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User Assemblages in Design: An Ethnographic Study

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Abstract

This thesis presents an ethnographic study of the role of users in user-centered design. It is written from the perspective of science and technology studies, in particular developments in actor-network theory, and draws on the notion of the assemblage from the work of Deleuze and Guattari. The data for this thesis derives from a six-month field study of the routine discourse and practices of user-centered designers working for a multinational microprocessor manufacturer. The central argument of this thesis is that users are assembled along with the new technologies whose design they resource, as well as with new configurations of socio-cultural life that they bring into view. Informing this argument are two interrelated insights. First, user-centered and participatory design processes involve interminglings of human and non-human actors. Second, users are occasioned in such processes as *sociotechnical assemblages*. Accordingly, this thesis: (1) reviews how the user is variously applied as a practico-theoretical concern within human-computer interaction (HCI) and as an object of analysis within the sociology and history of technology; (2) outlines a methodology for studying users variously enacted within design practice; (3) examines how a non-user is constructed and re-constructed during the development of a diabetes related technology; (4) examines how designers accomplish user-involvement by way of a gendered persona; (5) examines how the making of a technology for people suffering from obesity included multiple users that served to format the designers' immediate practical concerns, as well as the management of future expectations; (6) examines how users serve as a means for conducting ethnography-in-design. The thesis concludes with a theoretically informed reflection on *user assemblages* as devices that: do representation; resource designers' socio-material management of futures; perform modalities of scale associated with technological and product development; and mediate different forms of accountability.

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List of Abbreviations

AAA	American Anthropological Association
ANT	Actor-Network Theory
BMI	Body Mass Index
CAD	Computer-Aided Design
CDC	U.S. Centers for Disease Control and Prevention
CSCW	Computer Supported Cooperative Work
DEP	Digital Exercise Prototype
GUI	Graphical-User Interface
HCI	Human-Computer Interaction
ICT	Information & Communication Technologies
JAD	Joint Application Design
KMS	Kitchen Media System
MSB	Multi-Modal Sensor Board
PD	Participatory Design
RAD	Rapid Application Development
SCOT	Social Construction of Technology
SSK	Sociology of Scientific Knowledge
STS	Science and Technology Studies
UBICOMP	Ubiquitous Computing
UCD	User-Centered Design
UCDG	User-Centered Design Group
WHO	World Health Organization
WIMP	Windows, Icon, Menu, Pointing device

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Finally, I would like to dedicate this thesis to the memory of my father, James Morrison Wilkie, and my brother, David Morrison Wilkie.

Chapter 1.
Regimes of Design, Logics of Users

Introduction

This thesis is an ethnographic study of the many ways in which 'users' are employed in the practice of user-centered design (UCD).[1] I take the perspective of Science and Technology Studies (STS) to examine how users mediate the relations between the social and the technological during the application of UCD principles in the corporate setting of a multinational microprocessor manufacturer. Thus it is a study of the routine and practical techniques by which designers enrol, mobilize and deploy users in order to assemble novel Information and Communication Technologies (ICTs). I explore how users are involved in the material, aesthetic and technical innovation practices of designers, which contribute to the production of social and technological futures. The central argument of this thesis is that users are assembled along with the new technologies whose design they resource as well as with new configurations of socio-cultural life that they bring into view. Accordingly, I examine how designers mobilise people who live in North America and the ROW (Rest Of the World) to envision users and collectives coping with chronic diseases, managing health and fitness regimes, coordinating family digital content, and how they are electronically sensed as they go about their daily routines. In doing so I also describe how design practices are allied with the application of social science within industry and entangled in the economic strategies of a multinational semiconductor manufacturer and dominant ICT innovator.

In this chapter, I orient the reader toward the research in hand, its sociological relevance and the questions and associated arguments I develop in this thesis. In doing so, I demonstrate how this thesis connects to, and builds upon increasing engagements within sociology and social theory with design as an inventive practice concerned with the production of novel configurations of people and technology. Here, the growing prominence of design in the imagination of government and corporations, whether in relation to public service provision, democratic processes, policy futures or consumer markets indicates a key development in how science and technology permeate everyday life. I outline how this connects with longstanding debates within STS emphasising the role of the user in the construction of scientific facts and technological objects. Furthermore, I point to how my analysis of UCD contributes to a growing body of literature within STS concerned with how

[1] Throughout this thesis I use the American English spelling 'centered' given its prevalence, over the UK English spelling, in design discourse when referring to user-centered and human-centered design.

different, and often competing, social and technological futures are designed and managed in the present. In doing so I demonstrate how this thesis also contributes to emerging perspectives of UCD (e.g. Shove et al., 2007: 132) as a relational practice in which various kinds and forms of users participate in the making of complex artefacts and experiences endowed with qualitative and affective traits. I draw this chapter to a close by providing an overview of the thesis, outlining the content and the development of my research questions pursued through empirical argument and theoretical reflection.

This thesis entails three principal empirical tasks with which I open up a core set of research questions and arguments relating to the role of users in UCD. The empirical tasks are as follows: (1) to trace the diverse forms and uses of the 'user' in user-centered design processes; (2) to examine how, in design practice, different and multiple versions of the user are brought into being and managed in relation to the invention and development of ICTs; (3) to identify the conditions under which the multiple versions and meanings of the 'user' are accepted or discarded. In sum, these tasks structure my empirical work and provide a basis for my examination of the involvement of users in UCD practices and the construction of visions that are at once social and technological.

Two key and interrelated insights derived from STS set the context for my research questions. The first states that user involvement in user-centered and participatory design processes includes more than simply humans as 'active' participants (Callon, 2004: 4). This approach to user-involvement is what John Law calls 'materially heterogeneous' (1994: 2) and recognises the participation of both human and non-human actors in UCD processes. The second insight, based on developments in actor-network theory (ANT), is that users themselves are occasioned in the design process as social and technological *assemblages* that operate to serve and mediate multiple and divergent interests. Thus, in following STS scholars who have argued that technical objects are heterogeneously composed unities of interoperable elements, this thesis seeks to address how on the one hand the rhetoric of UCD maintains distinctions between the human and the technological whilst in practice it is unreservedly engaged in the production of complex entanglements of the two. At the core of such entanglements is the figure of the user as a pivotal actor in technological development that is literally and theoretically situated at the interface between the social and the technological.

Accordingly, the following research questions arise from the empirical tasks outlined above: (1) how and in what form are users enacted in UCD practice? (2) What and whose interests do users serve to mediate and how? (3) What forms of prospective people-technology configurations emerge and are deemed eligible in UCD practice?

Formulated as such, my research questions prompt me to follow a series of empirical and analytic directions in which I study the diverse identities, capacities and roles of users mobilised in design practice. In addition, I explore the varying relations between users,

designed artefacts and designers' anticipation of future everyday practices. This brings me to a re-examination of critical questions concerning the politics of user-centered design. These, I am persuaded, concern the merger of the human and non-human where new actors are brought into being with specific characteristics, new capacities for action, new ontologies, new logics and rationales irreducible to categories such as person-user and technology (e.g. Latour, 1988b; Foucault, 1991; Latour, 1991b; Hutchins, 1996; Berg, 1998). Clearly, then, the contemporary application of UCD provokes questions that are familiar to STS (e.g. Berg, 1998; Garrety & Badham, 2004). And yet, at the same time the uptake of UCD principles and methods for the fashioning of consumer commodities, government services, the built environment, workplace infrastructure, and medical technologies suggests that these questions require reformulation and re-examination. In this context, the pervasiveness and agency attributed to design to change and inflect the material and qualitative circumstances of everyday life signals what might be characterised as a *regime of design* (Marres, 2009: 126).

This thesis, then, examines users enacted in design processes as multiple in identity and composition and as such I investigate their various capacities to act, not limited to the representation of pre-existing persons and collectives. It is also about the extent to which the involvement and deployment of the user enables the enactment of futures within UCD, and how, as an upshot, people and technologies are made to count in the present.

Formative Preambles in Design and Sociology

This thesis has a back-story in my training and professional engagement as an interaction designer, beginning at the pioneering Computer Related Design masters programme at the Royal College of Art in the late 1990's. The research questions and arguments outlined above and discussed in detail in the following chapters emerged, for me, out of the intersection of developments in the design of computer technologies and ongoing debates concerning the role of design and the designer therein: how, that is, interactive devices for use in everyday life should be brought into being in relation to the desires and needs of people. During this time I was witnessing the expansion of the Web as a site for commercial, cultural and political activity (e.g. Rogers, 2000) and the increasing inclusion of computational technology into the objects and spaces of everyday life, for example mobile computing and communications, domestic appliances and entertainment devices, interactive museum exhibits and so forth. Furthermore, the demands of my education and professional practice were that I, myself, design novel social and cultural applications for computational technologies afforded by such contemporary developments. Thus, I was trained and employed to participate as an interaction designer in the production of novel interactive technologies (for example: experimental search engines, data-base driven web sites, mobile phone software and data services, so called 'social software', wearable technology, trade show exhibits, online

marketing, and workplace 'soundscaping' devices) in which various understandings of people, society and technology were made to matter. As I would later discover, my proficiency would prove to be instrumental in identifying the topic of this thesis and gaining access to the field site where I conducted an ethnographic study of design practice.

One way to include people in the design process, and perhaps the most prominently advocated and commonly applied, is to identify and gain knowledge on who the prospective user might be and model the interactive, material and aesthetic qualities of the design on understandings of their circumstances and capacities. Although user involvement and participation in the design of technology has its roots in efforts to implement democracy in the workplace, as discussed in detail in the following chapter, its uptake in economic and public policy and its pervasiveness in corporate R&D and marketing activities is instrumental in rendering new relationships between, but not limited to: government and citizens, brands and consumers, patients and the provision of healthcare. Currently, the active and creative capacities of people-as-users are harnessed to inform, evaluate and stimulate people in affective relationships and economies.

There were, however, radical and competing versions of the putative user and their aesthetic experience, based by and large on particular disciplinary lineages in design that were converging in interactive design, for instance: industrial and product designers interested in the physical and embodied capacities of people; graphic designers concerned with people's symbolic and linguistic reasoning; as well as architects exploring users in social and spatial conditions. Although critiques of existing conceptualisations of people – as users – in design argued that people were reduced to 'cognitive clarity' (i.e. Dunne, 1999: 23), the alternative models of users proposed seemed to me equally reductive. Here, for example, Dunne's commentary on human-factors and user-friendliness, as the generalisation and simplification of people and interactive artefacts in order to optimise and rationalize efficient interactions between people and computers, calls for an understanding of people as qualitatively social and cultural actors. However, the alternative models (see also: Margolin, 1997) in which people were conceived in equally humanist terms with innate faculties such as interpretive skills, psychological needs and desires seemed to mirror, if not extend, the very user-model being criticised. That is to say, Dunne offered an understanding of subjectivity that advanced an equally outmoded and essentialist and humanist view of users. In other words, Dunne viewed users as antecedent to and separate from technology despite post-structuralist trends within social theory, not least prior sociological developments within HCI itself. In addition, this view of users as qualitatively and psychologically complex, which designed artefacts supposedly respond to and enhance, inadvertently paralleled the contemporary role of design as understood and articulated in recent social theory. Here, design is viewed as an endeavour pre-occupied with enriching the qualitative experience of commodities – as engaging objects –

for economic advantage. Such debates in design, however, did alert me to the emphasis placed on the user – a figure that lies at the nub of contested and divergent views on the role of design and designed artefacts so pervasive in everyday life.

Regimes of Design, Logics of the User

Meanwhile, social theorists were starting to acknowledge the critical role played by design and interactivity, pointing to their increasing importance in everyday life characterised by developments in science and technology. In the context of a renewed interest in contemporary forms of capitalism (e.g. Boltanksi & Chiapello, 2005) design is understood to play a critical role in the creation, production and staging of commodities (Callon et al., 2002; Thrift, 2005; Thrift, 2008), brands (Lury, 2004), services, and scientific knowledge in the public domain (Barry, 2001) as well as its increasing prominence in economic policy. Central to such accounts is the role of innovation and creativity in producing *affective* objects and the active role of the people as a resource employed in such creative and inventive practices. One example of this is Thrift (2008: 39) who speaks of the design of consumer products as 'sensory design' where commodities are made to appeal to and entangle consumers via multiple material, visual and sensational registers. Moreover, Thrift (ibid. : 40) also recognises the increasingly important emphasis placed on 'user-centered innovation' in commercial product development. Interaction design, in this light, is redefined from a nascent discipline concerned with designing computer interfaces, to a contemporary design regime wherein commodities make available all kinds of sensual, material and semiotic interfaces between brands and consumers' everyday practices over and above instrumental and functional pre-requisites. On this score, the management consultants and experience economy boosters Pine and Gilmore (1999) narrate a plethora of experience commodities including Nike sneakers, Intel Chips, the revamped Volkswagen Beatle, Harley Davidson motorbikes and soft drinks such as Coco-Cola as exemplars of commodities enriched with qualitative properties, experiences and service infrastructures. For Pine and Gilmore the aim of such commodity qualification is the maximisation of revenue and economic value and the chief instrument of experiential enhancements is design in its various specialisations.

Similarly, for Callon et al. (2002), design now exists at the heart of economic activity. Here, the importance and prevalence of involving consumers in product development, whether through users, consumers or market research clouds normative distinctions between, for example, production and consumption, supply and demand. Not only that, but the 'positioning' of products, that is, their placement in the market in relation to competing commodities and brands, also structures and classifies the end user. In such economic activities, design is insinuated right across commercial organisations (Callon et al., 2002: 212). Moreover, Callon et al. (ibid. : 213) argue that this economy of attribute matching, between

product and consumer, is especially prevalent in the delivery of ICT mediated services. In this context, UCD allied with various forms of qualitative research, most notably ethnography in recent times, has become a key approach to commodity development in general (Norman, 1988; Shove et al., 2007: 131; Barry et al., 2008; Thrift, 2008: 47; Cefkin, 2009b) and a widely accepted alternative to quantitative approaches in particular. Distinctive to design, then, is how it operates to bring together, or *synthesize*, different rationalities, for example qualitative market research, economic imperatives, as well as technological and material affordances in the production of commodities.

Rethinking Design with STS

My early encounters with STS, however, exposed me to very different accounts of conventional sociological registers such as 'society', 'people' and 'technology' that routinely operate in design discourse. Indeed, such distinctions are a central and contested topic of sociological and historical accounts of science and technology. With notions such as 'hybrid' (Latour, 1993) and 'hybrid collectif' (Callon & Law, 1995), 'cyborg' (Haraway, 1991) and 'co-agent' (Michael, 2000b) I was persuaded that design, rather than making better technologies in order to meet the 'natural' qualities of humans or making technologies that impact and drive social relations is, in fact, a practice in which people and technology are mutually reconfigured with new identities and new capacities. In short, humans and technology elaborate one another in practice. Two implications arise here: first, that humans and technology are mutually bound in defining one another and cannot be separated, purified (Latour, 1993: 5) or bifurcated (Halewood, 2008: 2) into pre-existing and independent categories. What counts as the human or the technological are outcomes of design practice, not pre-conditions. Second, the building of new technologies is a thoroughly social process and vice-versa: technologies do not 'impact' society and people – both are mutually elaborated, hence terms such as technoscience (Latour, 1988b: 29) and sociotechnical ensemble (Bijker, 1999: 12), underscoring their co-dependency and reciprocal dynamics. This, it struck me, was especially germane for UCD and the stress it places on meeting human needs and delivering empowerment. Following such moves, and henceforth, I use the term 'sociotechnical' to rhetorically insist on such combinations at work within UCD.

STS analyses of the dynamics of technological development as social processes provide two important insights concerning technological development and the nature of technological artefacts. Both insights have profound implications for understanding design practice and understanding the material-semiotic resources and outcomes of design. In terms of design practice, STS taught me that technological objects emerge through the interplay of innovators, designers, institutions, stakeholders, users as well as technologies, discourse and practices. In other words, necessary to the doing of design is the doing of social and technical

innovation, and the participation and association of heterogeneous actors: either human, in the form of urban planners, engine designers, inventors and industrial designers; or non-human, in the form of highway underpasses, diesel fuel, electricity, laboratory equipment or the properties of synthetic plastics. In short, design, as in science and engineering, where facts and machines are built, is a collective and constructive process.[2] In this way the 'design' of an electric vehicle (Callon, 1986a) necessarily includes the visions, competencies, efforts and co-operation of a host of parties with varying interests, including, but not limited to: an electricity supplier, a car manufacturer, a government ministry writing favourable legislation, an engine and transmission producer, batteries, electrons to produce electrical current and end-users mobilised through the issue of pollution.

The second insight is that technical objects themselves are networks composed of interoperating elements. When technological objects work, as assemblies, they operate as a single unit: a 'black box' (Callon, 1986a: 29; Latour, 1988b: 2), the contents of which remain unproblematic and out of sight. When artefacts break down, however, black boxes are opened and their inner workings are exposed and scrutinized. Furthermore, this approach to objects is also extended as a post-humanist and relational view of people. Like technological objects, people are also viewed as combinations of the human and the technological that combine in practice and in particular settings, something scholars interested in design have started to address (Berg, 1998; Danholt, 2005a).

In sum, I am persuaded that these insights are crucial for understanding UCD. They insist that we pay attention to design practice, the objects of design practice, *and* users, as relational and heterogeneous. Moreover, insights from STS also point outside 'design practice' narrowly conceived, and its place within contemporary institutional, economic and policy settings. This stands in stark contrast to design literature which has been primarily preoccupied with historical meta-narratives and conditions such as 'modernism' (Pevsner, 1960; Mumford, 2000) and 'post-modernism' (e.g. Thackara, 1988) and their inter-relations (Whiteley, 2002, pp. 246-307), the history, criticism and evaluation of cultural objects (Fuller, 1988; Woodham, 1997), the meaning and function of the built or designed artefact (Heskett, 1980), biographies of gifted individual designers (e.g. Frampton, 1980; Sparke, 2010), the social and cultural contexts and impacts of industrially produced artefacts (e.g. Pevsner, 1960; Forty, 1986; Whiteley, 1993; Papanek, 2006) or the theories and discourse of designers (e.g. Banham, 1962; Margolin, 1989b) in how they conceive and frame the meaning of design and the designed artefact. [3] There are, of course, exceptions and design scholarship has tentatively reached out to STS: for example the Design Issues symposium (Woodhouse & Patton, 2004),

[2] I am paraphrasing Latour (1988b: 104) who likened fact building to rugby, evocative of Michel Serres' reported enthusiasm for the sport.
[3] For a somewhat outdated survey of design history literature see (Dilnot, 1984b, 1984a).

following a project at the Rensselaer Polytechnic Institute to develop 'An STS Focus on Design'; and the 2008 annual International conference of the Design History Society, entitled 'Networks of Design' (Glynne et al.), which addressed ANT in particular.

Despite the strengths of sociological and historical accounts of technology, as a trained and experienced interaction designer two weaknesses troubled me. Firstly, STS's detailed examinations of technological development tended to underplay the role of design, reducing it to an adjunct of engineering.[4] For instance, in the design of electric vehicles, the introduction of CAD software into the visual culture of engineers (Henderson, 1991), or the design of ICTs (Akrich, 1992a) STS had very little to say about the role and import of design as a discrete discipline with a legacy in the arts and crafts. Only recently has STS, and indeed sociology more broadly speaking, demonstrated a sustained interest in the role and practice of design in, for example, accounts of economic activity associated with product development (Callon et al., 2002), architectural design (Yaneva, 2009b) and product design (Molotch, 2003; Verbeek, 2005; Shove et al., 2007). Noteworthy, here, is how Callon connects up STS, economic sociology and design as glossed above. The second weakness concerns design as an anticipatory mode of practice where efforts and activities are oriented towards future social change and times to come; that is to say, in providing histories of the present, STS, until recently, neglected the future as an empirical and conceptual possibility. In the following section I outline the relevance of growing interest in the social sciences with anticipation and expectations in the form of discourse and practices associated with prediction, risk and optimization and how this relates to design practice, in particular UCD.

Expectations and Anticipation

As literature in the sociology of expectations shows, innovation and invention in science and technology are tightly bound up with and profoundly structured by efforts to know and manage the future, with times to come. On this score, scholars have started to address the temporal aspects of contemporary life, whether it be the hopes and expectations associated with novel scientific developments such as biotechnology and genetic engineering (e.g. Brown, 1998; Brown, 2003; Brown & Michael, 2003; Brown & Kraft, 2006), the institutional deployment of formal future forecasting techniques such as Foresight and Delphi (Brown et al.; De Laat, 2000), the speculation and development of commodities for future use (Deuten & Rip, 2000), the financial commoditisation of the future (e.g. Beunza & Stark, 2004; MacKenzie, 2006: 13), or the identification and indemnification of risks and uncertainties associated with modern industrial society (Beck, 1992). Accordingly, the future and

[4] With perhaps the exception Langdon Winner's (e.g. 1986: 28) eye for the specificity of design features in, for example, the built environment and industrial machinery, Wiebe Bijker's (1995) discussion of the efforts of industrial designers in shaping the success of Bakelite, Madeleine Akrich's (1995) study of modes of user representation and feminist accounts of civic web site development (Rommes et al., 1999) and grooming products (van Oost, 2003).

temporality are 'told, traded, tamed and transformed' (Adam, 2005: 1). This burgeoning field of interest not only addresses the prevalence of discourses of risk, reflexivity and uncertainty in western societies in general but the way in which expectations work in the present to actively shape sociotechnical futures that in turn shape the grounds and possibilities of the present (see Michael, 2000a).

Such work has struck me as particularly salient in relation to the study of design – a practice manifestly concerned with proposing, inventing and disseminating novel sociotechnical artefacts, inducing new everyday practices. As for this thesis, expectations are also constructed and negotiated though the figure of the user as, for example, deployed in policy discourse (Wilkie & Michael, 2009). In this respect, UCD is a particularly interesting practico-theoretical enterprise through which futures are modelled, contested and managed around competing versions of the putative user (ibid.: 5). Here, for example, path-dependencies rhetorically constructed around technologies, such as microchip development typified by Moore's law, intersect and jockey with the figuration of futures in human-centered design discourse. In this way the application of UCD will also be explored in relation to tensions enacted in discourse and practice between expectations shaped by technological and social dynamics. Furthermore, my attention to design practice and its production of anticipatory and speculative objects, such as visualisations, personas, prototypes and mock-ups will add a material dimension to literature on expectations which has primarily addressed futures performed in discourse, broadly framed. Thus, in this thesis I will explore how the various models of users deployed in UCD practice operate in the construction and management of sociotechnical expectations. Here, I examine the valence of the user in relation to how practices of knowing the future (epistemology) and equipping the future (ontology) are entangled and synthesised in the practice of design.

Invention, Innovation and Creativity

Three interrelated notions – invention, innovation, and creativity – lie at the heart of the contemporary concerns about the dynamics of technological development and design. This is evidenced, not least, by sustained policy preoccupation with stimulating the connections between 'creativity', industry and research in order to promote economic development. In the UK, for example, The Department for Culture, Media and Sport envisions the UK as the 'world's creative hub' and works in partnership with public and private organisations, such as the UK Design Council and NESTA (the National Endowment for Science, Technology and the Arts) to advocate the importance of design in industry.[5] Here, the practice of UCD, as applied in corporations such as Intel, is viewed as essential, as the authors of a Department of

[5] See http://www.culture.gov.uk/what_we_do/creative_industries/default.aspx. Date accessed: March 12th 2010.

Trade and Industry Report insist: "We urge all UK technology companies to put PCD at the heart of their R&D and innovation activities and promote a people-centred culture throughout their organisations." (Wakeford, 2004: 5).[6] This reflects broader international policy preoccupations with the economic harnessing of creativity by, for example, the United Nations (2008: 357).

With such notions too, I find recent STS accounts of invention and innovation particularly insightful and useful. In STS accounts, the dynamics of technological development are empirically detailed as distributed across the efforts, competencies and affordances of both human and non-human actors. Thus, invention is a collective (human and non-human) effort that is contingent, path-dependent and irreversible (Barry, 2005: 54). This, as Barry argues, has the following implications. First, invention includes the active participation of materials and substances. Thus, the conventional understanding of society is broadened to include how non-humans operate in the dynamics of innovation. Design, like the natural and applied sciences, invents new composites where prior innovations are combined with novelty. Invention is therefore also about association. In this way the notion of invention recasts the notion of innovation from a linear process of development (Godin, 2006) to a repetitive process of iterative transformations that work to open up new possibilities rather than close-down the trajectory of development (Barry, 2005; Barry & Thrift, 2007). This understanding of inventive practice and the dynamics of technological change points to how change is not a 'natural' progressive and sequential procedure that is correspondingly allied with the accumulation of knowledge (Lepinay, 2007: 530).

Such a view has radical implications, which have, in part, been programmatically addressed in scientific practice and technological development. As Latour (1988a) has forcefully argued, Pasteur neither discovered nor invented microbes. Rather, the interactions between Pasteur and all the resources and allies such as politicians, hygienists, laboratories, experiments, cattle and bacilli themselves worked to transform microbes from entities to qualified things with definite and stable attributes. Thus, to assign authorship to the figure 'Pasteur', or to credit the natural capacities of microbes, conceals all the complex interactions as well as the participation of numerous actors, both human and non-human. The implications of these arguments for design are plain to see, whether through the author function (Foucault, 2000) that continues to operate with such figurative force in design discourse or accounts that attribute historical changes in aesthetic form to purely social change or outcomes credited to developments in technology and industry. Moreover, the recognition of non-human factors and distributed authorship in design provides a way to overcome debates concerning how to attribute agency in UCD. Inventive and creative

[6] Here, 'people-centered design' (PCD) refers to user involvement in design processes.

agency, in this regard, is not attributed to nor concentrated in the individual designer, putative users or technology.

Doing Politics by Other Means

Last but not least, in this thesis I address how contemporary user-centered and participatory design practices re-connect with the doing of politics. The involvement and participation of users in the design of information and computer systems can be understood as a committed political undertaking in some approaches and as displaced or implicit within others. As I examine in detail in the literature review that follows, UCD's genealogy includes early efforts of instituting democratic workplace reform alongside the introduction of new industrial and organisational technology and work practices. Scandinavian 'Participatory Design', for example, included the fabrication and evaluation of material prototypes, which served to mediate negotiations between designers, users and stakeholders. Thus, the insight that the doing of politics is a pragmatic and material process involving non-humans is already ingrained into the imagination of participatory design and the nitty-gritty of its procedures. What counts here, however, is the application of different conceptions of people, mediated by users and formatted by the mode of politics being conducted. Bearing this in mind, UCD itself was originally advanced as a formal and experimental method for privileging intrinsic human qualities, such as goals and intentions, in the face of purportedly inhuman computer technologies. Latterly, these different approaches to user involvement converged, in part through the import of social theory, under the banner of UCD.

In the context of recent STS scholarship, in which politics is being thought anew in light of the recognition that non-humans – as material and semiotic actors – operate in the doing of politics, the practice of design, and UCD in particular, can be re-assessed as an enterprise through which dominant innovation actors, including multinational corporations, make eligible particular sociotechnical modes of being, at the expense of others. This attention to *being*, *agency* and the *material* is understood, following Mol (1999; 2003), as *ontological politics*. Here, the questions and problems shift from 'who' gets to be represented in deliberations over rightful outcomes, such as patients electing what counts as good care, employees contributing to the specification of their workplace technology, or for that matter consumer consultation in product development to critical questions addressing what new modes of sociotechnical life are brought into being and what unities and co-functioning of human-technology are eligible to participate in such futures.

Clearly, then, a study of UCD practice must confront how politics are locally and practically applied. In the above I have indicated how such politics link up with current concerns within the social sciences, for example contemporary concerns with economic life, developments in the politics of technology and the politics of anticipation (Adams et al., 2009).

Empirically, I address these issues through examining how multiple forms and modes of users are enacted in practice during the development of interactive consumer and medical technologies and during an industry conference in which differing accounts of users featured.

Thesis Structure

In this thesis, I develop the research questions and arguments introduced above through four substantive case studies drawn from my ethnographic fieldwork. In each case I consider different aspects of and intersections between user involvement, socio-material practices and expectation discourses. Each case study provides a different empirical object associated with and featuring user involvement, broadly framed. By way of preview, the case studies include: an ethnographic interview and related innovation meeting which were both part of designers' efforts towards inventing a new telemedicine technology; the role of a persona during the development of an information system for the kitchen; user involvement in the design of a prototype to encourage and manage fitness routines, and finally; an industry conference in which accounts of users mediate the doing of ethnographic user-studies in design. Prior to presenting the substantive material I examine the sociological context for this study and I provide and account for my theoretical and methodological approach.

In chapter two, I review how the user is variously conceived in both HCI and STS, given that both inflect and inform one another. Accordingly, this chapter is structured into two sections: a review of HCI and UCD literature tracing the various conceptions of the user in relation to the development of computer systems, and a more lengthy review of the various approaches to the user in STS literature. I summarise UCD as a practico-theoretical development within HCI where early 'cognitivist' models of the user have been challenged by 'sociological' and 'anthropological' approaches. Furthermore, I demonstrate how this move in the conception of the user coincided with a turn from workplace and organisational reform through the introduction of new technology to technological use in broader cultural settings. With regards to STS literature on the user I summarize five key approaches within the sociology and history of technology in which the role of the user is implicitly and explicitly examined in both the development and consumption of technology. The approaches include: (1) The Social Construction of Technology (SCOT) where the fate of artefacts is closely tied to the meanings attached to them by end-users; (2) the view that the capacities and identity of the putative user are semiotically inscribed into technologies during the design and development to be 'read', subsequently, by the end-user; and (3) studies inspired by and related to ANT in which the user is materially and semiotically entangled in and performed through heterogeneous networks of humans and non-humans during both the development and end-use of technology; (4) the work of feminist scholars of technology who have brought attention to the underrepresentation and active involvement of women during the design,

production and consumption of technology, most notably domestic technology, which points to other lacunae within user studies such as race; (5) the work of media and cultural theorists who have examined the way in which domestic users actively consume and culturally appropriate media and communication technologies and in doing so become linked up to ideological processes. In conclusion I expand on the conceptualisation of UCD as a mode of doing politics and as a form of socio-material experimentation, which serves to prepare the ground for the three key interconnected arguments that I pursue in this thesis.

In chapter three, I present my methodological framework for studying design practice and the enactment of users in the field. The chapter is structured in the following way. First, I introduce the organisational setting in which I conducted an ethnography of designers and users in order to ground my empirical work. Second, I discuss the key principles for conducting an ethnographic study of designers and the enactment of users within UCD processes. I identify correspondences between ethnographic accounts of users within STS (i.e. Woolgar, 1991a; Akrich, 1992b) and draw out a set of key methodological assumptions for following designers' practice and studying the situated enactment of users encountered as multiple, heterogeneous and emergent. Finally, I present a detailed description of my fieldwork methods including participant observation, document analysis, photography and ethnographic interviews. Here, I discuss the methodological issues and challenges I faced in participating in and studying design practices and user involvement within the context of a multinational corporation.

In chapter four, the first empirical chapter, I examine the role of a non-user in mediating the expectations of the design team tasked with inventing and designing a novel mobile health technology to enhance the management of a chronic disease. I trace how user-involvement was enacted in the form of an ethnographic interview conducted with an elderly man suffering from diabetes amongst other health conditions. I examine how data derived from the interview was employed by the design team to evaluate product opportunities associated with interactive enhancement of diabetes. Two principle observations follow from this. First, that user involvement included obtaining a 'thick' account of a diabetic situated in his 'natural' setting, occasioned as local and messily heterogeneous. Second, through the visual and material ordering of data derived from the interview the design team disentangle and re-order workable aspects of sociotechnical practice elicited during the interview. Treating the interview data as a diabetic user-assemblage, I argue that the design team were able to put to use features of a non-user during their evaluation of diabetes and its technological enhancement as a commercial prospect.

In chapter five, I examine how the design team brought into being and employed a persona representing a middle-class housewife during the development of an interactive system for the kitchen. Here, the representational practices of the design team come to the

fore in marshalling and combining pre-existing genderscripts as a means of including individual and collective users in their design activities. I demonstrate how this resources the specification, fabrication and demonstration of their vision of domestic computing to audiences whose continued support is crucial to the development of the technology. In contrast to conventional accounts of personas, wherein they are described as a-priori and discrete devices used to represent the requirements of a prospective user group, I argue that in practice the persona and the kitchen technology co-emerge. That is to say, both user and technology define one another through a process of iteration in which correspondences between the attributes of the persona and the features of the prototype are produced and managed.

In chapter six, I explore how multiple users resource the design and development of a prototype health and fitness technology. I approach the prototype as an assemblage of bodies, technologies and discourse that emerges out of collaborations between the design team and a research laboratory developing a novel mobile sensor. Heuristically, I organize the users involved in this project into two broad temporal categories. First, I define *distal-users* as figures that are explicitly articulated in the rational for the technology as representations of prospective users and user groups. Second, I define *proximal-users* as enactments of people (embodied and representational) mobilized in the present in order to discursively and materially format distal users situated in the future, including the designers themselves.

In chapter seven, I turn my analytic attention to the 'Ethnographic Praxis in Industry Conference' (EPIC) 2006. Here, I examine how the user served as a means for conducting ethnography-in-design as well as informing the conception and design of actual technologies, as discussed in previous empirical chapters. The central argument that I pursue in this chapter is how users *assemble* by way of various contradictory logics and tensions that exist at the intersections between ethnography and design. I address how empirical user-research in the design of ICT-related products and services is conducted under the auspices of 'ethnography' to meet the different demands of scholarly and commercial audiences and agendas. Accordingly, I analyse how users were discursively enacted as part of conference proceedings, including paper presentations and a workshop session. I identify and discuss three key interrelated tensions in conference participants' accounts of their work by which users emerge, including: (1) the interplay between realist reports of people and participants' reflection on the methods that are used to produce knowledge of users; (2) the relation between empirical analysis of users in their local cultural settings and the deployment of this knowledge to guide and manage future expectations more broadly; (3) the relation between, on the one hand, the study of particular socio-cultural-technical practices and, on the other hand, the use of abstract notions and concepts sensitising designers and organisations to sociotechnical life more broadly. To better grasp the multiple ways that ethnography and design relate I draw

on the image of the *rhizome* (Deleuze & Guattari, 1988: 6; Deleuze, 1993: 29) and employ the notion of the *ethno-user assemblage*. I describe the various engagements between ethnography and design as rhizomatic entanglements of practice and knowledge out of which different models of the user emerge. I conclude this chapter by reflecting on the nature of the user and consider the relevance of this chapter to the thesis as a whole, before moving on to the thesis conclusion.

In the final chapter, I conclude by summarising the main points of my empirically derived arguments and consider the implications for STS, the practice of user-centered and participatory design. Here, I return to sociological matters raised in this chapter. I argue that the contemporary application of UCD necessarily includes users as socio-material assemblages that are synthesised in practice. As such, users make available relational prospects between everyday practice, varying conceptions of people, emerging technology and corporate strategy. Thus, I detail how *design regimes* work by virtue of the discursive and material enactment of users throughout the design process. In so doing I return to the question of the politics of user involvement. I use the notion of user-assemblage as an analytic device to heuristically characterize different modes of user involvement to consider the assembling of new capacities for action to the exclusion of others. Accordingly, each chapter serves to examine in detail the various enactments of users and socio-material micro-politics at play in UCD. This includes the design of prospective everyday sociotechnical practices that are materially anticipated and envisioned, the disciplinary and career interests of innovations actors, as well as the strategies of an incumbent microprocessor manufacturer where such micro-politics are translated into the encoding of billions of microprocessors.

Chapter 2.
Users and the Confluences of HCI & STS: a Literature Review

Introduction

In 1965 Gordon E. Moore, co-founder of Intel, published an article in the journal 'Electronics'. In the article, Moore made the following observation concerning the development of integrated circuits:

> "The complexity for minimum component costs has increased at a rate of roughly a factor of two per year (see graph on next page). Certainly over the short term this rate can be expected to continue, if not to increase. Over the longer term, the rate of increase is a bit more uncertain, although there is no reason to believe it will not remain nearly constant for at least 10 years. That means by 1975, the number of components per integrated circuit for minimum cost will be 65,000." (Moore, 1965: 2)

This statement would later be recognised as the first example of what is now commonly known as 'Moore's Law'. The history and precise meaning of the term remain somewhat unclear, however it is generally accepted that Moore's Law describes an ongoing trend wherein the complexity, and therefore performance, of microprocessors (originally the amount of transistors on an integrated circuit) doubles over a fixed period of time (eighteen months to two years is commonly cited). The exponential rise in performance of microprocessors is widely held to be a determining factor of the continued development of contemporary ICTs, as well as the social 'impact' of computing technologies.

However, the emergence of the user as both an object of HCI, and analytic trope within sociological and anthropological studies of technology, can be understood as a response to determinist histories of technology, wherein somewhat natural laws, such as Moore's law, are seen to drive changes in society. According to Smith and Marx (1994: ix), technological determinism refers to the view that technology is responsible for changes in society. One example of technological determinism concerns the invention and diffusion of the stirrup, and how this can fully explain the emergence of feudal society (White, 1962). What technological determinism, in its various 'soft' to 'hard' forms (Smith & Marx, 1994: xii), ignores or downplays are the social conditions that contribute to technological change. I replay Mackenzie and Wajcman's argument (1985) to highlight persistent beliefs concerning the agency of technology and society, which remain deeply embedded in cultures of technological development in general, and sites such as the one I studied in particular. It also serves to set

the stage for the key perspectives and arguments on users examined in this chapter and explored through subsequent empirical material.

In this chapter I review how the user is variously applied as a practico-theoretical concern within HCI and as an object of analysis within the sociology and history of technology. I have organized this chapter into two sections. The first section addresses the user in HCI, and UCD in particular. By way of preview, this group of texts narrate how early 'cognitivist' models of the user have developed as well as being challenged and rejected in favour of sociological and anthropological ones, an issue I return to on page 56. In parallel, I also describe how early commitments to workplace democracy converged with micro-political engagements with human-machine interaction. In the following section I review STS literature where accounts of users feature in various stages of technological production and diffusion. I organize the STS literature into five key approaches, which have variously, and in my view successfully, challenged technological determinism by stressing the agency of users. The overarching narrative arc of this chapter delineates the confluences between HCI and STS perspectives on users. I highlight the import of sociological and anthropological conceptions of people and technology into HCI on the one hand, and on the other hand, STS's varying perspectives on ICTs and its relevance for studying design practice.

Through a series of theoretical insights derived from the two sets of literature, I highlight two implications that serve to set the sociological context for this thesis. My review of the literature therefore serves to open up a series of key analytic concerns that I address in this thesis. The first states that in design practice, users are enacted as dynamic assemblages of interests, technologies, knowledge and practical actions that work to reconfigure sociotechnical relations. Here, HCI and STS coincide with the understanding of the user as a complex and contingent socially situated actor. The second states that in design practice multiple and apparently incommensurable models of the user operate independently and cooperatively in the making of technological artefacts.

In conclusion, I discuss the reframing of the issue of user involvement based on the two implications above. Introducing the notion of *user-assemblage* as a key analytic lens, I argue that a study of users in design practice must respond to the following procedural questions: (1) how do users come into being? (2) How are they composed? (3) How do they operate? And finally, (4) how do users endure or not? Moreover, given the multiplicity of users at work in design practice, I argue that the analysis of users in UCD must also pay attention to whether and how such models co-exist: how, that is, different viewpoints and interests about society and technology, embodied by users, are managed, and, by extension how sociotechnical prospects are reconciled in the present. In this light, I describe a shift in how UCD is understood: from an implicit and explicit procedure for doing the politics of 'human' empowerment and representation to questions concerning the sociotechnical eligibility of emergent people-

technology configurations. Thus, the politics of user involvement moves away from early 'modernist' preoccupations with providing alternatives to technological determinism, equipped with essentialist definitions of the human, to micro-political engagements and prospective socio-material arrangements.[7]

Part 1: Users, Involvement and HCI

The involvement and representation of users in the design of ICTs has a long history, with multiple perspectives, lineages and agendas, sometimes like-minded but often incommensurable and discordant. Although a historical analysis of such developments is not my aim, in the following, I briefly summarise key approaches to user involvement in order to demonstrate varying conceptions of the user. In so doing I will examine the practical application of the user as a form of involving and representing people in the design process and its prominence in HCI discourse. Although UCD can be historically traced to particular disciplinary formations and concerns within HCI, it is now a term commonly used to denote user involvement in general, rather than a specific approach to doing user involvement. Moreover, as Asaro (1999) shows, user participation in the design of ICTs also intersects with two distinct post-war approaches to the development of workplace technology: a mainly North American approach exclusively concerned with information system development and a European commitment to industrial democracy.

The User in HCI and User-Centered Design

Presently, HCI covers a broad field of academic and industrial interests and activities associated with computer systems. HCI has many definitions (Baecker et al., 1996: 1) and it is broadly framed as 'a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them' (Hewett et al., 1992: 5). Thus, HCI was originally viewed as a 'science of design' (Carroll, 1997: 62). Recent surveys of HCI (Dourish, 2000; Dourish, 2001; Grudin, 2005; Bødker, 2006; Harrison et al., 2007) have identified three successive paradigmatic tendencies. Briefly, these include: (1) the human factors approach to man-machine interaction that seeks to practically and ergonomically optimise the fit between people and machines. Here, emphasis is placed on the physical form of ICTs and users understood as individual operators. (2) Human-machine interaction as the cognitive coupling of mind and computers as information processing units. Arguably, the user comes to the fore here as a construct of cognitive psychology engaged in the use of software interfaces. (3) Human-computer interaction as socially situated pointing towards the technological artefact conceived of as a

[7] See (Latour, 1993) for a discussion of the notion of the 'modern' including dualisms such as society and technology.

'socio-cultural-technical assemblage' (Barry et al., 2008: 36). This phase is broadly co-extensive with the emergence of networked and ubiquitous computing where the user is viewed as situated in settings of use in relation to other users. Accordingly, HCI lies at the intersection of multiple disciplines including, but not limited to: computer science, psychology, sociology, anthropology, industrial and interaction design (Hewett et al., 1992: 5). It should be noted that given the disciplinary complexity and pluralism of HCI and UCD there are many perspectives on who the user is and how to involve users in the design of computer systems.

There are also varying versions of the role of design in HCI, generally congruent with the different tendencies highlighted above (Wright et al., 2006; Harrison et al., 2007: 12). For practitioners of human factors and ergonomics, the application of design addresses engineering and usability problems centring on the physical fit between body and machine. Within cognitive approaches, design concerns the principled modelling, representation and testing of users (Wright et al., 2006: 3; Harrison et al., 2007: 12). This approach to design concerns the programmatic and structured application of principles in order to test hypotheses and determine the intrinsic psychological attributes of people. In the third approach the role of design, as a 'liberal arts' discipline (Buchanan, 1995; Wright et al., 2006: 3), has an increased prominence and, coupled with the application of the social theory, emerges as a discrete and identifiable mode of inquiry within HCI (Harrison et al., 2007: 12) equipped with its own methods and disciplinary concerns (e.g. Gaver et al., 1999) and non-instrumental models of users (e.g. Dunne, 1999; Gaver, 2002). Furthermore, what is now known as 'interaction design' emerged as a programme of 'radical interdisciplinarity' (Wright et al., 2006: 3) in which the designer is conceived of as an 'artist-designer' (Crampton Smith & Tabor, 1996; Gaver et al., 1999: 24). As such, the engagement between HCI and design is variegated and complex, about which STS, so far, has had little to say.

