10 The wrong trousers? Beyond the design fallacy: social learning and the user

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Introduction

This chapter reflects critically upon how a substantial body of writings in technology studies and user-oriented computing have sought to conceptualize design – and their tacit and explicit presumptions about what is wrong with technology design/development processes as currently practised.[1] Many of these analyses share a paradoxical view of design: presenting on the one hand a rather heroic view of design as successfully embedding a range of explicit purposes and implicit values (a view we refer to as the 'design fallacy'), while on the other hand demonizing design practices and outcomes. The chapter argues that this account is inadequate and derives from a flawed 'design-centred' perspective – that focuses narrowly on particular design episodes and conceives these as leading to finished solutions to social/organizational needs.

The chapter presents an alternative view of the role of design in the development of new technologies, particularly in relation to new information and communication technologies (ICTs) that have emerged in the course of the European Social Learning in Multimedia (SLIM) research project.[2] A social learning perspective is outlined that sees design outcomes/supplier offerings as inevitably unfinished in relation to complex heterogeneous and evolving user requirements. Further innovation takes place as artefacts are implemented and used. To be used and useful, ICT artefacts must be 'domesticated' and become embedded in broader systems of culture and information practices. In this process, artefacts are often reinvented and further elaborated ('innofusion').

The social learning perspective (Rip et al. 1995) analyses particular design episodes as located within longer-term processes of innovation across multiple cycles of technology design and implementation. It offers an evolutionary model of how societal requirements and technological capabilities might be coupled together. Although concepts of evolution and of learning may convey a sense of smooth and seamless interaction, our analysis points to the complex and often difficult interaction between them, offering an analytical framework that is more open (i) to the necessarily incomplete nature of the design process; (ii) to the unpredictability of outcomes; and (iii) to the multiplicity of actors and sites of innovation.

The design-centred perspective in technology studies

A problematic intellectual inheritance from early technology studies

The issue of design was central to the emergence of technology studies as an area of debate and field of study. Starting from an assessment of newly emerging technologies that focused upon the undesirable social and environmental implications, critical socio-economic analysis moved on to ask 'what was giving rise to technologies that were having these effects?'; critiques were advanced of the dominant form of technologies developed (MacKenzie and Wajcman 1985). For example, the 'social shaping of technology' perspective sought to investigate the choices inherent in technological design and development and how these were influenced by the various values and interests involved. The archetypal 'social shaping' study by Noble (1979) pointed to the explicit intentions of the developers (of automated machine tools), and the suppression of one technology (record playback) in favour of another (numerical control). A similar conception of the significance of design underpinned the espousal by socially concerned engineers of alternative approaches to technological design (for example, in ideas of human-centred technologies and participatory design; see Ehn 1988). In much of these early writings we see an 'essentialist' account (Wajcman 1991) of the relationship between technology and social values, in which the design of the artefact is a more or less simple reflection of the values and priorities of designers and developers – values which are assumed to be reproduced (or at least favoured; see Winner 1980) when these artefacts are deployed and used. In this view, consumers are seen as passive recipients of the technology and its embedded values (Sørensen 1994). Although critical of the substance of design, this view sees technology design/development as a straightforward vehicle for social values and intentions.

The subsequent development of empirical research and analysis has called this view into question. Recognition of frequent failures in technological development, of unintended technical and social outcomes, and of the complexity of social interactions around the development and use of technology (and in particular of the influence upon innovation processes of intermediate and final 'users' of an artefact) has called for the revision of various elements of this simplistic model (Sørensen and Williams 2002). However, we suggest that prevalent social shaping and constructivist analyses of design still bear the imprint of their past intellectual inheritance. We point to the continuation of a view of design that tacitly retains some modernist presumptions, in terms of an essentialist and somewhat mechanistic view of how values and preferences may become embedded in design and may be reproduced when those artefacts are subsequently consumed/used. Such a view would appear to be informed by a 'linear' rather than 'interactive' model of innovation, and conveys more than a hint of technological determinism. In particular, we argue that much of this analysis shares what we have described as a 'heroic view' of design, which at the same time demonizes engineers. It is heroic in the sense that designs are portrayed as finished products inscribing particular views of the user, user activities and priorities into the artefact. The 'design problem' is then conceived in terms of the failings of design practitioners – through ignorance of users (their purposes and contexts) or their commitment to different priorities – embedding the wrong values/specification of user requirements in design, with imputed serious negative consequence for the usability and use of those artefacts for particular purposes and by particular groups. We shall return to this argument about the socio-economic analysis of design. But first, we shall examine, under the rubric of 'the design fallacy' the implications for design practice.

The design fallacy

An important line of critique of design practice has centred around the perceived failure of ICT offerings to match the culture and requirements of users and in particular of the 'final users' who must operate the system. Failings of newly developed systems were attributed to the shortcomings of dominant 'technocratic' design approaches, and the difficulties experienced by computer scientists and engineers in capturing user requirements; to their narrow, functionalist understandings of the tasks being automated and their lack of understanding of the intricate culture and specific practices of the various users of information systems; and to the consequent gulf between designed systems and the circumstances and practices of the various groups of potential and actual users. Traditional requirements capture techniques, which emerged from the successful automation of routine record-processing tasks in early commercial computing, could not readily be applied to more complex activities involving the exercise of judgement and in novel applications where user requirements were not readily specified. Requirements capture is a potentially difficult problem because the needs of various current and potential users, and the means by which they may be fulfilled, are not fixed entities, but evolve, partly in the face of new technical capabilities and practices. In the face of these perceived problems, a range of user-centred design initiatives was launched which sought to develop richer understandings of the context and purposes of the user and build them into technology design. New design methodologies and models were proposed. Often user-centred design involved the deployment of social scientists alongside technology developers to study user contexts or to bring user representatives into the design process directly. Some interesting work has been done (see, for example, Ehn 1988; Bødker and Greenbaum 1992; Green et al. 1993).

