (Cooley, 1987)	Increased bureaucracy (Frenkel et al., 1999; Grant et al., 2006)	Increased surveillance (Robins and Webster, 1986; Sewell and Wilkinson, 1992)
	Patriarchy (Barker and Downing, 1985)	Impersonality/Isolation (Mann and Holdsworth, 2003)
Skill twisting (Zuboff, 1988)	Power shifts (Lash and Urry, 1987)	Amplification of existing tensions (Brigham and Corbett, 1997)
Technological effects shaped by local contingencies (Wilkinson, 1983; Wood, 1989)	Any structural changes shaped by local contingencies (Clark, 1995; Fry, 1982)	Any cultural impact shaped by local contingencies (Baruch, 2000; Jackson, 1999)

approach (e.g. Wilkinson, 1983; Wood, 1989) found evidence that employees were often able to resist management's deskilling strategies. Other researchers (e.g. Cockburn, 1983; Wajcman, 1991) found some support for the hypothesis but argued that gender (and ethnicity) as much as class relations of power were involved, and found a male gender bias in the social construction of skill. 'When a white man developed manual dexterity, it became a skilled trade; when a woman or black developed manual dexterity it was a natural characteristic and defined as unskilled' (Game and Pringle, 1983: 7–8).

Managerialist researchers regard the Marxist distinction between 'Capital' and 'Labour' as overly simplistic and the former's case studies tend to reveal how employees are often enskilled or upskilled once technologies were introduced by managers much keener to improve product and service quality, market share and product innovation, than they were to increase their control over the labour process (e.g. Matthews, 1989).

Although the vast majority of job design researchers ground their theoretical assumptions with reference to the dualism of determinism versus voluntarism, many conclude that, regardless of whether jobs were deskilled or enskilled, the role of technology was not a simple one-sided affair. That

said, a remarkable number of job design studies implicitly or explicitly offer technological determinism as the theoretical position to be disproved, and the methodology of choice is the case study. Case study research in a variety of organizations typically shows similar technologies being used in different ways and associated with different operating job designs. In explaining these findings researchers have examined the mediating role of organization size, culture, politics, environment, management concerns, employee concerns and other non-technical variables. Very few have examined closely the particular technology under scrutiny, preferring to treat it as a constant or controlled independent variable. In 'black boxing' technologies in this way the technological determinist position is virtually impossible to prove. This is all the more surprising when you consider that even managerialist researchers confess that technological design choices may constrain subsequent job design options. For example, the psychologists Hackman and Oldham, founding fathers of the highly influential Job Characteristics Model of job redesign (1980), argue that 'if work is to be meaningfully redesigned in an organisation either (1) the technology must be of the type that provides at least moderate employee discretion or (2) the technology itself must be changed to be compatible with the characteristics of enriched work' (1980: 122). Similarly Child admits that 'a given technological configuration ... may exhibit short-term rigidities and perhaps indivisibilities, and will to that extent act as a constraint upon the adoption of new workplans' (1972: 6).

With the notable exception of studies such as Noble's examination of the development of computer numerically controlled (CNC) machine tool technology (1984), case studies of core technologies tend to exclude any examination of the social factors and choices which influence and shape the design of the technology being studied. This failure even to differentiate between different types and makes of CNC machines (and they vary from user-friendly shopfloor programmable machines through to paper tape controlled machines with retro-fitted CNC controllers which have no shopfloor part programming facility) suggests that researchers have simply assumed the neutrality of CNC as a generic, homogenous technology before embarking on their job design study.

Technology and Structure

Managerialists are quite adamant that organizational structures should be adapted by executive decision-makers to exploit the benefits of new technologies, and offer numerous case study examples in support of this position. However, in reviewing 140 of these studies, Fry (1982) notes that they employ confusing, often contradictory conceptualizations of the two variables. His review shows that six different definitions of technology have guided the empirical research, that three different organizational levels of

analysis (organizational, group and individual) were examined, and a mixture of objective and subjective measures were deployed. This makes it difficult to reach any firm conclusions regarding their inter-relationship. Where measurement has been applied (and quantitative methods certainly dominate the managerialist studies) it often fails to disaggregate technological and organizational variables. On the one hand, this is understandable given the widespread development and use of organization-wide systems technologies which blur the distinction between technology and organization. On the other hand, given these technological developments, Fry (1982) maintains that researchers must fine tune their empirical and analytical instruments if the dynamic relationship between technological and organizational variables is to be understood.