UCD, with regards to systems design, emerged within HCI during the 1980's. Originally UCD set out at the intersection of computer science and applied psychology (Norman & Draper, 1986; Carroll, 1997: 62), drawing on and breaking with human factors and ergonomics (Bannon, 1991: 26). In the foundational text 'User Centered Systems Design' Norman and Draper (1986: 2) state that UCD concerns the design of computer systems, and more specifically, software interfaces from the perspective of the user's goals and needs and the tools and methods they need to perform tasks to achieve these. Moreover, such goals and needs are what Norman (1986: 33) calls 'psychological variables' in that they exist as attributes in the minds of people. Framed as such, UCD included a 'set of processes, dialogues, and actions through which a human user employs and interacts with a computer' (Baecker &

Buxton, 1987: 40).[8] As such, UCD arose as a normative project where cognitive psychologists argued that the specification of computer systems should be derived from users' inherent requirements and not technological factors (e.g. Norman, 1986). Practically, this meant UCD included the application of a set of principles in which the aspirations and needs of end-users were identified and privileged during the design of new computer systems.[9] In this way practitioners of UCD concerned themselves with making computer systems more usable, and more 'humane'.

Crucial to the UCD project to make technology more humane was the discursive construction of the user. In the cognitive sciences the term 'user' served as a rhetorical object to distinguish between the cognitive user from the 'operator' present in human factors and ergonomic discourse (Bannon, 1991: 28; Cooper & Bowers, 1995: 50). Moreover, as Cooper and Bowers argue (1995: 49) cognitive scientists claimed disciplinary expertise on and privileged access to the user: an object they had largely been responsible for creating. In becoming the expert spokespersons for users, cognitive scientists positioned themselves as the 'obligatory point of passage' (Callon, 1986b: 204) for the design and development of ICTs. Put differently, to employ users, systems developers were obliged to enlist the expertise of cognitive scientists.

Although UCD's provenance lies in the application of cognitive science within HCI, it is now more commonly deployed as a catch-all term to the various approaches to computer system design where the needs and requirements of end users are prioritised during the development of computer systems (Rosenbaum et al., 2000; Vredenburg et al., 2002). According to a survey of UCD practitioners (Vredenburg et al., 2002: 475), UCD methods now include field studies, user requirements analysis, iterative design, usability evaluation, task analysis, focus groups, formal heuristic evaluation, user interviews, prototyping, surveys, informal expert reviews, card sorting and participatory design.[10]

CSCW: users as multiple, socially situated and mutually dependent

Another key development in HCI in which the user featured prominently was the field of Computer Supported Cooperative Work (CSCW) where sociological and anthropological concepts and methods were brought to bear on the design of computer and information systems.[11] CSCW emerged in 1984 (Greif, 1988: 6), as researchers and computer systems

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[8] Carroll (1997) describes how human factors and usability drew heavily on Henry Dreyfuss's (1955) empirical approach to industrial design where people were involved in an iterative prototyping process, for example the design of passenger aircraft interiors.

[9] For accounts of the principles of UCD see (Norman, 1988, pp. 188-203; Gulliksen et al., 2003: 401).

[10] The ISO standard for usability and human-centered design ISO/DIS 13407-1997 "Human-centered Design Processes for Interactive Systems" provides a framework for applying UCD techniques. The standard describes usability as the "extent to which a product can be used by a specified context of use" (see: Bevan & Curson, 1997).

[11] See (Bannon & Schmidt, 1989; Grudin, 1991; Wilson, 1991) for comprehensive accounts of the field.

developers sought to address the design of software to support collaborative group work (groupware) in organizational settings. Thus, the primary focus of CSCW efforts was the local social context for teamwork and the requirements of systems that could support the collaborative production of a product or service (Schmidt & Bannon, 1992: 9). Lucy Suchman (1989: 1), a key figure in CSCW, provides the following definition: "the design of computer-based technologies with a specific concern for the socially organized practices of their intended users." As such, CSCW was viewed by its protagonists (Schmidt & Bannon, 1992: 15) as a response to developments in working practices in organizations and technologies in office automation and manufacturing. Moreover, CSCW emerged out of a critique of cognitive science and design practice (e.g. Winograd & Flores, 1986) wherein what was called for was a sociological and anthropological re-evaluation of HCI and the status of the user (Bannon, 1991; Luff & Heath, 1993).

One key study is Suchman's (1987a) ethnomethodological account of human-machine interactions played out in photocopier use, challenging approaches within HCI, cognitivist science and artificial intelligence. Suchman's notion of 'situated action' took hold as a core concept, for the then emerging field of CSCW, as did ethnographic and ethnomethodological approaches to understanding users for systems design. Challenging previous approaches within HCI, Suchman argued that cognitive 'plans' and purposeful action were occasioned locally as part of a person's ongoing practical activity. As such, concrete and contingent circumstances make up a user's context of use (ibid. , pp. 49, 52), which is dependent on and brought about in local settings. In this view, technology and human work practices are not seen as discrete categories but rather as mutually constitutive in elaborating one another.

Two further key concepts in CSCW are the notions of the 'boundary object' (Star & Griesemer, 1989: 392) and 'articulation work' (Strauss, 1985b; Gerson & Star, 1986: 266; Strauss, 1988), advanced most prominently in the work of Susan Leigh Star. Here, Star (Gerson & Star, 1986; Star & Griesemer, 1989; 1990, 1995; Star & Strauss, 1999) drew on the symbolic interactionist research of Anselm Straus (e.g. 1963; 1985a) and, like Suchman, also questioned the view that work practices can be meaningfully modelled by pre-determined plans. Instead, Star argued that work practices are characterized by ongoing negotiations, multiple viewpoints, distributed decision making and contingencies. In such contexts, boundary objects serve as the interface between the different viewpoints of actors involved in the development of a computer system. The notion of articulation work conceptualised the management of work practice as a local and dynamic process in which tasks and actors are administered in an ongoing, ad-hoc and contingent fashion: "Articulation consists of all the tasks involved in assembling, scheduling, monitoring, and coordinating all of the steps necessary to complete a production task" (Gerson & Star, 1986: 266). For Strauss (1985b: 8) articulation refers to the interlacing of task, efforts and actors involved in work practices.

Accordingly, CSCW systems were designed to facilitate and mediate formal and informal structures of work practices through the design of groupware including messaging systems, video-conferencing and office automation such as AMIGO (Danielsen et al., 1986), COORDINATOR (Winograd & Flores, 1986), DOMINO (Kreifelts et al., 1991) and COSMOS (Bowers et al., 1988). For developers of CSCW software applications the key issue, according to Schmidt and Bannon (1992: 14), was the problem of how to support the requirements of the management of ongoing activities and their articulation. In other words, how can system designers facilitate the situated and distributed workflows of workgroups involved in multiple decision-making processes mediated by networked and distributed computer systems?

Thus, CSCW engendered an understanding of users as multiple, socially situated and mutually dependent, rather than emphasising solitary and placeless users (Schmidt & Bannon, 1992: 5). In short, the inclusion and application of social theory and interpretive methods gave rise to sociological and anthropological derived models of the user (Hughes et al., 1991; Bowker et al., 1997; Berg, 1998). Furthermore, Suchman and Star's prominence in CSCW evidences the nascent intermingling of HCI and STS, broadly speaking, and UCD more specifically. Indeed, the concepts of 'boundary object' and 'situated action' continue to filter through both disciplines to this day and will be addressed throughout this thesis.

Participatory Design and Workplace Reform

The contemporary application of UCD also has a heritage inflected by the design of information systems for the workplace and organisational action research, which purposefully and explicitly involved the participation of workers in the design of workplace technology.[12] As in HCI, the history of user involvement in systems design has multiple genealogies and perspectives (Asaro, 1999) that precede, and in due course converge with, approaches in HCI and more specifically the sociological concerns of CSCW (Ehn & Löwgren, 1997). In each approach to systems design the user has featured as a key actor, though conceived and applied in radically different ways.

Joint Application Design (JAD) was a systems development methodology developed by employees of IBM, mainly in North America, in the 1970's (Carmel et al., 1993: 41) and has since been widely employed in the ICT industry (Davidson, 1999). The objective of this approach was the rapid formulation of systems requirements – an inventory of functional attributes of a system – in which the user acts to resource the specification of a system's capability. The purpose of JAD was to rationalize and speed up the Systems Development Life Cycle (SDLC), thus lowering costs whilst at the same time ensuring quality control.

[12] It is important to note that 'systems-design' refers to a very specific tradition of interdisciplinary design of technological systems, where design equates to a form of sociotechnical management.

Practically, JAD consisted of a series of structured meetings (sessions) between managers, system engineers and users during the early stages of development.[13] The aim of the meetings was to produce a consensual and detailed design document specifying the approved requirements of a user of the system. Thus JAD meetings functioned to enable technical experts to identify and 'represent users needs as objective data in the technical design phase' (Asaro, 1999: 264). Accordingly, the production of system requirements involved the translation of user needs into functional characteristics of a system.

In practice, however, the JAD approach reduced users to a 'functional input' controlled by management and technical experts (ibid.: 264). Although users participated in the design of information systems their say was limited to resourcing the interests of system designers and management. Thus, 'user satisfaction' ultimately meant meeting the management and designer's requirements for a system. Moreover, user involvement was restricted to procedural techniques in which the needs and interests of users were obtained.

European approaches to user involvement also addressed workplace technology, but were dedicated to questions of workplace democracy, such as collective security and individual autonomy in relation to the introduction of new technology in the workplace. Both approaches developed out of the Norwegian Industrial Democracy project, in which social scientists from The Tavistock Institute of Human Relations and the Norwegian Work Research Institute collaborated on four projects between 1964 and 1967 (Emery et al., 1976). From these collaborations two distinct approaches to user involvement and workplace reform emerged, namely the British 'socio-technical' approach and the Scandinavian 'Collective Resource' approach, later to become known as 'Participatory Design' (PD) through convergences with CSCW (e.g. Greenbaum & Kyng, 1991).

The socio-technical approach, associated with the work of Eric Trist, Fred Emery and Enid Mumford, addressed the group dynamics of workers.[14] Much of the work of the Tavistock researchers was conducted with workgroups in industrial and organisational settings in Britain, North America and Canada including, but not limited to: coal mines (Trist et al., 1977), iron and steel works (Emery et al., 1976), textile mills (Miller, 1975), ships (Herbst, 1997) and public services (Westley & Trist, 1993). In such settings the British researchers were concerned with maximising the efficiency of the worker as a component of an *autonomous work group*, as a means of instituting *industrial democracy*.

The notion of the socio-technical system theorised the relationship between workers and technology in an attempt to optimize their fit, and in doing so placed emphasis on ameliorating the social and psychological impact of new technology on workers. The researchers focussed on enabling 'autonomous' work groups who could be granted the

[13] For a description of the structure of a JAD meeting see (Carmel et al., 1993: 41).
[14] See (Trist et al., 1990, 1993; Trist et al., 1997) for reports of the work conducted by the Tavistock group.

capacity to determine their own working practices and routines with minimal supervision from management. For those applying the socio-technical approach, design meant the application of principles and techniques to workplace reform and thus it can be understood as a form of technological management. Notably, the user was equipped with social and psychological needs and treated as a subject who could be granted autonomy in relation to, and control over, technology. As Miller and Rose (1995) note, the socio-technical approach to systems design linked up with the Quality of Working Life movement as a principle instrument for organisational change. Here, the identity of the worker was conceived in relation to particular ethical, political, economic and technological concerns as a means to re-establish corporate legitimacy in industrial democracy.

The Collective Resource approach, inspired by Marxist critiques of technological rationalization, emerged in the Norwegian Computer Center, as it worked with the Norwegian Iron and Metalworkers union in 1970 (Ehn & Kyng, 1987). The focus of their work, a way paved in part by the Norwegian Work Environment Act (1977) granting participatory rights to all workers, looked at how the introduction of technology affected working conditions and how it might be used to serve union interests. Consequently, the purpose of the Collective Resource approach was to facilitate negotiations between unions and management, where technology was viewed as a management tool for exploiting workers. In this context, Collective Resource has a very specific meaning: 'collective' referred to the empowerment of trade unions, not individuals, in negotiating workplace standards and 'resources' referred to the collation, by trade unions, of information resources to be used during management-trade union negotiations and disputes (Ehn & Kyng, 1987: 42). In this way, the researchers sought to make visible bureaucratic processes and allow trade unions to intervene in management proposals through issues of technological reform.

Originally, the Scandinavian researchers' appreciation of design was underdeveloped and not viewed as central to trade union empowerment. Additionally, the involvement of individual workers (as users) was limited and considered problematic: for instance, shop-floor workers might become experts and gain promotion into management. Furthermore, worker involvement might result in management gaining access to information which the trade unions wanted to protect. User involvement might also prevent effective union participation and become an instrument by which management could manipulate workers. Consequently, emphasis was placed on deliberative rather than design processes.

In time, the Collective Resource approach evolved into PD, where the role of design, and in particular the practice of prototyping, played an especially important role. Here, 'low-tech' prototyping served as a means to involve users in the early stages of design (Bødker et al., 2000). For instance, during the UTOPIA project, designers employed props such as cardboard and wood mock-ups of computer workstations and illustrations of user-interface

elements as part of their work with graphic workers in the newspaper industry (Ehn & Kyng, 1991).[15] Notably, a cardboard box with 'Desktop Laser Printer' handwritten on one side and strategically placed between typographers and journalists served to occasion prospective proofing practices. At the time desktop laser printers were not commonly available, and so the prototype worked to materially and spatially re-configure users by embodying prospective work practices. The designers efforts were played out against a background of Marxist labour theory as an approach to 'emancipatory practice', Heideggerian phenomenology, and a Wittgensteinian approach to ordinary language as action, in order to conceive users as competent, embodied actors with linguistic capacities, involved in everyday material practices (Ehn, 1988). Design, in this context, was practiced as a process of negotiation where interests were socio-materially mediated (Bødker & Grønbæk, 1991; Grønbæk, 1991; Spinuzzi, 2002). One key example is described in Ehn and Kyng's (1991) account of the UTOPIA project (as above), where designers worked with journalists and typesetters to design a future computer system for newspaper production.

Attention to prototyping, as a performative practice for configuring new and provisional socio-material arrangements, has also been developed in STS informed accounts of prototyping (e.g. Suchman et al., 2002). Here, the design of a computer system for the US Department of Highways to store and retrieve documents relating to the building of a bridge worked to align multiple and 'discontinuous social worlds' (ibid. : 175). Arguably, prototyping is a distinctive practice within design, which has superseded or works in tandem with experimental practices conducted by cognitive psychologists. In this thesis prototypes and the practice of prototyping feature prominently. In chapter six, in particular, I examine in detail how multiple users are configured during the making of a health and fitness prototype.

In sum, for the Tavistock researchers the collective meant a workgroup whereas in the Collective Resource approach it meant unionisation and the representation of union interests during management processes. The socio-technical approach was criticised by Scandinavian researchers, who viewed it as promoting management values and beliefs concerning production and efficiency (Asaro, 1999: 268): such criticisms, however, tended to reflect a limited understanding of the socio-technical approach. Crucially, as Asaro notes (ibid. : 269) the variety of conceptions of work in the Quality of Working Life Movement enabled technology to be theorized as serving multiple interests. An example of this is how technology could serve to promote workers interests rather than simply exploiting and subjugating them (as in: Braverman, 1974; Noble, 1979a, 1979b).

[15] According to (Lundin, 2005: 1) "UTOPIA was an acronym in Swedish for training, technology, and products from a skilled worker's perspective, 'Utbildning, Teknik Och Produkt I Arbetskvalitetsperspektiv'".

As it currently stands, and as it plays out in mainstream HCI (e.g. Greenberg et al., 2009), UCD now counts as a general orientation and receptiveness to user participation in technological design. Two points are of importance here. First, many different views and models of the user are concurrently active within the field and indeed operate within individual contributions, even if epistemologically and methodologically incongruent. Second, the emphasis on users in HCI is typically allied to pragmatic practices that exhibit limited reflexivity, largely congruent with practical concerns. Moreover, STS commitments – and those developed within CSCW for that matter – remain somewhat sidelined or denatured as procedural keywords, e.g. 'situated' (White & Feiner, 2009). Thus, though there may be transitions and tendencies toward a so-called 'third wave' within HCI – "from human factors to human actors" (Bannon, 1991; cited in Bødker, 2006: 1) – first and second wave obligations and agendas remain firmly established within the discipline.

In this way users, and user-centered approaches, are prevalent in many engagements within HCI, which can heuristically be grouped in the following ways: social and cultural aspects of interactivity (e.g. sustainability, healthcare, education, public engagement, demographic groups, etc.), technological developments (e.g. mobile, online, tangible, gestural computing, etc.), and methodological reflection (e.g. prototyping, user modelling, research techniques, etc.).

With regard to the socio-cultural, two accounts of 'green' technologies (Chetty et al., 2009; Froehlich et al., 2009) serve to illustrate prevailing techniques of user involvement. Both cases involve quantitative and qualitative instruments with which to represent users. That is to say, they represent people as behavioural actors as well as actors capable of interpretive reflection of their routine activities in relation to interactive systems and the environment. Moreover, such accounts are indicative of an increasing interest within HCI of technologically mediated sustainability issues and practices (see for example: Blevis, 2007; DiSalvo et al., 2010).

Accounts focussed on technical issues of user-interface interaction (e.g. Mankowski et al., 2009; Wobbrock et al., 2009) commonly exhibit an emphasis on experimental methods, derived from cognitive science. Such techniques serve as a means of generating empirical insights on users' behaviour and demonstrating the efficacy of a proposed interface technology. The stress placed on experimental observation and data analysis, however, is not exclusive. Different models of, and approaches to users are often rhetorically deployed in accounts of practice in order to embed technological innovation within the wider history and agendas of HCI and practitioners' varying commitments to users. Wobbrock et al., for example, invoke 'PD' and deploy psychometric scales in order to formulate a classification of

gestural input for touch-based computing applications. In this case, political commitments to workplace reform, as practiced by Scandinavian researchers and borne out of collaborations with the Tavistock group, are eschewed for practical purposes concerning user involvement in the development of input systems.

Similarly, reports featuring methodological reflection also present various accounts of the procedures for user involvement. An example of this is Ylirisku et al. (2009) who draw on the concept of the 'frame', evoking Goffman's (1975) frame analysis, and Gibson's (1979) theories on perception to inform their study of ageing workers involving workshops, cultural probes (Gaver et al., 1999), and personas (discussed in detail chapter five of this thesis). Here, a hodgepodge of concepts and techniques for involving and representing users are instrumentally deployed and presented as methodological innovation for design practice. Bruun et al. (2009) also typify the assessment of research practices involving users. In this case, different ways to test software usability, in relation to spatially and temporally distributed users, are reviewed i.e. remote techniques vs. laboratory experiments. This case exemplifies how usability and task analysis, heavily indebted to the early program of UCD, continue to feature in mainstream HCI.

In summary HCI is replete with users, made manifest through a wide variety of techniques, operating in diverse forms and in multiple situations for different ends. Indeed, the term 'user' is arguably a core rhetorical product and component of HCI that operates to bind together HCI's contested and dynamic disciplinary relations (Cooper & Bowers, 1995: 62). As such, the very notion of user is openly understood as problematic within the field (Bannon, 1991: 28; Grudin, 1993: 112) as a consequence of its various meanings and the different way it is applied in practice. Given the evidence and acknowledgement of multiple perspectives on, and models of the user, I find STS, and especially ANT, particularly well-suited to the identification of different actors, whether human in the case of person-end users, or non-human in the case of statistical representations, organisations and so on. In other words, ANT provides the methodological and conceptual tools to understand how users operate in practice as both embodied humans and users as representations of people. In the following sections I will elaborate on STS accounts of users, and in the following chapter I will describe the methodological advantages of ANT for studying multiple users enacted during design practice.

Part 2: STS and Users

Presently, the 'commons and borderlands' between HCI and STS are firmly established and are being further explored by scholars in HCI (e.g. Danholt, 2005b; Sengers et al., 2008; DiSalvo, 2009). This is borne out both in terms of existing links (e.g. Star and Suchman) as well as shared intellectual roots and resources, such as approaches to language and ordinary

action, drawing on Wittgenstein and Marxist accounts of technology (e.g. Noble). In what is to follow, I examine in detail STS scholars' preoccupation with users. In doing so, I draw out further crossovers between HCI and STS that intersect on and at the figure of the user, as well as considering how STS variously appreciates design.

Users and the Social Construction of Technology

Perhaps the first approach within the sociology and history of technology to draw attention to the role of users in the development of technology was the social construction of technology (SCOT).[16] This section on SCOT sets out many of the issues to be developed further by subsequent STS approaches to users.

SCOT is an approach to the dynamics of technological change that is most closely associated with the work of Wiebe Bijker and Trevor Pinch. First defined in 1984 (Pinch & Bijker), SCOT is, in the main, a historical approach in which the involvement of 'relevant social groups', including users, are seen to be actively involved in determining the success or failure of a new technology. Whereas determinist approaches to innovation implicitly conceive of users as passive consumers of technology, the SCOT approach views users as active 'agents of technological change' (Kline & Pinch, 1999: 113) involved in shaping the meaning and use of an artefact, thereby determining the success of a technology. As such, Pinch and Bijker take issue with the linear and stepped model of innovation (1984: 405) in which the success of a technological artefact fully explains its development and vice versa.[17] In focussing on relevant social groups, SCOT demonstrates how the dynamics of technological change can be analysed by paying attention to the change in attribution of meaning provided by end-users, amongst other stakeholders (Bijker, 1999: 191).

Pinch and Bijker took their cue for SCOT from the sociology of scientific knowledge (SSK), American historical studies of technology including the systems approach (e.g. Hughes, 1983), and studies of labour relations (e.g. Noble, 1979c).[18] From the sociology of scientific knowledge, Pinch and Bijker extended the methodological principles of impartiality and symmetry.[19] Drawing on SSK wherein sociologists took a stance of impartiality towards the beliefs of scientists in accounting for the truth or falsity of scientific facts, the SCOT approach

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[16] SCOT emerged in reaction to deficiencies in the philosophy of technology (see: Johnston, 1972) and innovation studies (e.g. Schumpeter, 1943; Freeman, 1974) and out of the history and sociology of technology (e.g. Noble, 1979a; Hughes, 1983). See (Pinch & Bijker, 1987) for account of the development of SCOT. I use SCOT as a starting point due to the emphasis it places on the agency of the user.

[17] For a historical and constructivist account of the linear model of innovation see (Godin, 2006).

[18] Which, notably, also influenced Scandinavian researchers.

[19] In his book Knowledge and Social Imagery (1976, pp. 4-5) David Bloor sets out the four tenets of the strong programme for the sociology of scientific knowledge (SSK), including causality, impartiality, symmetry and reflexivity. In SCOT, the principles of impartiality and symmetry are applied to technology. SCOT analysts are impartial to the success and failure of a technological artifact. That is to say, the uptake or diffusion of technology cannot be explained by its technical superiority or weaknesses. SCOT analysts maintain that success is determined by social factors and not better technology. Accordingly, to understand technological development it is important to explain both successful and unsuccessful technologies. The principle of symmetry is employed to explain success and failure without assuming that success itself is an explanation. The notion of symmetry, and its critics, will be further explored in the following chapter where I present my methodological approach.

imputed impartiality in attributing the success of an artefact on its technological development. In this way, the success of Bakelite in the field of synthetic plastics, for example, cannot be attributed to its technical superiority but rather to the abundance of the ingredient phenol after WW1 (Pinch & Bijker, 1984: 406; Bijker, 1999: 101), amongst other social factors.[20] Thus, SCOT set out with the conviction that successful and unsuccessful technologies must be studied symmetrically.[21] In other words, the fact that a technology works does not explain how it came to work (Bijker, 1999: 270). Instead, the SCOT approach insists that technology works by virtue of its construction and acceptance by society; thus, the social and the technological must be explained in the same terms, and not as separate and autonomous registers to which the capacity for change is solely attributed. Scholars working under the rubric of SCOT have studied the development of numerous technologies, including, but not limited to: refrigerators (MacKenzie & Wajcman, 1985), electrical power generation and distribution (Hughes, 1983), nuclear missile guidance systems (MacKenzie, 1990), light bulbs (Bijker, 1999), and early electronic synthesizers (Pinch & Trocco, 2002; Pinch, 2003). For the purposes of this study, however, I focus on those accounts that pay particular attention to the role of users in the development of technology.

In what follows I outline the key concepts of SCOT and examine their significance in relation to sociological studies of users. In their account of the development of the bicycle, Pinch and Biker describe the role played by 'relevant social groups' (Pinch & Bijker, 1984: 414) in determining its form and use. The concept of relevant social groups refers to organized and unorganized groups of people who share a particular meaning associated with a technology. In the case of the bicycle, relevant social groups include producers, engineers, marketers, and various end-user groups, such as tourist, sports, and women cyclists. Different social groups often exhibited radically different interpretations of a given technology, such as the bicycle. In the late 1800's there were various forms and functions of the bicycle including high-wheeled ordinaries (penny-farthings for example), Lawson's 'bicyclette', boneshakers, safety bicycles, and so on. The formal configuration we now take for granted, namely the 'low-wheeled bicycle with rear chain drive, diamond frame, and air tyres' was originally regarded as a safety bicycle (ibid. : 416). The high-wheeled bicycle, favoured by male sporting cyclists, was viewed as unsafe by elderly and women cyclists who preferred the safety bicycle. Moreover, relevant social groups who contributed to the interpretation of the bicycle also included non-users (Bijker, 1999: 41). This user-group included people who couldn't afford to own a bicycle, and anti-cyclists, such as pedestrians, who actively resisted usage of the

[20] For a social constructivist study of the development and success of the synthetic plastic Bakelite see (Bijker, 1999: 101). In his account, Bijker draws attention to the efforts of Bakelite's inventor, Leo Hendrik Baekeland, in marshalling chemical experimentation and laboratory research, patenting, his efforts to enroll manufacturers as well as the public presentation of Bakelite to the American Chemical Society.

[21] For studies of unsuccessful technologies from an ANT perspective see (Callon, 1986a; Latour, 1996).

technology. Thus, a technological artefact has what Pinch and Bijker refer to as 'interpretive flexibility' (1984: 421) in that it has different meanings for different social groups and can be interpreted differently by different user groups. The controversy surrounding the introduction of air filled tyres further demonstrates the flexibility and openness of a technology to different interpretations. At first pneumatic tyres were introduced to address the problem of vibration on low-wheeled bicycles. Air-filled tyres, however, were rejected by the general public for aesthetic reasons and were deemed irrelevant by sporting cyclists riding high-wheeled bicycles, which did not suffer from vibration. When pneumatic tyres were publically demonstrated on a racing cycle, however, they were re-interpreted by relevant social groups as performance enhancing, and the air-filled tire became a 'high-speed tire' [*sic*] (Bijker, 1999: 84).

How, then, does SCOT explain the emergence of the 'safety' as the predominant bicycle form? Put differently, how does a dominant form and usage of a technology emerge and how does it become widely accepted? Bijker (1999: 86) provides two interrelated analytic concepts, *closure* and *stabilization*, to explain the social process whereby a particular technology prevails. The first, closure, describes attempts to curtail interpretive flexibility and pluralism. Pinch and Bijker note that there are numerous closure mechanisms; however, they emphasize two principle methods: semantic closure (Pinch & Bijker, 1987: 412; Bijker, 1999: 86) and redefinition, or translation (Pinch & Bijker, 1987: 427). Semantic closure refers to rhetorical arguments that are deployed in order to close down the meaning of a technology. Noteworthy here were advertisements that called attention to the safety aspects of the high wheeler bicycle. The second process of closure is referred to as the redefinition, or translation, of the problem. One example of this is the translation of the pneumatic tyre from an anti-vibration tyre to a performance tyre. If closure refers to the way in which the meaning of a technology is achieved across relevant social groups, then stabilization is the process by which a dominant meaning of a technology emerges within a group – that is to say, the process by which a technology becomes widely adopted amongst a group. According to Bijker, the stabilization of the safety bicycle was an eighteen-year process (1879-1897), involving, in the main, a group of cycle engineers. Thus, the SCOT approach to innovation and technological change views the emergence of a dominant artefact as the outcome of a gradual construction of meaning, achieved through social processes involving the interaction of social groups, including, but not limited to: producers, designers, engineers, scientists, end-users and non-users. This stands in stark contrast to heroic accounts of invention and design that centre on an individual's

biography and their act of creative inspiration or the natural emergence of a superior technology, such as White's account of the medieval stirrup.[22]

By placing relevant social groups at the centre of understanding the dynamics of technological change, SCOT emphasises the active role of users in the uptake of new technologies. In this way, SCOT views users as actively shaping the meaning and use of a technology and contributing to its adoption, rather than viewing users as passive consumers of technology. Here, end-users are held partially responsible for the success or failure of artefacts. In placing emphasis on the active role of users as 'agents of technological change', SCOT accounts also draw attention to the multidirectionality of technology (Pinch & Bijker, 1984: 411). The study of development of the bicycle, for example, shows how a range of possible variations, technological trajectories and social processes contribute to the development of the bicycle. Such a view of technological development stands in contrast to linear models of innovation whereby technologies emerge out of a rational path from basic research, through product development and finally arrive at usage. Indeed, the involvement of relevant social groups demonstrates how end-users are implicitly involved in technological development.

Various critics, however, have pointed to the shortcomings and weaknesses of the SCOT approach. An example of this is how, in seeking to provide a social explanation for technological change, SCOT has been accused of neglecting the capacity of technology and people to mutually shape one another. Bijker later addresses the problem of mutual shaping, drawing on Callon's (1986b: 196) general symmetry, using the notion of *sociotechnical ensembles* where 'the technical is socially constructed, and the social is technically constructed' (Bijker, 1999: 273).[23] In this updated version of SCOT, technology and social groups are understood to be co-constructed, as an attempt to avoid social and technological reductionism.

Bijker makes a further attempt to nuance the SCOT approach to the agency of technology and social groups by introducing the notion of *technological frame* (1999: 123), in order to better account for changes in meaning within relevant social groups. Drawing on Gidden's structuration concept (1984), in order to account for both change and constancy in technological development, the notion of technological frame includes all the elements and interactions that lead to the attribution of meaning of a technological artefact. As Michael notes (2000b: 6), likening the notion to Kuhn's concept of paradigm (1962), elements and interactions include: 'goals, key problems, problem solving strategies (heuristics), requirements to be met by the problem solutions, current theories, tacit knowledge, testing procedures and design methods and criteria, users' practices, perceived substitution function (what might a

[22] See (Forty, 1986) for a historical reading of industrial design that also seeks to downplay the 'careers, ideas and theories' of individual designers as a way of accounting for design.
[23] The term 'sociotechnical' should be differentiated from 'socio-technical' employed by Tavistock researchers discussed previously.

new artefact replace?), exemplary artefacts'. As such, the notion is employed to account for how artefacts are the outcome of heterogeneous production processes. Bijker describes the technological frame as a 'hinge' (1999: 196) between the social interactionist perspective and the semiotic perspective as a means to overcome the criticism of structure vs. agency by arguing that it is a process by which both the technological developer and end-user share meaning.

The notion of technological frame also makes the link between users and designers explicit. On this score, Bijker (1999: 179) describes the involvement of industrial designers in stabilizing Bakelite as a synthetic plastic of choice for moulded consumer product enclosures. During the development of Bakelite, on the one hand, industrial designers were mobilized to demonstrate to manufacturers how consumer products could be made from Bakelite. On the other hand, however, industrial designers also shared a technological frame with consumers by way of product enclosures that were designed to meet the needs of end-users.

The concept of closure has also been criticised for its rigidity in relation to the agency of users. SCOT accounts of technological development restricted the agency of users to technologies in development that were yet to be stabilized and closed down (Kline & Pinch, 1996: 767; Oudshoorn & Pinch, 2003: 3). Here, early work within SCOT was criticised for its emphasis on the design and development stage of technology (e.g. Cowan, 1987). As such, the agency of users in determining the meaning of a technology ceases once a technology achieves stabilisation and closure. Consequently, Bijker argues that closure is 'almost' irreversible; however, various studies have demonstrated the agency of users in modifying stable technologies (e.g. Akrich, 1992b; Mackay & Gillespie, 1992; De Laet & Mol, 2000).

The role of users as members of relevant social groups has also been criticised in that it disregards those actors who are not directly connected to technologies in use, and therefore remain invisible (Winner, 1993: 369). For instance, SCOT regards anti-cyclists as a relevant social group of non-users, whereas *non-relevant* groups remain invisible within the SCOT approach. Bijker's (1999) semantic notion of power is therefore insensitive to indirect users, and provides an instrumental view of non-users. In other words, it disregards lack of use, as well as users who do not alter a technology, but are, nevertheless, changed by it. Likewise, feminists scholars of technology have also criticised SCOT for its neglect of gender (Wajcman, 1991). Despite the role of women cyclists in the construction of the safety bicycle, feminist scholars have argued that women either had little influence or were virtually absent from constructivist accounts of technology. Thus feminists argued that SCOT constructed masculine accounts of technology and users, thus marginalizing or ignoring gender interests. Kline and Pinch (1996: 768) sought to address the two weaknesses – the closure of user agency and gender negligence – in their study of the appropriation and re-design of Ford Model T automobiles by farmers in rural America. Here, Kline and Pinch address the making of user

constructed gender identities (ibid.: 795) that contributed to the interpretive flexibility and stabilization of the car in rural America.

According to Bijker (1999: 192), SCOT also includes an ontological dimension. The notion of relevant social groups asserts that users have agency as active individuals and as collectives. Moreover, social groups and artefacts connect to one another via the technological frame. Here, the technological frame acts as an ontological 'hinge' (Bijker, 1999: 195) between interacting relevant social groups and technological artefacts through semiotic interpretation. Despite this, however, the notion of the ontological hinge further emphasizes the separation of technology and society as two separate ontological domains. Consequently, SCOT maintains the distinction between the technological and the social set in place by technological determinism. It simply relocates the source of agency from the impacts of technology on society to the social shaping of technology. Moreover, despite the belated addition of the notion of co-construction, SCOT views users as people with a relatively fixed identity shaping technology to meet their own ends.

Configuring Users in the Design Process

A semiotic approach to users has also been developed by Steve Woolgar in his seminal work 'Configuring the User: The Case of Usability Trials' (1991a). In his ethnographic study of the design and development of a personal computer he treats the 'machine as text' (1991a: 61) and in doing so seeks to interrogate the notion of interpretive flexibility developed in SCOT. In his case study, Woolgar demonstrates how the interpretive flexibility of an artefact was delineated, and to a certain extent closed down, during usability tests conducted with employees of the company producing the computer. For Woolgar, the metaphor 'machine as text' guides a heuristic approach in which he views the personal computer as an artefact that has a meaning to be read by the end-user. Thus, the user is viewed as an interpretive actor, and expert technology designers and developers are viewed as actors who define the identity as well as the capacity of the user. Here, Woolgar moves away from SCOT in two important ways. First, his semiotic approach grants technology (the personal computer) agency, in that it has the capacity to shape the actions of the user. Second, the concept of 'configuration' expands the notion of 'social construction', by providing a way to understand the agency of both users and technology in the production and interpretation of meaning around a given technology. Thus "'configuring' includes defining the identity of putative users, and setting constraints upon their likely future actions" (ibid.: 59). In contrast to historical accounts of user agency in SCOT, Woolgar shows how explicit user-involvement in the development stages of a new technology is an important site for the co-construction of technology and users. Moreover, Woolgar also attends to how users are represented in the design and testing process as a semiotic aspect of technological development.

For Woolgar, then, the agency of the user is distributed across both the machine and the user. The capacity and identity of the user is enabled by the machine, in the form of representation of what the machine can do. In this way Woolgar picks up on the ontological aspect of SCOT, arguing that users and technology acquire their capacities from one another and are elaborated mutually in 'boundary work' (ibid.: 89). In the case of the personal computer, the enclosure of the machine acts as the boundary between the company that produces the computer and the end-user. The process of design, according to Woolgar's account, is the struggle to encode the would-be user (ibid.: 89) as an ontological actor. In the case of the personal computer, the efforts of the designers are oriented towards the specification of a computer enclosure that enables specific forms of access and use (using software applications for example) whilst restricting others (opening the enclosure to make available the computer working parts). Thus, according to Woolgar the case represents the relationship of the user to the computer producer and thus addresses how competencies are shared across the user and the technology.

Woolgar's argument concerning the semiotic encoding of the user has been taken up and extended in various ways. Mackay et al. (2000), argue that configuring is not simply a one-way process, in which expert designers and developers define the user. In their ethnographic study of Rapid Application Development (RAD), in which users are employed throughout the development of computer systems, the authors argue that designers are also configured by their organizational settings. Similarly, Oudshoorn et al. (2004) demonstrate how user-centered designers were organizationally configured whilst developing what would now be referred to as social networking web sites. Moreover, scholars have also argued that it is not just the activities of those directly involved in the design and production of technology that do the configuring. Here, reminiscent of SCOTs emphasis on relevant social groups, scholars have pointed to other expert and lay stakeholder groups that are complicit in configuring users or people who act as spokespersons for users. Illustrative of this are: the participation of journalists in the development of male contraceptive technologies (Oudshoorn, 1999); patient advocacy groups who participated in the development of genetic testing for breast cancer (Parthasarathy, 2003); policy makers, funding agencies and women's health advocates involved in the development of birth-control technologies (van Kammen, 2003); and minorities (women, racial and ethnic) involved in biomedical research (Epstein, 2003).

Woolgar's work, like other studies concentrating on the development stages of technology, has also been criticised for its lack of symmetry. In this sense, symmetry is employed to describe the study of both the development and consumption of technology, rather than the impartiality of the researcher towards the truth or falsity of a scientific claim or the success or failure of a technology. Cowan's (1987: 263) notion of the 'consumption junction', where development and diffusion meet at the point at which a consumer makes a purchase decision,

is offered as a way in which the analyst can span development and consumption. Cockburn and Omrod (1993), for example, develop this approach in their study of the development and consumption of the microwave oven, discussed in more detail below.

Actor-Network Theory And Beyond: Scripts and Heterogeneity

Another perspective on users inspired by semiotics is the ANT approach developed by Madeleine Akrich and Bruno Latour. Employing anthropological techniques (Akrich, 1992b: 222), Akrich and Latour address the materiality of technological objects as obdurate embodiments of the relations between humans and technology. Akrich (ibid.: 208) likens artefacts to film scripts, in that they are formatted with programmes of use based on the vision of the designer and define a 'framework of action' in which users are obliged to act in combination with other people and technologies (ibid.: 208). In this way, the design stage of technology is viewed as the site at which scripts are written into objects; where the competencies (beliefs, interests, behaviour and motives) of future users and their (actor) worlds are anticipated, in the form of user representations materialized in the design of an object. Moreover, Akrich (ibid.: 216) argues that the interaction between the technical-object-as-script and the end-user structures a relational network of competences distributed across the artefact and user. During end-use, however, Akrich argues that artefacts' scripts are read and interpreted by users who can either obediently follow the designer's program of use, or re-script the artefact to define new arrangements of roles and responsibilities. This is where negotiations between designers and end-users take place: where imagined and end-users adjust to one another and in doing so determine the efficacy of a technology.

Akrich explores the concept of the script through three empirical cases, including: the development of a solar powered lighting kit in France and its deployment in Senegal; the use of electricity generators in rural Senegal; and the electrification of villages in the Ivory Coast. In each case Akrich describes how a technological object structures both social and technical relations amongst varying collectives of human and non-human actors. In the case of the photoelectric lights, putative end-users can be either strongly disciplined or excluded entirely: there is little scope for end-users to negotiate the light's script, and other relevant actors, such as local electricians who might repair the device, are excluded entirely. In the case of rural generators in Senegal, Akrich describes a collection of actors who contribute to the re-working of the technology, including "investors/purchasers, owners/users, associate users, renters and transporters" (ibid.: 213). Here, end-users are capable of displacing the user as imagined by the designers: they can re-write the relations embodied in the technology. In both cases, Akrich views the scripting of users as relatively weak. In the case of the lighting kit people may not even use it and the generator gently permits people to participate in small-scale economic relations implied in its use. Akrich's third case, however, shows how the electrification of

villages in the Ivory Coast forcefully enrols inhabitants into networks of electricity supply and consumption, which, in turn, ties users into forms of citizenship which work to re-structure the country 'spatially, architecturally, and legally' (ibid.: 214) as part of the modernization project of the country.

Taken together, the three cases demonstrate how technological objects – as scripts – operate in the conscription and maintenance of sociotechnical networks in which users are enrolled. The concept of the script, therefore, describes the cast of actors (social and technical) and their composition, identity and competencies during use, as well as defining the setting in which they are obliged to act. Moreover, space, in this view, is topological and performed by the networks of relations binding actors together that constitute the technological object (Law & Singleton, 2005: 334).[24] The different spatial structures defined in each case serve to illustrate this understanding of space. The solar lighting kit, for example, creates what might be called a small-scale space in that it implicates a user and distant technical experts who are capable of fixing the light. The network ends there. The generator, on the other hand, performs a more extended network, distributed over time and space, as it implicates an increased number of actors in various capacities, such as fuel suppliers who are required for the network to operate. Finally, the electrification of villages in the Ivory Coast seeks to establish and maintain much larger networks where users are implicated in new relations with large-scale agencies and organisations, such as the state and electricity suppliers. In other words, such networks are a means for doing 'long-distance control' (Law, 1986; Law & Singleton, 2005: 335).

Akrich and Latour (1995) elaborate the ANT approach to users by defining a terminology with which to understand the varying arrangements and relations of human and non-human actors involved in the development and use of technology. It includes notions such as *antiprogram*, *conscription* and *reinscription*. Antiprogram refers to conflicting or incompatible programs of action of the various actors involved in the use of a technology. Conscription refers to the alignment of actor's interests required for a technology to perform. The notion of re-inscription denotes how antiprograms can effect a change in the working of a technology without it breaking down completely. In this framework the designer is likened to a scribe who materially and semiotically authors programs of use, embodied by a technological artefact (ibid.: 262).

Latour's work provides further implicit and explicit examples of users as actor-networks in which agency is distributed across human and non-human actors, including, but not limited to users of: key fobs (1992), doors (1992), speed bumps (1999b), as well as guns (1999b: 178). The user-gun relation is particularly instructive here, and evokes Foucault's (1991: 153)

[24] For a discussion of Serres' notion of topological space see (Serres & Latour, 1995: 60). For a discussion of objects as networks within STS see (Law & Singleton, 2005: 335). Also, see (Law, 1999) and (Mol & Law, 1994).

'body-weapon' composite. The reasoning here is that neither the gun nor person can be understood individually, in that it is neither the gun nor the person that kills independently. Rather, it is particular configurations of gun-person, for example a criminal or a sporting markswoman (Latour, 1999b: 180), that combine to shoot in a particular setting for a specific purpose. In contrast to SCOT, where people are granted the status of actors, actively interpreting passive technologies, the ANT approach views both humans (users) and non-humans (technology) as actors, whose identity and competencies emerge through reciprocal interaction. On this basis, SCOT can be understood as an approach wherein ontological dualisms, such as human and non-human, society and technology, remain innate and distinct, whereas the ANT approach views such dualisms as emergent outcomes of the distribution of agency, between, for example, people and technology. Here, Akrich and Latour apply Callon's (1986b: 4) 'generalized symmetry'. In his interpretation of Bloor's principle of symmetry, Callon argues that the analyst must remain impartial in attributing agency to either social or technological registers. Under this schema, technical objects bring together heterogeneous networks involving varying types and sizes of human and non-human actors (Akrich, 1992b: 206). Accordingly, technological objects define and stabilize heterogeneous networks of actors in moral and spatial orders defining their roles, capacities and responsibilities.

The view of users-as-scripts bears similarity to Woolgar's approach, not least through the use of semiotics, the insistence that technological objects embody programs of use, and the shared aim to move beyond the social construction of technology. However, as Oudshoorn and Pinch point out (2003: 10), Akrich's methodological insistence on going "back and forth continually between the designer and the user" (1992b: 208) exposes the agency of the user in re-configuring the intended use of a technology and therefore their capacity to partially author their own 'geography' of relationships. Woolgar's attention to the putative computer user, however, leaves the capacity of the end-user to re-negotiate the terms and framework of use unexamined. Thus, the agency of Woolgar's putative user is presumed in the semiotic shaping of an artefact but how this plays out in use remains unknown.