However with hindsight, these kinds of project seem to have had only modest influence over system design overall, and some serious questions can be raised about their effectiveness – most immediately in relation to the uptake and wider applicability of models that emerged from user-centred design initiatives. More fundamentally, it can be noted that such initiatives failed to generate distinctively different models of artefact from those emerging from conventional design settings.[3]

While the shift towards user-centred design represents a significant and positive development, we need to avoid the pitfalls of what we have termed the 'design fallacy': the presumption that the primary solution to meeting user needs is to build ever more extensive knowledge about the specific context and purposes of various users into technology design. In large degree, the shortcomings of this view arise because the emphasis on the complexity, diversity and thus specificity of 'user requirements and contexts' (and the consequent importance of local knowledge about the user) is taken up within an essentially linear, design-centred model of innovation to emphasize the need for artefacts to be designed around the largely unique culture and practices of particular users. By seeing computer artefacts, once designed, as largely fixed in their properties, and thus privileging prior design (Procter and Williams 1996), the key question becomes one of building ever more extensive amounts of knowledge about the context, culture and purposes of users into the designed system.

Following on from this, socio-economic research, and in particular ethnographic studies of users were proposed to identify the *right* values and overcome the design problem, by capturing the increasing amounts of knowledge about specific groups of users and their purposes, practices and thus requirements that could be incorporated into the design of the artefact. Ethnographic and in particular ethnomethodological approaches were advanced as being uniquely suited to addressing the intricacy of specific contexts and practices – identifying the crucial differences and distinctions that conventional requirements capture techniques would all too easily overlook (Anderson 1997). Although this point goes somewhat beyond the scope of the current chapter, it can be observed that there are obvious limitations to the role of ethnography as a method for requirements capture.[4] However ethnographic approaches could be used in addition to or as an alternative to 'user participation' in design – in which representatives of various current and potential users could express their requirements for the new system and contribute directly to requirements specification and to design and development decisions.

Rethinking design – beyond the design fallacy

The design-centred model, with its exclusive preoccupation with prior technological design ('the design fallacy'), can be criticized on a number of grounds:

- it is unrealistic and simplistic;
- it may not be effective in enhancing design/use; and
- it overlooks important opportunities for intervention that are revealed, for example, if a design-implementation life-cycle model is adopted.

In particular we argue against the model of design as an inductive process of accumulating ever more information about current user requirements. Recognition of the complexity and diversity of user settings does not necessarily imply that technological design will or should be entirely shaped around the detailed needs of particular users.

The constructivist theorization of design: its conceptualization of the user and use

A central concern for social shaping and constructivist analyses of design has been to assess critically the way in which certain priorities and outcomes may be built in to technology development and therefore may be advantaged when those technologies are used (Winner 1980). In relation to new applications of technology, analysis has revolved around the way in which the future user and use of an artefact has been conceived. Indeed, in designing and developing an artefact, some model is needed of the anticipated user, the ways in which the artefact will be used and of the social and technical context in which use will take place. Designers do not simply develop an artefact – they must inevitably also develop some concept of the use context and lifestyle (van Lieshout et al. 2001). These representations (Vedel 1994) of the user/use may be more or less specific.

But how are these representations developed and implemented in designed artefacts? If design is shaped by the values and context in which technologies are developed, how are these values embedded, and how can they be identified?

We argue that social shaping and constructivist analyses have tended to veer, implicitly and perhaps unconsciously, towards a rather 'politicized' view of technological design as being *richly informed* by a set of specific values and presumptions from the development context, and in particular by specific and questionable conceptions of the user and use.

Noble's (1979) machine tool case refers to a highly polarized and visible context: the explicit intentions of the developers of automated machine tools around the choice of an operating interface that offered clear (apparently self-evident) implications for the outcomes – reducing the role of craft machinists. More sophisticated methodologies and explanatory concepts may be needed to grasp design choices in other contexts.

Important insights have emerged from analysts with roots in semiotic analysis and discourse theory. Thus Akrich (1992a) and Akrich and Latour (1992) claim that we may interpret the endeavours of designers as efforts to inscribe certain preferred programmes of action by users (which Akrich describes as 'scripts' or 'scenarios') in the design of a given artefact or technological system. Designers visualize a script of preferred reactions to the artefact, and they try to shape the technology in order to make these reactions as mandatory as possible (Sørensen 1996). In a similar vein, Woolgar (1991) describes designers as seeking to 'configure the user' – in terms of defining the characteristics of the user and how they may respond. By 'setting parameters for the user's actions' (ibid.: 61), the behaviour of the user is configured by the designer and the user is disciplined by the technology.[5] In this sense, the technology (and the designer) constructs 'the user'. This concept of configuring the user has been widely taken up.

A body of work has emerged from this perspective (for example, Woolgar 1991; Akrich 1992a, 1992b). Much of this conveys a view that design incorporates a comprehensive *representation* of the intended users, their purposes and the context of use. The user may be represented, for example, in terms of presumptions in relation to their skills, their identities (for example, in terms of gender, see Cockburn and Furst-Dilic 1994), or other social features such as race and class) and the activities that may be seen as appropriate and inappropriate.

We argue that this kind of critical analysis has paradoxically often produced a rather simplified, 'stylized' and overpoliticized account of how the social context shapes the content of design (for example, regarding which social values and relationships become embedded in design and how) – and can thus readily be 'read off' by the analyst. We identify a tendency, which we describe as 'narrative bias', towards a particular kind of story about technology.[6] The first move in such an analysis is, typically, to identify the representation of the user underpinning a particular design/development. The second move is then to examine whether these are often 'the wrong values', based on an inadequate or misleading view of users and their requirements. Thus researchers have tended to look for the problems that may arise where that representation is restrictive or out of line with the actual users that arise or can be anticipated to arise. One common example highlights the problems arising where engineers have relied on their personal experiences and presumptions to articulate a rather unrepresentative model of the user (Akrich 1995; Nicoll 2000) – a strategy which Oudshoorn and Pinch (2003) have described, following Akrich (1995) as the 'I-methodology'.

It can be noted that these studies of 'designers configuring the user' do not in general address both the design and the implementation of particular artefacts. There are many reasons for this – not least that product development cycles tend to be longer than the lifetime of most social science research projects.[7] The impact of design choices on the user is thus largely imputed.