Romanticist and Marxist research, in contrast, favour more qualitative research methods, and the examination of broader structural issues such as patriarchy, democracy and power (see Table 1.1). However, such research tends to focus on the socio-political dynamic between management and labour, and to downplay the socio-political dynamic between different (often competing) managerial and professional levels and functions. As Scarbrough and Corbett (1992) have noted, such broad emphases may do little to convey the uncertainties and interactions of the relationship between technology and everyday corporate life, nor do they account for the role played by groups and individuals in resisting or reshaping the impact of technology on organization structure. 'Indeed, on occasions the transformational power of technological knowledge may escape the intentions of the powerful and undermine, and not simply reproduce, existing social and economic structures' (Scarborough and Corbett, 1992: 23). This is one reason why so many early technology-led knowledge management initiatives failed. Recent research on knowledge management informed by a less managerialist 'community approach' (see Swan and Robertson, this volume) emphasizes the role of informal social networks and relationships in the shaping and diffusion of technology and technological knowledge. Whilst it may suit the egos of executive managers to believe that top-down technology-led initiatives will produce the desired changes in corporate structure, in reality the control of technology is not exerted quite as easily as that – technology is everywhere subject to political processes in which different groups seek to place particular elements of technology under their own control.

Technology and Corporate Culture

The concept of corporate culture came to prominence within OS following the publication of the managerialist bestseller, *In Search of Excellence* (Peters and Waterman, 1982), but it wasn't really until the 1990s that the role of technology in the shaping of culture was seriously studied within OS. Its

impetus seems to have stemmed from the emergence of company-wide information and planning intranet systems, and the rapid proliferation of electronic mail systems which suddenly started to appear on the computer screens in the offices of academic research staff. Research on Enterprise Resource Planning (ERP) systems (e.g. Grant et al., 2006), and on computer-based distance working (e.g. Baruch, 2000) reveals a complex picture and suggests that such technologies are a 'double-edged sword' bringing both benefits and costs to organizations. However, as Dery et al. (2006) have observed, the literature on the im2pact of ERP on organizational behaviour is heaviliy dominated by managerialist discourse such that the definition of 'costs' is phrased almost exclsuively in terms of efficiency and overall business performance rather than in socio-political or psychological terms.

Perhaps the most researched variable is the electronic surveillance of work which is often desired by management (Sewell and Wilkinson, 1992a) but not always successfully implemented (Timmons, 2003). Romanticists see particular problems with information and communication technologies designed for electronic surveillance of employee behaviour. For example, a survey of 900 large US companies by the American Management Association (reported in Huczynski and Buchanan, 2007: 81–2) revealed that over two-thirds of the sample admitted to employing electronic surveillance of their staff. Monitoring of email traffic, telephone conversations and internet use is relatively easy where machines are connected to a central server, and closed circuit television cameras are an increasingly common sight both inside and outside of business organizations. Romanticists such as Zuboff (1988) suggests that the use of an electronic panopticon – the all-seeing eye – is a very tempting one to over-worked managers, and especially to managers responsible for the performance of distance workers. Indeed, the case studies of call centres conducted by Bain et al. (2002) suggest that managerial utilization of targets to impose and measure employee performance via technology enables the continuation of the application of Taylorist methods into the twenty-first century.