Feminist scholars of technology have embraced the concept of the script and further developed it in as a means of analyzing the gendering of technology. The notion of the *genderscript* (Rommes et al., 1999; Oudshoorn et al., 2002: 473; Rommes, 2002; van Oost, 2003: 195) puts emphasis on the inscription of gendered representations into technologies which work to maintain or destabilize 'hegemonic representations of gender (Oudshoorn et al., 2002: 473). Empirically, these studies have focussed on both the implicit and explicit inscription of gender. An example of this is how technological competence is embodied by shavers designed for men as opposed to technical ineptitude reified in female models (van Oost, 2003: 206), as well as the implicit gendering of users during the design of a municipal

web site (Rommes et al., 1999; Oudshoorn et al., 2004). Here, the authors draw on Akrich's 'I-Methodology' (1995: 173) to describe how (male) designers unwittingly draw on their own capacities as representative of end-users, thus frequently and inadvertently defining male web citizens.

More recently, scholars of science and technology have sought to move beyond the division between the user and technology (Berg, 1998: 475) still present within ANT informed analyses by drawing on the notions of the *hybrid* and *assemblage*. One example of this is Dant's (2004) view of the driver-car assemblage, where he sets out to blur the distinction between purely human users and purely technological artefacts by describing a merging of human and non-human that cannot be understood as separate actors. Likewise, Michael's methodological attention to irreducible heterogeneity is examined through the concepts of co(a)gent and co(a)gency (2000b, pp. 16-17; Halewood & Michael, 2008). Empirically, Michael elaborates on the distributedness of agency in case studies ranging from users of walking boots (ibid.: 45), cars (ibid.: 71), remote controls (ibid.: 96) and dog-leads (ibid.: 117). Here, the user is viewed as part of a process in which both human and technology co-emerge. Likewise, Callon has also sought to demonstrate the emergence of the user as a human and non-human collective. In their the study of Muscular Dystrophy (1998), Callon and Rabeharisoa argue that patients and technologies co-emerge through sets of trials. In their work on economic markets, Callon et al. (2002) also pay attention to how users and commodities emerge as sets of properties (qualities) which undergo processes of entanglement and disentanglement.[25] In these cases, scholars have responded to the argument that the categories 'human' and 'technology' are historically contingent, contested, and irreducible to one another.

The feminist take-up of script theory and the work on the heterogeneity of users highlights two deficiencies in ANT approaches to users. The concept of genderscript, for example, indicates how accounts of actors in ANT centre mainly on the actions of managerial male agents (Star, 1991: 26), such as Rudolf Diesel (Latour, 1988b: 104) or Louis Pasteur (Latour, 1988a), despite Latour's insistence otherwise.[26] Moreover, the criticism of managerialism is also a criticism of the location of agency attributed in ANT. In narrating accounts of science and technology centering on the activity of scientists and engineers, ANT implicitly attributes agency to 'Machiavellian' human actors (Law, 1994: 100; De Laet & Mol, 2000: 227) who are responsible for marshalling and managing the constituent elements of an actor-network. Gomart and Hennion (1991) address this weakness in their study of music listeners and drug users, where agency is performed through abandoning personal action to the agency of music or drugs rather than purposeful and rational action. Moreover, the

[25] For an extended discussion of Michel Callon's approach to economic markets and the notions of entanglement/disentanglement see (Barry & Slater, 2005).
[26] See (Harding, 1991) for a feminist critique of the emphasis placed on male agency in science. For an alternative to 'entrepreneurial' models of actor-networks see (Star, 1991).

displacement of agency from a human actor blurs the distinction between user and non-user, as I will discuss in more empirical detail in chapter four.

The second weakness of ANT concerns the metaphor of the 'network' as an ordering principle.[27] de Laet and Mol's case study of a water pump in Zimbabwe addresses both the heroic agency of the user and the metaphor of the technological object as a stabilized network of material and semiotic relations. In following the water pump, de Laet and Mol focus on the agency of a non-human actor. The pump works variously for different user groups, including communities, villages and families. At the same time, the water pump constitutes these user-groups. At times the pump works with varying degrees of success, and at others the pump doesn't work. Accordingly, the operation of the water pump is 'fluid' (ibid. : 252) in that it moves into and adapts to different contexts of use rather than acting as a stable 'network'. That is to say, the water pump does different things for different users and stakeholders and its efficacy is variable rather than structured. In the following chapter I elaborate on the weaknesses of ANT as they relate to my methodology.

ANT has also been employed in analyses of UCD. Berg (1998) describes how the user is enrolled as part of the ontological orderings of participatory design in which the categories of human and the technological are normatively separated. The politics of UCD therefore concerns the question of how to take human-technology relations and their ontological emergence as the starting point for design, rather than meeting the demands of pre-existing user needs (ibid.: 480). On the one hand, the introduction of decision-making tools for the treatment of breast cancer 'redefines' the eligibility of patients for bone marrow transplantation and what potentially curable breast cancer is (Berg, 1997: 131). Here, the ontology of the user and the disease emerges in relation to technology. On the other hand, CT scanner software also participates in how patients are treated by radiologists and surgeons, demonstrating that the ontology of technologies are not fixed either (Berg, 1998: 481). Taking a performative approach, Danholt (2005a) also argues that user inclusion affects both users and technological artefacts in the design process. For Danholt, the user-centered design of a diet diary aid for diabetics performs certain bodies and certain subjectivities. That is to say, in mutually shaping one another, the patients and the diabetic technology emerge in particular configurations as, for example, the enactment of a 'better regulated diabetic' (ibid.: 8) or the enactment of a stigmatized patient (ibid.: 9). Also addressing participatory design through ANT, Callon (2004: 8) sketches out the implications of acknowledging non-humans in the form of *hybrid collectifs* in design. They include: (1) the recognition of the involvement of the non-human as well as the human in participatory design processes; (2) the acknowledgement of design outcomes as arrangements of humans (users) and non-humans

[27] The network as a constrictive metaphor in ANT has been discussed here (Law, 1999: 7). See (Law & Singleton, 2005) for an overview of alternative metaphors for objects as mediums for structuring relations between humans and non-humans.

(technologies); (3) human and non-human agencies are the product of design processes rather than pre-given constituents; (4) design involves bringing into being new forms of agency rather than responding to the needs or desires of users; and finally, (5) the stakes in participatory design, for instance in the field of ICT development, concerns the types of human agency that are to be developed.

Feminist Perspectives on Users

As previously discussed, the study of users features prominently in feminist accounts of technology. In particular, feminist scholars have drawn attention to the role of users and the occasioning of gender relations in the design, development and consumption of domestic labour saving technology, information technology and biomedical technology.[28] As Wajcman notes in her review of feminist studies of technology, the feminist project, applied to studies of technology, seeks to address the absence of women in accounts of technology: "to uncover and recover women 'hidden from history'" (2000: 447). Moreover, feminist accounts of technology have also sought to break open the normative gender categories of 'man' and 'woman' by stressing how their respective interests differ (ibid.: 452). Additionally, there are differences within gender categories, as well as between. Thus, feminist scholars provide alternative accounts of technological development where gender interests and power relations are implicitly and explicitly encoded into technology during design, and played out during use. In particular, the feminist preoccupation with users is a means by which the role of male actors on both sides of technological change – development and diffusion – can be downplayed (Wajcman, 1991).

Arguably, the feminist commitment to the study of users originates in the work of the feminist historian of technology Ruth Schwartz Cowan (Oudshoorn & Pinch, 2003: 4). In her re-appraisal of the industrialization of the household, Cowan (1983: 70) overturned the common (and determinist) assumption that the kitchen was transformed from a site of production into a site of consumption. Rather, through a detailed historical study of domestic labour saving devices Cowan argued (ibid., pp. 99-100) that household technologies played a key role in enforcing patriarchal gender divisions within the household, where housewives became solely responsible for the production of food as well as the management of clothing and medication. As I noted previously, Cowan (1987: 262) also developed the methodological principle of the *consumption junction* as the site at which the analyst of technology can study the consumer as they make choices between competing technologies. In putting the consumer at the centre of the 'network', Cowan, drawing on ANT, sought to bring into view all the various

[28] Feminist approaches to technology developed out of Marxist studies of production and labor in which class conflict shapes workplace technology (Wajcman, 1991: 20; 2000: 448). With regards to biomedical technology, feminist work has concentrated on childbirth and contraception, in-vitro fertilization, cosmetic surgery and genetic engineering (Wajcman, 2000: 457).

relevant social groups who influence a consumer's choice.[29] Moreover, Cowan argues that focussing on the consumer as an entry-point into sociotechnical networks, rather than concentrating on network builders such as scientists and engineers, prompts scholars of technology to consider the active role of the (female) user in stabilizing networks from the 'inside'.

One key work in which the notion of the consumption junction is developed is Cockburn and Omrod's (1993) study of the gender hierarchies and division of labour at play during the development, production, marketing, retailing, use and maintenance of the microwave oven.[30] Here, the role of women identified by Cockburn and Omrod includes: embodiments of cooking knowledge and home economics enrolled as representations of future female users in the design of the microwave; the employment of women in production line work; and as sales assistants as well as heterosexual end-users who cook in the home. Their male counterparts, however, play two main roles in the form of engineers and managers (ibid.: 14). Here, design is an overtly male dominated enterprise in which patriarchal gender relations shape the form and function of the microwave. In the design process the microwave oven transitioned from a 'masculine' brown good requiring technical competence to a highly automated and operationally simplified white good for domestic work. Wajcman (2000: 455), however, contends that Cockburn and Omrod's study fails to fully detail how designers imagined the gendered attributes and capacities of end-users. The gendering of technologies played out by designers, however, is explicitly addressed by Oudshoorn et al. (2004) in their study of the design of two social web sites: one civic and one commercial. Drawing on Akrich's 'I-methodology', the authors argue that male interests are covertly prioritised through the practices of mainly male designers.

Feminist scholars have also sought to unpack the notion of relevant social groups. Although SCOT accounts of relevant social groups brought to light the active involvement of users in shaping technology, feminist scholars have argued SCOT oversimplified the identity and agency of users (Oudshoorn & Pinch, 2003: 3). In addressing the diversity of actors involved in the design and consumption of technology, feminist scholars have introduced a range of notions that seek to draw out the gendered power relations played out during development and diffusion. Casper and Clarke (1998), for example, use the notion of *end-users* to describe those actors who are affected by technology during diffusion and consumption. In their study of reproductive medical technologies, Saetnan et al. (2000: 16) employ the notion of *lay end-users* to account for people who are absent or excluded from expert medical

[29] Cowan specifically refers to Law's (1987) study of the emergence and stabilization of the Portuguese trading galley in the 15th century as a network of heterogeneous associations and Callon's (1987) study of the introduction of an electric car in France in the 1970's.

[30] See the edited volume 'Bringing Technology Home: Gender and Technology in a Changing Europe' (Cockburn & Fürst-Dilic, 1994) for further studies of the relations of gender and technology played out in and around domestic sites.

discourse. Here, health professionals and government agencies take on the role of *intermediary users* (ibid.: 16) in that they act as spokespersons for end-users. Saetnan et al. (ibid.: 16) further elaborate on the status of users present in the different discourses involved in the cultural production of meaning of reproductive technologies. They identify numerous forms of users including, but not limited to: *virtual users* to describe the interests and conduct of prospective users as imagined by scientists and engineers developing the technology; *embodied users* who participate in the clinical trials of reproductive medicines; *aggregate users* who act as a collective of actors such as lobbyist and interest groups; *individual users* who received medical care from health professionals; as well as user representations written into media content by journalists. In drawing attention to the diverse roles of users in the discursive production and appropriation of reproductive technologies Seatnan et al. (ibid.: 11) argue that gender is 'dynamically constituted as symbol, structure, and identity'.

Another important term employed by feminist scholars to unravel the notion of the user is *implicated actor* (Clarke, 1998: 267). Again, critical of ANT's marginalization and disregard of invisible actors through managerialism and accounts of heroic action, Clarke draws attention to the discursive production of individuals and collectives, including non-humans, who do not participate actively in the development of reproductive technologies, but who are the primary users and consumer of, for example, the oral contraceptive pill.

Adding to the feminist typology of users is Sally Wyatt's (2003) study of non-users of the Internet. Here, Wyatt demonstrates that the stereotypical internet user – a 'young, white, university-educated man' (ibid.: 71) – falls apart on closer analysis and that use, rather than being categorized under the binary registers use/non-use 'should be conceptualized along a continuum, with degrees of participation that can change' (ibid.: 77).

In these various ways, feminist engagements with technology are instructive in foregrounding gendered power relations that contribute to technological development and use. Furthermore, feminist literature points to other lacunae in literature on users, such as race. The unpacking of the user into a nuanced range of figures explicates the various ways in which (women) users count (as imagined, active, embodied, marginalized, absent or collectivised and so on). Ultimately, such accounts are aimed at the empowerment of those actors, especially women, who are otherwise unrepresented or marginalized in sociotechnical studies. These subtleties of feminist accounts explicitly engage with the shortfalls of SCOT and ANT informed studies, which present dominant accounts of technology involving powerful and active (male) actors. An ontological reading of feminist studies, where the subtle shadings of the performance of gender relations are made apparent, emphasizes the involvement of absent/present actors, forms of agency that do not necessarily rest on the notion of 'activity', as well as attending to the full range and diversity of actors directly and indirectly entangled in technology.

Co-extensive with developments in feminist scholarship and ANT is the work of Donna Haraway, most notably her conceptualisation of the *cyborg* (1991: 51; 2004: 8). Blending science fiction and fact, the notion of the cyborg is a means by which Haraway examines the thorough synthesis of the human and the technological and critically re-appraises dualistic logics that have pervaded Western thought. For Oudshoorn and Pinch (2003: 7), the notion of the cyborg entails the intermingling of human and machine out of which the user emerges. The key point here being that there is no essential identity of the user. The user is constructed in relation to technology and her identity emerges as a result of intermingling between the technological and the social. Indeed, as in the hybrid approach, such categorical distinctions are no longer workable in a world of cyborgs. What makes Haraway's approach different to those employing notions such as hybrid and assemblage, as in this thesis, is the emphasis she places on feminist subjectivities and politics. Notably for this thesis, Haraway emphasizes the emergence of microelectronics and the silicon microchip as miniaturized material-semiotic technologies, the ubiquity of which invisibly permeates users with patriarchal politics (Haraway, 2004: 12). Haraway (2004: 8) is quick to assert that cyborg is an ontological notion that provides a way to break down conventional and interdependent distinctions between, for example, the human and the animal, the organic (human-animal) and the machine, and between the material and the semiotic. In doing so, Haraway argues that the notion of the cyborg provides a novel way of doing politics in that it does away with dualistic logics that structure Western humanist knowledge and 'practices of domination of women, people of colour, nature, workers, animals' (ibid.: 35). The consequence of this is a reconstructive and progressive approach that embraces technology as a means to restructuring everyday life, rather than resisting it as an ideological or domineering force. Thus, Haraway is concerned with accepting technology as 'fundamentally affecting the categories of 'self' and 'gender'' (Wajcman, 2000: 457). Perhaps, following the work of Haraway, the practice of UCD could be seen as a reconstructive process in which cyborgs participate in the development of 'hopeful' technologies.

Indeed, Haraway's work raises issues with the categories of the ontological and the epistemological as two distinct registers. For Haraway, the ontological and the epistemological are interwoven and are produced by and with one another. Knowledge of labour practices creates new ontological beings – wage labourers. The ontological implications of the figure of the cyborg for user studies are that users are simultaneously embodied, gendered, figural, fictional, factish and emergent. They are material and discursive combinations of the epistemological and the ontological. Moreover, a cyborg ontology of the user is one in which essentialist pre-givens, such as the 'innocent' body, gives way to the body as a physicality already encoded with 'maps of power and identity' (Haraway, 2004: 38).

Users and the Moral Order of the Home

If feminist accounts of technology have sought to unravel the gendered identity of users, and semiotic inspired approaches (configuration and scripting) have traced the inscription and translation of technology, then media and cultural theorists have emphasized the experience of users during the consumption and appropriation of information and communication technologies (ICTs) in the home. Crucially, for cultural theorists, ICTs have functional significance as both material objects and as media, thus acting as a conduit between the private household and the public. At stake here is the 'capacity of the household or the family to create and sustain its autonomy and identity (and for individual members to do the same) as an economic, social and cultural unit' (Silverstone et al., 1994: 19). Using mainly qualitative approaches, often historical or ethnographic, accounts of the consumption of technological commodities, such as the television (e.g. Silverstone, 1980; Silverstone, 1981; Morley & Silverstone, 1990), VCRs (Gray, 1987), the radio (e.g. Moores, 1988), home computers (e.g. Haddon, 1988; Wheelock, 1994; Haddon, 2006), and personal stereos (Du Gay et al., 1997; Bull, 2000) scholars interested in culture have drawn attention to the agency of users in actively creating and sustaining identities in the home through the consumption of commodities. Moreover, scholars of media and culture view the home as an ensemble of technologies in which households and various ICTs work in relation with one another (e.g. Hirsch, 1994; Silverstone et al., 1994) thus extending the scope of traditional media and domestic technology, such as labour saving devices. In addition, the so called 'domestic approach' (Haddon, 2007: 27) also views the user as an individual embedded in household collectives as well as linked up with broader aggregates of users, such as neighbourhoods, colleagues, peer groups, and most notably audiences and publics. Consequently, the attention to the sociotechnical household as the unit of analysis brings into view users in various roles, including teleworkers (Haddon & Silverstone, 1993, 1995c), single-parents (Haddon & Silverstone, 1995b) as well as the young and the elderly (Haddon & Silverstone, 1995a). This scholarship also includes studies of patriarchal gender relations in the home alongside the aforementioned studies of non-nuclear household cases.

Underwriting the view of users as cultural actors is the notion of the 'moral economy' of the household' (Silverstone et al., 1992: 16). Here, households are conceived of as caught up in a 'transactional system of economic and social relations within the formal or more objective economy and society of the public sphere' (ibid.: 16). The key argument is that commodities are incorporated into the home where, through use, they are redefined in terms of the occupants' beliefs and interests. Thus, technological commodities transition from formal economies, or 'objective economies', to cultural economies of meaning. Consumers make culture in the home as well as formatting relations between the domestic, the economy and

the public that are objectified in consumer products (Silverstone & Hirsch, 1994: 6). As such, users-as-consumers become entangled in broader social and economic processes through mundane cultural practices. For cultural theorists, like social constructivists, the meanings of ICTs are not fixed in production but open to appropriation, translation and transformation during consumption.

Perhaps the key concept developed by this approach to users is the notion of *domestication* (Silverstone et al., 1994: 16) which addresses how consumer technologies enter into and are managed in the home.[31] As such, domestication, likened to the taming of a wild animal (Haddon, 2007: 26), addresses the various processes in which users integrate technologies into their homes. By introducing technologies into the home, users co-opt their meaning, transforming commodities into cultural artefacts. The domestication approach mainly draws on three areas within the social sciences: (1) cultural studies, where audiences were conceived of as hermeneutic readers of media; (2) the social anthropology of material culture (e.g. Appadurai, 1986; Miller, 1987) and the biography of objects (Kopytoff, 1986); and (3) literature on consumption, choice and economies of aesthetic and symbolic meaning (i.e. Bourdieu, 1984).

According to Silverstone et al. (1992, pp. 21-26) domestication involves four interrelated processes: *appropriation*, *objectification*, *incorporation* and *conversion*. Appropriation describes the purchasing and inclusion of commodities into the home. Here, commodities leave capital economies and enter into 'moral economies' of symbolic value. It is also the point at which users begin to ascribe cultural meaning to technology. Objectification refers to the visual and spatial staging of objects in the home through curation and symbolic management. Thus, users are not only involved in usage, they are also implicated in symbolic practices within the home achieved through the arrangement and display of objects. Incorporation refers to how technological objects are integrated into the practices of everyday life. This is a focus on the temporality of objects in use, for example how televisions sequence domestic routines in accordance with broadcast scheduling and public events. Silverstone et al. argue that this brings into view particular identities of users in relation to age and gender as technologies mediate power relations within family hierarchy (Morley, 1986: 143; Michael, 2000b: 103). Finally, conversion describes how artefacts are displayed to others: how technologies mediate subjectivity and private meanings between individuals and collectives, such as households, colleagues, audiences and publics. The relations between domestic users, audiences and publics are theorised as a process of 'articulation' that binds the private sphere to the public realm.[32] In this way, domestic users take 'their place amongst wider culture and

[31] For a account of the origins of the concept of domestication see (Haddon, 2007).

[32] Here, the concept of articulation refers to how discourse and practice link with ideology in the formation of contingent political identities. Articulation was developed within Cultural Studies as a means to overcome economic and class reductionism prevalent in the work of Marxist cultural theorists. The concept, as employed by cultural theorists, was first developed by Ernesto

society, where issues of class, ethnicity, ideology and power define (should they be forgotten) the materialities of the everyday-life world' (Morley & Silverstone, 1990: 34). The concept of articulation was nuanced as 'double articulation' (Silverstone et al., 1994: 21), whereby ICTs precondition private and public meanings, as well as embodying the outcome of such negotiations through consumption. Thus, what might be called the micro-social and material worlds of domestic media consumption are viewed as interwoven in, and mediated by, macro-social discursive registers and ideological processes.

The concept of articulation also touches upon ontological aspects of users involved in domestication. One example of this is how users are viewed as the upshot of the interplay of discursive and material forces, and in doing so how they become caught up in conventional sociological registers, such as class, race and gender. Furthermore, the notion of ontological security (Silverstone et al., 1994: 20), drawing on Giddens (1989: 278), has been employed to grasp the ways in which users seek cognitive trust by way of the socio-material ordering of domestic objects and media.

Barry (2001: 127) also addresses how technology mediates the connection between users and publics. In his case study of interactive exhibits at contemporary science museums, Barry argues that museum visitors are transformed into 'interested, engaged and informed technological citizen'[s](ibid.: 129). At such locations interactivity is deployed to connect up the body of the visitor with the government, empowering the user as an active and responsible 'experimental self' (ibid.: 131). In practice, however, interactive museum exhibits pre-determine particular choices, thus delegating creative agency to the exhibit, not the user. Informing Barry's analysis is a comparison between Foucault's (1991: 153) notion of discipline and the rigid and normalising exercise of power through body-object arrangements, mentioned previously, against a reading of interactivity as a novel mode of political power based on choice, experimentation and discovery.

The domestication approach has also been developed by feminist scholars (e.g. Lie & Sørensen, 1996a) exploring the links between SCOT and Cultural Studies. In doing so, feminist scholars have sought to expand the notion of domestication beyond the home to incorporate other routine spheres of everyday life found in 'the factory, as well as in the home, in the office as well as in the sport arena' (Lie & Sørensen, 1996b: 15).

Comparable with script theory, the domestication approach views the user as embedded in sociotechnical cultures that are simultaneously domestic and national, public

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Laclau in his book *Politics and Ideology in Marxist Theory* (1977). For a discussion of the significance of articulation in Cultural Studies, especially in the work of Ernesto Laclau and Stuart Hall, see (Slack, 1996). Laclau further developed the concept in collaboration with Chantal Mouffe in their book *Hegemony and Socialist Strategy* (2001). Here, Laclau and Mouffe define articulation as 'any practice establishing a relation among elements such that their identity is modified as a result of the articulatory practice. The structured totality resulting from the articulatory practice, we will call *discourse*' (ibid.: 105). According to Hall (Grossberg, 1996: 141) articulation is a dual process of expression and linking where ideology emerges in process. The process of double articulation can be understood as the processes by which objects and discourse serve to mediate cultural appropriation and in doing so are themselves constituted in such articulations.

and private (Morley & Silverstone, 1990: 32). Thus, the user is articulated amongst a much broader set of relations than simply user-machine interactions, as in, for example, Woolgar's notion of configuration. Indeed, Morley and Silverstone (ibid.: 44), in discussing television viewing, raise issue with the user-as-reader model, arguing for a more nuanced understanding of what reading entails. For Morley and Silverstone different technologies require different modes of reading and individual technologies themselves often involve different patterns of use, at different times of the day for example. Accordingly, Morley and Silverstone (ibid.: 46) propose four ways in which the reader model of the user can be improved. First, use is not confined to user-machine interaction but is part of people's ongoing routine activities. Second, the role of the user-as-reader requires specification in relation to multiple technologies. In domestic settings users are embedded in a technological environment including technologies such as radios, televisions, telephones and personal computers. Third, usage has different modalities of attention – different intensities of engagement. It is not simply a binary on or off. Fourth, the relationship between media technology and its content needs to be understood in its cultural circumstances, where the individual reader links into a particular audience. In this way, the domestication approach views users embroiled in complex collective 'macro' cultural dynamics, through material, aesthetic and symbolic appropriation and use over space and time. Although a criticism of the user-as-reader model, the understanding that the individual user connects with larger user groups, does parallel Akrich & Latour's and Woolgar's view of users as entangled in more explicitly collective relations; that is to say, users can get drafted into putative consumer groups (by being configured), citizen populations (by following scripts) as well as audiences and publics (through domestication).

Clearly, studies of domestication intermingle and cross-fertilize with feminist studies of technology. An example of this is how gendered power structures are understood to play out amongst families, and the recognition of non-nuclear household units. However, rigid models of gender interests have been disputed by feminist scholars (e.g. Lie & Sørensen, 1996b; Silva & Bennet, 2004) who argue that gender relations are performed with and through technology, rather than operating as pre-given determinants.

Conclusion: Towards User Assemblages

In this review of HCI and STS literatures, my aim has been to demonstrate the importance placed on the user in making and analysing 'social' technology, and ICTs more specifically. I have ventured to emphasise the confluences of the two literatures, where sociological and anthropological concepts and methods have permeated HCI and where the practical materialisations of HCI contribute to performative accounts of technology. In short, this is the view that designed objects in the making operate as *sociotechnical assemblages* (e.g. Suchman et al., 2002: 175; Barry et al., 2008). Such perspectives, I believe, also correspond with and

arguably pre-figure rising interest in social theory on the role of anticipation and expectations in socio-material practices. In the following I summarise how my reading of HCI and STS draws out and re-frames key questions concerning the enactment of users in the design process: questions that concern the identity and capacities of the social and the technological, and, as the literatures clearly underscore, the contemporary forms of politics that are played out in UCD around varying conceptions of the user.

Broadly speaking, HCI literature exhibits a shift from an early conception of what can be dubbed cognitivist users to the view that users are situated in context of use, and whose competences are mutually elaborated through their various practical and ongoing interactions with one another mediated by technology. Similarly, STS literature, which has acknowledged and empirically detailed the active role of the user during the production and consumption of technology, has also arrived at such an understanding of the user. Arguably, this has been achieved by re-asserting the agency of technology entangled with the social, congruent with Deleuze's assertion concerning the medieval man-horse-stirrup symbiosis in which he states 'the machine is always social before being technical' (2002: 70). Incidentally, this evokes Wajcman and Mackenzie's argument rehearsed at the beginning of this chapter, who, like Deleuze, also draw on White's (1962) account of feudal technology.

The literature has also led me to the understanding that new conceptions of users do not simply successively replace, thereby rendering obsolete, more established views of the user. Perhaps because of the interdisciplinary nature of HCI, various different and competing models of the user co-exist in practice, as evidenced by the wide array of techniques employed in UCD to understand and involve users. Thus, cognitivist approaches to user-involvement can, and indeed do, work side-by-side with sociological and anthropological approaches. In the context of this study, UCD can be more fruitfully understood topologically, where multiple and often seemingly incommensurable versions of the user operate alongside one another in practice.[33]

Such confluences between HCI and STS literatures stress a series of key substantive and theoretical insights, which I draw on to inform this study. In brief, if technologies (in the making) are conceived of and operate as sociotechnical assemblages then users themselves can be better grasped as heterogeneous arrangements. This view of users includes the following key arguments. First, users and technology emerge in relation to one another, whether in production or end-use. This point is common to later SCOT analyses and ANT informed studies, as well as feminist and domestication literature. Second, in practice, users and technologies are both composed of and embroiled in diverse and unfolding relations of power with other actors of varying kinds, for example governments, commodities, knowledge about

[33] I am thinking here of Michel Serres (1995: 60) notion of the topological where different knowledge about users, from different moments in the history of HCI, co-exist and fold onto one another.

people, novel sociotechnical practices and so on. Here, developments in STS literature strike me as particularly instructive in emphasising the varying relations of power (e.g. gender and ideology) enacted in and through technological use. Third, as feminist scholars have convincingly argued and HCI literature affirms, users exist in a diverse variety of forms, both materially and discursively. This unpacking of user identities proves especially instructive both theoretically and methodologically. Feminist literature points to different enactments of users highlighting their multiplicity. Here, the key question, and one that lies at the core of this thesis, is how are such multiple enactments of users done in design practice and how do different versions of users co-exist, become patterned or wane? Finally, both HCI and STS converge on the topic of the politics of users. In relation to this, I am persuaded that UCD, following debates in STS on the politics of technology (Berg, 1998; Callon, 2004; Danholt, 2005a), concerns how users operate in the socio-material configuration of expectations about sociotechnical practices in the present. Here, the key question is: how are particular individuations – immanent subjectivities that emerge in design practice – deemed fit and eligible representatives of people at the expense of others?

Now, I am persuaded by the arguments above that both users and technologies emerge in practice by virtue of relational and mutual orderings. Users and technology exist as heterogeneous in composition and in association with others in varying scales, whether through the components that constitutes a technology, or through the practical relations through which people are enacted in design processes. I am also persuaded, by critics of ANT, of the failures of the network as an ordering principle and the emphasis the concept places on heroic presence. Moreover, HCI literature, and in particular prototyping, indicates that UCD – wherein users are enacted during the production of technological visions – is both materially and discursively engaged in provoking novel and inventive configurations of people and technology.

With the above points in mind, and inspired by developments in social theory, I turn to the notion of *assemblage* (Deleuze & Guattari, 1988) to help me to understand how the enactment of users during local design practices involves the interweaving of bodies, interests, practices, knowledge, technologies, organisations and visions during technological development.[34] The notion of *user-assemblage*, which I develop as an analytic outcome of this thesis, is useful in sensitising me to how, in practice, users are heterogeneously composed, the manner in which users emerge and occupy, or territorialize, contexts of interdisciplinary knowledge. It is also a particularly useful concept with which to understand how users and technologies are continuously in the process of mutual development, and to the assembling

[34] For the notion of assemblage in philosophy see (Deleuze & Guattari, 1988). One example of its uptake in STS is (Irwin & Michael, 2003). With regard to consumer commodities and brands see (Lury, 2009) For its utilization in anthropology see (Ong & Collier, 2005b). Marcus (Marcus & Saka, 2006) critique the notion as a modish concept.

practices of designers, inhabiting organisation and disciplinary settings where they build technologies, format users and construct sociotechnical visions. Thus, the notion of the user assemblage addresses the dynamics of multiple users enacted in practice: how users come together; how they are composed; how they hold together and operate; how they co-exist with other users; and how they break down or get reconstituted. The conjoint term user-assemblage further indicates how users are an effect of such assembling processes rather than act as *a-priori* actors or the product of the capacities of an individual innovation author.

As my literature review has shown, much work on users has an implicit concern with future users. Accordingly, design activities entail expectations about future users, sociotechnical practices, societies and so on. In this thesis I seek to explicitly examine the prospective work of designers and the role of user assemblages in embodying anticipations of technologically mediated healthcare and domestic practices as well as the disciplinary logic of UCD. This is something that I develop through the course of this thesis, drawing on relevant literature as I go along.

These 'themes', which I have derived from the literature, thus serve to frame my approach to the empirical study of multiple users. In what is to come I explore the practices of designers and the enactment of users and build towards the conclusion where I present the notion of user assemblage as an analytic outcome in detail. In the chapter that follows I present the methodology I have employed for empirically studying users as enacted in practice, which I apply to the four empirical case studies.

Chapter 3.
Design in Action: A Methodology for Studying Users in Design

Introduction

In this chapter, I present the methodological approach I have developed for studying the multiple enactment of users during user-centered design practices at a microprocessor corporation. The chapter is structured as follows: I begin by introducing the organizational setting that was my field site and my informants in order to ground my empirical work. I then discuss the key principles for conducting an ethnographic study of designers as they work with users as part of routine user-centered design processes. In so doing, I identify correspondences between Steve Woolgar and Madeleine Akrich's ethnographic studies of users. I draw out a set of key methodological assumptions for following designers' practice and studying the local enactment of users encountered as multiple, heterogeneous and emergent. Finally, I present a detailed description of my fieldwork and analytic methods, including participant observation, document analysis, photography and ethnographic interviews. Here, I discuss the methodological issues and challenges I faced in participating in and studying designers' practices and modes of user involvement conducted within a corporate context.

Studying User-Centered Design

In this section I describe the organizational setting for my fieldwork. I begin by introducing the corporation and then discuss the role of the User-Centered Design Group (henceforth UCDG) within the organization. Given the size and geographic extent of the corporation and its dominance as an ICT manufacturer, I will sketch out its corporate structure in order to situate my informants and field site within this context.

The corporation in which I conducted my fieldwork is a leading multinational microprocessor manufacturer in the computing industry. As such, it is a commercial organization that pursues the research, development, production, marketing and standardisation of microprocessors, as well as various ICT technologies associated with semiconductors and microprocessors. The corporation employs approximately 100,000 personnel in over 200 facilities worldwide. The organisation's headquarters are located in California, however, its biggest concentration of facilities and employees lies in the Pacific

Northwest of the U.S.A., in an area dubbed the 'Silicon Forest'.[35] It was here that I conducted my ethnographic fieldwork over the course of a six-month internship with the corporation. In addition to the development, manufacturing and retail of silicon microprocessors, the corporation is also engaged in the research and development of various technologies associated with computing architecture, including embedded processors, motherboard chipsets, integrated circuit boards, flash memory, graphics chipsets, as well as networking and communication technologies. As part of these efforts the corporation is also active in various national and international ICT standards initiatives, for example the worldwide consortia of semiconductor manufacturers SEMATECH, which works to establish and maintain public and commercial research agendas and interoperability between different hardware and software components, entailing co-operation between government and ICT manufacturers.

In 2005, and in part due to adverse economic conditions, the corporation was re-structured into a number of divisions formed to address different microprocessor and chipset markets and emerging market opportunities. The restructuring was communicated within the corporation as an efficiency drive and as a strategic re-orientation to a user-centered approach to the design and development of technology, broadly speaking. Not to be confused with UCD, the corporation's user-centered approach concerned the corporation's 'core' business of developing competitive silicon microprocessor technologies. Rather than Moore's Law being viewed as the principal model for strategic semiconductor development (Schaller, 1997; Miller & O'Leary, 2007), the user-centered approach, at the corporate level, equated to developing and delivering technologies that are were seen to respond to customer and market demands.[36] One example of this is the increasing emphasis placed on delivering increased energy efficiency of computing microarchitecture (Koomey et al., 2009). The corporation was, at the time of my fieldwork, organised into the following divisions, including: business computing, home computing, health and medical computing, mobile and embedded computing and a group addressing emerging geographical markets. Organisationally, UCDG was part of the business-computing division, which developed computing platforms to support the market for chipsets in business such as desktop computers, workstations, servers, storage technologies and related software. Primarily, this division was engaged in almost all aspects of motherboard production ensuring compatibility with, and market readiness for, the corporation's chipsets. Although the operating income and net revenue of the group had decreased significantly over the period of three years (2004 – 2006), the group's activities

[35] See (Dodds & Wollner, 1990) for a historical account of the Portland area as a centre for microprocessor industries.
[36] For a discussion of the role of Moore's Law as an economic 'mediating instrument' that links together multiple actors in envisioning of future markets in the microprocessor industry see (Miller & Oleary, 2007). For a history of semiconductors and microprocessors see (Braun & Macdonald, 1982; Mowery et al., 1998). For an example of the role of expectations in shaping the activities of microprocessor development see (van Lente, 1993: 10).

were viewed as essential to ensuring the uptake of new microprocessors, the success of which is largely dependent on the availability of compatible chipsets and motherboards.

Within the broader corporate context, UCDG was a relatively small operation. At the time of my fieldwork it consisted of fifty employees and two interns, including myself. The group was internally structured into different areas of expertise, including: human factors, engineering and usage requirements, design research, software and hardware development and engineering, user interaction design and industrial design, user experience evaluation, mechanical engineering, administration and operations, as well as a remote employee in India tasked with setting up a UCDG to engage with emerging markets in Southern Asia. The role of the UCDG within the organization was twofold. Primarily, it was tasked with supporting the activities of the business-computing group by producing reference designs for computer casings and enclosures. Furthermore, UCDG also acted as a resource for the application of user-centered design principles and practices to innovation activities across the corporation. In this way the group was viewed as a general strategic resource to aid the management of innovation within the corporation, including the translation of the 'social' into the design and production of microprocessors and computer hardware. According to key members in UCDG, this meant understanding how peoples' everyday computing 'needs' and market opportunities can inform the conception, design and development of new ICT technologies – as a principal member of the UCDG and a leading strategist within the corporation put it:

> "It's essentially user-centered innovation process. It's how do you go from either starting from a rough market opportunity you want to pursue, which is typically where you start; or, an observation or an insight about human beings and some social context or physical context – how you systematically translate and transform that into something that [the corporation] recognises as essentially a technical requirement, like a workload. We need this number of bits flowing across this bus from here to there. How do you relate this high level thing about people wanting something or desiring something emotionally to something that you can measure with voltmeters?" [37]

Practically, and in the main, this involved the design of reference hardware specifications (computer casings and input output device such as mice and monitors) for the business-computing group, the writing of usage to requirement specifications, user research conducted by design researchers and innovation practices centered around the development of prototypes. To this end UCDG was also involved in ongoing activities with various other groups within the corporation. One example of this is how, during my fieldwork, the group collaborated with various other groups within the corporation, including its global network of research laboratories, the health and medical computing group, the home computing group

[37] Interview with UCDG Innovation Strategist, August 9th 2006.

and the mobile computing group. Notably, such collaborations necessarily involved the application of UCD principles in the development of computing technologies. Such systems included an interactive device to support the early detection and onset of Alzheimer's disease and a fully functional computer system targeted at Chinese families. In both cases UCDG collaborated with different divisions within the corporation, and partnered with outside organizations, such as a leading voluntary health organization in Alzheimer care, support and research. The group also had an ongoing relationship with a small team of anthropologists and ethnographers also working for the corporation who were engaged in the strategic exploration of emerging microprocessor markets and usages. As a consequence, technologies and their associated user models and representations circulated amongst a variety of stakeholders and audiences within both the corporation and external organizations.[38]

Design in Action: Ethnography, Design and Users

How, then, can UCD be analysed as a practice that explicitly engages and involves users? Moreover, how can the role of users be understood as part of an endeavour that prominently features material and visual practices? Indeed, how can the identity, form and contents of users be better understood?

Accounts of design have tended to address the historical development of aesthetic form (Fuller, 1988), the meaning of the designed artefact (Dunne, 1999), biographies of individual designers (e.g. Pevsner, 1960; Sparke, 2010), the social and cultural contexts and impacts of industrially produced artefacts (e.g. Papanek, 1970; Forty, 1986; Whiteley, 1993), or the theories and discourse of designers (e.g. Margolin, 1989a) in how they conceive and frame the meaning of design and the designed artefact. More recently, however, social scientists have begun to address design as practice, such as the practice of architectural design (Yaneva, 2005, 2009a, 2009b), industrial and product design (Molotch, 2003; Shove et al., 2007) and the culture of design in general (Julier, 2000). In the main, the recent attention to the practices and objects of design draws on SSK and STS, in which laboratory studies demonstrated the deployment of linguistic, material and representational resources in the construction of scientific knowledge. Indeed, this commitment to design as practice links up with the field of HCI and CSCW, discussed in the previous chapter, in which social theory has been variously employed to resource and account for the design and development of ICTs (Berg, 1998; Suchman, 1999; Suchman, 2006).

[38] I use the term 'stakeholder' with the assumption that interests are constituted rather than merely reflected within the process of innovation. Furthermore, the term stakeholder also points to the different social groups whose prospective interests can be resourced by users (cf. Brown et al., 2000a: 12).

As John Law (2004: 2) reminds us, ethnographic studies of scientific laboratories have demonstrated that scientific knowledge and objects are created in *practice*.[39] Moreover, ethnographers of science have convincingly argued that such practices are *material* as well as *discursive* (e.g. Latour & Woolgar, 1986: 45; Latour, 1988b: 63). In light of laboratory studies and their legacy, it becomes apparent that to get closer to the role of users in UCD, the analyst of design must study the routine practices of designers in which users feature. Following Rayner Banham's call (1996: 299) for an anthropology of design where the design studio is acknowledged as the site in which the 'inner workings' of the tribe can be observed and understood, my methodological rationale was guided by the belief that the 'black box' of UCD, namely the user, can be better understood by participating in and observing how designers enact users in their everyday practices.[40] As such, the object of this thesis is therefore the user, as it is variously occasioned during routine design practices. Moreover, the metaphor of the laboratory serves to enlighten how design practices can be locally studied in the workplace set amidst the corporation.

Accordingly, the methodological rationale that I have developed for this study concerns following and tracing the various complex assemblages of practices, materials and discourse in and through which users are made to matter in design. That is to say, I follow Latour (1988b: 258), by studying designers and users in action: how users emerge, become stable and circulate amongst various innovation actors, stakeholders and audiences within and beyond the corporation. Further, and given STS's emphasis on controversy (e.g. MacKenzie, 1990), closure (Pinch & Bijker, 1987; Bijker, 1999) and failure (Callon, 1986a; Latour, 1996), my tracing of users also pays attention to how users do not succeed in design practice – for example how non-users are defined or how particular user representations are discarded. This, then, implies that in practice users are multiple and fluid, and points to the multi-functionality of users as they operate in relation to designed objects, the practices and beliefs of designers and the wider dynamics of technological development within the corporation. As such, users not only resource the scripting and configuring of technological artefacts but also function in various related innovation activities: for example, and by way of preview, users are employed to warrant particular innovation practices and legitimate technological decisions taken by designers; users feature in the communication of new technologies to colleagues, management, expert peer groups and publics; users feature in accounts of end-use that serve

[39] For ethnographic studies of scientific laboratories see (Knorr-Cetina, 1981; Lynch, 1985; Latour & Woolgar, 1986; Pinch, 1986; Traweek, 1988; Forsythe & Hess, 2001). For overviews of laboratory studies see (Pickering, 1992; Sismondo, 2003, pp. 86-96; Doing, 2008).

[40] The notion of the black box (Latour, 1988b: 2; 1999b: 304), derived from cybernetics, is a key term within ANT and refers to a technical object or process, broadly defined, the contents of which are taken for granted whilst the object or process works. As such, only its inputs and outputs need attention and the transformation and mediations effected by the black box remain opaque. Whenever the object breaks or fails its complex inner workings suddenly become problematised and open to scrutiny. Harman (2009: 34) argues that the term is central to Latour's view of the composition of material actors in general in that they are alliances or assemblies of associations between entities that act as a singular unit.

to mobilise management, as well as existing and potential technology partners, in support of sociotechnical visions; users are employed to resource designers' and innovation actors individual career paths and professional agendas; accounts of users serve to mediate the work of corporate researchers to scholarly audiences; and finally, users are also deployed to support arguments concerning the use of design and the importance of the 'social' within a corporate setting conditioned by the logic of Moore's Law. Accordingly, to apprehend and trace the various forms, competencies and roles of users in design practice, it is necessary to broaden the notion of the user to include more than simply users as embodied persons. That is to say, users can also be analytically traced in representations and usages embodied within artefacts, in the discursive deployment of rhetorical figures and in the complexes of data and knowledge that inform and support design practice.

As laboratory studies have demonstrated, the most suitable method for studying material and visual practice is ethnography. Following Law (2004: 41) an STS approach to ethnography amounts to a 'method assemblage' in which the empirical is actively constituted out of additions and relations between bodies, objects, practices and words. As Hess notes (2009: 239), STS ethnographies involve the collection of multiple forms of data sourced from various points of contact within the field. This, I will argue, enabled me to study the various involvements of users during the routine synthetic practices of designers, something the history and discourse of design has had little to say about. In this context, Hamersley and Atkinson supply a basic description of the ethnographic method:

> [Ethnography is] a particular method or set of methods which in its most characteristic form … involves the ethnographer participating overtly or covertly in people's daily lives for an extended period of time, watching what happens, listening to what is said, asking questions – in fact, collecting whatever data are available to throw light on the issues that are the focus of the research (1995: 1).