We would suggest that, when detailed empirical analysis of design/development settings is actually undertaken, it turns out to be rather hard to discern the sets of objectives and presumptions underpinning design. Design/development choices are dominated by the 'taken for granted' aspects of the innovation – and by a series of design choices that will tend to be justified in technical or pragmatic terms. Indeed, design is rarely conducted by a single actor, but emerges through a multiplicity of actors in interaction with various concerns and agendas in relation to a host of factors (price, technical constraints, interoperability standards and concepts of the user market). Design is often done by committee (or through more complex arenas), working to tight deadlines under conditions of conflict and accommodation, yielding compromises that may satisfy no-one. What can be 'read' about the user and the setting of use is typically underspecified, fragmentary and inconsistent. And when the designed artefacts are subsequently implemented and used, the design presumptions are by no means expressed in a straightforward way.

The implication in the idea of 'configuring the user' that users are recipients, of course, stands in contrast with another, increasingly influential, stream of analysis which emphasizes the 'interpretive flexibility' and choice that users and others are able to exert regarding the meanings and use of a technology (Pinch and Bijker 1984). Indeed, Latour, Akrich and other writers, from a discourse theoretic background, see technology as a 'text' that is capable of different readings (even though their writings also convey a strong sense that the technology inscribes a preferred reading). A growing body of recent accounts, influenced by developments in cultural and consumption studies, portray consumption as an active and creative process (Sørensen 1994). These emphasize that, although the designer may seek to prefigure the user – and thus implicitly to constrain the ways in which the product is used – ultimately users still retain flexibility regarding the meanings they attribute to technologies, and over choices about how the artefact will be appropriated. We capture these processes – and specifically, the key processes of domestication and innovation – within the more general heading of social learning. Recognition of social learning offers a very different view of the character and significance of design activities.

The social learning framework

The social learning framework is proposed as an extension to the social shaping of technology perspective that focuses in particular upon opportunities for reflexive practice in the development of technologies.[8] It draws upon concepts from the developing evolutionary tradition in economics and economic history which have long recognized 'learning curves': the gradual improvements that often arise in the performance of a technology over time. Arrow (1962) described as 'learning by doing' the idea that workers, individually as well as collectively, develop more efficient ways of employing machinery through their experience from usage. Similarly, Rosenberg (1982) characterizes as 'learning by using' the process through which a user gains familiarity with a given piece of technology and develops skills in making use of it. These concepts point to the fact that the properties of a technology (its affordances and limitations) may not be immediately apparent, but are discovered, learned and enhanced through experience, often in relation to particular productive processes and activities. As Sørensen (1996) puts it:

> Social learning can be characterised as a combined act of discovery and analysis, of understanding and giving meaning, and of tinkering and the development of routines. In order to make an artefact work, it has to be placed, spatially, temporally, and conceptually. It has to be fitted into the existing, heterogeneous networks of machines, systems, routines, and culture.

However, social learning is not limited to the site of technology application (what Fleck 1988a describes as the 'implementation arena'), important though this is. Such learning by doing provides a potentially very important source of information on the effective use of a technology. By giving suppliers access to what users have learned about their products and what deficiencies and potentialities they have discovered, it could provide invaluable information for subsequent product innovation. It has been further noted that this information is often not systematically collected and used – perhaps because of the strength of the rhetorics of technology supply (on the grounds that, if a new product already fulfils user requirements as claimed, what need is there to examine the problems that may arise in its implementation and use). This underlines the importance of the *linkages* between users and producers that can act as a vehicle for this kind of knowledge exchange. To innovate successfully, producers may depend critically on information from users, and vice versa. This is the basis of the idea of the learning economy (Andersen and Lundvall 1988). The social learning framework draws attention to the way in which these knowledge flows are achieved (often through the efforts of key intermediaries) through processes that Sørensen (1996) describes as 'learning by interaction'.

When using the term 'social learning' we are not referring narrowly to individual cognitive processes but are crucially addressing collective learning processes – conceived in the broadest sense to include not only knowledge flows but also interactions between actors and processes of negotiation and struggle. It thus includes processes of 'learning by regulation' (ibid.) in which the circumstances for the 'proper' operation of a technology are achieved.

We can further distinguish two related social learning processes by which users contribute to technology development and use: innofusion and domestication.

Innofusion

This view of innovation draws on Fleck's (1988a) concept of 'innofusion' (= innovation + diffusion) to demonstrate that the innovation of an artefact (robotics and industrial automation in his original exegesis) was not limited to the research and development laboratory, but continued as the artefact was diffused in its implementation and use. Innofusion refers to the 'processes of technological design, trial and exploration, in which user needs and requirements are discovered and incorporated in the course of the struggle to get the technology to work in useful ways, at the point of application' (ibid.: 3).

Domestication (or appropriation)

Silverstone's studies of the consumption of household technologies highlighted the choices available to family members in terms of where the product is located and how it is incorporated within family routines (Morley and Silverstone 1990; Silverstone et al. 1992). However, a broader usage of the concept of 'domesticating' technology has emerged, in the sense of *taming* the technology. This often involves innovation by the consumer: using artefacts in ways not anticipated by the designer (Berg 1994). Domestication (Silverstone et al. 1992; Sørensen 1994; Lie and Sørensen 1996) and the related concept of appropriation (Pacey 1983; du Gay et al. 1997) are used to highlight the efforts of users to integrate ICT applications within their particular contexts and purposes. In the case of information systems at work, domestication may include, for example, the development and redevelopment of: working and information practices; work-arounds to overcome faults/limitations in the designed system; and systems of meaning (for example, the classification of cases; see Star and Bowker 1999).

These two facets of social learning over technology – innofusion and domestication – are not separate. However, these concepts were coined separately and for differing purposes. They draw attention to differing aspects of the innovation process, respectively, the evolution and biography of artefacts (Pollock et al. 2003) and the evolution and biography of user (and user organization) practices/culture. The social learning framework combines these to achieve an integrated perspective – and one that addresses innovation over different phases of the cycle of product development and use and in different sites.