The development of the internet has introduced more complexity into the new technology–organization culture relation as it enables corporations to influence the external perception of its culture more easily than the internal culture can be changed. As Ogbonna and Harris observe, 'given that the Internet may become the only source of contact between many customers and certain organisations, external (web-based) perception of organisational culture may become more important than actual physical contact and interaction with an organisation' (2006: 172). Their case study of a financial corporation reveals how executives within the company viewed the introduction of internet operations as an opportunity to change the culture of the organization so that the entire organization 'embraced the values and assumptions defined by the executives as critical to maintaining competitive advantage'

(2006: 168). Ogbonna and Harris note that, in practice, this managerialist social determinism was undermined owing to the existence of competing and diverse sub-cultures within the case company.

Nevertheless, social determinist approaches dominate research on the cultural impacts of technology. However, in exorcizing the 'ghost' of technological determinism many of the analyses of the research data fall back on a rather simplistic model of organizational behaviour – especially when it comes to the notion of management choice. Technological impact is conceived as a negotiated process carried out primarily between a dominant coalition of organizational decision–makers (i.e. management) and labour. However, as noted above, this research tends to overlook the possibility of competing corporate sub-cultures or that management does not represent a homogeneous group of decision-makers. Research by Armstrong (1984, 1985) and others indicate that accountants, personnel managers, computer experts, engineers and marketing/sales managers may themselves have conflicting interests and differential influences on the design and ultimate configuration of organizational control systems such as factory automation systems (see Scarbrough and Corbett, 1992). The concept of 'strategic choice' tends to overlook this dynamic. It also assumes that choice is a rational process – a questionable assumption, at best, in the light of research on the irrationality inherent in much organizational decision-making (e.g. Cohen et al., 1971; Todd and Gigerenzer, 2003).

In concluding this brief overview of the diverse research findings on the impact of core technologies on job design, structure and culture, we should consider why no clear picture of the relationship between technology and everyday corporate life has emerged in the OS literature. One obvious reason lies in the huge variety of technologies being studied. The computer numerically controlled (CNC) machine tool was the technology of choice in the 1970s and 1980s, whilst the networked computer information system became the focus by the beginning of the 1990s. However, as we have seen, the lack of clarity may stem from the epistemological assumptions of the researchers and the way in which the empirical data is collected, collated and analysed.

In an effort to move beyond this impasse, researchers such as Orlikowski (1992) have emphasized the need to place core technology in its context and to analyse the linkages between action and structures. Based on Giddens's structuration theory (1984) she recognizes the fundamental duality of any technology: technology shapes and is shaped by the organizational context in which it is adopted. In other words, technology should be seen as both a material entity and a social construct. This is not the same distinction as the one made by Alan Fox between material and social technology we discussed earlier in this chapter. Rather, we are talking here about technology having a real physical presence but one which is open to different interpretations by different actors. We have already seen such interpretative flexibility in

the different interpretations of the impact of technology offered by Futurist, Marxist, Romantic, and managerialist commentators and researchers. A key point is that the way a technology is socially constructed plays an important part both in shaping technology's ultimate impact on organizational behaviour and in shaping actors' reactions to this impact. For this reason social constructivists are keen to question the distinction between technology and organization, and especially to question the need to consider technology as anything other than a social construct. In this way the content of the 'black box' of technology can be opened up to enable the context of its development and use to be placed under scrutiny (see McLoughlin, 1999). However, when aesthetic theories of technology and organization open the 'black box' they do so from the inside. It is to these theories that we now turn.