Further to this, Annemarie Mol points to the utility of ethnography as a methodological instrument for studying users, in which the ethnographer must be attentive to the synthesis and ordering of heterogeneous elements involved in socio-material practices:

> "The ethnographic study of practices does not search for knowledge in subjects who have it in their minds and may talk about it. Instead, it locates knowledge primarily in activities, events, buildings, instruments, procedures and so on. Objects, in their turn, are not taken here as entities waiting out there to be represented but neither are they the constructions shaped by subject-knowers." (Mol, 2003: 32)

Given that UCD, as described in the previous chapter, is a commitment to the practical application of the principles of user involvement, ethnography – a method calibrated to understanding practice – is the most applicable research method. Moreover, an STS approach to ethnography, which foregrounds the socio-material practices of interdisciplinary

innovation actors, is well suited to the study of design in action and the multiplicity of users enacted therein.

Some Principles for Following Designers and Tracing Users

For this thesis, the correspondences between Woolgar's (1991a) and Akrich's (1992b, 1992a, 1995) ethnographies of users, discussed in the literature review, serve to highlight the key methodological principles for studying users in design practice.[41] However, in contrast to Woolgar and Akrich's studies in which putative users are encoded into technical objects as protocols to be negotiated during end-use, I am concerned with how designers variously employ users as a local resource during design processes. Consequently, I am not exclusively concerned with the mutual shaping of technology and users, but rather the flexibility and multiple roles of users as they come into being and are deployed in design practice. Nonetheless, both Akrich and Woolgar provide important methodological premises, and point to the advantages of an ANT informed methodology.

The first parallel I want to draw attention to in the work of Woolgar and Akrich concerns the identity of users. Woolgar, for example, shows how users are encountered in a variety of forms, including test-users (1991a: 81) and rhetorical figures within the everyday conversations of engineers (ibid.: 73) and marketers (ibid.: 70). Similarly, Akrich (1992a: 174) argues that users have 'varying definitions' that come into view during different stages of innovation. Furthermore, both Akrich (1995: 168) and Woolgar (1991a: 89) view material objects as the semiotic embodiment of putative users. Practically, this insight implies that in following designers the analyst does not make the a-priori assumption that users only exist as human-users. Rather, the analyst must remain *impartial* 'as to the various actors we follow' (Latour, 1988b: 258). Accordingly, in following designers and tracing the involvement of users one must pay attention to the heterogeneity of entities and actors that participate in the design process, including, but not limited to: personas, prototypes, research papers, microchips, user-requirement models, presentations and publicity material.

The second parallel concerns how users take their form and acquire their attributes by virtue of their relations to other entities: in other words, the heterogeneous composition of users. On this score, Woolgar (1991a: 70) recognises that users require spokespersons – experts who speak on their behalf – which implies that users are not discrete actors but are, in practice, distributed across material and discursive processes. In short, their identity and composition is an upshot of the associations between entities. Likewise, Akrich (1992b: 222) argues that in order to understand users the ethnographer must pay attention to the reciprocal relations between an artefact and its users. In her view (ibid.: 205), technical objects are

[41] Arguably, these principles, most notably impartiality and symmetry, are derived from Bloor's four tenets for the sociology of scientific knowledge (Hess, 2009: 235).

composites of heterogeneous elements. Further, Akrich (ibid.: 206) asserts that users are entangled in sociotechnical networks that are formatted by technical objects. This can be illustrated by way of the empirical material that I present in chapter six. Here, an interactive healthcare technology serves to format the identity and capacity of putative users. The technology involves the interplay of mobile phone based software application, walking routines and social networking. It also assumes users' involvement in contractual and economic relations with a telecommunications service provider, contact with its employees, and the use of a technical communication infrastructure. In development, however, the health technology itself is also formatted through the configuration and involvement of various types of users. The attention to the relationality of users draws out a key methodological premise of ANT, namely the principle of generalized symmetry (Callon, 1986a; Callon, 1986b: 196; Latour, 1988b: 258; Callon & Latour, 1992: 348). Here, the epistemological assumption is that users are not a-priori human or non-human, material or discursive actors but rather emerge out of negotiations between those actors involved in the process of defining the identity and capacities of users. Thus, in following designers' practices what is studied are the alignments of heterogeneous actors that construct stable user networks (Michael, 2000b: 20).

The third parallel concerns the situated and mutual emergence of technological objects and users. Woolgar (1991a: 68), following Garfinkel (1967a), argues that computer systems are 'reflexively tied' to their context. In other words, the computer and its context of use mutually elaborate one another. Moreover, the user is also implied in and elaborated by this reflexive tie. Reckwitz (2002: 249) provides a way to understand design practice and user involvement in regard to social theory and method.[42] For Reckwitz, practice is a 'routinized type of behaviour which consists of several elements, interconnected to one another: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge.' A commitment to design as practiced locally and the role of the user therein also calls to mind Suchman's (2006) study of human-machine interactions, played out during the design of a photocopier expert help system. Here, Suchman develops an ethnomethodological approach to the design of interactive systems, wherein she attends to the situated actions of designers and how users and interactive systems are mutually accomplished as outcomes, not givens. As such, Suchman (ibid.: 12) views 'the boundaries between persons and machines to be discursively and materially enacted rather than naturally effected'. In this way, design practice is understood as the locus of situated sociotechnical achievements, where the agency of prospective users and interactive computer systems are defined. Moreover, as Suchman (ibid.: 259) argues, agency is distributed amongst humans non-humans, users and machines; thus

[42] For practice theory see also (Schatzki, 1996; Schatzki et al., 2001).

methodologically speaking, multiple users can be identified during in-situ practice of designers as they distribute agency across user representations and technologies.

Consequently, one key site in which users emerge in design practice is the workplace of the designers. It is here that designers gather and mobilise the heterogeneous resources that are required in the construction of designed artefacts. Like scientists, designers are also engaged in practical synthesis. Thus, following Latour (1988b, pp. 215-257; 1999b: 304), I approach the design studio as a *centre of synthesis* in which all the various social and technological elements that are brought into play during user-centered design practices are assembled into coherent socio-technological propositions.[43] Such designed outcomes include, but are not limited to: prototypes; user requirements and usage-to-requirement specifications; various representations of users; market and demographic projections that are all brought together with material affordances and stabilized during the production of novel technologies. The designers' *centre of synthesis*, however, operates by virtue of its interconnectedness to, and linking together of, other centres of calculation and synthesis in the corporation, for example scientific and engineering laboratories, meeting rooms, offices, workplaces, and industrial testing and fabrication facilities, all variously associated with the production of microprocessors and associated technologies.

One upshot of following the various roles and forms of involvement of users in practice concerns how the different users can be adapted for use by different interested actors or social groups, such as designers, design researchers, human factors specialists, marketers, management, technology partners and so forth. This implies viewing users as *boundary objects* (Star & Griesemer, 1989). However, the performative approach I take, following Mol, suggests that in design practice objects and users do different things in different contexts. Thus, I draw on Mol's (2003: 41) definition of the term 'enact' to describe how an ethnography of users in practice addresses the situated emergence of multiple forms of users. For the study of the multiplicity of users and heterogeneity of their composition Mol's notion of enactment is instructive. Mol's use of the verb enact is closely related to the notion of performance. However, Mol prefers the term 'enact' as it doesn't carry the frontstage/backstage residue of Goffman's (1956) dramaturgical model and its emphasis on human actors. What Mol does insist on, drawing on Judith Butler's (1990) analysis of gender identity, is that actors identities are occasioned in performance, not preceded by them. Drawing on theories of performativity and applying them to actors other than human actors enables Mol to speak about the enactment of objects, in her case the disease atherosclerosis. This view also aligns Mol with constructivist accounts of objects, most notably Latour and Woolgar's account of objects in Laboratory Life (1986). It is in the laboratory that objects

[43] I elaborate on the studio as a centre of synthesis in the following chapter.

become known and are stabilized. In short, it is where the reality of objects is established and maintained. As Mol (2003: 43) demonstrates, the ethnographic method orients my research to the routine and in-situ enactment of artefacts and users where assemblages of design come together to actualise and materialise virtual relations, in, for example, prototype technologies and representations of prospective users. With the above in mind, in this thesis I use the words enact and perform interchangeably in the manner defined by Mol.

The methodological premise that users are enacted as heterogeneous sensitises me to the material conditions in which users are brought into being and the specific contexts in which they are deployed. In other words, users' identities and competencies are locally assembled, and their identity can differ between sites. An example of this is how user representations enacted in concrete design practice differ to user representations enacted as part of meetings, communication material or demonstrations. During the making of actual technologies, users can be adaptable, contingent and contested, as I will demonstrate in chapters four and five. User representations enacted in communications, however, can be obdurate, strengthening the reality of the sociotechnical proposition to prospective customers and consumers: for example, the myriad of users that are narrated in ethnographic accounts of users presented in chapter seven.

In summary, Akrich and Woolgar's work on users provide three key methodological principles that serve as valuable heuristics for the ethnographic study of designers and the role of users in their routine practices. The principles include: (1) tracing the heterogeneity of users and technologies that are brought into play during design practices; (2) tracing the heterogeneous composition of users and technologies, i.e., their relationality; (3) and finally, examining how users and designed artefacts are reflexively tied to the specific contexts of design practice in which they emerge. Here, I draw on Mol's notion of enactment and Suchman's view of local design achievements to understand the specificity of users that both resource and emerge in the course of in-situ design practices.

Issues, Criticisms and Challenges

My ethnographic study of users as performed in design practice engenders a number of methodological issues. Although methodological reflection on ethnographic studies conducted under the rubric of STS is somewhat limited, Hess (2009) provides a useful summary, distinguishing between first generation laboratory studies and second generation cultural and interventionist approaches. In the following, I describe a key set of methodological issues and challenges I faced which, according to Hess, places my ethnographic study in the second generation of STS ethnographies. The methodological issues and challenges include: my 'native' competence as a designer; the empirical extent of users understood as heterogeneous networks; the 'network', as used by actor-network theorists, as an outmoded ordering

principle; the means I have used to avoid heroic and managerial accounts of innovation; and my rationale for not examining a single technology, a single instance of a user or one particular aspect of design practice.

As Hess points out (2009: 239), STS ethnographies often involve the researcher gaining 'near competence' in the technical aspects of the technologies involved. This is an epistemological competence. However my involvement in the field required practical expertise and tacit knowledge (Collins, 1974: 167) in designing user-interfaces and contributing to design processes. In this regard, I conducted my fieldwork as a 'Native Ethnographer' (Weston, 1997: 164), in that my hybrid role as designer/ethnographer blurred the distinction between my practices as an ethnographer and designer, as well as the subject and object of my study.

A key issue concerning the empirical study of users as emergent in heterogeneous networks enacted in practice concerns how all the disparate entities that participate in the coming into being of users can be encompassed and defined. That is to say, what counts as a user, and where do particular versions begin and where do they end? This issue concerns the boundary and extent of users. If they emerge in, and exist in, entangled networks of heterogeneous entities, how does one map the spread of entities, and where, practically speaking, does the ethnographer begin and end? For Callon and Law (1995) delineation is a matter of taste. Strathern (1996: 525) argues for an empirical version of demarcating the boundaries of an ensemble. For Michael (2000b: 21) defining the extent of a network is an analytic procedure that is determined in retrospect. For this thesis, then, the delineation of user (as heterogeneous) is a practical and analytic procedure that was in part determined by my access to data and my situated perspective as an intern designer/ethnographer. Practically, I relied upon my local encounters with users during participant observation and document analysis, where users were brought into play and variously enacted in relation to technologies in multiple contexts by different innovation actors. One example of this, in chapter six, is my examination of how a daily exercise prototype mediated the enactment of end-users as consumers, as well as the organizational practices and disciplinary commitments of producer-users. This example also serves to demonstrate how users come to light during analytic examination, and how my own partial (Clifford, 1986: 7) accounts of users involved empirical investigation of related material during and after my involvement in the field.

A related point to the above, and one that I will elaborate on in this thesis, is the utility of the notion of the *assemblage* in preference to the concept of the network as a means to understand users as heterogeneous ensembles enacted in practice. As Latour (1999a: 20) notes, the term 'network' as an analytic and topological ordering principle has suffered from the contemporary prevalence of 'double-click' networks, reducing the concept to a technical metaphor in which relations between actors and entities are ordered and well structured.

Criticism from within ANT has drawn attention to how networks speak of presence, immutability and durability but fail to capture transformations, absences and intertwined networks. This had given rise to alternative metaphors for understanding heterogeneous and topological arrangements, such as 'regions' and 'fluids' (Mol & Law, 1994) which seek to talk about contingency, temporality and multiplicity, as well as objects without well-specified boundaries, such as the treatment of anaemia in Zimbabwe (ibid. 1994: 658). In this thesis, I address this issue by drawing upon the work of Deleuze and Guattari, particularly their notion of *assemblage* (1988: 88) as a heuristic for writing about users as emergent actors, composed of and in heterogeneous relations, whose ordering and structure is empirically occasioned in situated practice.[44] The notion of assemblage also sensitises my analysis to how users circulate and disseminate amongst stakeholders, and work to resource not only the making of concrete technologies but also the construction of expectations. In contrast to network, assemblage also orients me to how users may emerge as disorderly, ambivalent and non-instrumental, for example the occasioning of an elderly diabetic non-user examined in chapter four. Moreover, I use the term assemblage to emphasize the synthetic, aesthetic and object-oriented practices of designers as they draw together disciplinary knowledge, emerging technologies and representational material in the making of sociotechnical propositions.

The notion of assemblage also has methodological implications, which are largely congruent with developments in ANT. One example of this concerns mapping the extent of relations encompassed in and produced by assemblages. As Deleuze and Guattari (1988: 503) put it: "The first rule for assemblages is to discover what territoriality they envelope". Assemblages are also made up of heterogeneous components, which at base includes form (material) and content (discourse) (ibid.: 43). Also, and crucially for this thesis, assemblages may contain aspects of power and resistance, but such political processes can never fully explain them (ibid.: 531). Now, the notion of assemblage plays a crucial analytic role in this thesis in how I describe how users are assembled – figuratively and materially – in design practice. In doing so I develop the notion in the form of *user assemblage* to better grasp the complex interweaving of bodies, technologies and discourse in UCD. As such, this thesis empirically builds up to an extended discussion of users-as-assemblages that takes place in the final chapter.

A further methodological issue is raised by feminist criticisms of ANT as a managerial approach to science and technology. Methodologically, I address this by focussing on the circulation of users as they are enrolled and deployed by various innovation actors involved in

[44] For an example of how the notion of assemblage has been adopted within STS see (Irwin & Michael, 2003: 119). For its utilisation within anthropology in relation to globalisation see (Ong & Collier, 2005b: 12). For a somewhat disapproving discussion of the uptake of the notion of assemblage as vogue within the social sciences and cultural theory see (Marcus & Saka, 2006). See also (Murphy, 2006) where the notion has been employed as part of a feminist account of technoscience in relation to the affective relations between buildings and bodies.

the development of technologies. On this score, Woolgar points out (1991a: 68) that users are the upshot of the activities of various innovation actors. This was also the case in my ethnographic study, where users are established and circulated by design researchers, interaction designers, industrial designers, computer scientists, and human factors specialists, as well as project managers. As a consequence, I do not focus on the heroic or managerial agency of a particular innovation individual or group, nor do I place emphasis on a single obligatory passage point (Latour, 1988b: 150). Rather, I show in the following empirical material how users pass and move amongst various points of passage, acting in the management of multiple and divergent interests. Admittedly, however, my field site was pervaded by what can be characterised as a male dominated engineering culture. As a consequence, gendered relations subtly permeated my field. I address this in chapter five where the persona of a suburban housewife is configured from existing genderscripts. The engineering culture inflecting my field site cannot be fully explained by gender differences. My informants, for example, often spoke about being marginalised as designers and, as a response, having to align their views on user-centered design with the corporate strategic orientation of user-centeredness.

Haraway has also raised concern with STS accounts of technoscience regarding the role of the researcher in the construction of knowledge. What Haraway (1991: 189) calls the 'god trick' can be understood to refer to how STS scholars trace technoscientific networks without accounting for their own participation and influence. In short, Haraway is pointing to a constructed analytic distance where the researcher views the researched from above. With reflexivity (accounting for my own account of design) in mind, I include, where relevant, my own involvement in the field in writing up my account of design practices. As such I employ Latour's 'infra-reflexivity' (1991a: 169) to make clear the production of my own text.[45] In other words, if the practices of designers constitute a form of design knowledge then my account of design practice constitutes sociological knowledge.

Cowan's (1987: 236) notion of the consumption junction also poses a methodological issue for the study of the role of users in UCD. For Cowan, technological artefacts must be studied from development to consumption in order to fully explain their success of failure. The circumstances of my study of designers at the corporation, however, meant that this approach was unfeasible for practical and methodological reasons. An example of this is how, in following designers and tracing the involvement of users in their practices, I was obliged to address various innovation actors and multiple technologies. The designers I followed were, themselves, working on various projects at any one time. Moreover, my obligations as an intern interaction designer necessitated my own involvement in various projects, making the

[45] For the methodological question about reflexivity, not to be confused with the ethnomethodological understanding of reflexivity, see (Ashmore, 1989; Woolgar, 1991b; Lynch, 2000).

following and tracing of a single technology impractical. The work of the designers was rarely, if ever, brought to market. Their work was primarily oriented around producing reference designs and visions of future computing applications in order to stimulate and guide corporate, partner and customer product development. Furthermore, many projects failed to gain continued resourcing and funding allocation, due to changing corporate strategy and agendas within HCI.[46] As I will empirically demonstrate, the 'products' of the designers played various roles, including, but not limited to: acting as demonstrable models for further R&D, as vehicles for designers' research agendas, and as indicators of potential markets. Furthermore, in practice users and technologies functioned in various forms to resource different interests and agendas.[47] In chapter six, for instance, I describe how multiple users resourced the development of a ubiquitous computing technology, including a novel sensor technology that resourced multiple computing applications and sociotechnical visions. Lastly, the product development process was far longer than the six-month duration of my fieldwork. Thus, rather than following technologies through the consumption junction, I follow users as they are variously enacted and deployed by stakeholders and audiences in the corporation, i.e. amongst designers and other experts including engineers, marketers etc. Thus, my examination of UCD shows how design processes involve much more than a commitment to fabricating fully formed commodities, and that users cannot be reduced to determining the fitness for purpose of design artefacts.

Fieldwork and Methods

I spent six months, from May to October 2006, in the field studying the UCDG and the role of users in their design processes. The duration of my fieldwork was determined by the length of my contract as an intern at the corporation. I lived in a city in Oregon and commuted to my workplace where I worked every weekday. After my fieldwork, I maintained correspondence with many of my informants in order to verify particulars and collect further data where relevant.

The field site was chosen for both practical and theoretical reasons. Practically, access to the UCDG was relatively straightforward and was determined mainly by the generosity of certain members of the group. Contact with the corporation was made through an employee who had studied the same postgraduate design programme as myself. My request for access was passed onto the manager of the design research team, who solicited the group for interest. The manager of the interaction design team, within the UCDG, required a skilled and

[46] In the context of the corporation 'customer' refers to technology manufacturers and service provides who purchase and include the corporation's microchip technologies in their product. As such a subtle distinction can be made in the corporation's terminology between 'user', such as end-user, and customer.
[47] Studies of failed technological projects (e.g. Callon, 1986a; Latour, 1996; Law, 2002) demonstrate that following a technology from conception to consumption does not ensure an analytic yield or methodological robustness.

experienced user-interface designer to work on a number of projects. Although I was employed as an intern, it was recognised that I embodied the skills and knowledge of an experienced interaction designer. Access was therefore dependent on my skills and experience as a designer. This was established through negotiations prior to my entry into the field where I supplied my gatekeeper and the interaction design manager with a visual portfolio of previous design work. This was followed by a telephone interview wherein my credentials and suitability were confirmed. In the field, I also became aware that members of the UCDG were predisposed to my study since many members were familiar with the social and human sciences, such as the discipline of psychology and various research methods, including ethnography, which they themselves employed as part of their everyday work activities. Moreover, the UCDG also had a long standing working relationship with the ethnographers employed by the corporation. As such, my role as an overt researcher was neither strange nor threatening.

In my capacity as a user-interface designer I was assigned to work on various projects underway within the design group. In this way, my role was dual: on the one hand I was an ethnographer conducting participant observation of design practice; on the other hand, I was a designer engaged in the practices and processes I was observing. In this way, my field site can be understood as a site in part constructed (Emerson et al., 2009: 354) by virtue of my own training as a designer and the needs of the UCDG.

As well as access to the field, I also encountered the issue of access within the field. The ID and access badge I was issued provided me with access to certain facilities only, which for my day-to-day participant observation proved to be more than adequate. On many occasions I also gained access to other parts of the corporation through various work commitments that necessitated attendance in other facilities. I was also provided with guided tours of the corporation's industrial facilities, including a microprocessor fabrication facility ('fab') and a microprocessor testing facility that continually monitored the quality of microprocessor yields.

The field site provided a location in which I could observe the routine enactment of users during the everyday practices of the design team. Here, the UCDG design studio was a site in which I could make first hand observations of designers and the diverse ways and forms in which users participated in the design process. Moreover, I observed how the enactment of users was interwoven into a broader culture of technological development. The corporation thus acted as a setting in which the principles and practices of UCD, as applied by my informants, could be observed in relation to other innovation activities within the corporation. As Kleinman (1998) shows, the field can be affected by institutional and historically structural contexts. An example of this were the structural dynamics at play in corporate rhetoric and terminology such as Moore's Law, 'silicon play' and 'core business' that were commonly

deployed in order to direct negotiations, and warrant particular design and technological decisions.

The design studio, where the majority of my fieldwork was conducted, was situated in a large two-floor facility that also housed the corporation's business-computing division. The UCDG also had a number of dedicated meeting and project rooms in other parts of the building. Given the studio's setting within the business-computing facility, the everyday activities of the designers took place in close proximity to workgroups dedicated to motherboard chipset development and marketing. Thus, the designers' workplace was set amidst a larger complex of individual workspaces, various types of computing laboratories, meeting and presentation rooms and logistical facilities, as well as catering amenities – where many face-to-face meetings took place. The building housing the UCDG was itself was part of a cluster of facilities, including other large multi-functional corporate buildings and industrial facilities related to the manufacturing of microchips.

My field site can be further understood as multi-sited for the two following reasons. First, my fieldwork extended across many of the workplaces that comprised the corporation's Pacific Northwest cluster of facilities. In some cases, my fieldwork also included off-site visits, including the ethnographic interview with an elderly man suffering from diabetes, discussed in chapter four. Second, I observed much of the designers' work facilitated and mediated by ICT networks, including the corporate intranet and the Internet. My study of designers' practices therefore encompassed exposure to multiple sites and modes of practice, including direct observation and electronically mediated contact. In these various ways, my access to the local was largely dependent on various modes and scales of technical infrastructures (Gupta & Ferguson, 1997: 8).

Participant Observation

Participant observation was conducted on a daily basis in the UCDG workspace, in and around the corporate facilities, as well as off-site locations. This included first-hand experience of the day-to-day activities of design practices of the designers in their organisational setting, as well as regular project meetings, briefings and weekly design meetings in which members of the design team within UCDG reported on the status of their work. I also attended presentations, research forums and a conference (the subject of chapter seven of this thesis). At the very beginning of my fieldwork I took written notes. However, it was common practice within the organization to carry a company laptop computer at all times. Employees would be working on their laptops whilst attending meetings and other group activities, and so in order to appear inconspicuous I typed notes directly into the laptop. As such, taking field notes was 'broadly congruent with the social setting under scrutiny' (Hammersley & Atkinson, 1995: 177). When it was not possible to take fieldnotes immediately, I would later write up

observations in my allotted individual workspace. This provided invaluable privacy with which to record fieldnotes somewhat contemporaneously with events. Finally, at the end of each working day I would write a 'running log' (Jackson, 1990: 6).[48]

During my fieldwork I worked directly on three projects. The first project centred on the design and development of a mobile health technology. My participant observation of this project forms the basis for chapter six. The second project, covered in chapter four, involved the conception and innovation of an entirely new health technology for people managing a chronic disease. For the final project I was asked to collaborate on a short 'ideation' project, where the market opportunities of a 'system-on-a-chip' computing platform were explored through a series of innovation meetings. I was also opportunistic in terms of access to different meetings across the corporation. This included my attendance at meetings not associated with my project-based responsibilities. Wherever possible, I tried to attend such meetings in order to elicit data concerning wider corporate practices where user-centered design and users might feature.

In line with British Sociological Association (BSA) ethical guidelines, I respected the physical, social and psychological wellbeing of my informants. I have anonymised all my informants in my field study in order to ensure their privacy and confidentiality. For employees of the corporation, I have either used pseudonyms or I have referred to their job title in order to register their disciplinary expertise within the UCDG. In accordance with the BSA and the American Anthropological Association (AAA) code of ethics I obtained informed consent from all my informants on an ongoing and dynamic basis including the future use of research data.

Ethnographic Interviews

Alongside participant observation, I conducted thirteen topic-guided qualitative interviews with key personnel within the UCDG. I conducted the interviews in order to elicit the views and beliefs of certain informants regarding the role of users in the design processes, project details that I was working on, and the terminology of my informants. Given that the interviews were conducted on-site with informants with whom I'd established ongoing and respectful relationships, and were part of my wider fieldwork, I consider the interviews to be ethnographic rather than qualitative (Heyl, 2009: 369). Informants were selected on the basis of their value to projects I was assigned to work on and their involvement in the UCDG, as well as their views on users. As it turned out the interviews provided me with an opportunity to investigate the role and emergence of the user-centered design group within the corporation and employees' roles and responsibilities – as well as determining the precise

[48] For an overview and discussion of the role of field notes in ethnography see (Emerson et al., 2009).

meaning of technical and corporate terminology, such as 'usage to requirements model' and 'silicon play'. During the interviews, however, my informants became guarded and cautious providing formal accounts of their organizational activities, and thus towed a somewhat official corporate line. Contrary to Seale's (2000: 207) suggestion that as part of field work, interviews with informants can generate trust and therefore lead to more accurate and intimate accounts I found that informants tended to be more open when engaged in routine conversation, rather than in settings where their role as an informant was emphasised. The interviews were taped, transcriptions were made from the recordings and informants and other identifying features were anonymised. For the ethnographic interviews, I obtained written informed consent, with each informant receiving a copy of the consent form. Finally, interview data was subjected to discourse analysis and used to support the arguments I make in the following empirical chapters.

Document analysis

A valuable resource for ethnographic studies is the analysis of documents (Walsh, 2000: 227). As with most corporate institutions, my host organisation produced vast amounts of documentation, of various types and forms, to which the UCDG contributed. The documents I analysed can be organized into three broad categories: corporate and strategic documentation, design and technical documentation, as well as scholarly and research documentation published for expert audiences. Corporate documentation included reports, strategy documents, technical, consumer and market trend analysis documents, microprocessor technical specifications, corporate and brand guidelines, commercial partnership propositions, market reports, and social and user research reports produced by the UCDG, as well as other groups in the corporation, such as the industrial ethnographers, microarchitecture concept specifications and meeting agendas. The design and technical documentation included product and innovation documents, usage models, software application specification and guidelines, usage to platform requirements, technical and design specifications. Design documents also included various types of visualisations such as personas, CAD renderings, graphical mock-ups of prototype systems, arrangements of Post-it® notes, photographs of users and research participants, user-interface wireframe diagrams, interface and industrial design concept sketches, conference posters and various other visualizations of users and technologies. These somewhat finished visual documents were constructed with computer graphic files, made with image production and manipulation software such as Adobe Photoshop and Adobe Illustrator. Such files and software applications were used for the production of user-interfaces and other visual material. Academic and research documentation included journal articles, conference papers, conference documentation and conference posters.

The majority of documents came in electronic form, such as PowerPoint documents; word-processing files, PDF files, and graphics files distributed via the corporate intranet or by email. My access to documentation came mainly through project work, as well as material associated with meetings and presentations within the group and within the corporation.

ANT teaches us that documents are not to be merely treated as representations (Cottle, 1997: 284), nor are they simply the representation of the organization's practices and processes to employees and relevant audiences (Atkinson et al., 2009: 5). An ANT inflected ethnographic approach to document analysis views documents themselves as material artefacts, linked into practices, and connected up with other entities in chains of reference (Latour, 1999b: 34). In this way, I view textual and visual documents as part of the processes by which users are assembled and circulated within the corporation, as well as the form that many users took during my fieldwork. Accordingly, in the following empirical chapters I make extensive use of documents found or related to my fieldwork.

Photography

During my fieldwork I shot approximately one thousand photographs of, in the main, visual material, physical prototypes, and the workplace. My use of photography has two principle functions. First, I employed photography as a form of visual note taking. In this way, photography was a means by which I collated visual data (Collier, 1967) on material and visual practices of the designers that were not verbalized (Henderson, 1991: 449). Practically, this enabled me to collect data whilst actively participating in design activities that were frequently organized around and resourced by visual material. Moreover, in certain cases, such as the 'in-home' interview discussed in chapter 4, I was tasked with taking photographs as part of my duties as a designer. In this case, photographs acted as data for the design process *and* data produced as part of my participant observation. Second, I have incorporated photographs as a visual resource in the presentation of my ethnographic accounts of user enactments in the design process. Here, I employ photographs to illustrate, frame and point to the visual objects and practices (Ball & Smith, 2009: 304) encountered in the field.

The use of visual methods, especially photography, has a long history in sociology and ethnography (Ball & Smith, 2009), and the role of visual material in scientific practice has also had considerable attention by scholars in STS (see for example: Lynch & Woolgar, 1990b; Burri & Dumit, 2008). In both, the interrelated issues of realism and representation concerning the visual as method and visual objects as empirical material are foregrounded (Ball & Smith, 2009: 311). These debates revolve around what has come to be known as the crisis in visual representation, where the authenticity and objectivity of documentary photography has been disputed (e.g. Sontag, 1977; Tagg, 1988). Theoretically, I treat photographs as *indexicals*, in that they stand for and point to the complex practices and tacit

knowledge of the designers enacted within the design studio. Moreover, photographs also act as indices of users as encountered as representational objects – for example, sketches, diagrams, tables, drawings, illustrations, photographs, computer renderings, posters, arrangements of Post-it® notes occasioned in meetings and embodied in physical prototypes. In this way the photographs presented in this thesis act as *inscriptions* (Latour, 1986; Latour & Woolgar, 1986; Latour, 1988b, 1990) in that they have been produced during my fieldwork and then deployed as figures in the writing of this thesis in support of the ethnographic text.

In both modes, as visual note taking and as ethnographic inscriptions, my use of visual representation is consistent with an ANT approach to visual material. That is to say, the view that representational material act as 'network-organizing devices' (Henderson, 1991: 456) that are indexical, in the ethnomethodological sense, to the setting in which they are deployed, as either the resources and accomplishments of designers in the field or as part of the literary construction of this thesis.[49]

Ethical Considerations

A general methodological point about ethnography is that its methods are locally applied in specific circumstances, which involves the ongoing interpretation and application of programmatic guidelines whilst in the field. As Garfinkel (1967a: 9) might say, the ethnographic application of ethical guidelines requires 'practical accomplishment'. Ethical guidelines attune the researcher to the welfare of informants and the sensitivities of the field and this requires active interpretation where viewed appropriate to the ethnographer. With this in mind, fieldwork, including ethnographic interviews, was conducted in accordance with ethical guidelines and codes set out by the BSA, the AAA and the Department of Sociology, Goldsmiths, and set out where relevant in the above.

In the previous sections, concerning data collection, I briefly discussed my approach to building trust and gaining ongoing verbal and written informed consent from my informants. As Murphy and Dingwall (2009: 341) note, the protection of the field setting and informants' identity by removing indentifying features at the earliest possible opportunity, as well as continually using pseudonyms and changing non-relevant details was carried out in the translation of my field-notes into written up ethnographic accounts. However, it is likely that the curious reader will likely be able to identify the source of data, and informants will likely be able to recognise themselves. Murphy and Dingwall (2009: 341) acknowledge this as a feature, and perhaps failure, of the ethnographic method in ensuring anonymity.

The first ethical issue concerns the identity and confidentiality of the technologies that I worked on during my research. My approach to this issue was on a case-by-case basis, with

[49] See (Garfinkel, 1967a: 5) for an explication of indexicality and ethnomethodology. See (Law & Williams, 1982: 19) for a discussion of the indexicality of terms within scientific papers, viewed as networks of resources.

two guiding principles. The first principle regards the public availability of projects and research material, for example papers published for conferences or projects that were communicated to audiences and available in the public domain. In chapter seven, for example, I reference material published on the Internet and in scholarly journals in order to provide empirical evidence of the cases supporting my arguments. The second principle regards the anonymisation of informants (humans) and technologies (non-humans). In chapter four, for example, where I examine an interview with an elderly diabetic man to resource the conception of a new health technology, I have anonymised the identity of the interviewee and the interviewer. Moreover, I deliberately avoid describing the technological outcomes of the following meeting and research process to ensure that commercially sensitive material is not disclosed.

The second issue concerns the organizational re-structuring that was ongoing during my time in the field and how it affected my participants. During my time in the field, one informant was made redundant and the others were under the direct threat of redundancy. I have deliberately omitted all references of this from my ethnographic account. My reasons for this are as follows. First, informed consent was granted on the basis of my research being framed in relation to the practice of design and user-involvement, not as a study of workplace relations in the context of organizational sociology or anthropology. This is demonstrated by my choice of topic, informants and setting, as well as my neglect of such literatures in this thesis. Furthermore, redeployment and redundancy, as far as I could gather, was an ongoing and background concern amongst employees due to periodic economic downturns and shifting strategic engagements. Consequently, and given my limited period of fieldwork, commentary on how such matters might affect the practices of my informants would be ethically inappropriate and analytically unsound.

Finally, in relation to the issues above, the 'temporal positioning of risk' (Murphy & Dingwall, 2009: 340) in the case of this ethnographic study is alleviated by the four year delay between the ethnographic fieldwork I conducted and the completion of this thesis. In this way, the organizational pressures and dynamics that I observed and participated in, the research agendas and issues of my informants and the time-dependent relevance of the technologies employed and prospected have no doubt changed.

Conclusion

In this chapter, I have outlined the concepts and methodological framework I have developed to study the role of users in design practice. I have also examined the key issues and challenges I faced in the field and during analysis. More specifically, I have described how the object of my inquiry, namely the user, can be studied as an emergent and relational actor that cannot be reduced to the person-user. As such, I have elaborated on an ANT-inspired framework,

drawing in the main on methodological insights gleaned from Akrich and Woolgar's ethnographic studies featuring users. This has equipped me with an empirical approach for exploring and understanding the enactment of users during user-centered design practices. These insights also set out the necessity of approaching the analysis of the practices of designers and their synthesis of heterogeneous resources (material, representational and discursive) requiring a form of ethnographic method assemblage: an approach I use to conduct an in-depth analysis of the user as it is variously deployed in design. In sum, this chapter establishes a means for approaching users as encountered in practices situated within the corporate setting of a dominant ICT manufacturer. In the following substantive chapters I present four case studies, drawn from my fieldwork, in which I examine in detail the involvement of users, as multiple and heterogeneous, in user-centered design practices. I open my study of the substantive material with the case of an interview with an individual and end with a case where scores of users were reported on during an industry conference.

Chapter 4.
Assembling Diabetes, Reassembling a Non-User

Introduction

As a substantive starting point to this thesis, I examine the role of a non-user in mediating the expectations of a design team tasked with inventing and designing a system to enhance the management of diabetes. I trace how user involvement was accomplished at two key interrelated sites: an 'in-home' interview conducted with an elderly man in his home, followed by an innovation meeting in which data derived from the interview featured prominently.

This chapter is structured in a twofold way in order to stress the assembly and reassembly of the patient-user as processual, and to underscore my own analysis as part of this. First, I describe the interview as an instrument with which a 'thick' (Geertz, 1973: 7) account of a diabetic in his 'natural' habitat was occasioned. I show how the interviewee was performed as a situated user in relation to various sociotechnical entanglements, including personal health management, domestic habits, and family relations, as well as health care provision. Due to the unruliness of his practices, as narrated during the interview, the design team classified the interviewee as a non-user. Despite this, I describe how accounts of practice derived from the interview were employed during the meeting to resource the evaluation of technological opportunities associated with diabetes. Second, I present a further analysis of the interview and the meeting. I discuss how visual artefacts, such as Post-it® notes, served as *descriptors* that rendered techno-diabetic networks, derived in part from interview data, available to the speculative and inventive practices of the design team. I describe how features of lived *medico-technological networks* (Brown & Webster, 2004: 105) derived from the in-home interview were abstracted and recompiled with other aspects of diabetes, as a means of re-assembling both patient-user and disease for innovation purposes. Furthermore, I describe how the meeting room, as the site where descriptors of diabetes were produced and visually arranged, functioned as a *centre of synthesis*. Here, the design team encoded and recompiled features of diabetes brought to the meeting. Thus, despite the classification non-user, the interview data resourced the prospecting of diabetes as a chronic disease suitable for technological intervention. I set my analysis of a non-user in relation to STS accounts of non-users and argue that, in accounts of situated use and in design practice, the dichotomy between use and non-use is not clear-cut.

In conclusion, I consider the broader implications of my analysis in relation to the development of healthcare technologies and my research questions. This includes how visible

assemblages of use are employed as instruments to probe novel sociotechnical links between patient's practices, health care provision and corporate strategy. As such, this chapter begins to call into question the human as a non-reducible actor within UCD.

From In-Home Interview to Innovation Meeting

A month into my fieldwork, in June 2006 I was assigned to work on the conception and development of an entirely new health technology. The objective of the project was to explore new healthcare markets and applications for microprocessors embedded in mobile ICT products. To this end, an interdisciplinary design team, a combination of designers, engineers and stakeholders from the corporation's healthcare division, was convened.[50] Our task was to establish commercial opportunities in ICTs related to curative and palliative healthcare, and then design a mobile health product for individual patients living with and managing a chronic health condition.

The project was split into two phases. In the first phase the design team investigated a series of recurrent and persistent health conditions including diabetes, cardiovascular disease, obesity, high-risk pregnancy and post-operative rehabilitation. The aim of this phase was to generate social, technological and economic data about each condition and determine the viability of developing a mobile interactive technology to enhance the delivery of care, as well as to support patient's self-management of their health. In a preliminary planning meeting, the design team agreed to conduct a series of 'in-home' interviews to understand the day-to-day needs of individuals managing chronic health conditions. The interviews were regarded as 'quick and dirty' research instruments with which to obtain knowledge about the everyday management and care of a condition grounded in routine practices. The outcome of the interviews would inform the team's evaluation and identification of end-user healthcare opportunities. Each interview was two hours long and conducted with a patient in their home. Moreover, due to the project schedule and budgetary constraints, contact with patients was limited to the interviews. The interviews were qualitative, topic-guided, and designed to elicit the following data: the circumstances of their diagnosis, their personal experience of managing their condition, expert and lay support they require and receive, and their use of medical and consumer technology. What set the ethnographic interviews apart from conventional qualitative interviews was the emphasis the design team placed on the location in which they were conducted. Here, the designers' deployed in-home interviews to produce accounts of people engaged in sociotechnical practices grounded in their domestic settings. Moreover, in

[50] The design team included interaction designers, an industrial designer, a design researcher, software and electronic engineers, mechanical engineers, design and personal health technology product managers, an in-house physician and healthcare consultant as well as a specialist in regulatory and corporate risk associated with healthcare. In this and the other empirical chapters I follow Grønbæk (1991) and Suchman et al. (2002: 176) in using the term 'designer' and 'design team' to refer to the range of practitioners involved in design practice. Where appropriate I distinguish between these category distinctions, for example where the viewpoints of designers and engineers come into conflict.

the home, topic guided interview dialogue was combined with written observations and photo-elicitation of informants' material and technological setting. The design team viewed the interviews as the application of UCD principles whereby the needs of patients in their 'natural' setting were prioritised during their design process. In short, the interviews were devised as a means of collecting in-situ qualitative data that would evidence the complex medico-technological configurations in and by which people coped with chronic disease. In this context, I accompanied a design researcher in conducting an interview with Ron, an elderly man living in the Pacific Northwest and coping with diabetes mellitus (type 2), amongst numerous other acute and chronic health conditions.

The second phase of the project consisted of a series of evaluation and innovation meetings. The purpose of the meetings was to assess the data collected on each condition and explore the commercial opportunities associated with their curative and palliative care. Ultimately, the design team were required to recommend one condition for further development. During each meeting the design team conducted their evaluation by drawing together accounts of patients' everyday medical practices, derived from interview data, with research conducted by each team member drawing on their disciplinary expertise. To this end, the industrial designer investigated the form and functionality of existing end-user medical hardware; the computer scientist assessed various end-user software applications designed for managing chronic diseases; the mechanical engineer scoped sensor technologies and the representatives of the health division surveyed the delivery of expert healthcare. Thus, to appraise the commercial prospects of a chronic health condition such as diabetes, accounts of an interviewees' lived reality of managing their health were gauged against technological, institutional and commercial developments associated with the condition. Due to limited resources, and to make use of my expertise as a designer, I was assigned the task of planning and facilitating the series of meetings.

My participant observation of both the interview and meeting provided me with the opportunity to follow the occasioning of accounts of use and their consequent use during the evaluation of diabetes as a site for technological intervention. I have divided my analysis into two sections. First, I examine the occasioning of accounts of the interviewee's daily health management through dialogue and photo-elicitation. Second, I explore how data derived from the interview resourced the innovation practices of the designers. In so doing, I demonstrate how discrete aspects of medico-technological use were drawn from heterogeneous and messy accounts of local practice, and visually ordered during the meeting to resource the designers' inventive speculation.

The In-Home Interview

One afternoon the design researcher and I visited Ron at his home. There, we carried out the interview, observations and photo-elicitation. The interview dialogue was recorded on two digital voice recorders and I also took additional notes using a laptop computer. During the interview we also shot a number of photographs of Ron's home, notably his medical and domestic technologies. Our choice of photographic subjects corresponded to the pre-designed interview topics, as well as other topics that emerged as relevant during our visit.

The interview began with the design researcher obtaining verbal and written informed consent from Ron and establishing basic biographical details. The design researcher then ushered Ron through a dialogue guided by a series of interrelated questions. The interview schedule began with his diagnosis and segued into topics including his daily medical routines and management of his health, the lay and expert healthcare he receives, medication consumption, as well as the various medical and consumer technologies he regularly uses. The following extract shows the onset of the interview dialogue:

Design Researcher
01:44
Okay, so it's not really that important. You were diagnosed fifteen, umm about fifteen years ago, umm so how old are you?

Ron
01:52
Sixty-nine.

Design Researcher
01:54
Okay.

Ron
01:55
Excuse me, sixty-eight.

Design Researcher
01:57
Oh, you do like I do and look a year ahead.

Ron
02:00
[Inaudible]

Design Researcher
02:01
Laughs okay, so, erm. [] How has, okay so you were diagnosed fifteen years ago and initially you took oral medication for it?

Ron
02:18
Yes
.
Design Researcher
02:20
Okay, and how did that impact your life?

Ron
02:22
Not real much.

Design Researcher
02:23
You didn't have to make a lot of changes or anything?

Ron
02:25
No, I take the pills and...

Design Researcher
02:27
And you were working at the time?

Ron
02:30
Yeah, I used to have a used bookshop in the city.

Significantly, Ron's seemingly trivial error in which he misstates his age signalled how the dialogue would continue. Perhaps on account of his age, multiple medical conditions and consumption of medication his responses were often ambiguous, occasionally humorous and sometimes self-admittedly fictional. This extract, where Ron jokes about the metal implant in his foot, is typical of the messy heterogeneity elicited throughout the dialogue:

Design Researcher
05:01
Okay, all right. And, were you experiencing, you weren't experiencing any more symptoms or anything like that that drove you to the doctor or...