A social learning perspective on design

The social learning perspective on design thus locates design within a broader context. Episodes of design are not viewed as snapshots in isolation – temporally from what precedes and followed it, or socially from its broader context – but are seen as moments of innovation across multiple cycles of design, implementation, consumption and further enhancement and dispersed across a wide range of players, sites or phases.

We have elaborated and tested this framework through a series of case studies of digital experiments and trials, conducted under the SLIM project – an eight-country study funded by the European Commission. The SLIM case studies unusually sought to encompass the design, implementation and consumption of new multimedia systems across a range of contexts – commercial, education, public administration, community information and everyday life. This work has highlighted the pertinence of the social learning framework to understanding technology design.

A schema has been developed for understanding innovation in ICT applications. As this portrays a rather different view from received models, it is helpful to briefly outline some of the salient points. However, it is first important to address important changes that have taken place in both the form of ICT applications and its attendant design/development processes captured by the analysis of ICT as 'configurational technology'.

ICT applications as configurational technology

Social shaping of technology research has produced a number of important insights into the form of technology (particularly in respect of ICT applications), the process of innovation and the opportunities for influence by various players. It reveals that today, ICT development virtually never takes the form of *ab initio* design of complete systems (as is tacitly presumed by the design-centred account). Instead, ICTs are typically 'configurational technologies' (Fleck 1988b), created from selections of existing (often standard, commodified) component technologies and tools and some customized elements configured together.[9]

The configuration and customization of cheap, generic component technologies has proved a remarkably effective way of acquiring ICTs (and one that has had far more impact than user-centred design). The trade-offs between price and scope and so on yield a range of technology supply/acquisition strategies between, for example, customizing a large generic application (involving a small number of 'large grain' components) for a particular context and the knitting together of a 'fine-grained' array of simpler flexible components (for example, standardized components and tools) selected and configured around the requirements of a particular user (Fincham et al. 1994).

Opportunities for user influence vary with the form of technology: user-led innovation in configurational technologies

These differing circumstances offer varying opportunities for user influence (which Koch 1997 has characterized as 'bricks and clay' in the hands of the local user). In the latter case we find that the organizational user is able to exercise considerable choice over the final configuration/solution. Indeed, it could be argued that this configuration activity opens up opportunities for a kind of user-led design, despite the user's virtually total exclusion from the prior design of the component technologies.[10]

Recognition that ICT applications take the form of configurational technologies also changes our view of the character and sites of design activity. Design of configurational technologies is most immediately about the appropriate selection and artful combination of the array of standard components as well as the creation of customized components. The user can exert considerable choice over the final configuration. What is critical in terms of this current discussion is that the development of configurational technology is a model in which *technology design and implementation are closely coupled*.

Supplier ICT offerings inevitably fail to provide finished solutions

One of the reasons for innofusion/domestication and emergence of user-led creation of configurational technologies is the implausibility of the expectation that design outputs/supplier offerings could immediately and completely match user needs (not least since user needs are inchoate, varied, complex and evolving). This is particularly marked when we are dealing with ICT applications in complex organizational and cultural contexts. In other words, supplier offerings are inevitably unfinished; work must be done to adapt them to the technical and social contexts of use. This is a process of mutual shaping in which, on the one hand, the artefact may be reworked to meet specific user exigencies, while on the other, the artefact, in being incorporated within local systems of practice and meaning, may open up new ways of doing things. The social learning perspective seeks to capture these intertwining innofusion and domestication processes in the implementation and use of technologies as well as the possibility of drawing lessons for future technological supply.

Design as specific or generic

For example, we need to bear in mind that artefactual design is inevitably generic to some degree in relation to specific users. Since not all users can be directly involved in design, selected users must inevitably to some extent stand proxy for their peers and for future potential users. Indeed, successful system design depends on an ability not just to capture the specificities of the user context, but also to translate these into a form in which they can be more widely used. While the design fallacy conceives the improvement of design in terms of building in ever more knowledge about users into the artefact, there are also risks in trying to prefigure too closely the users and their purposes; in seeking to foreclose user choice around the expressed preferences of particular sets of users. There are issues around the building of representations of the user. Moreover, design is subject to a number of contradictory paradoxes – between making a solution specific and generic; between aligning with and moving beyond current practices and models.

These factors may mandate in favour of adopting more generic design approaches. We thus see strategies to build upon successful specific applications, but to design out from the artefact reference to its specific contexts of origination and use which might limit its future use and market – or more precisely to 'redesign' and re-present the artefact to make it more generic and open it up to broader markets. Designers may need to balance between building solutions that are very tightly configured around particular local requirements – which may, for example, act as a barrier to utility and use in other contexts – and keeping the system more flexible. Schumm and Kocyba (1997) have described the related processes as involving on the one hand 'decontextualization' of this knowledge (its separation from particular contexts, its codification to make it more widely applicable) and of 'recontextualization' (to implement this generic knowledge within particular artefacts). This involves a shift in perspectives from particular users to a generic representation – of 'the user' or a set of classes of user. Despite the rhetorics of the accountability of design to the user, designers and developers may have only a limited understanding of, or concern about actual users. 'The user' is thus a construct – a projection of potential users – built around various kinds of partial knowledge of actual users together with other agendas (for example, supplier capabilities and commercial strategies).[11] For example, in the creation of a packaged ICT application for an organization, we may find a shift from a niche solution designed around specific organizational users to a generic solution built around suppliers' decisions about their intended market and its common features. In the case of novel mass-market products, there may be no existing users to refer to. While the preferences of users may be assessed through panels and trials with selected proxy users, the product will be developed and promoted around rather different sets of categories and knowledge from, for example, market research (for example, demographic information, established languages and statistics for characterizing lifestyle groups and market segments).