'Aesthetic' Theories of Technology and Organization

Aesthetic approaches to an understanding of the relationship between technology and everyday corporate life often utilize the cyborg as their basic epistemological category and they consequently reject any straightforward notion of technology (as object or other) having an impact on the social (as subject or self). Rather, technologies are conceived as *nobjects* (Macho, 2000) that are so implicated in social organization that you can no more set them apart than you can actually separate the mind and the body. As Gilles Deleuze (1992: 6) argues, 'types of machines are easily matched with each type of society – not that machines are determining, but because they express those social forms capable of generating and using them'. Whilst empirical case studies predominate in prosthetic theory research, researchers sharing an aesthetic approach often take a more longitudinal, historical perspective and criticize the former for its lack of reflexivity. Hollway (1991) and Townley (1992), for example, stress the active role played by work psychologists and human resources specialists in the construction of the organization as a technologically-based order in which the employee becomes a component in a collective enterprise that connects technical means with productive ends. As Hill (1988: 39) opines, 'the world and our experience of it is enframed by technology, and revealed only within the on-going dynamic of order that this frame implies, and not within the aesthetic that is humanly constituted in everyday action and individual control'. In other words, the meaning of organizational behaviour derives from what technologies can do to it. We are everyday cyborgs, not occasional 'users' of technology. We are not like people from the Middle Ages who happen to watch television or travel in aeroplanes. Our entire outlook on the world has been shaped by technologies which have become so commonplace that we take them for

granted. This is why philosophers such as Heidegger (1977) and Ihde (1990) argue that any understanding of technology requires an understanding of the everyday cultural practices and 'mindset' which technology reflects and reinforces. In a sense, we are all inside the 'black box'.

Take, for example, what is probably the most taken-for-granted technology of modern times – the mechanical clock. The word clock derives from *clocca*, the Latin term for a bell. In twelfth-century Europe, everyday life in Christian monasteries was regulated by the manual ringing of a bell to mark the beginning and end of different collective activities (prayer, reading, eating, sleeping, etc.). By the fourteenth century innovations in time-keeping design heralded the development and diffusion of mechanical clocks out of the monasteries and into towns and cities. These clocks were capable of displaying equal hours on a clock face and were to have two profound consequences for the European mentality (Corbett, 2003).

First, the mechanical clock symbolized a decisive step in the appropriation of time away from the heavens and from God (especially the liturgical practices of the Church) to humanity; from eternity to the here and now. Fourteenth-century money changers and lenders, tax officials and industrialists were the groups eager to appropriate this new time standard. In the Churches of the Byzantine East and Greek Orthodoxy the installation of mechanical clocks was forbidden lest eternity became contaminated with time. The Roman Church in Western Europe, by contrast, embraced the new technology and turned its back on eternity and the mystical interpretation of numbers. Before long Roman church bells were ringing secular, mechanical time – a process started by King Charles V of France in his 1370 decree requiring all public clocks in Paris to be synchronized to his own palace clock. Thus, as Mumford (1934: 17) notes: 'The bells of the clock tower almost defined urban existence. Time-keeping passed into time-saving and time accounting, and time rationing. As this took place, Eternity ceased gradually to serve as the measure and focus of human actions'. Furthermore, as Boorstin (1983) argues, the newly-calibrated equal hour was a declaration of humanity's independence from the sun, new proof of our mastery over ourselves and nature.

The second consequence of the encroachment of public clock-time into everyday urban life was equally profound. Historians tell us that the medieval populus were innumerate as well as illiterate. How much reckoning could a person do in a world that knew no uniformity of measurement? Units of distance were linked to physical characteristics that varied as people do (the English *foot*, for instance), whilst weights typically were converted to volume standards (a *bushel* of grain) that inevitably varied from place to place. Landes (1983) argues that with growing trade in the twelfth and thirteenth centuries came the need to calculate and reckon. Roman numerals were displaced by the now familiar Arabic numerals during this period and these made calculations

easier. It was the urban commercial populations that seem to have been the quickest to learn the new language and techniques of reckoning:

> Arithmetic was the province above all of the unlettered speakers of the vernacular (as opposed to Latin). Many of these learned arithmetic in the shop or on the road, but even before they entered trade, they learned to count the bells of the clock. Not by the old church bells ringing the canonical hours; these did not mark equal units and hence did not lend themselves to addition and subtraction. But the new bells and the calculations they made possible (how long until? how long since?) were a school for all who listened and began to organise their lives around them. (Landes, 1983: 78)

So, in the towns and cities of late Medieval Europe, it became possible to keep ap*point*ments fixed by points on the face of the mechanical public clock. The punctuality demanded of the monks was enforced by the ringing of the cloister bell, whilst, in secular life, punctuality was the quality of being *on the point* which was read from the mechanical clock face. As Ihde (1990) argues, such secular time discipline was to intensify with the refinement of the portable clock and the personal watch; with the growth of a civilization even more attentive to the passage of mechanical time and hence to productivity and performance. Today, of course, clock-time is so fundamental to the vast majority of organizing practices that it is difficult to conceive of organization without it (see Legge, this volume, for elaboration).