Ron
05:11
Well, I had a swelling in my legs and feet and as a matter of fact I had a lot of problems with my right foot and it was hard to walk even, and although I came to find out later when they removed a toe from the diabetes that, err, there's a little metal spring in my foot. Aliens put it there. Now, I had an operation way back down when, dunno, when I was somewhat out of my teens or something like I'd had problems with my feet and apparently they did it then and I didn't even remember it.

Design Researcher
05:47
Oh.

Ron
05:48
That's why I like the aliens story better.

His joke about non-human and unearthly implants centres around the amputation of one of his toes, attributed to diabetes. It shows an example of Ron reflexively accounting for his lapses in recall concerning his medical history. Here, Ron substitutes a biographical detail with an imaginary association with alien technology. The design researcher, however, avoids Ron's mundane reasoning and moves the interview on. Ron's seemingly unreliable accounts of practice were played down, and the design researcher gently moved the interview onto topics more relevant to the prescribed pre-occupations of the design team.

At this point it is important to acknowledge the significance of the home as a site for the production of sociotechnical user data. In his domestic habitat Ron was materially situated amongst a micro-landscape of objects and technologies by and with which he conducted his daily life. For the design researcher and myself, his home made visible and recognisable Ron's practices and the efficacy of his accounts of practice. Moreover, Ron's belongings made available further material and technological evidence of use not verbalized during the interview dialogue. This can be illustrated by a passage where Ron mentions where he stores his medication whilst describing his routine medicine consumption:

> **Ron**
> *12:03*
> I have some containers that goes for two weeks and when I start to run low and I just go through I have a whole load of bottles lined up in my bathroom and I...
>
> **Design Researcher**
> *12:13*
> Can we take a picture of that, or . . .
>
> **Ron**
> *12:13*
> Oh, sure.

At this point photo-elicitation came to the fore as a means of documenting his ongoing material-technological practices conducted within his home. Figure 1, for example, is a photograph shot during the interview showing his medication drawer in the bathroom. The photograph, however, is not just a means of corroborating Ron's accounts. It is a visual mode of eliciting the lived practices of a patient-user to be transported back to the workplace to work in combination with the interview data. Figure 1 makes visible a particular material site (the bathroom) and techniques (medicines stored in a drawer) in and by which Ron routinely manages medicine consumption. The photograph renders contextual features of his local ongoing practices related to the dialogue but not verbalized in detail. In this way photography was a technique for further eliciting and substantiating Ron's local specificity – in relation to material practices and technology – during the interview.

Figure 1: Ron's medicine drawer.

Thus, the interview proceeded through a series of complex and interrelated topics, loosely following the pre-formatted topic guide, in which accounts of Ron's varied and local entanglements with diabetes were occasioned. The interview dialogue consisted, in the main, of an extended passage in which Ron was asked to encapsulate a typical day in his life. His summary included descriptions of his daily management of diabetes interwoven with other aspects of his daily routines. The following is an excerpt of his account of a typical morning. It consists of his blood sugar monitoring and dietary management entwined with television viewing:

Design Researcher
10:39
So, umm why don't you give us a, err, a counting of kind've what your daily routine is like.

Ron
10:47
Hmmm.

Design Researcher
10:47
So, you get up in the morning or get up when, what time do you get up and then what you do.

Ron
10:53
Yeah, hmm, I usually wake fairly early seven thirty eight o'clock .

Design Researcher
10:57
Okay.

Ron
10:57
and I, uh, come out and err, and first I check my blood sugar and take my shot if I need it yet and take a handful of pills... come out and I have my breakfast and... which is usually just, err, cold cereal with a banana on it and, turn on the news or listening to the news all the time see with the news happening during the day and whether its going to rain or not, they always lie.

Design Researcher
11:24

Yeah. I think they just don't know. I haven't figured that one out yet. So, what other medications do you take besides your insulin.

Ron
11:37
Oh, I have a whole list of them [goes to get a list of the medications].

Design Researcher
11:40
This is where we like to take pictures [gets digital camera out]. Oh, you have a whole list, okay so you've got 'em listed out for ya. Okay. [pause]. And so what do you do with this list as you're getting ready to take your medications?

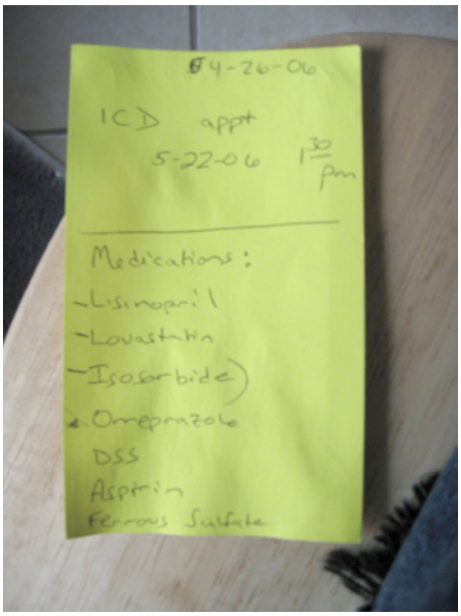

Figure 2: Ron's medication list.

Accordingly, the dialogue served to verbally occasion accounts of Ron's local and embodied entanglements in *techno-diabetic* networks.[51] Ron's accounts of his lived experience of diabetes occasioned the messy heterogeneity of practices, technologies and actors that constitute his daily life, associated with, but not limited to, diabetes. In the above, Ron articulates a concatenation of objects and technologies bound up in-situ practices through which he maintains his health. This included pricking parts of his body, such as fingers, to obtain a blood sample, then staining a test strip with this blood, which he then electronically measured for glucose levels. Ron describes using the read-out to determine his body's immediate insulin requirement. Here, Ron's account of his management of his glucose levels transitions into accounts of his diet, for example a typical breakfast and lunch. It also includes, for example, a description of a mundane medication list handwritten on a piece of paper, and kept ready-to-hand. At this point the design researcher interrupts the dialogue and seizes the opportunity to

[51] Henceforth I use the term 'techno-diabetic' to emphasize the fact that survival for people living with diabetes depends on their use of technology (Mol, 2008: 10) and their involvement with other forms of technology, such as lay and expert health care, and so on. Moreover, I also use this term to indicate the design team's purpose of getting to know diabetes as necessarily sociotechnical and their efforts to bracket out other seemingly non-relevant medical and technological circumstances.

take a photograph (see Figure 2). The interweaving of accounts of medical and non-medical practices is further performed when he mentions the unreliability of news reports on morning television. Thus, Ron's local practices were never purely diabetic, never entirely medical. Rather, he was messily entangled and caught up in numerous ongoing practices, including other sociotechnical usages in which diabetes was intimately tied but not foregrounded.[52]

Later, as the dialogue reaches Ron's evening routines, the design researcher exploits the opportunity to inquire about the members of his family. Here, Ron recounts the day-to-day logistical support his daughter provides, as well as an episode where she provided more extended lay healthcare. Ron's account, however, also occasions abbreviated features of his and his siblings' biographies, and how one of his daughters is engaged in formal education.

Design Researcher
18:31
How many daughters do you have?

Ron
18:36
I have four kids, three of them female, one male. I guess that was redundant. Umm, two of them I am very close to [inaudible] and one of them she goes to school yet although she is forty. She just quit her job and started going back to school. She wants to improve herself and she's just really been great. She takes me to all my appointments and things and when I had my most recent problems with health she just dropped out of school and came and moved in with me for two weeks and, err, took care of me...

In addition to lay healthcare, the dialogue also drifted into (all too brief) accounts of Ron's reliance on expert health care delivery:

Design Researcher
22:40
So, then the nurses there managed your insulin injections and…

Ron
22:44
Yes.

Design Researcher
22:44
…and taking your insulin, your glucose level and stuff like that?

Ron
22:48
Yes, all those medicines and things.

Design Researcher
22:48
Right.

Ron
22:52
C'mon, wake me up and 'are you ready for your sleeping pill now'…

Design Researcher
22:53

[52] See (Mol, 2008: 26) for an alternative account of people coping with diabetes.

Yeah, I know. Yeah, that is bothersome isn't it [laughs].

Ron
23:04
Yeah, I was pretty weak there for a while and I had to have a lot of help from the nurses. I couldn't even go to the bathroom by myself.

Design Researcher
23:10
Yeah.

Ron
23:10
And they gave me a lot of help.

The interview also addressed Ron's use of consumer technologies, including personal computers, as well as his television viewing habits. Given that the design team were tasked with designing a novel medical technology for patients, it was viewed as essential that the design researcher obtain data that would enable them to evaluate Ron's fitness as a user of medical technologies and consumer ICTs. The following passage, where Ron reports on his computer usage and his television viewing preferences, serves to illustrate this point:

Ron
16:47
Yeah and somewhere in there, oh, before I go back to bed in the morning I usually hit the computer.

Design Researcher
16:53
Oh, okay.

Ron
16:53
[inaudible] all the news coming in there. And, then I'll go ahead and lay down like I say, after Bill leaves and take an afternoon nap. Get back up and I could read or I usually watch TV, that's what I watch, the History Channel and stuff like that a lot and often times I'll just like to sit here and stare out at my back yard there's a squirrel feeder up there, not there now but he's very often up there and I'll watch the squirrel and a little over a week ago I had a gaggle of ducks that came to the pond every day.

Design Researcher
17:29
Oh.

Again, photo-elicitation was deployed to engender further visual data of use. On this score, Figure 3 shows Ron's home computer in his study. On the floor, around the computer, sat cardboard boxes filled with "The Track Record", a Bigfoot Sasquatch Yeti publication he was once involved in producing. Here it is worth noting, from the excerpt above, how Ron's account of television viewing transitioned into a depiction of his object-centered involvement ('the squirrel feeder') with, and observation of, wildlife from his back window.

Figure 3: Ron's personal computer.

Following the interview the design researcher obtained Ron's permission to continue photographing his domestic setting. We set about identifying and shooting interiors, objects and technologies equipping Ron's daily life. We paid particular attention to shooting his material involvement with expert health care provision. Our aim was to evidence Ron's management of diabetes for the design team to review later. This included aspects of Ron's embodied, technical, economic and contractual relations with diabetes and healthcare, played out in his home. For approximately half an hour we investigated Ron's home, including his bathroom and bedroom, as well as his open-plan living room and kitchen where the interview was conducted. The photographs were shot with compact consumer digital cameras invariably using the flash to illuminate the dark interiors where daylight was absent. The photographs can best be described as candid and amateur, as we paid little care and attention to composition and exposure, or so I thought at the time. Our task was to quickly shoot photographs with as little interference and inconvenience to Ron as possible. We shot photographs of Ron's medications and their storage; his kitchen and the items in his kitchen such as a wall-mounted calendar and a corkboard panel adorned with family photographs; his living room, his television, and his telephone; his study, including a bookshelf, personal computer, and open boxes of "The Track Record", as well as maps and posters attached to his office wall. Finally, we photographed the medical technologies he used to manage his diabetes, including his pillbox, blood sugar monitoring devices, handwritten records of medication and so on.

Whilst taking photographs, however, I inadvertently included the design researcher's hand (see Figure 4) in a shot. The design researcher noticed this and gently informed me that that we shouldn't be present in photographs. I got the point. We were to format our photographs with little or no visual indication of our collusion in their making, a point I will return to later in this chapter.

Figure 4: Ron's pillbox and the design researcher's hand.

Sadly, as the interview came to a close, we became aware that Ron was mismanaging the slow failure of his health. Ron was coping with a complex set of interrelated acute and chronic illnesses, not least diabetes. He was managing his health by way of a series of medico-technological practices, including daily blood sugar monitoring and insulin consumption, check ups at the local Veterans Affairs (VA) healthcare facility, being "zapped" (Interview, 19:42) by a defibrillator and so on.[53] On this score, Ron related how, in December 2005, he suffered a major heart attack and was nursed by his wife until the arrival of the emergency services. He was also suffering from cardiac arrhythmia, and as a form of treatment was receiving doses of electrical energy administered by a defibrillator attached to his body. Ron's eyesight, as perhaps a symptom of diabetes, was deteriorating, and he was due to have an eye operation as a result. Ron's account of his eating habits indicated that his diet often contravened expert health advice and, as a result, was most probably jeopardizing his health. Moreover, Ron was wheelchair bound as his other (left) leg had been amputated, as well as his right toe, replaced by the metallic implant. Finally, and tragically, Ron's wife had recently died of cancer. Ron's dark humour and lack of self-interest betrayed his despondency and the ongoing deterioration of his health related to "a bunch of bad things" (Interview, 06:59) he had recently endured, not least the loss of his wife. As Ron movingly put it: "We didn't think for tears then." (Interview, 06:52).

[53] The Veterans Health Administration (VHA) is a subdivision of the United States Department for Veterans Affairs. It is responsible for the provision of healthcare to veterans and their families. It claims to be the largest "integrated healthcare system" (see: http://www1.va.gov/health/aboutVHA.asp date accessed: 15 May 2010) in the US and was commonly referred to by my informants as the VA.

The Innovation Meeting

Following the interview accounts of Ron featured in two meetings. The first was an initial report back to the design team on the progress and outcomes of the in-home interviews. Here, the design team classified Ron as an unsuitable representative of patient-users. His conduct in coping with diabetes amongst other health conditions, his failure to adhere to expert health care advice and his ambivalence towards the competent use of medical and consumer technologies was viewed by the design team as indicative of a non-user. Consequently, Ron was categorized as an exemplar of individuals who would resist adopting or voluntarily reject the design team's vision of a health technology. As a result, aspects of Ron, derived from the interview, were to be excluded from explicit inclusion in the project. As it turned out, however, the interview data would feature in the innovation meeting due to the lack of other material.

The second meeting was one of a series that I planned and facilitated, in which the design team reviewed their market research into chronic disease and identified product opportunities. More specifically, their task was to determine the commercial prospects of developing some form of mobile telemedicine application targeted at a recurrent or long-lasting health condition, such as diabetes. In this setting, market research and disciplinary knowledge were brought to bear on reports of in-home interviews that functioned to make accountable the lived medico-technological reality of a given condition. As such, the design team evaluated diabetes as a disease grounded in the practicalities of day-to-day practice, mediated by technology, and managed in relation to healthcare provision. In other words, the feasibility of diabetes for interactive intervention and enhancement was appraised.

By this time in my fieldwork, I had already observed various techniques used to manage the co-operative innovation practices of interdisciplinary design teams within the corporation. In particular I'd observed how Post-it® notes (henceforth notes) were commonly employed in the production and visually ordering of sociotechnical knowledge in order to prospect novel interactive systems. Typically, a facilitator supervised the meeting's proceedings, orchestrating discussion as well as the production and visual arrangement of notes. Practically, this included managing the production of notes with handwritten sociotechnical aspects of a particular topic and their subsequent spatial ordering. Visualization was thus a group activity in which notes were spatially ordered on a vertical surface, often a wall. For this purpose, the walls of many UCDG meeting and project rooms were clad in brown foamcore panels, and thus prepared for the staging of wall-based visualization activities where visual material was frequently presented and scrutinized.[54] Over the course of such meetings, I observed how

[54] Foamcore is a lightweight and rigid board used mainly for mounting photographs and artworks. It consists of polystyrene sandwiched between two layers of paper.

participants would write and sketch on notes and spatially arrange them in order to visually explore *retrospective-prospective* aspects of a particular topic.[55] In such activities each participant was expected and encouraged to produce notes of whatever came to mind in relation to the meeting agenda and ongoing discussions. Accordingly, the production and ordering of notes played a key role in innovation meetings. In what follows, I examine the meeting as a site in which the production and visual arrangement of notes served to draw together aspects of the interview data and market research, and in doing so produced a depiction of a generalised and anonymous model of a patient-user.

To encourage the production and ordering of the entries in the meeting, I designed a set of hexagonal cards (see Figure 5 and Figure 6), drawing on my prior observations.[56] I designed the cards as visual and material devices to structure the ordering of inscriptions based on my preliminary interpretation of the interview data. The cards were made of colour printouts adhered to foamcore and cut into hexagons. On the cards I specified the topic of the meeting and four analytic categories I had identified from a prior analysis of the interview data and background reading on diabetes. In addition, I provided numerous blank hexagonal cards for the design team to use instead of notes. The categories I formulated included "Education and Self-knowledge", "Support", "Education" and "Self-monitoring". During the meeting, the design team added two further categories: "Physiological Triggers" and "Psychological and Emotional". Permanent marker pens and additional notes were also supplied to aid the meeting process. Figure 5, below, illustrates the cards I designed for the meeting.

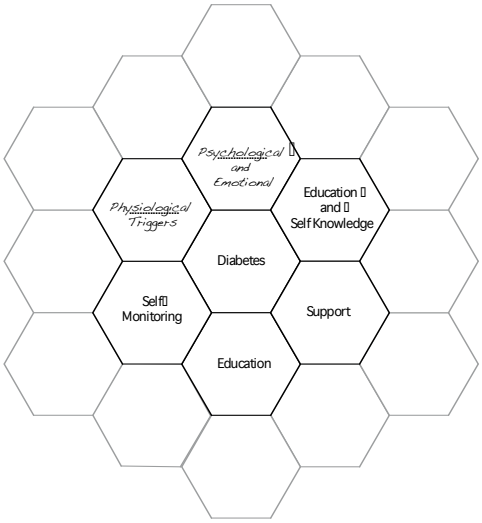

Figure 5: an illustration of the hexagonal cards.

[55] Garfinkel (1967a: 41) uses the term 'retrospective-prospective' to describe how people know what they are talking about, drawing on past experience, and simultaneously anticipate 'common understandings' of what they are saying. I use 'retrospective-prospective', however, to refer to the capacity of visual artefacts, used by the design team, to function as descriptions of aspects of past and existing use and their capacity to act as propositions of future use.

[56] Henceforth I refer to hexagonal cards as 'cards' to distinguish them from notes.

During the meeting, I narrated accounts of the interview and guided the discussion organized around the topic headings. Despite the classification 'non-user', the design team worked through accounts of the interview provided by the design research and myself. As the topics were discussed, the design team inscribed the cards and notes with descriptive and interpretive statements drawing on accounts of the interview, market research and disciplinary knowledge of the design team, as well their own anecdotal knowledge. Reminiscent of Garfinkel's (1967a: 202) study of the competence of clinic personnel in reading evidence of clinic work in written clinic records, the design team's skills of extracting relevant instances of sociotechnical use was crucial. The design team's competence in listening *into* my accounts of Ron made possible the identification and codification of diabetes onto visual artefacts.

To capture the role of notes and cards during the meeting, I refer to them using the term *descriptor*. With this term, I liken the visual and verbal entries used during the meeting to *inscriptions* (Latour & Woolgar, 1986: 45; Latour, 1988b: 64) employed by scientists and engineers to represent and mobilize natural and technical objects. It also evokes Akrich and Latour's (1995: 259) vocabulary to describe programs of action inscribed into technical objects. With the term descriptor, however, I emphasize the ambiguity played by the notes and cards in the meeting. On the one hand descriptors expressed existing programs of techno-diabetic action; on the other, they served to indicate speculative techno-diabetic networks. That is to say, they *de-script* or reconfigured the sociotechnical practices they were describing especially when used in combination with other descriptors, as I will show in what follows.

Once written, descriptors were attached to the wall, adjacent to categories or previously inscribed entries. Descriptors produced by the design team included "Family and Friends", positioned next to the topic "Education and Self-knowledge", to indicate the involvement of lay caregivers during the management of the disease. This was a translation of data derived directly from the interview. However, Ron's identity was excluded and, as a result, this descriptor featured an aspect of techno-diabetic practice purified of its provenance. Next to the category "Self-monitoring", a participant placed the descriptor "Poor Adherence" to convey the difficulties diabetics faced in managing health regimens. This was also derived from the interview data.

The team members also engaged in elaborating the categories I had proposed. Accordingly, the category "Support" was further divided into "Formal Support" and "Informal Support", with "Informal Support" being further subdivided into "Direct – Indirect" support. Here, descriptors juxtaposed different aspects of patient-users derived from their market research and disciplinary knowledge.

Since the production, arrangement and interpretation of descriptors was a co-operative activity, entries were authored at a scale that allowed the group to read the ensemble of descriptors from where they sat. Consequently, descriptors had to be exceptionally concise.

One example of this was the entry "Learning by Logging" which acted as shorthand for a more complex sociotechnical practice. It indicated the gradual process by which a diabetic learns to calibrate their glucose intake in relation to their embodied experience of diabetes, by monitoring and journaling their blood sugar levels. Similarly, the descriptor "Learning by Logging" engendered conversations covering the associations between a diabetic, the provision and use of electronic monitoring equipment, consumption of insulin and adherence to expert medical advice.

Descriptors derived from interview data also included "VA", invoking the U.S. Department of Veterans Affairs healthcare provision. This was placed under the headings "Education and Self Knowledge" and "Support" and was produced whilst Ron's service in the Korean War was recounted. Another member of the design team authored and positioned the descriptor "Complexity of Routine" after examining photographs of Ron's domestic management of medicines, including the drawer containing his medication (Figure 1), his handwritten daily schedule of medicine consumption (Figure 2) and his pillbox (Figure 4).

Finally, descriptors also included the design team's anecdotal knowledge: for example, the entry "I Dislike Needles" was written down and attached to an emerging cluster of entries whilst a designer recounted how a friend experienced discomfort whilst self-injecting. In sum, descriptors served to render retrospective-prospective aspects of a generalized user constituted by features data derived from the interview, market research, expert and anecdotal knowledge. The patterning of descriptors brought into view a partial representation of a patient-user constituted by intravenous drug use, pedagogical forms of blood monitoring and the mundane material reality of medicine consumption. Of course, each descriptor implied further entanglements: for example, contractual relations with healthcare providers supplying medical technologies and services. In other words, each descriptor acted as shorthand for a more extended sociotechnical arrangement. Nevertheless, Ron's identity, local reality and the messiness of his daily routines were expunged from the visual patient-user assemblage that took shape on the meeting room wall.

During the meeting the placement of descriptors was contingent and subject to change. Initially, the relative positioning of descriptors related to existing patient-user arrangements. Redundant cards and notes, however, were separated out individually or into isolated piles. Speculative descriptors were also added to the wall. One example of this is how the team brought into play computing practices not previously associated with aspects of diabetes brought about by the team's research, including "Blogs & Online Groups", which was added to the concatenation of "Informal Support – Indirect – Wider Lifestyle" to prospect new modes of lay health care. This descriptor did not draw on interview data or market research. Rather, it was drawn from a designer's knowledge of emergent online sociotechnical practices. This engendered a discussion amongst the design team about the issues surrounding the

development, adoption and usage of such services for diabetics. Here, particular economic and technological pre-occupations and concerns of the design team came to the fore, a case in point being how members of the design team voiced a number of concerns in relation to social networking, including: doubts concerning the links between social networking technologies and prospective microprocessor sales; the lack of relevance between blogging and the development of health related consumer hardware, as well as doubts about blogging as a source of income for healthcare providers. Thus a novel telemedicine application, with origins in the commercial provision of online communication services, was considered and rejected. This, in part, was due to the design team's mutual conviction that the corporation's interests ultimately reside in microprocessor manufacturing as the basis for healthcare service provision. At a local level the design team were enacting corporate strategy in relation to the diagram of patient-user practices arranged on the wall, a strategy dominated by manufacturing and commodity sales as a means of integrating the corporation and end-users into economies of healthcare, rather than service provision in which patient roles might be less strictly managed.

In all, I observed three principal ways of ordering descriptors. First, they were positioned to denote existing relevance and association. The participants placed notes inscribed with words such as "Gait", "Smell" and "Skin" next to the topic "Body", for example. Second, descriptors were positioned away from the main arrangement. Here, their relevance could not be established. However, they remained in view in case their relevance emerged later. One example of this occurred during the meeting where descriptors were produced to indicate the process from diagnosis to managing the condition, from the perspective of the patient-user. These notes were placed to the side of the main ensemble, as the design team failed to agree on where they might be located in relation to other entries. Third, the design team included prospective descriptors. Rather than placing entries in arrangements that reflected the lived reality of diabetes, the design team produced new entries and re-arranged them with existing descriptors, which served to transgress descriptions of existing medical relations, thereby pointing to novel and speculative techno-diabetic practices. "Blogs & Online Groups" were a case in point. The arrangement of entries over the course of the meeting manifested the design team's retrospective-prospective evaluation of diabetes as a condition for technological intervention. On the one hand, descriptors ordered their knowledge of existing aspects of practices related to diabetes; on the other, descriptors were recombined to visualize prospective practices. In these ways, the arrangement of descriptors constituted a particular visual description of the putative patient-user: one that emerged out of the local and co-operative practices of the design team and their handling of the various features of diabetes.

The arrangement of descriptors over the course of the meeting was, however, most meaningful to members during the meeting. It was in the process of discussing diabetes, producing and handling entries that attributed them with particular meaning. After the meeting the descriptors were removed to free up wall-space for subsequent meetings. Occasionally, group work would be documented by transcribing note layouts into a spreadsheet, word processing document, or photograph, as I did immediately after the meeting (see Figure 6). Transcriptions, however, omit the local sequencing by which arrangements of descriptors build up and change over time. The entries, therefore, literally (materially and semiotically) mediated the de-individualisation of Ron into operational aspects of diabetes, thereby opening the way to sociotechnical points of intervention between user and disease. However, unruly aspects of the interview data, such as Ron's involvement in the production of the Yeti newsletter, his joke about metallic alien implants or, more importantly, his increasing failure to manage multiple diseases and health conditions were effaced or simply ignored. Although the meeting made visible the heterogeneity of actors, practices and processes that constitute diabetes, it was a process in which ethnographic data was purified of its rich and unruly 'thickness'. At the close of the meeting the design team agreed that the immediate viability of diabetes for technological enhancement lay in further developing telemedical forms of expert support.

Figure 6: notes and cards produced during the meeting.

During and after the meeting the design team commented on the efficacy of the cards. In the main, they spoke about the material affordances of the cards compared with notes. Here, I review their comments as a way of highlighting the material and visual affordances of Post-it® notes, which served to occasion a shifting and emergent techno-diabetic user assemblage. One

main concern expressed by the participants was their worry that they might damage or deface the cards since they were limited in numbers and time consuming to make. Notes, on the other hand, were plentiful and mundane so their damage wasn't a concern of the participants. Moreover, their scarcity emphasized the act of authoring, where more care had to be taken writing descriptors. With notes, however, entries were discarded without care if mistakes were made. The cards also had to be pinned to the wall, making the process of attaching and re-attaching unwieldy. In contrast, the adhesive properties of Post-it® notes afforded their quick and relatively easy positioning. Furthermore, pinning cards one on top of the other became increasingly strenuous due to the thickness of the foamcore and the length of the pins. Notes, on the other hand, could be stacked one on top of another with relative ease. The hexagonal shape of the cards also proved to be a key constraint. During the meeting, the participants felt compelled to pattern card arrangements in a honeycomb where subdivisions become binary. In this way, the hexagonal shape of the cards constrained the visual arrangement of descriptors. In contrast, notes could be arranged in any number of ways – into columns, piles, clusters, and linear forms, occasioning varying types of spatial and temporal association. Figure 6 shows such contrasting arrangements. Thus, the material properties of notes permitted multiple ways of visual patterning and arrangement over time. In these many ways, the cards highlighted the specific material properties of notes and their suitability for visual ordering of descriptors during innovation meetings.

From Situated User to Non-user

In this section I examine the in-home interview and the innovation meeting in relation to the production, encoding and visual ordering of sociotechnical data that mediated the involvement of a user in the design process.[57] I describe how the interview rendered an existing patient-user in 'thick' ethnographic detail. Despite the best efforts of the design researcher, I describe how Ron was classified as a non-user: a person unfit for use, owing to his accounts of undisciplined health management mediated by technological use. However, I describe how during the meeting, which I characterize as a *centre of synthesis,* accounts of Ron's techno-diabetic practices were translated and encoded into visual descriptors that were juxtaposed with other data brought to the meeting. I describe how the design team compiled a partial representation of diabetes (from a patient-user perspective) in order to explore future healthcare and medical technologies for patient end-users.

[57] For an alternative account of the role of ethnographic data in design meetings see (Nafus & Anderson, 2009).

The deployment of the in-home interview as an instrument for producing knowledge of a patient-user raises the question of how the methods and techniques of the social sciences shape, rather than naturalistically represent, the user. If, as recent scholars have argued, the social sciences are productive of the social (Osborne & Rose, 1999; Law & Singleton, 2005: 334), then the interview can be viewed as a device by which Ron was *enacted* as a situated and individual patient, whose day-to-day practices and medical biography and lifecourse were occasioned, both verbally and visually. The practical application of the interview, as a research instrument, constructed Ron as a particular type of entity for the design team to scrutinize. Treating the interview-as-resource as a topic, I examine how the interview – a combination of dialogue, observations and photo-elicitation – occasioned Ron in his material and technological habitat as an 'observable-reportable' (Sacks & Garfinkel, 1970: 342) patient-user, heterogeneously enmeshed in, and through, a seemingly irreducible combination of day-to-day routines, technologies and their use, interpersonal relations and dependent on wider networks of treatment and healthcare service delivery.

Although I address the engagement between UCD and ethnography more extensively in chapter seven, it is important to note how the in-home interview occasioned Ron as an existing user and putative non-user. In other words, how this distinction was arrived at by way of the interview. Here, I rely on my participant observation of ethnography as applied during design practice, rather than practitioners' accounts of ethnographic practice presented in the conference setting as examined in chapter seven. As studies and accounts of 'corporate ethnography' note (Barry et al., 2008: 34; Cefkin, 2009a: 3), and as I have described in my literature review, ethnography has long been part of innovation practices within the ICT industry and HCI.[58] It can be understood to have developed from the field of CSCW. Here, system developers were concerned with understanding the everyday setting and organization of technology in use, as well as acknowledging the views of users. Within HCI, ethnography is understood as a research technique used to evaluate the existing use of technology 'in the wild' (Dourish, 2006: 542). Nafus and Anderson (2006: 250) draw attention to the 'reality effect' produced by naturalistic ethnographic representations, produced by in-home interviews, photo-elicitation and participant observation etc. Here, the in-home interview and the ethnographer are viewed as mediating devices between contexts of use and corporate innovation processes: they transport the 'social' (users and settings) into the workplace of designers and innovation actors. Such an understanding brings into view the practices of

[58] The term 'corporate ethnography' was employed by my informants to describe the application of ethnography for commercial and organizational ends (e.g. Cefkin, 2009a: 4). It is not to be confused with sociological and anthropological studies of the workplace. Henceforth, I use the term corporate ethnography as shorthand for the application of ethnography within commercial enterprises.

representation by which Ron was configured as a situated user of medical and consumer technologies. This includes, for example, accounts of blood sugar monitoring, medication management, personal computer use and habitual television viewing elicited during the interview that work to establish Ron as an existing user. Thus, the primary effect of the interview was to render a patient-user situated in his ongoing use of technologies as a necessary component of living with disease.

The occasioning of Ron as a situated patient-user can be set in relation to theories of social practices' (e.g. Reckwitz, 2002: 243). Here, the basic unit of the social is the orderly routinized action made up of, but irreducible to, embodied and mental activities, background understanding and emotions, as well as objects and their use over time. Moreover, as Reckwitz (ibid.: 250) notes, citing Schatzki (1996: 89), practice is a 'nexus of doings and sayings' that are knowable to the actor performing the action, as well as being recognizable and understandable to observers. For instance, blood sugar monitoring as an embodied medical routine that involves patients' lived experience of the disease linked to their use of monitoring equipment to obtain and measure blood, requiring awareness of the device's readout. As such, the interview relied on making accountable Ron's daily medical routine, his knowing use of technology and his emotional state, which were occasioned within the artefactual landscape of the home. Thus, the interview moves through a series of interrelated topics that produce accounts of Ron's use as necessarily heterogeneous. As Michael (2004) shows, interviews are micro-social events in which humans and non-humans all participate in the ordering of accounts of the social. The in-home interview was therefore a process that required the participation of Ron, the design researcher, myself, and our technologies of recording, as well as the technological and material setting of the home. The interview took place by virtue of these heterogeneous relations, and it was a process that produced accounts of the social and the technological as variously ordered around the figure of Ron as a patient-user. The dialogue delineated his biographic lifecourse grounded in his ongoing bodily and routinized practices. This included reports of Ron's breakfast routine, stringing together his use of technology to monitor his body, his consumption of medicine and foodstuff to affect his body and his comprehension of the news, involving tacit knowledge of local weather patterns.

The interview also occasioned descriptions of the local and wider spatio-temporal nature of Ron's daily life. Accounts of his domestic use of technologies, in, for example, the living room, his study and his bathroom were produced in-situ. Furthermore, Ron's medical biography related the delivery of lay and expert healthcare as geographically distributed: his day-to-day health management was conducted at home whilst expert health care was delivered at a nearby VA healthcare facility. Thus, the enactment of Ron as a patient-user situated him as enmeshed in local self-management and informal health care, as well as extended networks health service provision. The spatial distributions of Ron's activities were

also narrated as unfolding over time: for example, the summary of his daily routine ordered his medico-technological practices over the course of a day. Time and place were therefore crucial in the ethnographic construction of his identity as an existing user (cf. Massey & Jess, 1995: 88). Taken together, the interview served to make accountable Ron as an individual patient-user formatted in relation to his ongoing and local daily practices, the sociotechnical landscape of his home and their spatio-temporal distribution.

Now, the manner in which messy and complex accounts of Ron's practice were managed is important here, especially concerning the individuation of Ron as a patient-user. Although the dialogue occasioned his day-to-day health care practices, it also invariably segued into accounts of non-medical practices. An example of this is how Ron's reports of his medical routine transitioned into watching the local wildlife, bringing into play his backyard, the squirrel feeders and ducks. His description of personal computer use quickly shifted into his interest in Yetis and his prior involvement in the publishing of a newsletter on the popular myth. Further, Ron's quip concerning fictional alien technology raised doubts about the veracity of his accounts. Crucially, at such points in the dialogue the design researcher would gently curtail segueing and topic drift. Such moments can be viewed as ongoing attempts to fashion a particular set of relations between interviewers and Ron as a patient-user. They can also be seen as practical efforts to manage the emergence of particular medico-technological assemblages, whilst inhibiting accounts of non-medical use. Echoing Michael (2004: 14), this points to how interview narratives play up particular human-non-human relations whilst downplaying or discouraging others. What counts as a patient-user, during the interview, was largely dependent on the local application of the topic-guide as a means to filter out non-relevant and nascent narrative paths.

Like the interview dialogue, photo-elicitation was also subject to representational construction. Photographs were shot quickly with point-and-shoot digital cameras of the material setting of the home as found. Consequently, photography was deployed as an instrument to bring into view the home as a site for techno-diabetic practice by way of a 'naturalistic' visual vernacular. However, a specific form of photographic naturalism was achieved by both design researcher and myself, mobilizing what John Tagg (1988: 161) refers to as a coherent chain of procedures that enact the 'truth effect' of documentary photography. Here, highly coded semi-staged amateur photography was deployed in order to make visible the material and technological resources of a patient-user. This included selecting and composing certain objects, scenes, aspects and angles for photo-elicitation whilst disregarding others. Photographs were also shot relying on the camera's pre-programmed capacities for focusing, metering and exposure. In addition, our roles as researcher-photographers were stage-managed in attempts to make invisible the work that goes into producing ethnographic knowledge (Nafus & Anderson, 2006: 243). The photograph showing the presence of the

design researcher's hand, interfering with the in-situ reality effect of the photograph of Ron's pillbox, serves to illustrate this point. In this way, 'thick' and naturalistic visual accounts of Ron's use were orchestrated in relation to verbal accounts of his entanglement in techno-diabetic networks. Evidently, in this case making accountable the practices of users also included making opaque the work that goes into practices of accountability and the production of knowledge about users. This is a variant of STS accounts of the production of objectivity, where the agency of scientists is made invisible in discourse (Gilbert & Mulkay, 1984), as well as in literary (Latour & Woolgar, 1986: 63) and material practices (e.g. Latour, 1988b; Bowker, 1994; Pickering, 1995).

In these ways, the principal effect of the interview was to make Ron accountable as a techno-diabetic user (of a defibrillator, medication, pillbox, etc.), an individual intertwined in other medico-technological networks (e.g. his use of the antibiotic efflux pump), as well as a user implicated in non-medical networks (e.g. news reports, wildlife). The interview served to enact Ron as an embodied person whose status as a user emerges by way of various heterogeneous entanglements with technology, not least techno-diabetic networks.[59] However, despite the best efforts of the design researcher to manage the production of medical and diabetic data, accounts of Ron's daily activities would invariably draw out details of undisciplined health care practices, as well as activities unrelated to treatment and care.

Given that the design team described the in-home interview as an 'ethnographic' study, thereby implicitly acknowledging the success of Suchman's work within HCI (Dourish & Button, 1998: 8), Ron can be understood as a user produced by virtue of practical and heuristic sensitivity to ethnomethodological insights of incarnate action. Here, Ron was manifested as a user who was materially and discursively indexical to the technologies in and conditions of his home. Moreover, accounts of his health care practices were rendered 'publically available and mutually intelligible' (Suchman, 2006: 76) during the interview. As such, the interview made observable and recognizable Ron as situated in his ongoing and routine usage of medical and consumer technologies. Here, use is dependent on Ron's material and social circumstances (Suchman, 1987a: 70).

In sum, the in-home interview was an instrument that served to individuate Ron as a situated patient-user. It was deployed as an instrument with which to create detailed user-centered accounts of living with a disease. Here, ethnography – derived in part from ethnomethodology – serves as an *anthropocentric machine* for configuring human-centered accounts of action.[60] In this way the interview produced a human-user as a 'thick' patterning of recognizable and meaningful features. It rendered Ron's ongoing and contingent

[59] See Callon and Rabeharisoa (1998) for the notion of entanglement as it relates to a patient's embodied reality of living with Infantile Spinal Muscular Atrophy.
[60] The in-home ethnographic interview is a certain kind of anthropocentric machine in that it is configured to produce human-users in contrast to non-humans, such as, medical and information technologies and domestic artefacts.

sociotechnical practices, centering on his use of various medical and consumer technologies. Despite the efforts of the design researcher, the interview also brought into view the messy heterogeneity of living with diabetes as a part of everyday life. The in-home interview constituted an existing patient-user entangled in various sociotechnical relations in order to inform the specification of attributes of a medical technology that the design team knew in vague outline but not in detail. Ron's heterogeneity (the composition, distribution and sequencing of his sociotechnical practices) included narrative and visual accounts of the medico-technological which segued into accounts of actions not reducible to use, and, as such, making observable and recognizable, practices and 'things' of questionable relevance. Despite the management of the dialogue and attempts to discipline Ron as a patient-user assemblage, the interview resisted 'methodological clarity' (Law & Singleton, 2005: 333). As I will explore in the following, however, such resistance to clarity and Ron's seeming unfitness for use did not render accounts of him unusable as representative of patient-users.

Reassembling a Non-User in a Centre of Synthesis

What rendered the interview data, and by extension Ron, usable as representative of a patient-user were the visual and material practices of the design team during the meeting. As I have described in detail above, this relied on the encoding of information onto uniform descriptors, and their visual juxtaposition on the specially formatted meeting room walls. To my mind, the practices of the design team evoke accounts of the visual practices of scientists and engineers, who deploy representations in order to construct facts and to strengthen the reality of 'natural' objects and artefacts, and in so doing make them manageable from a distance. In the following, I examine the role of descriptors in the visualisation practices of designers. I employ this term to stress the dual role they play in describing and re-describing techno-diabetic networks.

The encoding of descriptors had a number of important features, which can be summarized as follows. First, they were produced as uniform visual objects. Second, they acted as semiotic shorthand for a more complex techno-diabetic network from the perspective of the patient, e.g., "I don't like needles". Third, they were produced in such a way as to purify the data of existing users' identity, place, time and context. Accordingly, entries were anonymised and de-situated. Fourth, they could be visually combined with one another in order to construct more complex and nuanced diagrams of diabetes. Here, descriptors acted like *inscriptions* (Latour & Woolgar, 1986: 51; Latour, 1990: 35) and *conscriptions* (Henderson, 1991: 456), in that they were visible representations of particular entities which had been extracted from another place, and had the essential qualities of being mobile, as well as being visually readable, presentable and combinable with one another. In addition, like engineering drawings, descriptors could serve to enlist designers into group participation.

However, descriptors were only loosely like scientific and engineering inscriptions. Their efficacy was not entirely dependent on accuracy, mimeses or stability. Instead, entries often exhibited mutability during, for instance, encoding where data underwent simplification and transformation, such as processes of anonymity. Descriptors were also partially indexical to their deployment and arrangement in the meeting where they resourced the ongoing discussions of the design team. Descriptors could lose their relational meaning outside the spatio-temporal setting of the meeting if they did not solidify around a program of action, such as, for example, telemedical systems. Descriptors also exhibited the two forms of representational directionality described by Lynch and Woolgar (1990b: 6) and Henderson (1991: 455). They worked to build up knowledge about patient-users and chronic disease, as well as operating to reconfigure this knowledge in order to prompt speculation on future patient assemblages, exemplified by the inclusion of the note "Blogs & Online Groups". Fifth, descriptors could include calculable objects, such as "VA" and "Medication", where healthcare delivery and pharmaceuticals could be economically measured and quantified. However, in the case presented in this chapter, entries were principally encoded as indices of lived techno-diabetic practice. As such, descriptors, such as those derived from interview data or anecdotal knowledge, were qualitative in disposition. Thus, like inscriptions which act to visibly construct and strengthen an empirical reality (Latour, 1988b, 1990), and conscriptions which determine the construction of an engineered technology (Henderson, 1991: 455), descriptors served in the building of a partial and visible assemblage of diabetes as lived and technologically mediated. If inscriptions strengthen the reality of scientific facts, and conscriptions describe in detail how to fabricate a technical object, then descriptors slightly differ: in this instance, they made visibly manifest the movement from existing techno-diabetic networks to user-centered healthcare futures. In short, descriptors enabled the design team to probe prospective healthcare practices and their extended medico-technological networks by reassembling aspects of an existing user together with knowledge of healthcare markets and related products.

Now, descriptors also evoke Latour's (1988b: 215) concept of *centre of calculation* as the site at which inscriptions are brought together. For Latour, centres of calculation are local places, such as cities, laboratories and garages, where information about the world is gathered and combined in order to create a visible representation that permits remote control and domination to be exercised. Cartography and sea-navigation are cited as a key historical example of knowledge production and action at a distance. For Latour, centres of calculation work by virtue of the logistics of data and its transformation into reliable and repeatable knowledge. This includes: (1) making local knowledge material and transportable; (2) ensuring inscriptions have stable properties when moved over time and space; (3) maintaining a place where inscriptions can be accumulated and combined. In this view, the in-home interview can

be understood as a process by which local knowledge about the lived reality of diabetes is produced, and the meeting as the site where it is made compatible and presentable with other information brought to the meeting by the design team. Accordingly, the meeting can be viewed as the site at which various aspects of diabetes were brought together and visually arranged in order to locally explore the disease as a prospect for commercial and technological intervention.

Despite such equivalencies (with inscriptions and centres of calculation), I have emphasized the discrepancies in order to draw out the specificities of design practice. Here, the accumulation of qualitative and quantitative representations of patient-users and a chronic disease are brought together in order to evaluate, explore and prospect existing medico-technological practices. Rather than the construction of facts and technical objects, the designers were engaged, by virtue of classification, in determining future users, technologies, services and markets. In this chapter, as I have argued, design practice evidently includes the assembling of an existing user, their translation into a non-user and then the visual reassembly of a partial representation of the user-as-patient. Through these processes, the designers were engaged in the resolution of an invention or innovation and its prospects for alignment with microprocessor and healthcare markets, and the lived realities of diabetes. Consequently, the meeting stands as an example of a *centre of synthesis:* a place where designers put on display and scrutinize the implicit qualities of users, practices, technologies, and organizations, in order to bring into being new actors (e.g. users and technology) with new capacities. In the case examined in this chapter, the designers' synthesised future patient-user configurations and future medical technologies.