There are important trade-offs between making artefacts unique and making them standardized. For example, the cost and other benefits of re-using software 'code' generates a trade-off in software acquisition strategies between the *increased utility* to the particular user and *higher cost* of solutions custom built around their particular requirements and cheaper generic solutions which may match their requirements less exactly (Brady et al. 1992; Fincham et al. 1994). We see increasing resort to commercial off-the-shelf (COTS) software solutions (Pollock et al. 2003). Suppliers may seek to adapt applications developed in one context to sell them on as niche or generic solutions, securing additional returns on their development effort. Users may choose to adapt to the constraints of cheaper packaged software for a variety of reasons.[12] Thus the rapid spread of packaged software and tools reminds us that the possible price (per unit functionality) advantages of mass-produced standard solutions may outweigh the costs to particular users of adapting systems or adapting their activities to system constraints and affordances. The attractiveness of standardized offerings is further increased by the possibility of combining them with customized elements into configurational technology solutions. This is further assisted by conscious attempts to design such component technologies to be readily linked together and customized.

Design as a hypothesis about the user

This perspective involves a shift away from the idea of the supplied artefact as a finished solution for particular users. Instead, we took the broad view that artefactual design embodies something of a *hypothesis about the user* (Lobet-Maris and van Bastelaer 1999). In this sense, digital experiments and trials can be seen as providing an opportunity to *test* these hypotheses. However, the SLIM investigations have shown, across a range of case studies, that in the design and development process for multimedia products and services, these hypotheses about the user and use often remain implicit and underspecified. The presumptions made about the user typically remain largely unstated and are often poorly elaborated. These presumptions are then tested – for example, under simulated or actual conditions of use. We return to this in the following section when discussing how an effective representation of the user is achieved.

Representation of the user – revisited

Our critique of the main tradition of analysis of design highlighted the difficulties in generating an adequate model, or 'representation' (Vedel 1994), of the user and user requirements. Despite this, it remains the case that development/design needs to prefigure a number of elements about the context, purposes and activities of the user. However a richer understanding of the representation process is perhaps called for.

Representation relates to a number of different elements. For example, Nicoll's (2000) 'contextual usability' model conceives the usability of technology as a complex of interdependent elements within a particular context, including *usefulness*, (the development of) *usage* patterns, and the particular social and cognitive exigencies of situated *use*. Following on from this we suggest that representation encompasses: the technical configuration of the system, content, usage, uses and 'rules' (formal and informal) about proper usage/users.

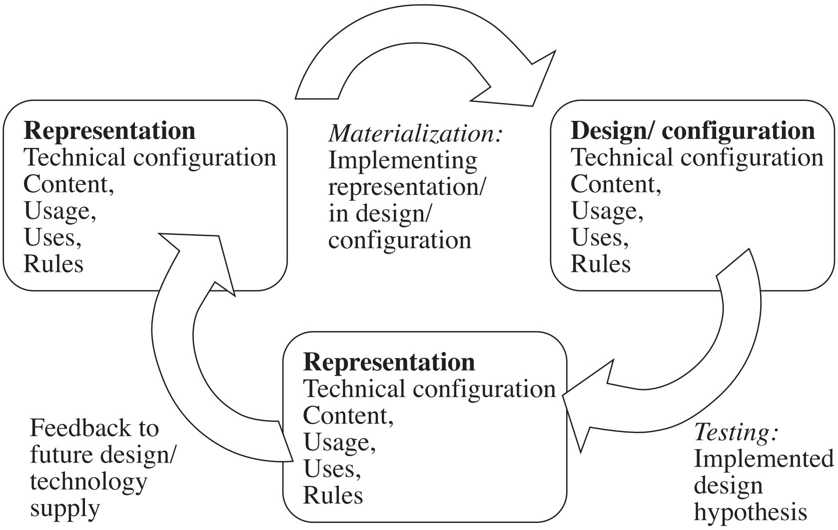
In principle, the hypotheses embodied in the design/representation are attempts to prefigure these very dimensions of the eventual use of the artefact. However, it is difficult, indeed impossible to prefigure these reliably – hence the importance of social learning, both in testing and refining the design hypotheses whether through 'synthetic' social learning processes in the course of development, or by securing feedback from actual social learning processes in the appropriation of artefacts in real-life contexts to future technology design/representation (Akrich 1995).

There are, then, a number of ways by which designers may seek to 'configure the user' (in the Woolgarian sense – comprising attempts both to prefigure/incorporate the user in the design of the artefacts and to align actual users to that view). Vedel (1994) identifies a range of mechanisms through which developers seek to configure the user – including, for example, advertisements, directions for use and technical guides – as well as technical design. Van Lieshout (1999) takes this further to include representations of the context for operating the technology. Developing these ideas, Lobet-Maris and van Bastelaer (1999) identify the different elements of the artefacts through which the user may be configured (in the design of 'Digital Cities'):

1. the interface, and in particular, the way information is presented in the interface (for example, the metaphors that are used will 'configure' the user and induce a specific usage);
2. the language and terminology used in the interface;
3. services offered – the types of information;
4. rules allowing or forbidding particular behaviours;

5. access possibilities – for example, where equipment is accessible, opening hours and so on imply different types of user; and
6. training.

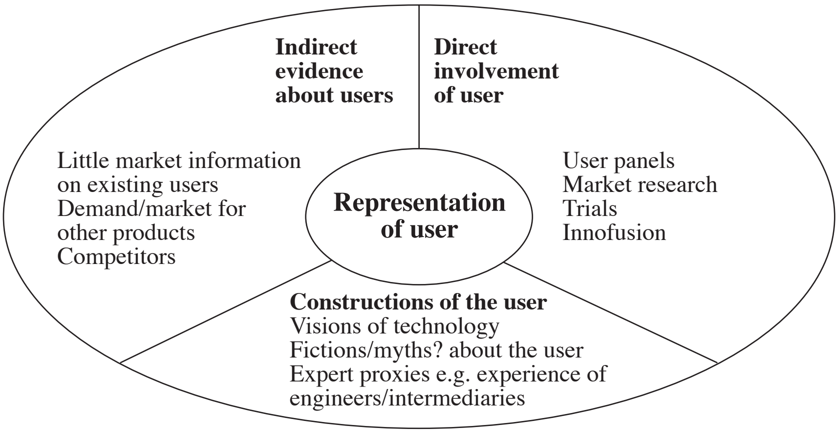
However, design is not a one-off act, but is part of an iterative series of activities, informed by earlier design practice and feedback from the appropriation and use of other systems (earlier technologies in this application domain; similar technologies in related domains). Figure 10.1 shows schematically the various moments involved in a particular cycle of development, and the relationships between them. It shows the iteration between the articulation of *representations* of user/use at the outset of, their materialization in particular *designs/configurations* and finally testing the implemented design hypotheses through processes of innofusion and domestication in particular contexts of use followed potentially by feedback to future technology supply/design.