Along with many other everyday technologies, such as the mechanical printing press (McLuhun, 1962) and the flat-glass mirror (Mumford, 1934), the mechanical clock illustrates how technology has enframed our relationship to the world for at least 500 years, how machines and humans have a common cultural history. It is in this sense that we are cyborgs and our organizations are cyborganizations. Our identities are inextricably bound up with timetables, mirrors, electricity, clocks, calculators, books and photographs, and we have learned to trust these technologies more than our own bodies. Similarly, within business organizations there is often unquestioning reliance on the technology of the company balance sheet in understanding everyday corporate activities and 'performance'.

According to Seltzer (1998), it is not so much that the application of technology to human organization has led to a mechanization of the human; rather humans have come to rely increasingly on technology to understand themselves. This, in essence, is the thrust of technology-as-aesthetic theory. There are no essential characteristics attributable solely to the human, the social or the technological. All four of the conventional prosthetic theoretical positions share an essentialist epistemology in that they regard human nature as something shared by all humans (regardless of colour, creed, gender or culture) and quite distinct from technology. Deleuze and Guattari (1984) employ the term *mechanique* (mechanic) to describe this view of technology–organization relations.

Although the binary choice between technology as either good or bad offered by most prosthetic theorists is rather bleak, some aesthetic theorists have not entirely given up hope – Grint and Woolgar's (1997) argument for 'anti-essentialism' in technology studies, for example. If we take a properly symmetrical approach to such anti-essentialism, and question the common organizational content of both technology and of the human, then it might provide a way out of the impasse in conventional theorizing about technology and organization. Such an approach might draw upon the insights of actor-network theory (Callon, 1986; Hassard and Law, 1999; Law, 1992), proximal organization theory (Cooper, 1992; Cooper and Law, 1995) and post-humanist cyborgology (Haraway, 1991; Wood, 1998) to productively deconstruct the dualistic oppositions of human – machine, and organization – technology. Deleuze and Guattari (1984) employ the term *machinique* (machinic) to describe this notion of the cyborganization which

> is never stable at all: it incessantly creates and recreates itself. It also accepts that the relationship between self and non-self is quite vague: it works as Massumi (1992: 192) points out, by dint of contamination than by dint of isolation. Even more importantly it is not subordinated to a master pulling the strings but rather loses itself in a continuous play with its environment. The machinic machine is an open-ended process. (ten Bos and Kaulingfreks, 2002: 25)

Yet such a move towards *nobjectivism* may prove threatening to the discipline of OS. As Land and Corbett (2001) suggest, any attempt to take technology seriously is too readily interpreted as an attempt to privilege the technical mastery of the engineering disciplines over the humanities. But such a reading is the result of an inability to think outside the oppositional dualism of organization and technology. Rather than questioning the premises upon which this dualism is constructed, such thinking can only succeed in overturning it, leading to the privileging of one or the other of its terms. While there have been numerous analyses of the ideologies hidden within seemingly neutral technologies, too rarely has this analysis been turned back upon the humanistic social theories conducting these analyses.

Spicer (2002) observes that as soon as the question of technology passes our lips it attaches itself to the points of good and evil. This is as true for prosthetic theorists of technology as it is for everyone else. Yet, aesthetic theorists counter-argue that the relationship between technology and organization cannot be deduced and evaluated so easily. Ultimately, if we truly are cyborgs, then it is equally valid to ask ourselves if we are good or evil. 'Perhaps questioning our tools tells us more about ourselves, our society and our desire for moral quandaries than even post-humanists like Haraway suspect' (Spicer, 2002: 82).