Making A Non-User Work

As I show in the literature review, the role of non-users is well documented within STS literature. Recent studies, however, suggest that the dichotomy between use and non-use as either active (having agency) or passive (no agency) is misleading. Mol (2008), for one, describes how living with diabetes, a technology dependent condition, is unruly and messy. Despite patients' best efforts to effectively use blood sugar monitoring devices, blood test strips and insulin delivery technologies, sustaining healthy blood sugar levels is challenging even for the most competent and disciplined user. Consequently, patients' monitoring practices are often disorderly and undisciplined. People with diabetes do not fit neatly into categories of use or non-use. The lived practicalities of the disease prevent such easy classification. Given the messiness of coping, and taking issue with the conception of patients as consumers, Mol argues that people with diabetes are active managers of their blood sugar, and therefore active users of diabetic technologies. For diabetics, being active is not based on rational choice at privileged moments of consumption or disciplined use. Even when diabetics are not

monitoring blood sugar levels and managing injected doses of industrially produced insulin, their blood cells are continually and actively burning sugar (ibid.: 80). Similarly, Gomart and Hennion's (1991: 243) study of music listeners and drug users shows that the agency of users can be enacted through passivity and abandonment. In both cases, the distinction between use and non-use blurs into a continuum where different modes of agency operate. Moreover, Berg & Mol (1998: 6) show how the agency of diabetics cannot be reduced to the normative standard of the "patient as a whole" by describing how blood cells continue to actively burn sugars whilst the patient is passive. Here, the agency of diabetics takes place within the patient. On the other hand, Gomart and Hennion argue that the active passivity invoked in the 'passions' of skilled listeners and heroin users is brought into play during events where affects arrive in time, i.e., where users are seized by a drug or by music. Here, the (active) user is viewed as a subject-network that extends beyond the human by virtue of a connection to an active object (e.g. heroin or improvised Jazz) that takes hold of the user.

Abandoning the dichotomy of use-non-use and the view of the user as either an active or passive unified whole helps me better to grasp the involvement of Ron in the design process. On the one hand, the designers define Ron as a non-user. They suppose that his collusion in the deterioration of his own health indicates that he will resist or reject the use of a new health technology and he is therefore excluded from the design process. In line with Mol (2008: 25), my case study of the in-home interview demonstrates how living with diabetes is messy and unpredictable. In this view, Ron was an exemplar of living with diabetes. With this in mind, being a diabetic patient-user includes varying tensions between engagement and disengagement with the disease and medical technologies. It is therefore no surprise that Ron was considered too messy and too unreliable to act as a user representative. To be eligible for inclusion in the design process, a representative of a patient-user would have to make observable and reportable strict discipline in a research setting, such as the interview.

In practice, however, the reality of the design process is itself more complex and messy. If the dichotomy between use and non-use were itself to be strictly adhered to, in practice and in analysis, then accounts of Ron's involvement would end at the classification non-user. Crucially, though, aspects of the interview data endured in the design process, and as such Ron's involvement, persisted. This chapter clearly demonstrates how the continued involvement of data derived from the interview, as encoded descriptors, problematises both the distinction between use and non-use and the involvement of the 'patient-user as a whole' in UCD.

Here, the key to making a non-user work included the encoding of interview data into a diagram where aspects of techno-diabetic practice were compiled and recompiled. Notably, descriptors were authored without reference to Ron's identity. Neither Ron, his siblings nor his peers were named on entries and reference to place was omitted. In this way, descriptors

mediated the complex messiness of living with diabetes as discrete, placeless and timeless indices of techno-diabetic practice. Descriptors therefore played a crucial role in mediating between individual practices and generalized collective practices, implying alignment between corporate strategy and developments in health care delivery.

Having demonstrated how the recompilation of data derived, in part, from the interview acted to transcode a situated user into a mutable and visual assemblage, I now use this notion to understand how a non-user is made to work in design practices. In a study of Internet users, Wyatt et al. (2002: 35; 2003: 76) classify four types of non-users prevalent in the end-use of technologies, including ICTs. The first group includes active *resisters* who do not use a technology because they do not want to. Here, as well as Wyatt et al.'s study of Internet users, further literature in STS provides many examples of non-users as resistors, including, but not limited to: people resisting use of the internet as well as the telephone and electrification in rural American (Kline, 2003); farmers opposed to cars, also in the rural US (Kline & Pinch, 1996); and people opposed to cycling (Bijker, 1999). The second group, *rejecters*, defines people who no longer use a particular technology. The third group covers users who are *excluded* through lack of access and the fourth group are those users who have been *expelled* from using the Internet. Wyatt contends that the notion of the user becomes problematic when non-users move within these categories: when, for example, a rejecter starts using the Internet again. As I have shown in this chapter, non-users can be included in the design process beyond simply being classified and excluded. In doing so, however, I call into question distinctions between use and non-use, as well as the user-as-a-whole. I also call into question the prevalence of the so-called "I-methodology" (e.g. Akrich, 1995: 173; Lindsay, 2003) within technological development, where designers and producers draw on their own personal experience in order to model user representations. My case study demonstrates how, as part of user-centered system development, accounts of an existing user were transcoded and compiled as an assemblage of use and non-use, emergent within the ongoing heterogeneity of sociotechnical practice, from which aspects of use and non-use were abstracted, encoded and recompiled. Thus, in this case of user-centered design, the (non)user works, not as an irreducible unit that belongs to a single category of use at any one time, but rather as a visible user assemblage that was simultaneously splayed across multiple categories of use. Moreover, treating the (non)user as an assemblage means paying attention to the variety of usages and their constitutive heterogeneity and multiplicity. Of course, the irony of my study is that through the local and situated practices of the designers, a situated user is transformed into a non-user, which in turn is rendered usable.

Conclusion

In this chapter I have begun to address my research questions and arguments in empirical detail. I have described how, in design practice, a 'user' comes into being by way of an in-home interview, and how data derived from the interview resourced user-involvement during the innovation meeting. By way of a series of transformations and transcoding – from interview data to visual descriptors – the designers moved from a situated patient-user to a non-user, and then to an arrangement of discrete and impersonal features of techno-diabetic practices. In this case, user involvement included engagement with an embodied person, as well as the translation of ethnographic accounts into combinable and mutable visual artefacts. Through these processes, the designers made evident their preference for patients capable of disciplined conduct in relation to their health, despite the complexities and messiness of the diabetes-as-lived. The ongoing involvement of what the designers considered to be a non-user, in the form of discrete and abstracted aspects of techno-diabetic practices, clearly shows that in practice the human is not a irreducible unit of UCD. Rather, it is a trope, around and through which, sociotechnical knowledge can be retrospectively and prospectively ordered.

On a broader note, Brown and Webster (2004: 83) contend that technologies of health maintenance are under continual development through 'bioscience and clinical and public health research' that seeks to render the body in increasing microscopic detail, for example micro-surgery. This chapter demonstrates how aspects of lived reality can also be mapped onto the demands of a globalized economy of healthcare (Cartwright, 2000: 347). This includes the production of a patient-user entangled in techno-diabetic networks, amongst other medical and consumer networks. I also demonstrate how detailed ethnographic data about users is operationalized during co-operative visual work. This application of UCD demonstrates how the design of new medical technologies mobilizes knowledge of embodied practice, further discrediting 'cyber' theorists' (e.g. Kroker, 1987) claims about the virtualization of healthcare delivery. It also points to what Cartwright calls *actuarial techniques* (2000: 356), that is to say, the spatial management of patient populations via telemedical technologies, and how they are being modelled in relation to the qualities and attributes of people's embodied practices in corporate settings.

In the next chapter I shift my attention to the design of a domestic technology. In contrast to this chapter, which featured an embodied individual user, I will show how UCD can constitute new users through existing user representations.

Chapter 5.
Revisioning the Housewife of the Future

Introduction

In this chapter, I explore how designers achieved an example of user involvement by way of a fictional representation of a housewife. I describe how a design team, again drawn from the UCDG, put together and employed a persona to resource the design and development of a household media management system intended to be used in the kitchen (hereafter KMS for Kitchen Media System). In the previous chapter I examined a series of transformations through which an elderly man was occasioned as a user in the design process. I described how an ethnographic interview configured Ron as a situated user: how he transitioned from user to non-user, and how data derived from the interview facilitated the transition from non-user to a heterogeneous multiplicity of discrete and combinable visual descriptors. With such practical means, the design team operationalized qualities of a non-user in such a way as to visualize aspects of a future patient-user.

In sharp contrast, this chapter describes how a gendered persona was brought into being as an amalgam of existing representations of housewives. I show how this included pre-existing personas, as well as a common North American rhetorical trope, derived from U.S. political discourse. I then examine two distinct ways in which the persona was locally enacted during the development of the KMS. As part of practical and technical group work, I first describe how the persona resourced the construction of a prototype system. Under these conditions, I show how the persona acted as a loose and unfolding assemblage of sociotechnical attributes with multiple points of interface between cooperating team members. Crucially, I show how the persona and the prototype defined one another, as they were co-configured during development. Second, I describe how, as part of demonstrations of the KMS prototype to existing and likely stakeholders, the persona acted as a simplified, structured and somewhat immutable figuration of sociotechnical qualities. In both instances (practical design work and demonstrations of technology), I show how the persona resourced the management of expectations and visions amongst designers, and between designers and stakeholders. On the one hand, and during the fabrication of a prototype, I show how discrete attributes of the persona served to mediate the practical and tactical expectations of the design team. On the other hand, I examine how – as part of pitches and visual presentation material in the form of Microsoft PowerPoint® documents (PowerPoint) – the persona operated as an integrated, coherent and durable figurative device with which the design team sought to

persuade stakeholders of the strategic viability of the system. Here, staging the KMS required various sociotechnical alignments to be plainly and persuasively articulated so as to function as a coherent rationale. In this context, I describe how the persona served to make evident the links between technical features, contexts of use, putative user groups and anticipated market conditions: how it brought a concrete and compelling vision of future kitchen practices into view.

Empirically, I draw on my participant observation of the construction of the prototype and various enactments of the persona during practical design work, meetings and demonstrations. This was carried out for during my fieldwork as part of my ongoing study of the designers' practices. I conducted a series of ethnographic interviews with various members of the design team engaged on the project. I interviewed the project manager and design manager, the interaction and industrial designers, as well as the mechanical and software engineers. Participant observation and interview data is supplemented by photo-elicitation of the prototype as it was constructed in the workspace, in relation to various instances of the persona. In addition, I studied documentation of both the persona and the KMS, including PowerPoint documents, which feature in detail later in this chapter.

Personas in Design

Personas are a particularly common tool employed to represent users in routine UCD practices. For an approach to systems design that prioritises the inclusion of people-as-users, personas make possible and practical a technique for doing user involvement through (almost) entirely imaginary and fictitious means. That is to say, the use of personas does not necessitate contact with, or the study of 'real' people during design. Instead, personas are caricatures of people and are widely employed in UCD as proxies for users in the design process. As Grudin and Pruitt note (2002: 3), personas are descriptions of imaginary individuals. They are figurative models of users, endowed with particular qualities. To this end personas are typically configured with various 'human' traits. Personas have an identity, interests, needs and goals and they are given names, age, gender and ethnicity. Furthermore, they are ascribed practical tasks and goals, such as writing word-processing documents or using email software, in order to accomplish routine objectives. Personas inhabit a 'social' context where other fictional characters come into play, such as family, friends and colleagues. Personas have biographies, including life stories and family history as well as educational and work experience. Personas have provenance, and they are associated with a particular place. They have birthplaces, places where they live and work as well as places to which they travel. Personas also have status, including socioeconomic circumstances, possessions, professional standing and educational achievement. Crucially, personas primarily represent people involved in either the delivery or consumption of commodities and services. In both capacities

they depict employees or consumers. Typically, all the above are strung together in illustrative 'scenarios' that serve as narratives to bring and keep future use in view (Bødker, 2000: 63).

The introduction of personas as an innovation technique within UCD is widely accredited (Blomkvist, 2002; Grudin & Pruitt, 2002) to the software developer and consultant Alan Cooper. In his book 'The Inmates are Running the Asylum' (2004) Cooper argues that designers, not engineers, should design software systems, and that the process of product development should involve and respond to detailed descriptions and representations of putative users: what Cooper calls 'pretend users' (ibid.: 124). For Cooper, echoing earlier cognitivist efforts towards user involvement, systems should be designed in response to the requirements of people (as imagined), rather than technological prerequisites. Cooper (ibid.: 21) also emphasizes the importance of 'interaction designers' during innovation. He defines interaction designers as innovation actors who are responsible for determining the points of contact between the end-user and technology and, as a consequence, they determine the technical workings of the system. Thus, rather than embellishing existing technical solutions, interaction designers, according to Cooper, determine the workings of systems. In STS terms, interaction designers make *black boxes* rather than package pre-existing black boxes.

In brief, the following four points help better to appreciate the role of personas during design practice. First, personas are representations of individuals who stand in for a user group (Cooper, 2004: 129). They are viewed as 'archetypes', or proxies of collectives, and as such, they personify a demographic classification. Cooper, for example, defines numerous personas including website designers (ibid. , pp. 172, 189); software engineers (2004: 172); ten year-old boys (ibid.: 189); air passengers and airline crew (ibid.: 143) etc. Second, although personas can be derived from data produced by prior user research, such as interviews or participant observation, personas are hypothetical demographic descriptions of putative user groups (ibid.: 124). Third, personas pre-exist the specification and construction of a technology. According to accounts of personas in HCI and design literature (e.g. Blomkvist, 2002; Blomquist & Arvola, 2002; Calde et al., 2002; Grudin & Pruitt, 2002; Pruitt & Grudin, 2003), designers first define a persona and then specify and construct a technology to correspond with its traits. Finally, and as I have outlined above, personas are configured with cognitive, social, economic and technical qualities. In short, they are constituted as a heterogeneous body of traits. Personas are figurative users with human-like qualities and technical skills (cf. Latour, 1992) and as such operate to format notional sociotechnical networks compatible with a system's specifications. Taken together, personas operate as scripts of future use that serve in the modelling of prospective sociotechnical conditions in the present. Further, and in contrast to other user representations in design, such as ergonomic measurements of the human body, personas are scaffolds for explicitly heterogeneous contents

(social, economic and technical attributes).[61] They can, for example, include ergonomic information but they are by no means limited to one descriptive mode.

The Kitchen Media System

The design team conceived the KMS as a networked home computing system to be sited in the kitchen. The system was envisioned as a device to support and enhance the common computing tasks of families including both parents and children. Employing a touch-screen interface, the KMS was designed to support a variety of digital content and communication activities, including the management of digital photographs, electronic communication (e.g. email and Internet telephony), and Internet browsing, as well as multi-player family games. Furthermore, the KMS was viewed as a domestic computing 'hub', where digital content could be synchronised with home computers and mobile phones. The centrepiece of the KMS was a shared calendaring and contact system and interactive noticeboard (see Figure 7). Through touch, pen and voice input family members could organise and access digital media and communicate with others.

As such, the KMS featured two novel approaches to interactivity in the home. First, the system included a touch-screen graphical user-interface (GUI), presenting and organising content according to time: for example, digital media was stored and made available in relation to key dates and times on a calendar. Instead of employing the windows, icon, menu and pointing device (WIMP) interface configuration conventionally employed by personal computer operating systems, such as Microsoft Windows, Mac OS and Linux workspace environments, the design team envisioned the KMS running a specifically designed GUI. This included a limited set of software applications "closely aligned to the natural patterns, activities, and social needs of the family . . ."[62] Accordingly, the design team took a 'walled garden' approach to interactivity, granting users access to a prescribed set of applications, content and services, whilst restricting access to others. Second, the KMS featured a mechanical wall-mount (see Figure 8) that allowed parents and children to easily adjust the height of the KMS to suit to their ergonomic needs. Through both of these features the design team sought to re-imagine the role of information technology in the home. Rather than supporting 'productivity', which they believed to be the case with existing personal computers, the designers envisaged the KMS as a system that would enrich the lifestyles of families; domestic practices were envisioned as increasingly involving the creation and management of personal digital media and communication with family and friends over the Internet.

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[61] See (Dreyfuss, 1955, 1960) for an early example of the physiological personification of individuals in the design process. Here, the characters Josephine, Joe and Jr. act as descriptions of standard human measurements used in ergonomic design.
[62] Slide 21 of KMS 'Share Life at Home' PowerPoint presentation, examined below.

Figure 7: A visualisation of the KMS.

Figure 8: the KMS wall-mount.

To bring their vision into reality, the design team set about making a prototype KMS. Throughout the duration of my fieldwork the KMS prototype gradually took form as a concrete and interactive artefact in the UCD workspace. The design team were preparing the prototype for demonstration to stakeholders within the corporation, and potential partners such as PC manufacturers and software vendors, as well as for public display at a major U.S. electronics trade show.

The conceit of the KMS prototype was that it would be demonstrated on a faux kitchen wall (see Figure 9). To this end the prototype included a metal framework approximately two metres high, one meter wide and half a meter in depth. Each façade of the frame was clad with wallpapered fibreboard to create an enclosure onto which the touch-screen interface could be mounted. The purpose of the box, apart from providing a stable structure for the wall-mounted screen and the conveyance of a kitchen wall, was to house a computer running

the system software out of sight of audiences and publics. Though the design team envisioned and presented the KMS as an individual product, in reality the resource constraints of the project and the demands of prototyping meant that an off the shelf touch-screen monitor and a separate computer were used to simulate a functioning interactive system. The front façade, where the KMS was mounted, also included a section of skirting-board and an electricity socket, imitating domestic fixtures and fittings. To further cement the mock-up of a kitchen, the design team ran the screen's power cable to the electrical socket and in so doing presented the illusion of a system in a single box. However, a black tube running from the display to the computer inside the enclosure, carrying signal and data cables, betrayed the prototype's reliance on a hidden computer to run the system.

Figure 9: the KMS prototype in the UCD workspace.

On most days various members of the design team attended to the fabrication of the KMS in the workspace. The interaction designer often sat with the prototype, diligently programming and de-bugging the GUI, using the hidden system computer as a development machine. Mechanical engineers and industrial designers would routinely install newly fabricated and sprayed enclosures for the touch-screen, corresponding to changing decisions about the material qualities of the KMS, such as it's form, colour and patina. Often, as designers gathered around the device, both practical and speculative conversations would ensue between team members and members of the UCDG not working on the KMS. As such, the

prototype materially defined a site at which ongoing dialogue about the system and the persona's efficacy routinely took place amongst the designers and the wider UCDG.

Now, to inform and warrant the conception and ongoing development of the KMS, the design team relied heavily on a persona of a suburban housewife. It was around the figure of the housewife that the design team constructed their vision of domestic practices enhanced by interactivity. Moreover, the persona figured prominently in the design team's deliberations about the technical, material, mechanical and interactive features of the system. Here, the design team regularly deliberated on a broad range of issues, such as who might be responsible for purchasing the product; which family member would administer the system; which software applications should be included or excluded, and how easy might it be for parents and children to adjust the height of the display. In these and most other deliberations the design team would routinely invoke the persona to establish and reconcile their various and sometimes conflicting viewpoints. In what follows, I examine in detail how the design team brought a persona into being and how it was locally enacted to resource practical development and the communication and demonstration of the designers' vision to stakeholders.

More than One, Less than Many

To follow the local enactments of the persona means paying attention to multiplicity. In other words, it requires me to describe how the persona was configured and what it did in a given situation. In the context of the development and construction of the prototype, I describe how the persona unfolded as a loose and open assemblage with multiple points of interface when enacted by team members managing their cooperative work. As part of PowerPoint presentations given to audiences such as stakeholders, I show how the persona was enacted as a reduced assemblage of sociotechnical attributes directly corresponding to the KMS. In short, I demonstrate how particular co-configurations between the persona and the KMS were crystallised in PowerPoint. Here, I also show how the persona expressed the design team's rationale and reasoning for the KMS interface. As the title of this section suggests, and invoking Strathern's (1991: 36) reading of Haraway, I explore how the persona operated somewhere between the human and the non-human, the social and the technical, the individual and the collective and the hypothetical and the concrete. Moreover, my attention to the local enactments of the persona, where different versions come into play, addresses how the persona hung together as a consistent and coherent figure and how this was achieved in practice (cf. Mol, 2003: 55). I have organized my analysis in a somewhat heuristic fashion, since, in practice, versions of the persona arose amongst team members and across stakeholders in any number of ways, for instance: in conversation, through emails, as anecdotes during weekly design meetings and so on. Nevertheless, I seek to draw out the

salient features of the case: how personas functioned in design practice to resource the socio-material envisioning mediated by the prototype.

Prospecting Housewives

To render their vision of the family and the home where the KMS would operate, the design team created a persona named "Abby". This persona depicted middle-class suburban housewives and mothers living in North America. The design team envisioned it as representative of a household and family manager: an actor primarily responsible for others' activities, most notably husbands and children. Further, the housewife was also viewed as the domestic gatekeeper: the parent responsible for making key purchasing decisions, especially regarding appliances. It was around this loosely concocted definition of the housewife that the design team configured their vision of domesticity congruent with the KMS.

As discussed above, personas are portrayed in design and HCI literature as visual artefacts configured prior to system specification. In such accounts, personas are derived from interpretive work carried out by designers based on prior research (interviews and participant observation for example), as well as drawing on designers' own tacit and self-knowledge, evoking Akrich's (1995: 173) 'I-methodology'. Here, personas are formed out of patternings of attributes that express their identity, capacities, and competencies (e.g. 'goals', 'needs' and 'tasks'). Once defined, designers then go about translating the attributes of personas into system specifications, including material, visual and interactive features. Thus, system design involving personas as presented in the literature is a progressive procedure: an interrelated sequence of activities (or translations) stepped in the following way:

Persona attributes → user needs → system requirements → system specification

My study of the KMS, however, tells a very different story about the production and involvement of personas in UCD: a story that is more complex and less procedural. In this section I examine how a housewife persona arose through a combination of pre-existing personas and a trope drawn from contemporary North American political discourse.

According to the design team, the KMS persona was modelled on two existing housewife personas: a persona used by the UCD group to resource an earlier kitchen system and the other, a persona employed by Microsoft. In recounting their previous persona, the design team presented me with accounts of the sequential version of persona production: interviews were conducted with housewives, and data derived from these interviews was translated into the attributes of the persona. This gave rise to a persona called "Amiko", a representation of an Asian-American mother who, in the words of the interaction designer,

was "much richer than Abby".[63] Due to changing corporate agendas, market conditions and project resourcing the development of this system was discontinued. During the early phases of development of the KMS the design team drew on another housewife persona. This persona, also named "Abby" (Microsoft Abby), was one of seven personas produced and employed by Microsoft to resource the development and marketing of the Microsoft Windows Vista operating system (Pruitt & Grudin, 2003: 8).[64] One member of the design team described how the designers drew heavily on Microsoft Abby in order to define the KMS persona. The following excerpt, from the article 'How To Build A Better Product—Study People' published by an online consumer information technology web site, briefly describes Microsoft Abby:

> "One of Vista's consumer personas was a woman named Abby, who the researchers envisioned was mother to a teenage son. Abby became an intrinsic part of Microsoft's research process, Lovejoy said. Each time the team convened to discuss potential Vista features; they would relate their ideas to each persona to examine relevance and usefulness, among other things.
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> Vista researchers were given documented profiles on each persona. Microsoft officials also displayed detailed posters about each profile in the workplace and project managers were encouraged to think about Abby and the others when writing up specification sheets about products."
> http://www.ladlass.com/ice/archives/010887.html (date accessed: Tuesday July 1st 2008).

Notably, this passage relates how personas can function to resource development in various guises: as discussed, as profiled and as visualized in posters. In preliminary planning meetings, the team of designers and engineers discussed the suitability of Microsoft Abby as a fictional user of the KMS. During one interview, the design manager encapsulated the relationship between the two personas (Amiko and Microsoft Abby) as "resonance".[65] He also recounted how, as an upshot of various design meetings, including an ad-hoc focus group with wives and female partners of the team, they agreed to knit together attributes of the two personas to bootstrap a suitable hybrid persona for the KMS: "Instead of resurrecting Amiko, we decided to use Abby and transfer some of the identity, capacity and so on from Amiko to Abby." The name "Abby" was retained and over the course of a series of design meetings the team integrated Microsoft Abby and Amiko. As the KMS project manager put it:

> "We did very little research on that particular project. You know... We did a very informal two to four hour meeting with friends on the team. We read over other research and our own internalisation of the Abby persona." [66]

The focus group, with wives and partners of the design team, included the use of formative cardboard mock-ups of the KMS, a material technique to involve people during early phases

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[63] Interview with KMS interaction designer, August 17th 2006.
[64] See also http://www.ladlass.com/ice/archives/010887.html (date accessed: Tuesday July 1st 2008) and http://experiencedynamics.blogs.com/ (date accessed: Tuesday July 1st 2008) for accounts of Abby as a persona developed in relation to the product development of Microsoft Windows Vista.
[65] Interview with KMS design manager, July 7th 2006.
[66] Ibid.

of the design process popularised by PD (Ehn & Kyng, 1991: 172). The mock-ups acted as cursory system representations to materially convey the attributes of their persona, assembled from Amiko and Microsoft Abby. The designers employed mock-ups to resource their evaluation of a prospective system. As such, they served to provoke the focus group participants into imagining what it might be like to live with the KMS. They were then asked to describe an imaginary scenario in which they could envisage using the system as part of their routine domestic practices. Thus, the participants were asked to speculate on their future practices in relation to the designers' verbal descriptions and the material embodiments of the future. For the designers, the material provocation of future use was crucial. Without the props the design team believed participants simply "wouldn't engage" in acting out their sociotechnical visions.[67]

During the focus group, it became apparent that amongst members of the design team two competing interpretations of the persona arose. The design team characterised their conflicting viewpoints as representative of the beliefs of the engineers, on the one hand, and the designers on the other. Thus, the focus group was a site in which designer-engineer expectations came into conflict around the configuration of the persona. Whereas the engineers viewed the housewife as a children's "drillmaster", the designers viewed the housewife as a "co-ordinator".[68] The engineers and designers held very different expectations about how household and family management was to be regulated by housewives, supported by the KMS. The software and mechanical engineers preferred a strict and disciplined form of management where family activities follow the dictates of the housewife. The designers, (the design manager, the industrial and interaction designers) however, argued that the housewife should orchestrate the self-determined and autonomous activities of family members. As it turned out, the designers' viewpoint more closely matched the views expressed by the focus group participants. Consequently, the housewife-as-coordinator prevailed as the overarching demeanour of the persona.

Another important aspect of the focus group was the category the design team attached to their wives and partners, and subsequently, to the persona itself. As the interaction design manager and project manager recalled, they were characterised as 'soccer moms': a predominately U.S. demographic category referring to suburban middle class housewives.[69] The term soccer mom, now a somewhat common term in U.S. parlance (along with more recent variants such as 'security mom' and 'hockey mom'), refers to women who are characterised by their domestic relationships, especially their commitment to their children and lifestyle practices oriented around consumption. Notably, this term has a very specific

[67] Ibid.
[68] Interview with KMS design manager, August 10th 2006.
[69] Interview with KMS interaction design manager, August 10th 2006 & interview with KMS project manager, August 17th 2006.

provenance in relation to contemporary North American political discourse. Here, Vavrus's (2000) discussion of the rhetorical use of the term 'soccer mom' in the discursive construction of women swing voters by news media during the 1992 U.S. presidential electoral campaigns is instructive. Vavrus explores how this demographic category reduces women to their relationship with children. Most notably, the term soccer mom defines the role of housewives as managers of children's activities, such as ferrying them to and from soccer games, as well as to patterns of consumption and lifestyle choices (ibid.: 194). Despite these highly gendered connotations, the design team picked up on the term and routinely used it as shorthand for the KMS persona and, in turn, for housewives more generally.

In the above I have shown how Abby came into being as a hybrid that arose out of two previously existing personas and expressed as a typecast by way of the soccer mom trope. The practical biography of Abby, that is to say, the personas provenance during the KMS project, is a story where gendered visions of the future, inscribed into Amiko and Microsoft Abby, were re-used and re-imagined. In short, and capturing both appropriation and speculation, the KMS soccer mom persona was *revisioned*. The design team interwove the two existing personas to configure a new more suitable persona and, in doing so, they adapted and adopted preconfigured identities and expectations. Thus, in the case of the KMS, the process of personification included the interlacing of the attributes of Microsoft Abby, a white mother of a single teenage child, with the characteristics of Amiko, a non-white mother of three. Through processes of becoming – the integration of personas, the use of a political trope and the material evaluation of rough mock-ups by focus group participants – the KMS persona came into being as a gendered figure. In other words, Amiko and Microsoft Abby underwent transformation as the personas merged into a white mother of three and housewife (as manager).

Two important analytic points can be drawn from the above. First, in design, users (like technical objects) serve to format sociotechnical networks (cf. Akrich, 1992b). In this case, the persona is both formatted by, and formats, the practical sociotechnical work of the design team, as well as serving to script the future sociotechnical practices of families around the figure of the soccer mom. Evoking the notion of the *boundary object* (Star & Griesemer, 1989), the persona acts to mediate the management of the design team's viewpoints towards the shared goal of the construction of a concrete technical object. Unlike boundary objects, however, in certain instances, such as the conflict over the management style of the housewife, points of disagreement arise where one viewpoint prevails leading to particular interactive features. Rather than supporting multiple viewpoints, the persona permits flexibility around certain attributes and demands closure around others. The overall ethnic profiling of the KMS persona (as a white mother), for example, didn't erase the ethnicity of Amiko. Instead, Amiko's ethnicity was retained, but de-emphasised as a photographic representation of the

persona during a daily activity. Given this, the coordination of work amongst the design team can be thought of as a continuum with minimal interaction on one end and in-depth collaboration on the other. For designers who require nominal exchange, such as engineers and interaction designers, the persona serves in the arbitration and closure of conflicting viewpoints. For members who collaborate more extensively, such as the interaction designer and software engineers, the persona facilitates thorough and ongoing teamwork. Given the above, I am persuaded that the notion of assemblage more closely captures the shifting and interleaving workings of the persona as it emerges, with various openings and closures, in the design process. In the case of the KMS persona, the designers' viewpoint prevailed over the engineers', as they played a more significant role in envisioning the KMS.

The second point concerns the irony of the KMS persona as a gendered representation of suburban housewives. Although the design team sought to distinguish the KMS from conventional workplace computing, what arose in practice was a persona that served to script the housewife-user as the household digital media manager. Here, the housewife was configured as responsible for scheduling and administering the family using the KMS: tasks that are not dissimilar to workplace computing, such as time management, email and so forth. Moreover, given the normative model of the heterosexual nuclear family group inscribed into the persona, the aforementioned administrative duties of the housewife-as-soccer-mom are compounded. Thus, rather than supporting and enhancing non-work related interactivity, the design team were in fact envisioning a future kitchen in which suburban housewives are tied to further mundane chores. Another way to view the definition of soccer mom as coordinator is as a form of I-methodology. That is to say, and drawing on Akrich (1995: 173), how the designers implicitly derived their understanding of housewives and their role within family life from their own personal experience. However, rather than using themselves as models for future users, the design team mobilized their wives and partners personal experience during the focus group mentioned previously.[70] Here, the designers' own assumptions remain in play, mediated by their partners' experiences whose routine practices, in part, they share.

In this way the KMS persona formats the kitchen as a site for sociotechnical intervention and gender politics.[71] Here, feminist scholars have brought attention to the gender politics at play in the industrialisation and rationalization of the kitchen through the introduction of various forms of appliances (e.g. Cowan, 1983; Cockburn & Ormrod, 1993; Chabaud-Rychter, 1994; Ormrod, 1994). Cowan, for example, argues that the industrialized

[70] Interview with KMS design manager, July 7th 2008.

[71] Notably, the kitchen has also been the subject of international politics and ideological struggles as in the case of the infamous 1959 'Kitchen Debate' between Richard Nixon and Nikita Khrushchev during the American Exhibition in Moscow (Colomina, 2001; Carbone, 2009; Oldenziel & Zachmann, 2009). The kitchen, therefore, has a relatively long history of contested sociotechnical politics, not least by designers. See (Bell et al., 2005) for the use of historical analysis and ethnography as 'defamiliarisation' techniques with which to design interactive technologies for the kitchen whilst being cognisant of cultural politics.

American kitchen was a site in which the housewife was transformed from a producer to a consumer in relation to, for example, food preparation and home-made clothes. Cockburn and Ormrod follow how gender relations, in particular those of a heterosexual couple, were constructed during the development, marketing and end-use of microwave ovens. The industrial kitchen has also been a site where traditional gender roles have been contested. During Germany's Weimar Republic, for example, the Austrian architect Margarete Shütte-Lihotzky designed the first mass-produced fitted kitchen. The acclaimed 'Frankfurt Kitchen' was designed using time and motion studies and utilized standardised construction techniques. For Shütte-Lihotzky (1994: 462), her efforts brought into being the figure of the housewife (designed by a woman) as the manager of the rationalized household, in order to emancipate women from mundane domestic chores. Here, Shütte-Lihotzky viewed technological rationalization as a means for reconfiguring the gendered role of housewives reified in kitchen technologies.

Although the design team envisaged the role of the KMS as a technology to support and enhance domestic interactivity, their vision was underwritten by the appropriated gender politics of the hybrid KMS persona. With what can be likened to pre-fabricated *genderscripts*, imprinted into Amiko, Microsoft Abby and the soccer mom, the design team brought into play prevailing and dominant gender identities further enacting gender politics in the design of the KMS, but not in the way they imagined. By simply 'adding women and stir' (Harding, 1986 cited in; Oudshoorn et al., 2004: 54), the design team exacerbated the housewife-as-manager by failing to fully grasp the implications of the soccer-mom trope and the way in which women were represented in the focus group. They were unwittingly making the KMS and the persona subject to feminist critiques of technological design by inscribing normative gender hierarchies and divisions of labour into the identity of their model housewife and family, and the interactive features of the KMS.

In sum, my story of how the KMS persona came into being suggests that personas – as groupings of sociotechnical attributes – are malleable and can adapt through the editing and recombination of, and emphasis placed on, attributes. Indeed, personas can also have a life beyond their immediate requirement to resource a single technology. As the configuring of the KMS persona demonstrates, personas can be re-utilized. In the case of the KMS persona, this equates to the flexibility of genderscripts to be revisioned and re-deployed, according to the requirements of other designers working on other technologies. In the following section, I continue my examination of the emergent nature of the KMS persona in design practice: how it is further defined and redefined in relation to the assembling of the KMS prototype, where persona and prototype serve to configure one another.

During the practical development of the KMS prototype, the design team routinely employed the housewife persona to inform and warrant the technical features of the device. In the following section, I highlight two instances of the housewife persona to demonstrate how it resourced the construction of the prototype. First, I examine the persona in the form of a visual diagram of attributes that resourced the building of the KMS prototype. Second, I show how the attributes of the persona mediated sociotechnical issues and opportunities associated with the KMS. In particular, I concentrate on how traits of the persona and technical features of the prototype developed in tandem: how changes to one necessarily incurred change to the other as development work proceeded.

In a project room, where many formal KMS meetings took place, the design team arranged and displayed various visualisations associated with the system. The visual material included diagrams of the system and CAD renderings of the enclosure, as well as photographs of related and competing products. One visual representation stood out amongst others as part of the designers' practical efforts: a large poster-sized diagram of the housewife persona, "Abby" (see Figure 10). The diagram included photographs, categories and captions that outlined the identity, biography, needs and objectives of the persona. Moreover, the diagram also included brief scenarios, or "Day-in-the-Life" depictions of the persona's activities over time. To indicate that the diagram represented the KMS persona the top right corner includes the caption "Abby". The name was located next to a photograph of a smiling middle-aged white woman wearing glasses. The layout of the diagram asserted that this was Abby, as imagined by the design team. Underneath "Abby" a paragraph located the persona in relation to family, place, possessions and everyday practices, including a reference to computing practices implied by the use of a digital camera:

> "Abby Salazar lives in Marietta, Georgia with her husband Ed, and their three children, 16 year old Toby, 11 Year old Tamra, and 9 year old Tanner. Marietta is a mid-sized city of 46,000 north of Atlanta GA. Abby and Ed have been married for 17 years. Abby returned to work as a part-time bookkeeper at a small real estate firm in 1996 when Tanner turned 5.
>
> In her spare time, Abby enjoys gardening, spending time in the Kennesaw Mountains with her family and their dog, Sir Lancelot. Abby also enjoys photography. Her family bought her a digital camera for her birthday. Her other interests include reading (she is an avid member of Oprah's book club), low fat cooking (to help Ed's high blood pressure) and volunteer tutoring at the elementary school."

Figure 10: the diagram visualising the properties of Abby.

The diagram of the persona was organized into four main areas. One area depicted family and friends, with photographic portraits of people culled from the Internet and image libraries. Another section visualized the persona's settings and possessions. Here, various household interiors were depicted, including a kitchen. A number of consumer technologies were also presented, such as a mobile phone, a digital camera and a car, portraying the persona's possessions and routine use of particular consumer technologies. Underneath, three goals were listed: "Practicality", "Concerned for those around her", and "Relationships with her family". Here, the housewife persona was defined in relation to the imagined services a housewife provides to other family members. Again, found photographs from the Internet have been included to portray family members and mundane domestic practices. At the bottom of the diagram were located four daily scenarios in which the housewife persona features, illustrated by way of photographs. Activities portrayed in the photographs included serving breakfast, waiting in a car whilst using a mobile phone, children playing soccer, cooking, gardening and running.

In sum, the diagram visualized the housewife persona as a grouping of sociotechnical attributes, expressed as a soccer mom. It incorporated a proxy user with a gendered and racial identity, entangled in marital and domestic life as a wife and mother of three. The diagram also located the housewife in relation to technological artefacts employed in practices situated in domestic and suburban environments. Furthermore, the sociotechnical practices of the

persona were framed as the everyday management of family logistics, health and home administration.

The use of photographic images is noteworthy for three reasons. First, the photographs served to set the sociotechnical conditions in which the persona was embedded. To this end the diagram included an assortment of found photographs including professionally shot portraits and product shots, as well as amateur photographs of routine family events and occasions. These representations defined the sociotechnical practices wherein the persona uses the consumer technologies depicted. Moreover, photographs indicate the technical features the KMS will require in order to support the daily life of a housewife, as soccer mom. Here, the inclusion of representations of digital cameras and mobile phones define current ICT practices, as well as warranting the particular technical features of the KMS.

Second, the stock and amateur photography, included in the diagram, acted as indices of everyday life. The amateur photography served to depict everyday life as lived, whereas stock photography sourced from commercial image libraries and acquired through the Internet, were highly constructed scene-stagings, for example, a busy mother on the phone, waiting to pick her children up from soccer practice. Together, the photographs operated to depict a semi-fictional visual narrative mixing aspects of lived reality with simulated scenes. They depicted local contingency and specificity, in the form of photographs of everyday life, and they involved staged interpretations of everyday life mediated by the stock photography.

Third, the photographs de-individuated the persona. Although the persona is primarily associated with the photograph of a middle-aged woman in close proximity to the name "Abby", the housewife was also depicted in various other guises throughout the diagram. In sub-sections such as "Relationships with her family", "Dinner Time" and "Fun", the photographs depicted entirely different women and other family members, including women from different ethnic backgrounds, as mentioned above. Although the persona is associated with a specific identity and biography, it was also portrayed as women of differing ages and ethnicity. As such, the photographs blur the identity of the persona somewhere between the specificity of the individual and the classification of the soccer mom. Likewise, the specificity of artefacts and place also shift between photographs e.g. interiors, vehicles and technologies are never quite the same. They simultaneously express specificity and generality. In sum, the diagram served to render the persona as a visual index of soccer moms. It arose out of design meetings and served to render representations of users, technologies, and situated practices available to subsequent development work – as visible and recognisable registers.

In early design meetings, the diagram was routinely used by the design team to resource the translation between the figure of the soccer mom and the specification of the KMS. Another visual artefact, entitled "Abby Problem & Context Areas" (see: Figure 11), – produced by the designers during one such meeting and hung next to the diagram – evidences

the designers' persona-to-system translations, i.e., the correspondences between the persona and the KMS prototype. To this end, and underneath the title, Post-it® notes were inscribed with handwritten descriptions of the personas domestic practices and beliefs, as imagined, featuring technology as well as analogous issues translated into more specific user needs.

Figure 11: the designers' analysis of the persona.

During the meetings the notes were arranged in a grid-like pattern. As the design team discussed the persona – its competencies, cognitive abilities, understanding and perception of ICTs, and how they mediated relations with other family members – they produced notes, translating attributes of the persona into descriptions of mundane computing practices and tasks: indicating possible system features. As such, the significance of this artefact is that it visually and materially mediated the translations between the persona, routine computing tasks and system specifications of the KMS. Moreover, and as I have argued in detail in the previous chapter, the notes contained aspects of *descriptors,* in that they script sociotechnical networks, as well as rendering them available for speculative de-scription, intervention and recombination.

Here, for example, the note: "Her family talks on the phone a lot, and often runs out of phone lines" was translated as a technological problem that could be addressed by the

inclusion of emerging Voice over Internet Protocol (VoIP) technology. This statement also connected up with photographs of mobile and landline telephones, as well as captions such as "Relationships with her family", included in the diagram of the persona. Accordingly, the design team translated the sociotechnical practices of the persona, such as telecommunication carried out between family members, into proposed system features, such as VoIP. These translations were expressed in the terminology of UCD, such as 'user requirements', denoting correspondences between prospective users and interactive capabilities.

In the above, I have shown how the design team produced translations between the characteristics of the persona and specification of the KMS: in short, persona-to-technology translations. Notably, the design team made many translations in the other direction where the KMS resourced the definition and reconfiguration of the persona. One such example serves to illustrate system-to-persona translations. The industrial designers and engineers, making the physical components of the KMS, such as the casing and mount, predicted that recent alterations to the proposed design would increase the production and retail cost of the KMS. They anticipated a rise in retail cost to over $1000 USD, understood to be a key price point for domestic appliances. To resolve the mismatch between persona and system, the design team raised the imagined spending power of the housewife to ensure consistency between the persona and the prototype. However, in turn, the newly specified retail cost impacted on the designers' expectations of the KMS. To warrant the rise in price the design team incorporated further interactive features, including children's games and interaction with the KWP via mobile phones.

As I have described above, the attributes of the housewife persona and the features of the KMS were co-configured during the making of the technology. Moreover, this was an iterative process, where changes elaborated further changes and so forth. In the case of the KMS, a change in its material qualities brought about a change in the persona's socio-economic status, from which further changes to the KMS arose. Thus, in practice, the housewife persona and the KMS co-emerge in the design process, where a change in one entailed a corresponding change in the other, and vice-versa. This example also goes to show how in practical work, designers synthesize social, technical and economic factors.

The co-configuring of the persona and the KMS prototype further problematises the concept of the boundary object as a means to understand the management of designers' viewpoints. In what I have discussed above, both the persona and KMS emerged in relation to one another. Neither the prototype nor the persona were individually flexible enough, nor well formed enough to accommodate changing and conflicting viewpoints. Rather, flexibility and coherence were an outcome of the mutual alignment of properties between the two artefacts. The modifications and changes I have described above can be better understood as a sociotechnical assemblage that unfolds during design practice, where persona and system

cohere as a concrete and discursive arrangement. As such the persona and prototype do not remain the same, like boundary objects. They are subject to ongoing change and mutual reconfiguration. Following the arguments made by Mol (2003), as well as Law and Singleton (2005), where the differences between objects, such as the personas presented in this chapter, are understood as *ontological* differences rather than differences in perspective, personas can therefore be better grasped as assemblages that in practice are performed differently each time. In other words, objects (such as personas) do not remain the same in the face of varying perspectives; rather, they perform different sets of relations in different contexts of practice. Understood as relational objects that acquire their reality in practice, personas also merge with other objects, such as the prototype. At times, the prototype and persona were distinctly separate objects, as I have described above. At other times, the persona and prototype explicitly co-existed, as in the PowerPoint documents I examine next.