Source: Williams et al. (2005).

Figure 10.1 Schematic diagram of user representation and appropriation

Following on from this we ask what intellectual resources do designers and developers have for building a representation of the potential user? Figure 10.2 shows some of the sources of ideas and information that designers/developers may deploy.



Source: Williams et al. (2005).

Figure 10.2 Resources for building representations of the user

The figure illustrates a number of points. First, in a context in which information about potential users is typically incomplete or of uncertain reliability, players may be obliged to 'knit together' different kinds of knowledge from diverse sources with different evidential status and with different degrees of gearing to 'actual' users.

Second, there may be relatively little empirically grounded information about existing users. Many studies have drawn attention to the crude and limited ways in which technology suppliers have sought to understand the requirements of potential users (Cawson et al. 1995). There have, of course, been important improvements over the last decade in the techniques by which firms gain direct information about users (for example, through market surveys, consumer testing of prototypes by panels of 'proxy' users and feedback from 'real' users of early versions of the product; see Akrich 1995), although these kinds of exercise are expensive and may not be seen as justified, particularly in relation to smaller-scale development. In the absence of direct knowledge of users, there may be resort to more or less well-justified indirect constructions of the user – for example, by extrapolating from similar technology applications. Constructions of the user, created by 'experts' (for example, engineers or intermediaries) may, for example, be derived from their own personal experience and culture (Nicoll 2000) or may be more firmly rooted in experiences in this or other product markets. Expert constructions may be informed not only by rigorous evidence and pertinent experience but also by visions of technology and narratives (myths?), including anecdotes or stereotypes about the user which may turn out to be more or less close to actual users and their behaviours. Developers do not work in a vacuum – but may be influenced here by popular opinion, media views and in particular by the behaviour of peers and competitors – which may be reflected in clustering of supplier offerings or the mutual reinforcement of supplier visions and presumptions. These kinds of alignment of expert views, and consequent mission-blindness, have been identified as the root of a number of high-profile and expensive failures of ICT systems (Collingridge 1992).

The potential weaknesses of the latter forms of evidence are clear – informed as they are by 'implicit' presumptions and knowledge of uncertain evidential status rather than the systematic application of explicit verifiable techniques (Akrich 1995). However, it would be misleading to see the application of formal techniques as obviating the uncertainties surrounding users and their requirements. We would like to carry this argument further. Our third point is that all the forms of information about future users carry their own uncertainties and difficulties. For example, the most systematic empirical information available about user choices and preferences (as revealed, for example, in aggregate form through market behaviour) is likely to exist only in relation to established products (even then, user preferences may change over time as some elements become seen as essential features in a particular product market (for example, in the way that every mobile phone sold today includes the relatively recent SMS (Short Messaging Service) innovation). In contrast, where products are changing, expert views are liable to be rooted in prior experiences in other related markets. The question arises as to how far one can extrapolate from such information. The problem perceived in relation to 'radical innovations' is that knowledge about the users and uses of existing applications may not provide a reliable guide to the novel application. There is inevitably a metaphorical leap.

Empirically grounded information about users of a new product may be sought through a variety of methods: the direct involvement of proxy users in panels; market research surveys; and trials (ibid.). However, various difficulties arise regarding the interpretation of such direct information about potential (and ultimate actual) users. For example, user panels need to be introduced to new technologies and given some training in their use – however, their selection and training mean that they are in some ways no longer independent and representative of wider publics. Sørensen (1996, section 2.3) describes this as 'simulated social learning', involving as it does 'people that are supposed to act as if they were users, but under artificial, laboratory-like circumstances'. Initiatives for 'user involvement' in the design/use of prototypes raised similar problems about representativeness. Since, in most organizational settings, not all current users can be involved, user involvement (directly in design or in panels and trials) is inevitably based on an incomplete sample of existing users (let alone future, as yet unknown, users), which throws up a set of further uncertainties and choices. How should appropriate 'proxy users' be selected? Is their behaviour in the laboratory a good basis for understanding behaviour in everyday life? Would their responses provide a secure foundation for anticipating the larger cohort of 'real' users that the supplier wanted to attract? For example, we know that many initial users of a technology may be 'enthusiasts' who, in their skills and interest in a technical field, may differ substantially from later adopters in terms of their expectations and requirements (Rogers 1983; Norman 1988). This may be one of the reasons leading to the development of baroque technologies (for example, the video machine or microwave oven) with features that most users cannot fully utilize.

Many of these considerations tended to mandate in favour of live digital experiments and trials – which would allow experimentation around the acceptance and utility of a product in relatively naturalistic settings (Nicoll 2000).

The proliferation of digital experiments and trials over the last decade underpin the potential importance of social learning in the innofusion and domestication of ICT applications – in that it can provide rich sources of more direct and reliable information about 'actual' user responses to supplier offerings (though issues arise about how such appropriation experiences can be fed back to generate more robust user representations for future design).

It remains the case that it is not possible to produce through experiments and trials a fully comprehensive and wholly representative account of the user's reactions (just as we observed in relation to requirements capture). The knowledge base is, of necessity, incomplete and potentially open to challenge. It is, in consequence, necessary to exercise judgement in a context of uncertainty.

Reconceptualizing the design process

The goal of this chapter is a more adequate and intricate understanding of design, its various 'audiences' and how they are incorporated in the design process and its outcomes. The analysis we have presented calls for some rethinking of certain common presumptions about design. For a start, we argue for a broad understanding of design, as involving a range of decisions about system design, development and deployment. In parallel with this we move away from a conception of design as an individual cognitive process, embodied in a particular designer, to seeing it as a negotiation process; a collective endeavour involving many players, including, for example, project managers as well as just design specialists. Design is, to use John Law's (1988) term, 'heterogeneous'. Third we stress that design has a number of audiences as well as the projected final users and the organizational user who may have commissioned the design. This may include, for example, developers/designers of complementary products as well as managers linked to the particular development project, standard setters and others who may act as gatekeepers or proxies for ultimate potential users. MacKay et al. (2000) make a similar point when arguing that the designer is 'configured' by the context of design.