In sum, I have argued that in practical efforts towards making a concrete technology, the persona acted as a loose and shifting assemblage of attributes, derived mainly from pre-existing personas. As a flexible and changing assemblage of attributes, the persona facilitated multiple types of interaction between the designers, as well as their interactions with the prototype. The persona also underwent a series of closures as it emerged. As an assemblage, however, closure in development did not equate to absolute resolution to a design issue. Issues were contingent and subject to change, but allowed practical work to progress. In this case, the design team arrived at points of closure during group meetings, where the identity and capacities of the persona were explicitly resolved in relation to conflicting viewpoints between designers and engineers, and in relation to the emergent properties of the KMS. In other words, the persona and the KMS underwent ongoing and mutual configuration and closure during practical collaborations between groups of designers and engineers, as well as individual cooperation between team members.

PowerPoint and the Persona

Another important aspect of the design and development process involved the designers' efforts to communicate, demonstrate and pitch the KMS to numerous audiences. The audiences for the KMS included existing and likely stakeholders, as well as associated innovation actors active within the corporation. Most importantly, the design team required and sought the ongoing support of management, in whose hands the system's success (continued development) ultimately lay. The success of the system was also dependent, though to a lesser degree, on so called 'buy-in' from PC manufacturers and software vendors. Here, the designers treated the interest of external partners as a gauge against which their vision of the home could be roughly measured. The interest of other ICT manufacturers and vendors indicated the alignment of their vision to market conditions and consumer demand and, as

such, evidencing the technologies viability as a mass-produced commodity. In the following, and in contrast to the previous section, I argue that in such contexts the persona was mediated by PowerPoint, where its correspondences with the KMS were summarized and crystallised as a simplified sociotechnical script.

With the aid of PowerPoint, the design team regularly communicated the KMS to contributors, management, peers and relevant third parties in industry. It was routine for the design team to pitch their rationale and demonstrate features of the system in order to communicate their vision, as was the case with other ongoing projects during my fieldwork. For these purposes, the design team habitually turned to PowerPoint as a presentation tool: a ubiquitous visualization medium in corporate and institutional settings (Tufte, 2003; Wakeford, 2006; Stark & Paravel, 2008). PowerPoints were also used in a variety of ways, not just as a visual resource for live presentation. As such, the design team routinely disseminated PowerPoints as project documentation to relevant and interested actors such as colleagues, management and other researchers within the corporation. Designers also printed out and attached PowerPoints to project room walls: making the process visible and accountable during cooperative work, such as meetings. In sum, PowerPoints functioned in various ways during design practice. One example of this is how PowerPoints functioned as visual resources deployed during live performance. Here, they resourced reflection and communicated accounts of a technology that could be read independently to live presentations. To operate with such versatility, PowerPoints, as Tufte (2003) argues, often feature well-scripted and coherent narratives reduced to structured key points, which are, in part, determined by the visual affordances of PowerPoint. The designers often expressed frustration with PowerPoint as a visualization tool. They routinely reported viewing the corporation's insistence on implementing brand guidelines, in the form of pre-designed PowerPoint templates, as an irritating and needless constraint on their communication skills. Designers also viewed PowerPoint's pre-configured hierarchies and slide sequencing as further constraints. Though, in practice, designers (and other employees for that matter) would often disregard brand guidelines, altering templates or creating layouts from scratch to suit their immediate work at hand; or, occasionally, they would use alternative visualization software.

In the following I examine two PowerPoints featuring the housewife persona. First, I present a PowerPoint communicating an overview of the KMS. Following this, I provide an account of a PowerPoint detailing the designers' vision in relation to the interactive features of the KMS. The purpose of my detailed descriptions of the two PowerPoints is to show how they both constitute a reduced set of attributes between the persona and the KMS. On the one hand, the overview PowerPoint serves to show how an abridged set of attributes and system features resourced the designers' vision of future kitchen practices. On the other hand the PowerPoint detailing the relations between specific practices of the persona and key

interactive features of the KMS demonstrates how their vision could be made concrete. The key point I make is that the particular co-configurations witnessed in both PowerPoints enact a summary and crystallisation of the particular co-configurations between the persona and the KMA. Both PowerPoints featured in my fieldwork during live pitches, as accessible archives on the UCD servers, as printed material to be read in private, and as a resource during design meetings, as well as being attached to a KMS project room wall (see Figure 12).

Figure 12: the printed PowerPoint attached to a project room wall.

After a rudimentary preamble, the narrative of the overview PowerPoint states the claim that 'our homes share six core values' (Slide 8). Through a sequence of slides, the PowerPoint outlines and qualifies the design team's vision of the home, with reference to the housewife persona, as the site where family practices can be enhanced. Here, particular attributes of the persona were associated with the principles of domestic life, which the design team held as emblematic of everyday family life in general: for example the principle "control" was qualified with the attribute "efficiency" and "a sense of accomplishment". Further, the principle "togetherness" was qualified by the attributes "family time & communication" and "socializing", amongst others. In this way, the six principles of the home were associated with a set of four or five short qualifying statements, normalizing domestic sociality. Furthermore, the qualifiers described domestic life from the imagined perspective of the housewife, as in "sense of accomplishment" under the principle "control". Crucially, the persona is only presented in detail after the sequence of slides setting out the designers' vision of the home. The effect of this, as an upshot of the sequencing of slides enforced through PowerPoint, was to pre-figure the identity and capacity of the housewife, that is to say, to equate the principles of the home with the attributes of the persona. As such, the PowerPoint's narrative served to

communicate the persona as the reasoned outcome of the design team's user-centered view of the home to stakeholders.

The designers' interpretation of domesticity was followed by a more detailed description of the housewife persona. This included the persona's biography, "needs" and "goals", as well as depictions of its social and material setting. Although many aspects of the housewife persona have been carried over from the diagram, discussed previously, there were also a number of key differences. In terms of similarities, the portrait of middle-aged women was retained, as was the biographical narrative. However, the persona that featured in this PowerPoint was both nuanced and markedly different to the diagram. The photographs depicting family members clearly show different people to those in the diagram. Photographs of actual kitchens were included, expressing evidence of the design teams focus group and everyday life. One photograph, for example, showed a refrigerator covered in handwritten messages. Despite the differences, the persona retained the identity and capacities of a soccer mom by virtue of key descriptive elements carried over from the diagram. Moreover, the 'human' and 'social' qualities of the persona were reduced to the following:

"**Needs**	**"Goals**
Stay informed	Have fun, involve family
Feel connected to the family	Be a good mother. Raise good kids
Keep everyone up to date	Maintain healthy marriage
Feel in control of the chaos	Stay in touch with family and friends"

Figure 13: a PowerPoint slide featuring the persona Abby

Towards the end of the PowerPoint, after domestic life and the persona have been outlined, the KMS is finally introduced. The system was visualised using CAD renderings, with technical features drawn out and set in relation to the designers' vision of domesticity and the

persona. The upshot of this was a series of translations where the rationale for the KMS was articulated in relation to the cognitive capacities and objectives of the persona. Table 1, below, shows translations made from the specific, such as "Stay Informed", to abstract categories such as "Togetherness". Moreover, Table 1 also shows how attributes of the persona were transformed into "Design Principles" reducing domestic practice and family life to notional guides for the design of the KMS.

As I will discuss in more detail following my description of the second PowerPoint, the key point is the particular co-configurations that we are witnessing in the PowerPoint between the persona and KMS. Whereas in the making of the KMS the correspondences between the technology and the persona were distributed across, and implicit in, representations of the user and the prototype, the PowerPoint draws together and makes clearly evident the correspondences in one representational object. In other words, both the PowerPoints I examine here summarized and crystallised the particular co-configurations between the user representation and the technology. Furthermore, the process of making the attributes of the persona and the technology correspond in the PowerPoints was reductive. The persona was reduced to particular sets of characteristics that directly correlated with and support the physical and interactive features of the KMS.

Needs	Goals	Design Principles	Value Proposition
• Stay informed • Feel connected to the family • Keep everyone up to date • Feel in control of the chaos	• Have fun, involve family • Be a good mother. Raise good kids • Maintain healthy marriage • Stay in touch with family and friends	• Flexible • Immediacy • Works the way each person does naturally	• Togetherness • Advancement • Control Love and Spirituality

Table 1: the design principles and value propositions formulated by the design.

Accordingly, the second PowerPoint communicating the KMS also featured a much condensed description of the housewife persona, albeit in a different manner and for different means. Here, the persona featured in the design team's detailed description of scenarios of use in which touch, voice and pen input mediate interaction with the systems calendar-based interface. The sequence of this PowerPoint begins with a brief description of the housewife persona and the kitchen. This is followed by a detailed scenario in which family members coordinate their schedule, visualized by a series of wire-frame diagrams modelling the GUI in outline. This PowerPoint ends with the design team's vision for the KMS user-interface.

The persona featured in this PowerPoint depicts the housewife in relation to family members (see Figure 14) and the kitchen. The persona was composed of "goals" and "needs" used in the overview PowerPoint as well the same photographs depicting family members, as described above. In this case, the photograph of the housewife was positioned at the centre,

surrounded by family members, implying the persona's role as a coordinator and indicating the involvement of other family members in the scenario to come. Furthermore, Figure 14 shows how elements of the persona were foregrounded in order to communicate the designers persistent gendering of the housewife.

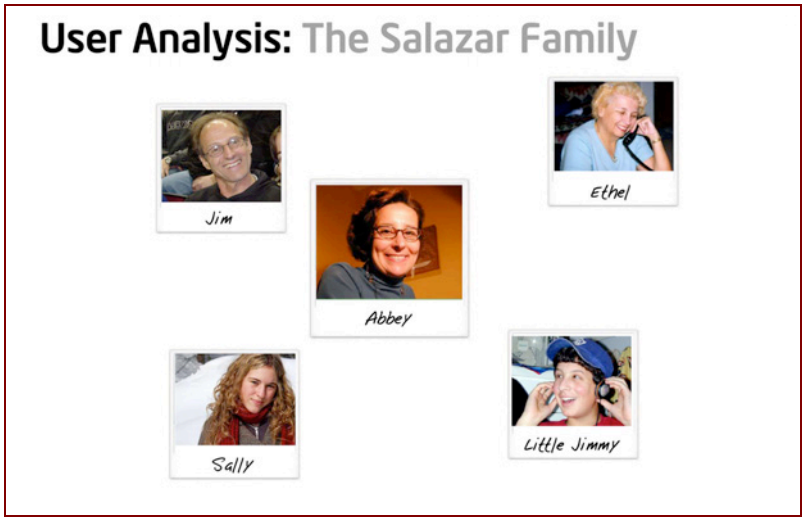

Figure 14: the housewife persona and family members.

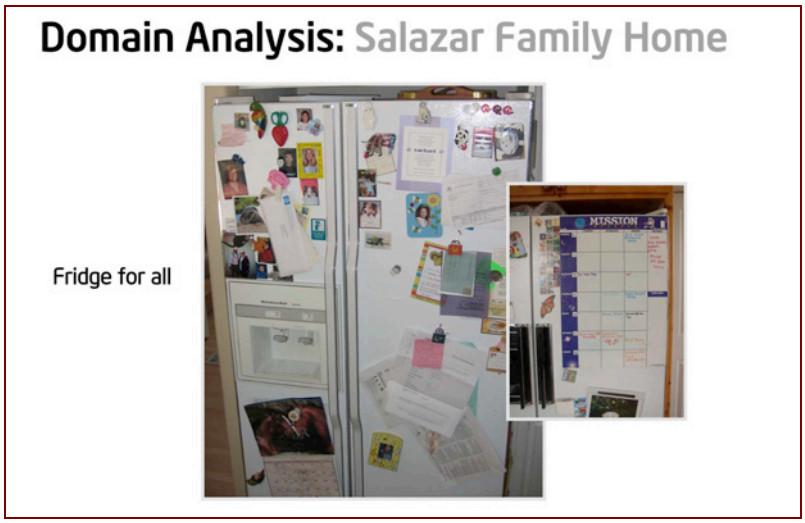

Figure 15: a PowerPoint slide including photographs of a refrigerator in use.

In this PowerPoint (Figure 15) the refrigerator is characterised as a "Fridge for all" and held up as an exemplar of routine socio-material practices suitable for interactive enhancement. Note the calendar on the right in Figure 15, which serves to anticipate the KMS user-interface design. In addition, routine practices of the family – as imagined – are listed, clearly showing the emphasis placed by the design team on the mundane chores of the housewife in support of children's activities. In contrast to the overview PowerPoint, where the home and

persona are summarized in the form of overarching principles, here specific everyday chores are brought to the fore.

Figure 16: the everyday practices of the family as imagined by the design team.

The workings of the GUI were detailed by way of a fictional scenario of user interaction with the system. Through a sequence of slides the steps necessary to schedule an event were illustrated in the form of wire-frame interface diagrams (e.g. Figure 17). The storyline of the scenario is as follows: Abby chooses a date free of events in the calendar; she creates a new event; she changes the event to another day free of events due to a conflicting event; Abby sends a message to her husband and children informing them she has gone shopping, though she has prepared a meal for them and left cooking instructions with the food. Next, the husband schedules a trip to Chicago, which is reviewed by the housewife via a GUI dialogue box. Thus, the specific features of the GUI emerge as the narrative progresses.

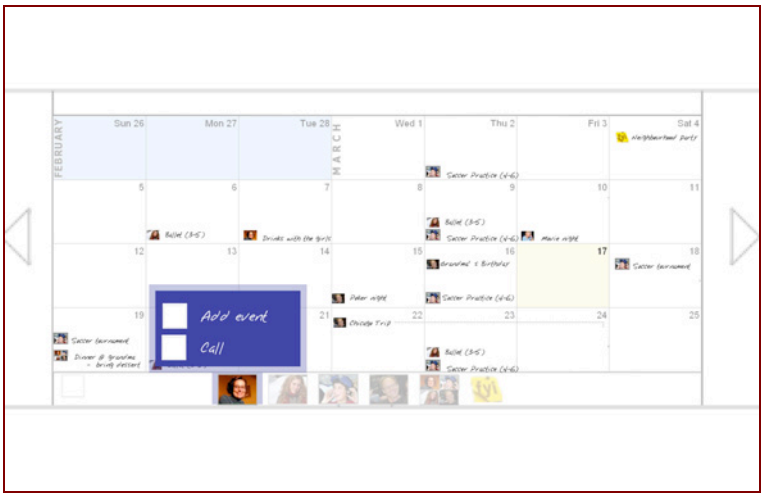

Figure 17: a wireframe diagram of the KMS user-interface.

As I have described above, the KMS user-interface was visually detailed with wireframe diagrams. Crucially, the diagrams are populated with thumbnail photographs depicting the housewife and family members, carried over from the initial description of the family and consistent with the overview PowerPoint. The thumbnails indicated family members' use of the system and their ownership of digital content, as well as pinpointing which user was interacting with the system at a given moment. Figure 17, for example, depicts the housewife creating an event. Events, for that matter, are depicted in a handwritten format, indicating the systems capacity for pen-input, and delineating activities consistent with the designers' vision of family life, especially the identity of the housewife as a soccer mom. An example of this is how the calendar itemizes the imagined activities of the children including "soccer practice", "soccer tournament" and "ballet practice". It also lists the imagined activities of the parents, including "Drinks with the girls" for the housewife, and "Poker night" for the husband. Here, events listed on the calendar are also set in close proximity to small thumbnail portraits of individual family members, indicating the user responsible for creating the listing and involved in the event.

The PowerPoint concludes by framing the designers' vision for the GUI. It is a vision by which the KMS is presented as the interactive successor to the "Fridge for all". It presents a future where the various practices, competencies and cognitive characteristics of the housewife persona have been translated into a family scheduling system. Furthermore, it is where the abstract "value propositions" formulated by the design team, including "Togetherness", "Advancement" and "Control, Love and Spirituality" are manifested in interactive time management practices.

Like the overview, this PowerPoint communicates a somewhat simplified and concise version of the housewife persona. That is to say, the extent and flexibility of the persona is curbed: the scripting of people, practices and technologies is strictly limited. In this case, domestic activity centres around the kitchen as the site in which events are coordinated: daily activities depicted in the diagram have been replaced by five brief indicators of tasks, and many of the soccer mom's material possessions have been omitted. The visual elements that do endure, however, play a crucial role in the depiction of the coordination of family events. Portraits of family members and event listings, for instance, are repetitively distributed across the PowerPoint slides. Moreover, events are consistent with the imagined identity and capacity of the housewife-as-soccer mom. Thus, the simplicity and immutability of the persona assemblage is performed through repetition and slight variation. The stepwise ordering and repetition of elements (names, photographs, types of events) that persist throughout the scenario are nuanced and detailed by way of certain interactive aspects of the GUI, which reify the identity of the persona.

Another important aspect of the persona depicted in both PowerPoints, as an abridged representation of the soccer mom portrayed in the diagram, is that the translations between the persona and the PowerPoint are multiplied. Although the identity and the capacity of the persona is reduced to the patterning of 'key' points directly and explicitly related to the KMS, these points are numerous. As such, they serve to articulate the specific form and function of the technology in relation to the designers' vision of family interactivity.

Thus, the delivery of live pitches is both resourced and ordered by the PowerPoints. They are digital objects in which heterogeneous elements (words, photographs, CAD visualisation, diagrams and table etc.) are strung together (Stark & Paravel, 2008) to form a sociotechnical narrative of future use. They serve to make accountable the design team's use of user-centered principles in order to support and enhance a gendered vision of suburban family life. The narrative, as a rigid sequence, enacts the persona as an immutable and tight-knit script where a well-reasoned progression from persona to system specification ties into the overall vision for the technology. Accordingly, the PowerPoints crystallize and make explicit the relations between the persona and the KMS. As performed during meetings, the PowerPoint iterations of the persona served to persuade audiences of both social and technical matters (Stark & Paravel, 2008: 31) by way of a sequenced and somewhat immutable sociotechnical assemblage.

The key point here concerns the particular co-configurations enacted in the PowerPoint between the persona and the KMS. The PowerPoint summarises the relations between the persona and the technology, and it also crystallises particular correspondences and translations. That is to say, the PowerPoint visualizes the translations between the persona and the KMS as clearly accountable. The PowerPoint articulates the KMS as a technology modelled around the identity and practices of the housewife, and then represents more specific activities, such as planning mundane recreational events and how they are supported by the system. In this way, design presentations can be further grasped in how they differ from scientific and political demonstrations that are primarily concerned with showing a technical object or effect (Barry, 2001: 32). That is to say, the designers' show both technical effect and its relation to bringing about or enhancing practices and social change. In the cases I describe here, this is achieved through the local co-configurations of the persona and the KMS to suit the purposes of the design team's presentation. Also, in contrast to other demonstrations, the PowerPoints also featured a future system under construction and typecasts of future users. The PowerPoint resources the efforts of the design team to bring into existence the system and its users by way of a cogently scripted near future. That is to say, the communication of the KMS, by way of the PowerPoint, serves to persuade management about the designers' anticipation of housewives' practices. Here, the persona, as a credible

and lucid, but simplified sociotechnical assemblage, expresses alignments between family life as understood in the present alongside prospective practices and technical features.

According to Wakeford (2006), PowerPoint functions as a device that provides contextual 'thickness' to pitches, presentations and demonstrations. Likewise, in live performance, both the overview PowerPoint and the PowerPoint describing the systems interactivity also entered into hybrid relations with presenters and interlocutors, wherein visual and textual descriptions support and elaborate spoken presentations. For the design team, unlike the corporate ethnographers studied by Wakeford, their objective was to attain buy-in from stakeholders to their sociotechnical vision. A comparison between the two is useful. Whereas for Wakeford PowerPoint functions to mediate social data produced by ethnographers, in the cases here, PowerPoint served to convey entanglements between the social and the technological. Moreover, they also entangle pasts, presents and futures through the representation of the actual (contemporary family life) with future fictions (future users using future technologies), in contrast to the staging of cultural life as an empirical object that has taken place. Lastly, where the messiness of the social is included in the PowerPoints of corporate ethnographers, it was bracketed out of the KMS PowerPoints. In other words, the mutability of the persona, as exhibited during practical development work, was vastly curtailed. The messy and complex stories of how the persona came into being and how it variously resourced the designers' practices were omitted. The PowerPoints amounted to formalized accounts of the design team's process, matching others' accounts of a step-wise progression from user definition to system specification. They included clearly articulated translations between the persona and the KMS purified of the messy complexity of the combination of genderscripts as well of accounts of actual housewives practice – which in any case they didn't have access to other than through engagement with their own partners and friends. As such, the KMS PowerPoints fictionalise both the process of design and future domestic practices in order to make accountable and convincing the efficacy of the team's process and vision to stakeholders.

Under certain conditions, however, the KMS PowerPoints resourced other, related, practices. When PowerPoints were printed and arranged on a wall, as was the case with the KMS PowerPoints, their narratives were no longer sequenced over time in a stepwise fashion. Instead, slides were spatially arranged, allowing viewers to skim over and focus on particular content. The slides could be read in sequence and they could also be read out of sequence. Likewise, disseminated PowerPoints can be read sequentially or not. Nevertheless, in all of the local PowerPoint iterations of the persona, it was curbed to match the technology and the vision proposed by the design team.

In both cases examined above, the attributes of the persona were woven into coherent visions of near future domestic practices, wherein the attributes of the housewife correspond

seamlessly to the features of the KMS. As such, the design team ensured that the properties of both persona and technology matched and that there were no redundancies, mis-matches or loose ends between the persona and the system. In contrast to the diagram, which served to flexibly mediate the construction of the prototype, the PowerPoints operated as rigid and cogent scripts of future interactivity that crystallize a simplified and aligned set of correspondences between the persona and the prototype.

Conclusion

As I have argued in this chapter, the role of personas in design practice is far more complex and much less procedural than accounts of personas in design and HIC literature assert. I have shown how a new persona was assembled from existing genderscripts associated with a consumer product, an aborted technological project, and a common North American political trope. The view that user representations, like technical objects, simultaneously embody and format sociotechnical networks helps me to better grasp how the persona resourced the practical and cooperative work of the designers, on the one hand, and on the other, served to format sociotechnical visions as strategic narratives, and as cogent and tactical descriptions of proposed system functionality. As a heuristic, the persona can be understood to have resourced the making and deployment of expectations in the following key ways. First, the persona facilitated multiple points of interaction and closure during the construction of a concrete and workable technology, thus mediating near-term technical issues and problem solving. Second, as part of the GUI scenario, the persona mediated the designers' vision of interactivity, as a functional aspect of the system, which can be viewed as a medium term objective. Third, the persona made accountable the practices of the designers in relation to the application of UCD principles, aligning and rendering accountable their endeavours with the broader strategic agenda of the corporation, as well as to colleagues and peers also working under the rubric of UCD. Viewed in this way, the persona facilitates the coordination of interdisciplinary expertise towards building a single technology, as well as communicating accountability. Finally, the persona served to express the design team's overall vision of the KMS to stakeholders and associated innovation actors, in contrast to their medium term objectives.

In sum, personas are not pre-given figures to which the features of a system are matched. Instead, they can be better understood as highly adaptive sociotechnical assemblages that are locally performed in order to meet varying demands. It is, perhaps, by virtue of their fictional nature that they can undergo various transformations and co-configurations to suit a given situation, as, for example, loose and flexible arrangements of sociotechnical attributes, or, as simplified and immutable traits. The multiple instances of the persona hung together as 'Abby', due to the tenacity and repetition of key figurative elements, such as first name,

biographical narratives and photographic portraits. The upshot of all the local adaptations of the persona – expressed as a soccer mom – was the re-visioning of a highly gendered and culturally dominant view of housewives and domesticity.

Chapter 6.
Prototyping and the Prospects of Obesity

Introduction

Whereas the previous chapter concerned the efforts of a design team to stabilise a technology around the figure of a soccer mom, this chapter examines how the making of a prototype involved multiple users. In this chapter I examine how a diverse cast of users resourced the construction of a prototype health and fitness technology, and how, in turn, the prototype served in the configuration of multiple users. The daily exercise prototype (DEP) – a combination of mobile phone software and wearable sensors – was formulated as a ubiquitous computing (ubicomp) technology to address the causes of obesity, as well as to allow patients suffering from the disease to self-manage treatment.[72] Broadly framed, the purpose of the DEP was to encourage people to carry out and manage routine exercise with the aid of wearable sensors communicating with a mobile phone.

Analytically, I approach the DEP as a changing arrangement of users, technologies and discourses that variously served to resource the interests of the design team, individual groups within the design team, and management. To illustrate how the DEP served multiple interests and expectations, not least those associated with the prevention and palliative care of obesity, I provide a detailed examination of the discursive scripting of future consumers, the recruitment and deployment of embodied test-users and how the constituent members of the design team were themselves locally configured as users. To better grasp the relations between the prototype and users performed during it's making, I divide my analysis of users into two broad temporal categories. I make the heuristic distinction between *distal* and *proximal* to differentiate between users that operate in the present but occupy different temporal moments in relation to the prototype. First, I define *distal-users* as prospective figures deployed in the present in order to envision a particular future terrain. In this case, distal users count as representations of collectives situated in an outlying future that may benefit, or not, from the proposed exercise technology. I describe how the designers deployed an *inventive risk discourse* with which to envision distal-users, in the form of statistically predicted health publics. *Proximal-users*, in contrast, count as users who participated in the making of the prototype in

[72] Ubiquitous computing, coined by Weiser (1991), is a vision of computing where microprocessors and calculation are seen as an embedded feature of everyday objects and activities.

the present.[73] This includes the acknowledgement of the designers as users. I employ the term *designer-user* to grasp the various ways in which the DEP resourced designers' professional activities and agendas, including my purposes as an ethnographer, within the corporation and amongst the HCI community.

With this in mind, I argue that the prototype resists interpretation as a cogent script of future use: a technology delineating a particular course of technological development that in turn configures a single future. Instead, I argue that the various prototype-user arrangements occasioned during practices of envisioning, assembly, demonstration and performance served to mediate manifold, open and somewhat indeterminate prospects. As such, the DEP functioned as a highly variable socio-material assemblage that served to align a range of entangled interests and expectations, including the opening up of new healthcare markets and consumer populations, the efficacy of novel sensing and software technology, and the figuring of future users capable of behaviour change and self-managing palliative care, rendering accountable the designers' working practices and innovations to management and to a wider HCI community pre-occupied with developments in ubicomp.

Prototypes in Design: Materializing Futures

Before tackling the case in hand, I first want to sketch out the role of prototypes as socio-material devices for ordering the future in the present. There are many approaches to prototyping in design. Bødker and Grønbæk (1991: 198) provide a useful and critical summary of four applications of prototyping in design practice, including system requirements evaluation, complete system specification, exploratory artefacts and 'cooperative prototypes'. In brief, prototypes used in system evaluation allow for adjustments to be made to system specifications. Prototypes as complete system specification provide a full and formal description of what a future system will do. Exploratory prototypes are rapidly made and disposable mock-ups that aid the clarification of system requirements. Lastly, cooperative prototypes mediate the capacity of both users and designers to formulate system requirements. This approach, closely associated with the role of prototypes in PD (e.g. Ehn, 1988; Ehn & Kyng, 1991) and CSCW (e.g Bødker & Grønbæk, 1989), challenges the conventional view that systems should be designed by expert designers. Instead, cooperative prototyping incorporates the knowledge of end-users in the design of technological systems, such as trade-union members, as discussed in chapter two. As such, prototypes act as both literary devices, where system specifications are abstractly inscribed, and as socio-material configurations that embody practices in durable artefacts (Suchman et al., 2002: 166).

[73] See (Woodhouse & Patton, 2004) for a discussion of professional designers views as 'proximate' as opposed to design by society e.g. design by users.

Now, one particularly salient aspect of prototypes is their capacity to reify the future in the present – not least in the coding of future practices. As socio-material artefacts that are indexical to designer-user interactions, prototypes operate to durably align various interests (Suchman et al., 2002: 168). As such, prototyping can be viewed as the local and material enactment of a future system design in the present, wherein users are mobilized in the design process as either active and 'creative' actors or passive instruments for system evaluation (Grønbæk, 1990: 8).[74] Accordingly, prototypes function as performative artefacts (Danholt, 2005b: 1) with which designers materially envision and construct the future in the present, which in turn works to bring about a future. That is to say, prototypes entail the management of substantive representations of the future in the present (cf. Michael, 2000a: 22), where visions of the future determine the present and where the future is determined *in the present*.

According to Ehn (1988, pp. 128-129) and Mogensen (1992: 1), the central dilemma of prototyping concerns the choice between two alternative prospects: to support existing practices or to bring into being entirely new practices. Ehn characterises this as the dialectical opposition between tradition and transcendence. As a future-making practice, viewed alongside other methods of managing and coordinating uncertainty such as Foresight, risk analysis and DELPHI (De Laat, 2000), prototyping can be understood to provide its own methodological vectors into the future. On this score, Floyd et al. (1984) describe the practice of prototyping as a 'learning vehicle' in which the specifications of a future system are determined in the present through progressive steps extrapolating the present into the future. Thus prototypes operate as heuristic artefacts that allow designers to explore socio-material alignments between future users and technology ('paths'). Bødker (1998: 112), drawing on Norman's (1991) application of the notion of *affordance* in design, argues that prototypes delineate development along a single temporal path whilst resisting others. In other words, prototypes afford particular temporal directions; however, 'breakdowns' brought about by alternative prototypes and representations of a system can force a change in direction. Danholt (2005b) elaborates on these interpretations of the prototype – as heuristic, path determining and progressive – by describing how users and technology are co-constituted during the prototyping of a 'diet diary'. Here, novel diabetic subjectivities, bodies and healthcare technologies are performed through what Danholt (2005b: 6), drawing on Stengers' (2000: 148) view of scientific knowledge, refers to as 'vectors of becoming'.

To my mind, the notion of vector provides a useful way to understand the temporalities of prototypes and the patternings of technological change, especially in relation to the concept of the assemblage. A common metaphor to describe the temporality of technical objects in STS is the notion of technological trajectory. As Mackenzie points out, the notion of

[74] See (Asaro, 1999; Spinuzzi, 2002) for accounts of various prototyping traditions (e.g. JAD and PD) informing UCD practices, as discussed in chapter two.

technological trajectory makes it possible to extrapolate growth and development into the future. Although the notion of trajectory does have appropriate connotations, for example the 'social' patterning of technological change through which a technology is constructed, such as the pre-programmed accuracy of a ballistic missile (MacKenzie, 1990: 168), like Mackenzie, however, I also find the notion of technological trajectory misleading. It suggests a mechanical understanding of technological change: one that evokes Newtonian physics and laws of motion. It also suggests, as Mackenzie points out, that change is 'natural' and self-sustaining. In short, it provides an explanation of change that is determined by either natural laws or social conditions. Rather than letting these associations interfere with my analysis, I use a different word that doesn't carry the baggage of a natural or social trajectory. The term *vector* is useful here, and it is possible to say that in design practice, efforts and resources coalesce around a vector occasioning a patterning of technological changes, which in turn contribute to the vector or necessitate a change in direction. Moreover, vector also suggests dynamic multiplicity and directionality without reduction to a single spatio-temporal logic. For the case in hand, the prototype, this is important as it allows me to speak about the manifold interests and directions the DEP resources, not just efforts to address the increasing prevalence of obesity in global populations. Whereas trajectory speaks of a singular development and change, vectors speak about multilinear ensembles that can follow different directions that can be broken, subject to change and drift.[75] Lastly, mathematics speaks of *vector-objects,* which points to objects that are in continual processes of becoming that cannot be abstracted from their spatio-temporal circumstances.

Against this reading of prototyping as a socio-material technique for performing the future in the present, I examine the local enactment of the DEP as the making of multiple futures. In what follows, I examine the diversity of technologies, users and practices through which a prototype is occasioned. Invoking Ong and Collier (2005a: 12), I present the case in hand as 'the product of multiple determinations that are not reducible to one single logic'. This includes the emergent temporalities of the prototype and prompts me to consider the different sociotechnical arrangements formatted in and by the prototype. That is to say, how the prototype engenders much more than a single vector into the future. My analysis therefore attends to the multiplicity of the prototype mediated by putative users, anticipated contexts of use, the prospective provision of healthcare, and research agendas in HCI, particularly ubicomp; as well as individual career paths. Finally, my attention to the DEP as a distributed and somewhat loose configuration of users, technology and discourse that is locally enacted

[75] I am paraphrasing Deleuze's (1992: 159) description of Foucault's notion of a *dispositif*. Deleuze (ibid.: 162) argues that dispositifs "are composed of the following elements: lines of visibility and enunciation, lines of force, lines of subjectification, lines of splitting, breakage, fracture, all of which criss-cross and mingle together, some lines reproducing or giving rise to others, by means of variations or even changes to the way they are grouped." Thus, the notion of lines, or vectors, can incorporate various logics, movements and interactions, which might include trajectories for that matter.

does not rely on the explanatory power of cohesion, consistency and order. In what follows, I demonstrate how the DEP accommodates interpretation as both an artefact patterning multiple interests, resources and future visions, as well as a material-semiotic entanglement that works by virtue of being provisional, flexible and open to change.

Prospecting and Assembling The Prototype: Distal and Proximal Users

In 1999, according to various sources including publicity on the web, the corporation became active in the development of healthcare technology and related services. According to the publicity, the corporation's engagement with healthcare came about as a consequence of research conducted by corporate ethnographers who identified the 'real' needs of 'real' providers and patients, thus pointing to healthcare as a prospective microprocessor market. Since these early efforts, healthcare has become a major preoccupation of the corporation. At the time of my fieldwork, the corporation had committed considerable resources in support of a wide range of innovation activities, such as R&D and marketing, to establish itself as a global provider of healthcare systems and related services. Notably, the corporation's efforts included the establishment of a health computing division, responsible for developing medical and healthcare ICTs for service providers and patient-end-users. Hence, the healthcare division's interests and offerings included: information systems for healthcare providers, health insurance companies and government health agencies; expert and information systems for pharmaceutical and biotechnology companies; communication and telemedicine technologies to facilitate remote healthcare, and patient care information systems for doctors and nurses.

Within this context, the UCDG was engaged in a collaborative effort with one of the corporation's many research laboratories to design and develop the DEP. In contrast to the previous substantive chapters, where technologies were managed and made by interdisciplinary teams resourced almost exclusively by UCDG personnel, the DEP was being developed in a separate research laboratory by group of researchers working independently of the UCDG designers. Recognising that they lacked the appropriate skills to design a consumer oriented GUI, the researchers in the laboratory turned to UCDG for the necessary design skills. Here, UCDG embodied considerable experience with, and knowledge of, developing healthcare technologies. Examples of this include two medical prototypes that were under development during my fieldwork: a diagnostic device to allow people to self-test for Parkinson's disease, and a domestic telemedical device to facilitate the remote clinical care of elderly patients.[76] As many designers within UCDG were already committed to these and

[76] The Parkinson's self-test device was another example of a prototype that did more than configure a user or determine a single technological path. This health technology was demonstrated at the corporation's annual R&D forum as an exemplar of interactive healthcare products for patients. It was also articulated as the alignment of particular networks of healthcare, to lay

other projects, I was assigned the role of GUI designer for the DEP. As such, this chapter draws on my participant observation of the prototype from the standpoint of a designer, as well as interviews with other team members and document analysis. To ensure anonymity, references to documents and published papers have been omitted where appropriate.

Distal Users and Inventive Risk Discourse

The rationale underwriting the development of the DEP, formulated by the laboratory researchers, was to motivate and support people at risk or suffering from obesity to carry out higher than normal levels of daily physical activity. The researchers' key insight was that any routine activity could count as physical exercise, and that ubicomp technologies provided the means to render such activities visible and manageable. Equipped with this insight, the researchers designed a wearable technology to support individual and groups of users to carry out both formal ("structured") and informal ("opportunistic") routine exercise, with a particular emphasis on the latter. Here, formal exercise counted as a planned and sustained increase in heart rate, during swimming or running for example. Informal exercise was defined as the recognition of non-exercise related to everyday activities such as walking, climbing up stairs and so on. Of chief concern to the researchers was the way in which unrecognised physical activities could be incorporated into physical fitness regimes. To make everyday activities visible as exercise the DEP incorporated a pedometer in combination with a mobile phone software application for journaling footsteps. This set-up made it possible for users to view and reflect on their daily exercise in reference to footfall. Furthermore, the DEP was viewed as a wearable computing device, worn and used everyday in order to render previously unreported embodied activities as exercise. With the mobile phone software, users were encouraged to reflect on and "self-administer" programs of daily exercise.

The broader rationale supporting the development of the DEP, recounted in conference proceedings, corporate presentations, meetings, and sites of publicity placed the prototype in relation to increasing alarm about the national (U.S.) and global threat of obesity. Invoking reports published by the U.S. Surgeon General, the U.S. Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO), the designers mobilised existing fears to point to two future health scenarios: a future without and a future with the DEP. The existing health context portrayed populations of people currently suffering from obesity. Drawing on official statistics, the designers claimed: "over one billion overweight adults worldwide (300+ million of whom are obese)" and "overweight and obesity

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claim to new intellectual property and to configure elderly people as housebound patient-users. Furthermore, it was also deployed to demonstrate the efficacy and relevance of the application of UCD principles to management. In short, the Parkinson's self-test prototype, like the case I present here, was another example of a prototype that functioned to resource multiple interests and expectations. I focus on the DEP because I was a participant observer during its development, whereas with the Parkinson's device I had only limited access to a development process that was nearing completion.

in the U.S. are an epidemic, affecting over 60% of adults". The designers also pointed to the economic implications of obesity – quoting over $100 billion USD in costs associated with the treatment of the disease. Against this existing climate, the designers discursively constructed two future health prospects associated with obesity, where lifestyles turning into a disease are turned into a socio-economic opportunity. First, the designers invoked statistical forecasting, such as increasing obesity rates, and they deployed expressions such as "epidemic" and "risk factors", to assert that the disease would uncontrollably propagate one health future alongside related chronic diseases such as diabetes, heart disease, hypertension etc. The second health future, derived from expert medical advice from the U.S. General Surgeon and the CDC, was depicted as one where routine exercise regimes contribute to the prevention and treatment of obesity and related conditions amongst a given population. This was a containment vector in which obesity rates are curtailed, in line with U.S. government and UN policy. As such, the rationale for the DEP linked the local efforts of the designers to develop a technology promoting everyday physical activity for individuals and groups of users, to global economies of healthcare, where the prevalence of obesity and the anticipated future of the disease is managed in a given populations.

Drawing on Beck (1992), the rationale deployed in support of the DEP can be understood as an example of risk discourse as applied in design, where the dialectic between future sociotechnical threats and opportunities are rhetorically played out in order to warrant inventive and creative practice. Here, the term *inventive risk discourse* characterises the articulation of a calculus of future risk set against prospective sociotechnical opportunities in which new future markets and contexts of use are rendered the object of action in the present.[77] Thus, the inventive risk discourse associated with the prototype portrayed two possible future health vectors: a future population without the prototype, and a future in which people are managing their health with the aid of a ubicomp technology. Non-users of the DEP represent members of one future health population, whilst users of the DEP constitute members of a health vector leading to populations of individuals monitoring and managing their situated physical exercise. A key feature of inventive risk discourse, deployed by the designers here, are the speculative alignments forged between individuals and political populations. Following Foucault (1998: 140), this application of inventive risk discourse can be understood to contain aspects of *biopower* which serve to align the designers' research agenda concerning ubicomp technology, as well as the corporation's strategic re-orientation to user-centered innovation applied to healthcare, with government and inter-governmental instruments of population management. For Foucault, biopower, as a form of politics,

[77] Beck (1999: 49) alerts us to the inventive capacities of risk promoting the "exploration of new worlds and new markets". In doing so he draws upon Giddens' (1999: 8) recognition of risk as a productive and active 'energizing principle'.

operates along two lines simultaneously: one, where individual bodies are disciplined and optimized; the other, where populations are regulated by government technologies. If inventive risk discourse works to rhetorically connect up users and ubicomp technologies with the policies and techniques of government, then the socio-material prototyping practices of the designers, examined next, can be viewed as the doing of *anatomo-politics* (Foucault, 1998: 139) in efforts to configure bodies and technologies to the terrain of political practices. However, by identifying the logic of the designers' vision as inventive, I suggest, following Deleuze and Guattari's (1988: 531) criticism of biopower, that the designers' discourse cannot be reduced to speculations about the exercise of control via interactive technologies. In short, it is a key aspect, but not all encompassing.

The distal-users of the DEP were modelled, along behavioural scientific lines, as individuals capable of self-administering their exercise routine, as members of a motivational community and, crucially, as members of an interactively enhanced population. The designers' model of the future user was further mediated by the inclusion of the MSB and the GUI in the second stage of prototype development, configured by way of the three technologies, each containing different versions of the identity and capacity of the putative user. As such, the form and capacity of the distal user, figured into the DEP, emerged as a hybrid of the different future users inscribed into the individual components of the DEP. With the inclusion of the virtual garden GUI and the MSB, the design team further specified the putative user of the DEP. Moreover, with the inclusion of the virtual garden GUI, which abstracted the visualisation of exercise data into graphic representations of plants, the designers elaborated on the user as a self-monitoring individual and member of a community group described above. The belief of the designers was that exercise data was private, and the display of the mobile phone a semi-public site; in other words, a display other people might see. Accordingly, the designers took the view that the GUI should disguise the data produced by activity monitoring individuals using the prototype.

The DEP rationale, as inventive risk discourse, establishes links between the proposed technology, an existing national and global health issue, governmental and inter-governmental health organizations, the existing prevalence of obesity and its future amongst populations, economies associated with the treatment of the disease, and the everyday practices of individuals and communities. In short, it renders a future market for the proposed technology where the sociotechnical relations between individuals (as users), populations, technologies and institutions are drawn out. As an object discursively brought into being, the prototype occasions the linking up of global health issues and economic futures with the lives of individuals and various populations at large. It serves as a discursive joint (cf. Wilkie & Michael, 2009: 12), articulating the present with two alternative health future vectors: one in which obesity has spiralled out of control, and a second in which the DEP binds together

novel situated medico-technological practices with global economies of healthcare, governmental policy and management of healthy populations.

Against this alarmist and compelling backdrop, the researchers presented the application of UCD as a "timely" corrective. Practically, this meant mobilising various types of users in the design process to configure both technology and putative users. By way of preview, the users enrolled by the researchers included photographs of elderly people conducting exercise, accounts of embodied people using the prototype, psychological models of behaviour, statistical descriptions of populations, and so on. Furthermore, the DEP was also presented as a contribution to agendas within HCI, most notably ubicomp. In these reports, the DEP and prototyping were expressed as methodological contributions to the "in-situ" evaluation of interactive systems and users, where sociotechnical knowledge is partly produced outside the computer laboratory and in combination with non-experts – what Callon and Rabeharisoa call 'research in the wild' (2003). Accordingly, the DEP was simultaneously enacted as a future health technology and as a methodological development in HCI, where UCD is pressed into the service of ubicomp visions. Moreover, the researchers were working with users as combinations of people and technology, to explore futures as ways of being (ontological), as well as contributing to knowledge about future prospects (epistemological).