Design as a configuration process

We would also make a slightly different point, deriving from our analysis of configurational technology (see above), that design is a constrained configuration process. This contrasts with the heroic account of design by seeing the process of design not as an open search,[13] but as constrained, enabled and channelled by its insertion in a broader setting and history of prior design choices. An important feature of many system design processes is thus the creative selection and configuration together of a selection of already existing bundles of knowledge, practices, artefacts, as well as novel elements. Design in this context is revealed as a process of *configuration*: in the sense of an artful selection and combination of diverse fixed and malleable elements but operating largely within existing repertoires (which Whipp 1985 described as structural repertoires of established problem diagnoses and designed solutions).

Our use of the term 'configuration' draws attention to the application of relatively restricted sets of rules for reconfiguring (that is, selecting, reworking, adapting and combining) existing knowledge and practices.[14] Design may 'configure' the user (Woolgar 1991) but it is also conditioned by its context and history.

'Design as accountability'

The design fallacy and ideas of participatory and ethnographically informed design can be seen as linked to the more general idea, which we can find across a range of socially oriented computer contributions, that 'good' computer system design would be a design process that is subject to the requirements of these diverse user groups. Indeed a rather similar conception underpins more formalized structured systems design methodologies. We have described this as a model of 'design as accountability', in which the requirements of all stakeholders are to be represented and seen to be represented in the eventual design. The designer's role is thus to receive this specification and to embed it authentically and reliably in the eventual designed system. However, this represents a rather restricted, bureaucratic and uncreative view of the role of the designer and the character of design work.

'Design as creativity'
Although designers may see advantage in presenting their role in this neutral technical manner, design is of necessity more than simply the induction from articulated user requirements. For example, designers inevitably play an active role in establishing which requirements are prioritized in a context of potentially conflicting requirements of competing demands on limited resources. Our critique of the conceptualization of computer-systems design in terms of the *accountability* model suggests an alternative model of design as a *creative* process, and one that valorizes *authorship.* In this mode the designer is given leave to construct new concepts of use – to reconstruct the user and transform existing genres of use (albeit within the bounds of what particular users can be convinced is acceptable/attractive, based on whatever evidence may be deployed regarding user preferences). This is particularly evident when we consider the design of novel applications (especially for mass-market products) where there are no existing users.

When actual design settings are studied (for example, in the SLIM case studies), the primary design goals and purposes of a project were not typically induced from user responses, but were instead invoked in the original conception of the project. The cases varied in the emphasis given to user objectives and uses; in some, there were relatively clear sets of parameters emerging from consideration of user requirements, while in others, the technical potential (and its imputed self-evident advantages) were more central.

We can explore this by examining the analyses that have been advanced of the development of a class of community information systems known as Digital Cities. Amsterdam Digital City (DDS), the forerunner of many European initiatives, was studied both by Lobet-Maris and van Bastelaer (1999), for the SLIM study and subsequently by Oudshoorn et al. (2004) for another European Commission project – SIGIS.[15] Lobet-Maris and van Bastelaer argue that failure in some Digital City projects to focus upon specific user groups resulted in technical criteria prevailing over design decisions.[16] Rommes (2002) and Oudshoorn et al. take this point further, arguing in DDS that where interfaces are designed for 'everybody', instead of with a specific user group in mind, the tacit default user will continue to be the 'typical Internet-user' (the highly educated, white young male with extensive computer experience).

In contrast, it seems that those design cases in which a clear and determined attempt was made to transform existing gendered presumptions, designers found it helpful to conjure up stereotypical representations of users – not with any implication that these were actual representations of particular groups of actors, but as self-consciously stylized archetypes – as tools for rethinking design presumptions.

Conclusion

This brief review has sought to lay out a more comprehensive and more realistic[17] view of the process of design building on insights from research into the social shaping of technology (particularly in relation to ICTs) and the emerging social learning perspective.

We have criticized the 'design fallacy' and the common presumptions of user-centred design and major currents within social shaping and constructivist analyses of current design, which see a solution to shortcomings in current design practices in terms of 'building in' to artefactual design an increasing body of knowledge about the requirements of diverse specific users.

The design-centred model is criticized on the grounds of theory and practice: on the one hand it provides a simplistic and unrealistic stereotypical account of the design process; on the other, it overlooks important opportunities for intervention and improvement in design processes if a design-implementation life-cycle model is adopted. In particular we argue against the model of design as an inductive process of accumulating ever more information about current user requirements. Recognition of the complexity and diversity of user settings does not necessarily imply that technological design will or should be entirely shaped around the accumulated detailed needs of particular users. When design is viewed in its broader context of multiple overlapping cycles of design–implementation–use, we see many routes for matching evolving technical affordances against emerging usages/user requirements in addition to merely contributing to prior technological design. The way in which technological development may cater for different social purposes and players is equally complex. Thus, in addition to designing specific requirements into artefacts, there may be a need to 'design out' references to specific users/contexts of use in the creation of generic solutions. This process of making a product generic may well be at the expense of meeting the specific requirements and relevances of particular users – indeed, the creation of standardized mass-market solutions may exclude many in favour of the majority (Pollock et al. 2003). In some circumstances this may not be problematic. We must bear in mind that many of the most successful ICT applications in recent years have been media and communications technologies (e-mail, mobile telephony, SMS, the internet and the world-wide-web) which make few presumptions about the kinds of activity being supported. This is one of a number of paradoxes surrounding design that need to be resolved in particular design episodes – between making designs specific or generic; standardizing and providing unique solutions; prefiguring user requirements and keeping artefact design and usage open; between matching current practices and considering future extensions.

Increasingly sophisticated methods are being adopted to obtain more robust evidence about users' requirements – through direct knowledge of specific proxy 'users'; and through forms of social learning in more or less natural contexts of use. The importance of these more naturalistic sites of social learning is demonstrated by the explosion in social experiments and technical trials in new ICT applications. However, design must confront the inevitable metaphorical leap in creating a representation of 'the user' in a context of incomplete information about current users and their requirements (let alone future users who do not yet exist).

The social learning perspective being developed opens up our understanding of the innovation process. It offers some cautious grounds for optimism, in place of the pessimism of the design-centred account, for a range of avenues for improvement in practice rather than merely one rather prescriptive route. It draws attention to the multiplicity of sites and spaces for intervention:

- involving different avenues and kinds of activity;
- involving (directly and indirectly) a wider and more diverse range of actors including non-specialists;
- affording varying opportunities for influence, depending on the context and form of technology; and
- requiring various kinds of tools and support.

This exploration has offered some important insights. However, the challenge may be for a more systematic study of technology design and development (in its broad setting, encompassing multiple cycles of design and implementation), which has potentially important lessons for design and development.

Notes

1. This chapter is based upon a talk initially presented at The European Association for the Study of Science and Technology (EASST) 2002 (York, 1 August 2002). An earlier version appears in Harald Rohracher (ed.) (2005), *User Involvement in Innovation Processes: Strategies and Limitations from a Socio-technical Perspective*, Munich: Profil-Verlag.
2. The SLIM project was funded under the Targeted Socio-Economic Research programme of the European Commission Fourth Framework Programme (Contract 4141 PL 951003). Some findings appeared earlier, notably in van Lieshout et al. (2001). The main findings are published in Williams et al. (2005). We are grateful to our European collaborators for their contribution to the ideas and material on which this analysis is based.
3. This was true also of some of the multimedia social experiments explored in the SLIM study, reported here, which had broader ambitions to be exemplars and fulfil certain social ambitions.
4. There are obvious limitations to the role of ethnography as a method for requirements capture; it is an expensive and slow method for data capture. Effective requirements capture and design is much more than the accumulation of knowledge of diverse user requirements; you could never carry out enough ethnography to create an all-inclusive

account of, for example, a large organization; nor could you simply induce a design solution from such a knowledge base. Effective design also requires generalization, based on some kind of accommodation, satisficing and prioritization between the specific requirements and preferences of multiple individuals and groups. The undoubted strength of ethnographic methods is in picking up and providing insights into the intricacy of work contexts and practices at a level of detail which does speak to design. However, in most circumstances its role can only be as a resource to deepen other methods of requirements analysis rather than as a primary requirements capture methodology.

5. Mackay et al (2000: 737–57 note 18) draw attention to the diverse formulations that Woolgar has deployed for configuring which include defining the identity of future users and setting constraints upon their likely future actions (Woolgar 1991: 59 note 17).
6. We use the concept of 'narrative bias' to refer to the shortcomings that have characterized much writing in this domain in which certain elements and issues are pulled into the foreground, and others downplayed, to produce a stylized and simplified story which seems to hold a certain narrative compulsion to that group. Particular (sub)disciplines seem to favour particular types of narrative (for example, the demonization of designers). Often this serves to augment the perceived social significance and centrality of the locales and actors under study.
7. In mass consumer products, consumption is far removed in time and space from development. The small number of case studies where design and implementation are both addressed are almost always those of the development of specific IT applications – in which designer and organizational users are part of a linked institutional nexus (as well as our own work, Williams et al. 2000, 2005, see, for example, McLaughlin et al. 1999; Mackay et al. 2000). Following on from this, many studies of design have been snapshots, focusing upon the activities of designers and underplaying the extent to which design operates as part of a broader process involving commercialization, implementation and application and feedback into future design/development.
8. We are influenced here by work from organizational studies (for example, on 'organizational learning', Schon 1983) and elsewhere which has emphasized the adaptive and reflexive capabilities of actors.
9. Indeed, the development of configurational technologies is now so pronounced that it is difficult to find examples that correspond to Fleck's (1988b) counter example of *system technologies.*
10. This is, of course, a very different model of user input to design and development than the conventional concept of users contributing to the specification and design choices around specific technologies (component or whole applications). It is, however, a model in which the user is able to exercise considerable influence over the final designed system.
11. While designers think of the user through the 'lens' of a technical artefact, others may have different understandings of these people – as customers, clients, patients, citizens, ratepayers – not revolving around technology systems.
12. Users may find additional benefits from adapting to standard offerings – notably various network externality benefits from the interoperability of standardized technologies – including, for example, the greater availability of skills to maintain and use a package.
13. As might be inferred by Latour's (1988) portrayal of technical specialists as *Modern Princes* ('Sartrean engineers') acting with a high degree of autonomy.
14. Dan Shapiro and co-workers have deployed Levi Strauss's concept of *bricolage* to describe this process (Büscher et al. 2001).
15. The latter study was undertaken for another EC project on Strategies for Inclusion, Gender and the Information Society (IST 2000 26329 funded under the Information Society Technologies Programme). SIGIS seeks to understand how design and development choices may exclude certain actors (focusing in particular on the gender dimension) and in particular what strategies might promote social inclusion.
16. This does not mean, of course, that there was no scope for social learning and experimentation in the more technically focused projects. For example, the SLIM portfolio of cases included a number of projects that were primarily concerned to develop and test a new technical infrastructure. However, there is a sense that technological objectives have taken first

place, and only after they have been realised has space emerged for experimentation about usages (for example, in the above cases, about educational objectives). The presumption that the technology would provide a solution *per se*, meant that users have had to grapple with the constraints and affordances of new technologies under circumstances of use and according to the parameters configured in design. However, this testing has required the implementation of particular applications to run on the infrastructure and presumptions. Some form of user experimentation has needed to take place even though this had, to some extent, to be 'smuggled in' (Jaeger et al. 2000).

17. We seek a realistic understanding in the sense of a more intricate account and one that presents a more adequate account of design/development practice that might, for example, be recognized by practitioners. We have sought to avoid the pitfalls of 'narrative bias' described earlier.

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