To summarise, the DEP was a combination of an electronic pedometer and mobile phone handset, running software to facilitate the storage and journaling of step-count data. The software logged step-counts sensed by the pedometer and visually presented this data to end-users via a GUI by way of a journal. The development of the prototype was conducted in two clearly defined stages. During stage one, the researchers "rapidly" assembled the DEP by employing off-the-shelf pedometers and mobile phones, which worked in conjunction with a purposely written software journaling program utilizing a rudimentary user-interface. In this form, the researchers deployed the prototype as an experimental device to be used in a field trial. The trial was conducted with a group of thirty female users in order to assess the efficacy of the DEP to motivate increased levels of physical activity. In effect, the trial was evaluating the fitness of both the technology and the model of users configured by the designers. During the second phase, a new GUI and a new sensing device were incorporated into the DEP. The GUI was designed to visually enhance the existing journaling software and the new sensing device, also under development in the research laboratory, replaced the pedometer with far more sophisticated sensing capacities. Lastly, the researchers also changed the name of the technology. During the first phase of development the DEP was dubbed with the name of a U.S. city, a common practice within the corporation to avoid extended negotiation over an appropriate name that might overly determine the technology. This naming procedure suggests that the corporation was structurally pre-disposed to the multilinearity of technological development. In the second phase of development, the DEP was renamed with

a compound of ubicomp and exercise, expressing its relevance to both HCI and to a form of situated computing. In contrast to the above, where I have described the discursive configuring of distal users, in that which follows I examine in detail the involvement of proximal users during the two phases of prototyping.

Proximal Users: Prototyping Behaviour Change

The first version of the DEP was rapidly and purposely developed as a wearable computing application to be tested during a three-week pilot study. This prototype was designed to provide users with a visual record of their step-count, the ability to specify and progress towards a daily objective and mediate physical activity related communication amongst the trial participants. Each trial participant was required to wear a pedometer (Omron HJ-112) and carry a mobile phone (Nokia 6600) running the step count journaling software. To interact with the system the participants manually entered their step-count, read from the pedometer, into the software at any time during the day. The software also allowed participants to annotate step-count data, for example "went for a run", or "slow day", which in part served to define the context in which exercise was accomplished. The journaling software also mediated electronic communication amongst the trial participants. Here, for example, the participants could 'buddy-up' and monitor one another's progress. They could send step-count data and annotations via text messages. They could also send ad-hoc messages (e.g. encouragement and activity suggestions) to one another.

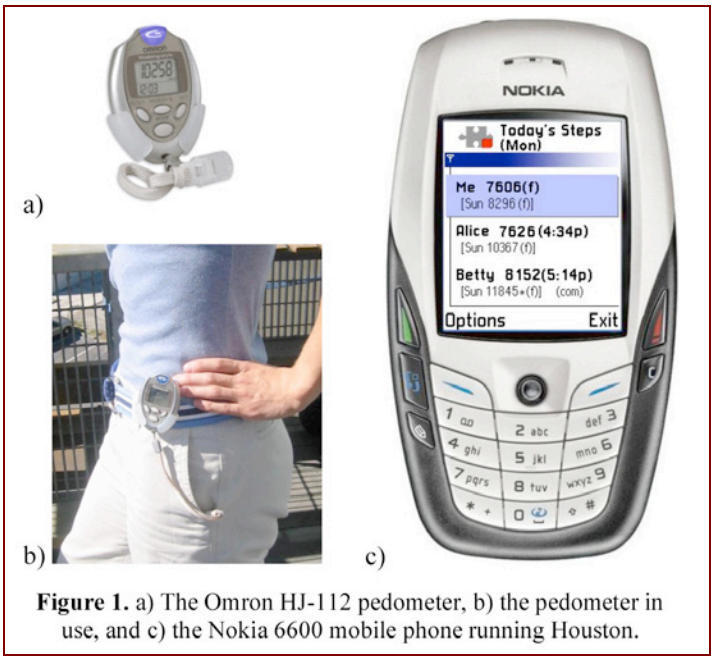

Figure 1. a) The Omron HJ-112 pedometer, b) the pedometer in use, and c) the Nokia 6600 mobile phone running Houston.

Figure 18: the components of the DEP as published by the researchers.

The designers produced the prototype as part of a field trial in which three groups of women, with four to five women per group, were recruited to use the DEP for three weeks alongside their everyday activities. Before deploying the prototype in 'in-situ evaluation' the designers trialled the system, both on themselves and on colleagues not involved in the research. The journal software, written to run on the Nokia mobile phones and to be used by the research participants, was created specifically for the field trial in the programming language Python – used for the speed at which applications could be developed. To enter a step count into the software, the user was first required to read the output display of the pedometer and then manually enter the step count into the journal, using the mobile phone. Entered data was also transferred and stored on a server. The server handled data storage and communication amongst test participants, and also provided the researchers with an exercise dataset to be analyzed later.

Three different versions of the journal software application were developed for the trial: first, a "baseline" version with which participants could enter and edit their step count for the present or preceding day, and view their step counts for the past seven days. Each time a user entered or edited a step count this information would be sent to the designers' server for logging and analysis. If the trial participants failed to enter a step count then the software prompted them to enter one. A constraint of the baseline software was that the participants could only enter their step count for the present and previous day but no other day. A feature, the researchers claimed, to "encourage active participation in the pilot study". The second, "personal", version of the software, included additional interactive features. As well as entering and viewing their step counts, participants were also presented with a daily goal, their progress towards the goal and confirmation that they had achieved the goal. In addition, participants also had the ability to annotate their step-count. The third version, "sharing", further enhanced the first two. It included the ability to share step-count data and annotations with exercise "buddies".

A market research company and the researchers recruited the field trial participants. The participants all hailed from the Seattle area and were aged between 28 and 42. For the trial, the participants were organised into three groups, corresponding to the different software versions, and each group included at least two friends, to encourage communication. The researchers made a point of recruiting participants who expressed a commitment to engage in physical activity and who matched a number of socio-economic requirements. To identify individuals who fitted their requirements, and thus obtain usable research results, the designers and the market research company employed a screening process that included the homogenous sampling method and the "Sample Physical Activity Questionnaire to Determine Stage of Change" produced by the U.S. Department of Health and Human Services. Their sampling technique measured the suitability of applicants according to a set of

relevant variables: mobile phone usage, involvement in paid work, etc. It also included a questionnaire by which applicants were measured in terms of their 'motivation' to change their behaviour. The questionnaire draws on the "spiral model of the stages of change" (Prochaska et al., 1992) developed by a group of U.S. behavioural scientists who sought to understand how people can intentionally change addictive behaviours. Using the questionnaire, and with it the spiral model of behavioural change, the researchers classified applicants into the following categories: "precontemplation", "contemplation", "preparation", "action" and "maintenance". Applicants who, for example, were classified in the category precontemplation were rejected, as they expressed no interest in undertaking physical activity. Likewise, applicants who were engaged in physical activity but expressed no intention of increasing their current level of physical activity were also rejected. To be included as a participant, the applicants had to fit the contemplation category, which identified people who exhibited the intention to change.

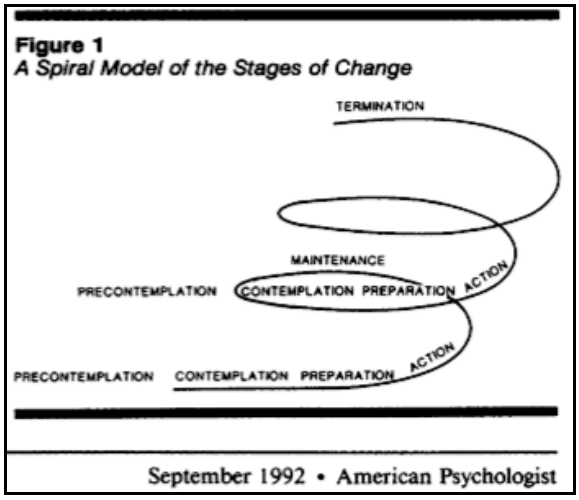

Figure 19: The spiral model of intentional behaviour change.

Accordingly, to qualify for the pilot study applicants had to fit into a model of behavioural change conceived as a means for understanding the intentional behaviour change of addicts: individuals who smoke, who abuse alcohol, who use opiates and crucially those individuals suffering from obesity. The move the researchers made here was to translate persons engaged in physical activity into an addictive related behaviour by way of obesity. Moreover, the stages of change, proposed by the US cancer researchers, provided a model for including persons who demonstrate the capacity to be the right kind of users, as well as a temporal ordering of how users are classified and how their progress can be understood. Thus, field trial users were configured as actors who could move along the same temporal path as addicts, and it was only those candidates understood as capable of progressively moving along the stages of change that were included.

To further examine the temporal ordering of the field trial participants, I will take a brief detour into the work of the US based behavioural scientists invoked by the designers. In the publication 'In Search of How People Change: Applications to Addictive Behaviour' (Prochaska et al., 1992) the authors develop a spiral model for understanding the stages of change through which addicts must pass in order to withdraw from substance dependence; the process, that is, which an addict must go through in order to cease being an addict. Their aim was to understand how addicts could intentionally change their own behaviour. In the early stages of their research, a linear model of change was proposed whereby smokers, for example, would progress "from precontemplation to contemplation, then from preparation to action, and finally to maintenance" (ibid.: 1103); the obvious limitation of this early model being that it presented a linear progression from a state of unawareness, through to action and finally to the prevention of relapse. As a temporal schema it could only account for advancement through, or stabilization in, one of the five stages: "initially, we conceptualised change as a linear progression through the stages; people were supposed to progress simply and discretely through each step" (ibid.: 1104). Relapse, however, presented a problem for the authors, as it is "the rule rather than the exception". To accommodate relapse, the authors developed a spiral mode of change whereby the line of progression was replaced by a spiralling line that crossed itself (see Figure 19). The spiral model therefore accounted for how addicts could progress, regress or become stabilised in a particular pattern of behaviour.

Now, by employing this model, the researchers configured the users of the DEP field trial as cognitive actors capable of self-modification: expressing the intention to change, modifying their behaviour, and the ability to progress through a sequential model of behaviour change. That is to say, users were configured as people who could move through a particular temporal and behavioural ordering. More importantly, the propensity for participants to change was established independently of their capacity to change in unison with the DEP: the capacity of users and technology were viewed as autonomous and pre-given. Thus, the screening process enacted bifurcations, or purifications (Latour, 1993: 11), between humans (users) and non-humans (technology), and in doing so oriented the trial towards a successful outcome.

During the three-week trial, the participants, organised into groups, were obliged to use the DEP in its 'baseline' form for one week in order to determine a step-count goal. In the following two weeks, the participants used either the personal or the sharing version of the software. One group was asked to use the personal version for two weeks, and two groups were asked to use the sharing version for two weeks. Throughout the trial participants were obliged to respond to a number of questionnaires and 'face-to-face' interviews. The researchers defined the participants' program of use during the trial by modifying the guidelines set out by the 'President's Council on Physical Fitness and Sports', a volunteer

committee who advise the U.S. government on physical activity, fitness and sport. Whereas the President's Council recommends a six-week fitness program, the field trial lasted for only half that time. The program was as follows: for one week the participants recorded their daily step count. At the end of the first week the participants identified the highest daily step count and used that as the daily goal for the next week. The researchers modified this during the trial as several participants recorded unusually high step-counts.

To quantify the efficacy of the DEP during the field trial, the researchers turned to Body Mass Index (BMI) measurements, a standard means for determining deviation from a normal weight. [78] The BMI of participants was obtained at the beginning of the trial in order to classify participant's bodyweight in relation to three statistical norms: underweight, average weight and overweight. Curiously, in the context of the obesity epidemic set by the researchers, only two of the participants were categorised as overweight whilst the others were mostly normal or underweight. To work around the inconsistency between their rationale – preventing and treating obesity – and trial participants' BMI, the researchers extended the scope of the DEP from "preventing weight gain" to simply encouraging increased physical activity in general. In deploying BMI measurements, the researchers linked the physical bodies of the participants to national and global health agencies, i.e., the Weight-control Information Network, presented on the web as 'an information service of the Institute of Diabetes and Digestive and Kidney Diseases and National Institutes of Health', and the WHO (World Health Organization). Thus, in order to configure the future user, the body's of existing users were linked up to national and global statistical orderings of populations in relation to body weight.

Here, the techniques by which users are configured and evaluated (with the DEP) connect into the biopolitical aspects of the designers' inventive risk discourse. The interweaving of the bodily and cognitive capacities of participants served to configure them as users in tentative anatomo-political arrangements, wherein they were articulated with the practical political techniques of body management. If the inventive risk discourse deployed by the designers portrays the technological self-management of populations, then the prototype worked towards configuring bodies to be compatible with this future scenario. Here, proximal-users served in the shaping of the *anatomo-politics* inscribed into the DEP. Their involvement also demonstrated the drift between the designers' rationale and the configuring of users. The enrolment of normal and underweight trial participants willing to do exercise on a daily basis allowed the DEP to be re-articulated as a general-purpose consumer product.

[78] BMI is a statistical index used to classify the weight of an individual. It is calculated by dividing the weight of a person by the square of their height. A person's weight is then classified by locating the calculation in a classification table, such as the World Health Organization's Global Database on Body Mass Index.

To evaluate the trial, the researchers employed both qualitative and quantitative research. The researchers expressed disappointment with the quantitative data in light of the relatively short duration of the trial (three weeks as opposed to the six week schedule recommended by the President's Council), and there were unforeseen complications, such as the obligation for participants to carry an extra mobile phone and reports that the participants found the pedometer ungainly and that it attracted unwanted attention. Despite these shortcomings, the researchers were hopeful. Seven participants out of thirty exhibited an increase in their daily step count, which suggested that the DEP-user arrangement did, in practice, affect a change in behaviour. The overall outcome of the trial was translated into a set of four guidelines to inform the future development of the DEP in particular and as principles for ubicomp 'technologies that encourage physical activity' in general. They are as follows:

1. Give users proper credit for activities
2. Provide personal awareness of activity level
3. Support social influence
4. Consider the practical constraints of users' lifestyles

In the above I have described the assembling of visions, users and technology during prototyping. In this case both actual embodied users (proximal), as well as prospective users (distal) were formatted simultaneously. During this phase of development the construction, alignment and performance of a particular sociotechnical arrangement (female trial participants, the combination of technologies constituting the DEP and the research methods of the designers) resulted in a set of design guidelines in which the identity and capacity of putative users engaged in technological enhanced exercise was prescribed. I have also described how, at this stage, the prototyping practices of the designers included the delineation of various health vectors that allowed for shifts in emphasis and agenda, the point being that even at this stage, the prototype (users, technologies and discourses) was already displaying a propensity to multilinearity. In the next section, I describe how the formatting of putative users was carried through to the next stage of development.

Proximal Users: Prototyping Situated Activity

The second phase of development included three significant changes to the DEP. First, the commercially available pedometer was replaced with a wearable sensor platform being developed by computer scientists in the research laboratory. Second, the journaling software GUI was enhanced with a more nuanced graphical representation of exercise. Third, as I discussed previously, the project was re-titled expressing the application of ubiquitous computing to fitness regimes. I will return to this point later in relation to designer-users discussed in the final analytic section of this chapter.

In phase one, the DEP included the commercially available Omron HJ-112 pedometer. Reflecting on the outcome of the trial the researchers concluded that the measurements produced by the pedometer provided little or no information about the location and context in which steps were made. Consequently, the device gave no clue to the differing levels of effort exerted by the participants towards achieving their daily step count goal. The problem of "context of effort", as the researchers put it, involved two interrelated issues: "representation" and "accuracy". In other words, the pedometer could not identify where participants exercised and it provided no evidence as to the kind of exercise they performed: pedometers only measure footsteps and not the embodied and situated circumstances of exercise. Accordingly, the pedometer data did not distinguish between walking up an incline as opposed to walking on a flat surface. Moreover, footsteps are not significant indicators of some activities, such as climbing, swimming and cycling, and would simply go unnoticed. Consequently the "accurate" sensing of footsteps – the amount of effort a footstep entails as part of a situated physical activity, and the recognition of activity where footsteps figure little or not at all – became a principal issue for the researchers.

The solution to the accurate representation of context of effort came in the form of the "multi-modal sensor board" (MSB): a novel wearable sensing platform also under development in the research laboratory. At the time, the MSB was being developed as an automated activity recognition system for healthcare monitoring applications. When worn by a user, the device produced activity data by way of multiple sensor readings. The identification of activity was made possible by the use of artificial intelligence (AI) software that matched the multiple sensor readings against pre-identified data patterns. In this way step-count data, for example, could be compared against barometric pressure readings to provide an indication of walking up or down an incline. In addition, the MSB also included wireless data and networking communication in the form of a novel micro-communication chip, wired data communication via USB and a rechargeable lithium polymer battery.[79] For the designers of the DEP this was significant. It meant they could avoid unreliable user input of data. The MSB, with its small physical size, sensing capacities, wireless networking and integrated power supply, addressed many of the issues identified by the researchers in phase one; it could perform the role of a pedometer, as well as provide further sensing capabilities. In sum, the MSB provided the technical means to automate both the accurate sensing and recognition of situated exercise and the communication of data to the journaling software (thereby bypassing user input). For the software and hardware engineers developing the MSB, the device pointed to a future context of healthcare, in which the MSB replaced manual

[79] Examples of such chips include microchips using the Zigbee specification and iMote chips (Nachman et al., 2005).

patient observation, by either expensive expert medical staff or by unreliable and untrained self-reporting patients.

As such, the MSB addressed the first 'design requirement', whereby the exercise systems should register and represent all physical activity undertaken by users. The story of how the engineers achieved this system also included the involvement of users, but in a very different way to the trial of the DEP. In what follows, I describe two ways in which users were employed to construct the accuracy of the MSB. First, I describe the involvement of two male undergraduate students. Second, I describe the involvement of twelve male and female graduate students. In both cases the involvement of users was part of the engineers' efforts to produce a system that could automate the process of accurately and reliably identifying and monitoring the situated physical activity of individuals wearing device. To produce such a system, the engineers took the novel technical approach of combining multiple sensors ("modes") into a single sensing device sensor. As such, the MSB included the following combination of sensors: audio, 3-axis acceleration, barometric pressure, temperature, humidity, compass heading, and ambient light level the data from which could be selectively used. The scientists were confident that this combination of data (environmental conditions and inferred human activity) could provide a way to make embodied action visible, recognisable and calculable.

The role of the users in all this was to facilitate the creation of data sets that the engineers could use to model data patterns, and match them against situated physical activities. The data patterns, in turn, were used to "train" software, using machine learning programming techniques, to automatically match previously classified situated physical activity with data patterns produced by the MSB in the present.[80] An activity such as walking up stairs, for example, would produce particular acceleration and barometric pressure readings that could be recognized by matching the output of the MSB with previously identified patterns representing walking up stairs. The analysis and classification of data patterns, mediating situated physical activity, resourced the scientists' efforts to programme a pattern-matching algorithm to be included in the MSB.

In the first instance of user involvement, the scientists enrolled two undergraduate students. The engineers equipped the students with backpacks fitted with MSB sensors and webcams, and asked them to perform a series of indoor and outdoor physical activities over a period of six weeks. The webcams served to visually record the environments in which the students were being monitored. Later, the engineers used this footage to identify context of activity and match it against the data patterns produced by MSB sensors. In other words, to

[80] Machine learning is a broad subfield of artificial intelligence (AI) in which software algorithms are designed and employed in order to automatically gain information from data, for example by recognition of patterns within given data sets. The notion of 'learning' refers to the ability of the software algorithms to self configure their performance during data processing, commonly referred to as 'improve automatically through experience' (Mitchell, 1997. Sewell 2006).

visually 'annotate' sensor data. The engineers referred to the video footage as "ground truth", a realist classification of the actual environment and actual physical activities of the students. The second instance of user involvement included twelve graduate students who were enrolled to create further data for the development of the software algorithm. These students were each equipped with three MSB units (placed on a shoulder strap, on their waist and on their right wrist) and a small notebook computer to collect sensor data. A human observer (replacing the role of the non-human web cam) accompanied each student, entering annotations – location and type of physical activity – into a PDA. Like the webcam footage, the observer's 'ground truth' was then used to correlate situated physical activity and sensor output. As part of these tests, the students were asked to perform a number of activities, for example 'sitting on a couch for a few minutes before walking up the stairs to brush their teeth'.

To recognize activity, the scientists compared sequences of sensor data (see Figure 20 below). The graphs, in Figure 20, show how associations between different sensor readings were used to recognize situated physical activity.

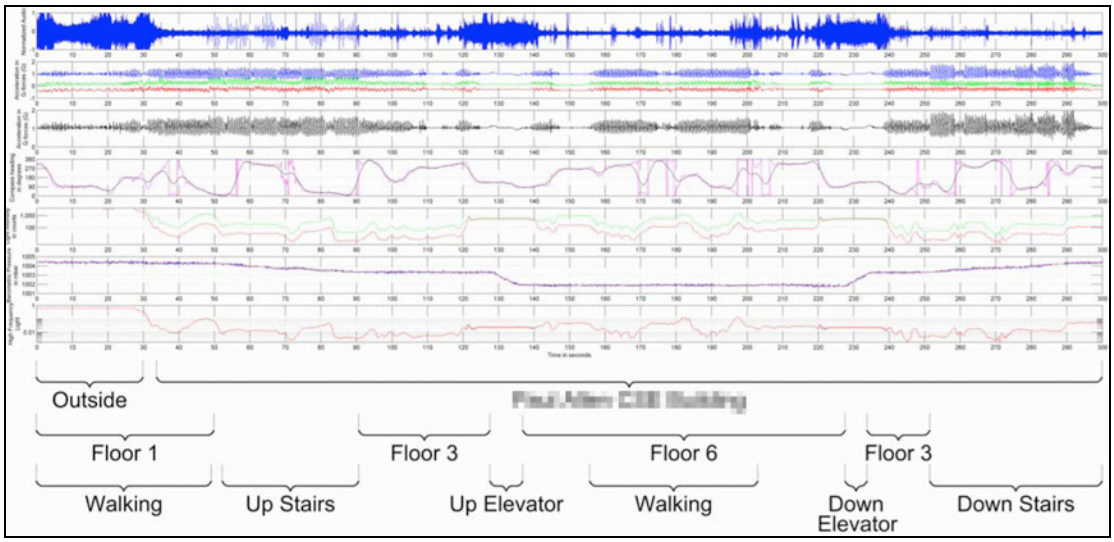

Figure 20: a visualisation of the sensor data collected from the students.

With the annotated data sets, collected with the aid of students, the scientists used machine learning techniques to develop a software algorithm to automate the recognition of activities. In brief, the algorithm could match live data output against pre-determined patterns. One example of this is how the activity of walking up an incline could be inferred from a particular combination of sensor readings, such as high frequency light, barometric pressure and acceleration that closely matched a previously identified data pattern.

During the first instance of user involvement the engineers collected 28 hours of data from which they identified ten basic physical activities (sitting, standing, walking, jogging, walking up/down stairs, riding a bicycle, driving a car, and riding an elevator up/down) with "better than 95% accuracy". In the second instance, where a multi-user data set was produced, the engineers collected 12 hours of data and state 90% accuracy in recognizing 8 different activities (sitting, standing, walking, walking up/down stairs, riding the elevator up/down, brushing teeth). Thus, the outcome of the MSB user involvement was a minimum of 90% accuracy of situated activity, generalized to a population. Furthermore, the algorithm had only to be trained according to location and not specific individuals. The scientists were confident that the accuracy of the activity recognition system would not be affected by variation across larger samples of users, with the proviso that further research was to be conducted with a wider variation of individuals of differing body types and ages, and in different settings, to further demonstrate accuracy. The scientists also found that a combination of only three sensor modes (audio, barometric pressure and acceleration) produced sufficient data to classify situated physical activity.

Designer-Users

Finally, in this section I examine the role of designers as users of the DEP. If proximal users are those actors that are locally configured to resource the immediate requirements of prototypes, then the designers of the DEP also count as users. Acknowledging designers as such also leads me to include my own involvement as the designer of the GUI and as an ethnographer. In what follows, I illustrate the role of designer-users by way of three examples. I first describe in detail the design of a new mobile phone GUI to work in tandem with the MSB. I then present two anecdotal examples of how the DEP was deployed by the designers and management to make accountable their own practices during a corporate wide research forum, and during a presentation to another company. Finally, I briefly describe how the different components of the DEP resourced the design of further technological systems in order to demonstrate the multiplicity of the system.

As part of the second phase of the DEP development, and in addition to the inclusion of the MSB, the researchers also sought to include an enhanced GUI for the DEP, in line with the second design requirement established phase one: "provide personal awareness of activity level". With the GUI, the researchers' objective was to provide users with ongoing visual feedback of their physical activities on the home screen of the mobile phone. The GUI was designed to work alongside the rudimentary user-interface of the journal application

developed as part of phase one.[81] During design meetings between the researchers developing the DEP and members of the UCDG tasked with designing the GUI, it was decided that the interface would include three basic requirements. First, to provide continual visual feedback on three types of activity with minimal interaction required from the user. Second, to provide the user with the ability to manually enter exercise data that the MSB failed to recognize. Third, to present users with a visual record of daily and weekly exercise data. To this end, and after a number of alternative design solutions visually rendering exercise over time had been drawn up, discussed and rejected, the researchers opted for an abstract representation of physical activity in the form of an illustrated and animated virtual garden.[82] This particular design employed illustrations of flowers to depict both physical activity and the amount of activity entered into the software either by the MSB or by direct user input.

The virtual garden GUI (see Figure 21 and Figure 22) was designed to provide users with immediate visual feedback on their daily and weekly exercise data, in the form of flowers set amidst grass and sky, presented on the home screen of their mobile phone handset. Each flower represented a sustained period of physical activity, such as walking or jogging. Over the course of users' everyday routines, physical activity was logged and the virtual garden bloomed accordingly – for example, when a user starts walking a flower appears on the bottom of the screen. As the user continues to walk, the flower rises towards the top of the screen (the sky). The height of the flower, as a visualization of accumulated walking data, therefore depicts the occurrence of the activity and also the amount of exertion – for example how many footsteps were undertaken during that sustained period of activity. The longer a physical activity is performed the higher the flower grows up the screen of the GUI. In addition, different coloured flowers represent different forms of physical activity. During early designs, different coloured flowers corresponded to specific physical activities, such as running, jogging or cycling. However, when the GUI was implemented the flowers represented different categories of exercise, including "cardio", "strength" and "flexibility", as well as the common activity of walking. Over the course of a particular activity, as the flowers grew (rising up the screen), butterfly icons would appear to indicate that the user had met a pre-programmed daily or weekly exercise goal. In total, the GUI depicted one week of exercise data, after which the user would be presented with an empty garden to be populated with depictions of the next week's exercise data. Figure 21 is an illustration of the garden GUI without any exercise data; Figure 22 shows the GUI with exercise data.

The virtual garden interface, described as a "glanceable display" featuring a "non-literal" graphic representation of physical activity and goal attainment, mediated a distal-user

[81] I use 'home screen' to refer to the default screen displayed on a mobile phone prior to user input, for example pressing a button to arrive at a list of applications, contacts, SMS messages and so on.
[82] Other designs variously visualized step-count in relation to depictions of progression. One example of this being how step-count was mapped onto distance travelled up a mountain, visually likening routine steps to hiking.

with particular aesthetic sensibilities and behavioural characteristics. Aesthetically, the distal-user undergoes affirmative confirmation of their achievements without being made aware of their failure to attain physical exercise goals. They are themselves expected to monitor the automatic monitoring of their physical exercise, and are thus aesthetically enrolled into the continuous administration of physical activities. The garden interface also serves in the re-ordering of the DEP assemblage, where new trials involving further proximal-users are staged. Thus, the further configuring of distal-users includes the involvement of more proximal-users who serve to demonstrate, or not, the efficacy of the GUI model.

Figure 21: the DEP garden GUI without flowers.

Figure 22: the DEP garden GUI with flowers.

My involvement with the DEP, as a GUI designer, began with a meeting. During the meeting I was briefed by a manager on the rationale and the history of the project, and equipped with various types of documentation, including early sketches of the GUI, produced during meetings between the researchers and members of the UCDG. The documentation included PowerPoint presentations, academic papers and conference proceedings, as well as technical material. Somewhat apologetically, the manager pointed out that the DEP wasn't a standard user-centered project. In my capacity as a designer, I was asked to use others' accounts of users, featuring in the documentation, in place of contact with people. Consequently, my role as a user-interface designer on the DEP project was to translate existing models of users

specified by the researchers. The implicit belief expressed by the manager was a normative claim suggesting that designing using pre-existing user representations produced by other designers was not in line with his understanding of the principles of UCD. In light of the use of the Microsoft persona "Abby" (see Chapter 5), in contradiction to this manager's view, this claim can be further interpreted as the belief that user-centered designers view themselves as the obligatory point of passage for the acceptance of user representations.

One implication of this remark concerns the way in which the GUI resourced the beliefs of designers concerning the right way to apply the principles of UCD. As a proximal user himself, the design manager was expressing his view that one aspect of prototyping is to make accountable the application of user-centered principles. For him, the GUI provided a means by which these principles could be articulated. Moreover, and in relation to my analytic distinction, he also expressed an implicit criticism of using others' representations of users during the practical development of technological system. This points to a more nuanced understanding of distal users as vicarious representations of users employed in the design process (evoking the redeployment of housewife genderscripts described in the previous chapter). Here, the notion of distal users also includes representations of future users defined by others to be locally configured during design.

My involvement in the design of the GUI also brings into view my own dual role as a proximal user: as both designer-user and ethnographer-user. The DEP was the first project I was assigned to work on during my fieldwork. As such, it served as an important means to demonstrate my own capacities as a user-interface designer capable of working with others in order to inscribe user representations into designed artefacts. In my capacity as an ethnographer, the DEP also served as an analytic object around which I was able to participate and observe prototyping practices. As set out in this chapter, the prototype also served to make my own fieldwork accountable. That is to say, I use accounts of the prototype here to make sense of the practices of the designers and the role of the DEP to mediate the role of users therein.

How the DEP resourced alignments between designers and HCI can be illustrated by way of the name change of the prototype. Initially, the DEP was dubbed with the name of a U.S. city, a common practice within the corporation to avoid disputes and the over-determination of a technology. In the second phase of development, the DEP was renamed with a compound of ubicomp and exercise, expressing its relevance to a particular area of interest within HCI interested in situated computing. Here, the designers sought to establish the relevance of the DEP to ubicomp, in both aligning their vision with the agenda of ubicomp, as well as articulating the MSB as a discrete methodological contribution to the

evaluation of situated activity.[83] This example also serves to demonstrate how the DEP and the MSB worked both in unison, and also independently of one another. As a methodological contribution to ubicomp, the DEP was articulated as an application of the MSB technology, whereas in publications and demonstrations of the DEP, the MSB was staged as a technical component.

The articulation of the DEP and MSB to ubicomp communities brings me to further anecdotal examples of designer-user practices where the prototype featured in corporate presentations. The first example concerns the demonstration of both the DEP and MSB during the corporation's annual research forum. Soon after the completion of the GUI, the designers demonstrated the prototypes alongside the research activities of other employees, including scientists, designers and ethnographers and so forth. For one day, the forum played host to individual project stalls where researchers, from the corporation's worldwide network of research laboratories and centers of development, disseminated their activities in the form of, for example, presentations, working prototypes, publicity and visualisations such as posters. Whilst attending the research forum, I came across demonstrations of the DEP and the MSB. I introduced myself as the GUI designer to a prominent member of the DEP development team. Surprisingly, the researchers' response was utter indifference and further discussion did not ensue. In this context, I encountered a different enactment of the DEP in which my role as the GUI designer was sidelined. In effect, the researcher was emphasising her role as author, as well as downplaying the importance of the GUI in the further development of the prototype.

In contrast, and next to the DEP demonstration, an intern scientist manned a stall devoted to the MSB. More amenable than the DEP designer, the intern enthusiastically described the sensing capacities of the MSB and imaginatively highlighted numerous future applications, such as a situated surveying technology, various industrial applications and further healthcare related opportunities. Presented side-by-side, the DEP and the MSB were simultaneously demonstrated as cooperating technologies and divergent. On the one hand, the MSB was subsumed into the vision of the DEP; on the other hand, the DEP was cited as just one of many possible MSB applications including the detection of Chronic Obstructive Pulmonary Disease, physical fitness applications and part of more general purpose 'activity databases'. The MSB engineers, themselves deploying a form of inventive risk discourse, discriminated between distal users as individuals suffering from obesity, chronic obstructive pulmonary disease and people seeking to increase their physical activity, as well as elderly people requiring care support and people with cognitive disorders. Further MSB communication and publicity material disclose further distal users as participants in "mobile

[83] For a critical account of the visions associated with ubicomp see (Bell & Dourish, 2007).

surveys". Locally enacted as demonstrations, the DEP seemingly encompassed the MSB and vice versa. The partial connections between the two technologies, including overlapping visions, shared proximal and distal users, permitted different modes of relevance to be occasioned, in attempts to animate shifting relevance to the different demands of co-worker publics and their different corporate agendas. As such, there were disjunctures between the expectations attached to components and the unity of the DEP. The DEP, as one particular arrangement of the prototype assemblage, served to delineate a particular health vector relating to public government concerns about the prevalence and rise of obesity. The MSB, which included the more ambiguous and vague figuration of the distal user as an individual whose situated activity is continually monitored, worked to resource closure of meaning around other distal users, for example: individuals monitored in 'smart environments', task monitored individuals in the workplace, and assisted elderly people.

Lastly, during the course of my research I came across a publically available online video featuring the then director of the research laboratory where the DEP and MSB were being developed. The video documents his presentation to a research group of another multinational ICT corporation. Here, the DEP was presented as an exemplar of the corporation's broader research effort to 'simplify' consumers' everyday activities, using body worn sensing devices and data processing.

Conclusion

My examination of the DEP as a multilinear and shifting arrangement of users, technologies and discourse demonstrates how prototypes served to resource the exploration of multiple sociotechnical futures. To understand how the prototype occasioned visions of future sociotechnical practice and the immediate requirements of the designers, I have distinguished between distal and proximate users. Distal users, I have argued, count as fictional occupants of a future terrain in which the DEP and the MSB were imaginatively located. As such, distal users served in the linking up of designers' expectations with corporate and government agendas, such as biopolitical processes addressing the increasing prevalence of obesity. The role of proximal users illustrates how the prototype worked as part of the practical and ongoing configuration of users to meet the practical demands of design work. Moreover, my own use of the prototype, as a designer and an ethnographer, occasions the DEP and the MSB as relevant matters for sociological enquiry. Echoing Suchman et al. (2002: 175), the prototype can be understood as a shifting and somewhat loose sociotechnical assemblage encompassing various form of users. In practice, the prototype occasioned a multiplicity of engagements between designers and users that functioned to bring together numerous alignments including, but not limited to: designers' visions and research agendas with government and inter-governmental policy and corporate strategy; the formatting of bodies

and technology; the connections between technical innovation and product development, as between the activities of the designers and engineers, in relation to wider research and development in the form of publicity. In this view, the prototype, as a user-centered form of socio-material futuring, served to colonize multiple temporalities, including government, corporate and disciplinary agendas, as well as personal career development, promoting research and job security. In the next and final substantive chapter, I continue to examine the enactment of multiple users in the form of ethnographers' reports and accounts of users deployed during an industry conference.

Chapter 7.
An Assembly of Users:
Mediating Ethnography-in-Design

Introduction

"You're not the only one . . ." remarked one of the conference organizers as we engaged in a brief conversation during one of the conference lunchtime breaks. I had 'informed' him about my role and capacity as an ethnographer studying the conference, and he, an ethnographer working within the ICT industry, mentioned that there were other social scientists in attendance, also treating the conference and its contents as research objects, including an eminent sociologist of science and technology conducting research on interdisciplinary collaboration. My research interests, however, lay in the accounts and representations of users variously brought into play at the conference. In this, the final substantive chapter of my thesis, I examine the multiple roles of users at the annual 'Ethnographic Praxis in Industry Conference' (EPIC) held in 2006: a conference that took place towards the end of my fieldwork, in which accounts of users featured as a central concern of the conference participants.

The overarching argument of this chapter, in relation to the thesis, is how the user operates as a medium for conducting ethnography-in-design, as well as informing the design of particular interactive systems or projects. More specifically, I argue that users *assemble*, by way of numerous contradictory logics that exist at the intersections between ethnography and design.[84] Although I have touched upon the use of ethnography in design in previous chapters, in this chapter I address how empirical user-research in design is conducted under the auspices of 'ethnography' to meet the variable demands of scholarly and commercial agendas. In this chapter, I analyze how users were discursively enacted as part of the EPIC 2006 proceedings. Accordingly, I examine three key tensions mediated by accounts of and perspectives on users: the relation between representational realism and methodological reflection; the polarity between empirical analysis and future guidance; and finally, the relation between the specific and the abstract. In doing so, I address questions of how ethnography and design relate by way of the multiple mediations of users. Here, I employ the notion of *ethno-user assemblage* to better grasp the various interweavings of practices,

[84] This slightly strange locution (i.e. users assemble) is an argument that I build towards in this chapter. For the moment, however, it should be noted that I am pointing towards a relational process that is neither active nor passive, but attempts to include the actions of various actors and entities in the construction of users, including research subjects themselves without prioritising their 'reality'.

technologies, institutions, authors, knowledge and issues out of which users emerge. In conclusion, I reflect on the nature of the user as a figure that assembles, by way of the multiple dimensions at play during the conference at the interfaces between ethnography and design. Following this, I consider the relevance of this chapter to the thesis as a whole.

EPIC: The Setting

EPIC 2006 took place at the very end of my fieldwork, and I was given the opportunity to participate and observe as part of my role within the UCDG. For my informants and other employees of the corporation engaged in user-centered research and development, EPIC was an important event. For one, the conference was co-organized by members of the small group of anthropologists and ethnographers employed by the corporation to explore emerging microprocessor markets. For them, EPIC served, in part, as a platform for further establishing and advocating the legitimacy of the engagement between ethnography and the design of products and services, as well corporate and institutional strategy: a legitimacy that is tied to the extent to which it succeeds in constituting a distinctive domain within HCI, in which knowledge about users as socio-cultural actors is produced and made available for design processes. As such, EPIC was an expert forum in which the problems, issues, methods, theories and recommendations of innovation actors, employing and drawing on ethnography, were made accountable to a professional coalition, interested and invested in developing the burgeoning discipline of ethnography-in-design. The conference therefore provided an opportunity for ethnographers and designers to articulate their work in relation to scholarly and expert review, rather than routine project demands and commercial accountability.[85] EPIC was also a forum in which various engagements between user-centered design and ethnography were addressed. For my informants, it provided an opportunity to evaluate others' use of UCD techniques; to learn about novel user research techniques such as video-ethnography, and to gain exposure to emerging topics, usages and markets that featured in practitioners' accounts of their work. As such, my informants regarded EPIC an important event in their professional calendar, where their day-to-day work practices, concerns and outcomes could be presented, exchanged and disseminated, amongst a wider audience of practitioners. Indeed, many of their colleagues within the corporation also attended or participated in the conference proceedings. My participant observation included the usual note-taking, as well as photography and audio recordings of paper presentations. I observed all the paper sessions. I participated in a workshop session entitled "Deep Impact: Creating Strategies for "Meaning-ness" in Research Deliverables" (Anderson & Lovejoy, 2006b: 262), as well as breakfasts, lunches, dinners and evening events. In sum, I observed the formal

[85] Throughout this chapter I refer to actors employing ethnography in industry simply as ethnographers.

reporting and dissemination of ethnographic studies; I participated in a workshop session facilitated and attended by practitioners, as well as conducting participant observation of attendees in more informal settings.

EPIC, itself, is a conference where practitioners involved in the commercial application of ethnography convene to address the practice of ethnography as it is employed in commercial product and service development (Anderson & Lovejoy, 2006a: 3). It is part of the *epistemic culture* (Knorr Cetina, 1999: 8) of industrially practiced ethnography. To this end EPIC attracts a range of attendees with diverse institutional and organizational affiliation including, but not limited to: employees of multinational ICT companies, product development and design consultants, as well as university academics and civil servants.[86] Common to all of the attendees, whether embodying business, academic or government interests and pre-occupations, was their engagement with innovation practices in which ethnography plays a major role in construing the complex relations between computational technologies and situated practices. The diversity of attendees' professional roles and commitments can be demonstrated by the following examples of job positions: ethnographers and cultural anthropologists employed in commercial research by multinational companies and small consultancies, computer scientists active in commercial and academic research, academics engaged in researching human-computer interaction, user-experience managers, principle scientists of user-centered technology, customer experience and design executives, doctoral students conducting ethnographic studies of ICT development and usage (including myself), and consultants working for design and product development consultancies. As such, conference attendees were all engaged in different aspects of the involvement and participation of people in ICT innovation. The institutional affiliation and professional interests of the attendees demonstrates the increasing uptake of ethnography by companies in industries other than ICT, but where ICTs play a critical part in the provision of products and services – for example banking services and the provision of public services. EPIC 2006 was organized by a number of employees working on behalf of various organizations. Notably, one of EPICs organizing bodies was the American Anthropological Association (AAA), responsible for managing the conference registration, and also for the installation of a presence in the conference, in the form of a 'manned' stall, where attendees could sign-up to the association and learn about the online resources collated at 'Anthrosource', part of the online presence of the AAA.[87] The involvement of the AAA confers on the conference a disciplinary and epistemic legitimacy, as well as providing the AAA with a site in which it can be seen to be engaging with novel developments associated with the discipline of

[86] Since 2006 the conference has been held annually. The continuance of EPIC indicates that the success of the organizers and participants efforts to mobilize an international 'community' of practitioners (Anderson & Lovejoy, 2006a: 3).
[87] See: http://www.aaanet.org/publications/anthrosource/

anthropology. Moreover, the involvement of the AAA further demonstrates how the application of ethnography in the ICT industry is increasingly drawing on and allying itself to the discipline and discourse of anthropology more broadly, beyond the specific preoccupations of ethnography.

The 2006 theme for EPIC was embodied by the notion of "Transitions". According to the conference organisers, this theme provided a means to link-up sociological categories and objects, such as "macro" and "micro", "global" and "societal" with notions associated with temporality, for example "changes in people's daily lives" (Anderson & Lovejoy, 2006a: 3). It also served to notionally fasten together the sociological and the ethnographic with the interests and concerns of commercial organizations, such as the temporal relation between an organization and its customers – articulated as "shifting" (ibid.: 3). The three paper themes, "Cultural Transitions", "Social Transitions" and "Transitions in Everyday Life", therefore provided the context through which the relations between peoples' routine local practices with technology, sociological categories and business, broadly framed, were brought together.

The organizers divided the conference into four sections: paper sessions, a discussion panel, workshops and posters. The paper sessions were divided into three themes mentioned above. The discussion panel invited "industry-recognized" (ibid.: 4) panellists to respond to the question "What constitutes success?" (ibid.: 4). On the afternoon of the second day of the conference, which, incidentally, lasted for three days; 14 workshops were run, in parallel, to provide attendees with practical experience and advice on key topics in the commercial application of ethnography. Since the workshops were run in parallel, I could only attend one workshop. Finally, there were posters, affixed to the walls of the dining and refreshment areas, included as a way of providing attendees with a means of visually staging their work to one another.

A cursory survey of the titles and abstracts of papers, topics of posters and workshop subject matters at EPIC 2006 provides an insight into the range of preoccupations, technologies, practices and research objects to which the organizations and attendees focused their work and oriented their interests. The proceedings also indicated how the participants and their employers were engaged in constituting notions, sites, research objects and practices for technological intervention. Examples of methodological reflection drawn from the conference's paper proceedings include: reflections on the ethnographic method and ethnographic representation (e.g.: Nafus & Anderson, 2006; Wakeford, 2006); studies located in industry sectors, such as the pharmaceutics (i.e.: Wendel & Hardy, 2006), healthcare (Elliott & Dalal, 206) and banking (i.e.: Beers & Whitney, 2006); the demarcation of different field sites such as geographical and national territory, as in Africa (i.e.: Jones, 2006b) and Egypt (i.e.: Hasbrouck & Faulkner, 2006); the domestic (Zafiroglu & Asokan, 2006); temporary spaces (Anderson & De Paula, 2006), and, naturally, representations of ethnographic figures,

such as people living with chronic diseases (Elliott & Dalal, 206; Reichenbach & Maish, 2006), and people who move from domestic settings to work spaces (Metcalf & Harboe, 2006).

Moreover, the conference proceedings also exhibit the diversity of accounts of users deployed during EPIC 2006, about which I will have much to say in what follows. Taken together (attendees, sponsors, affiliated organizations, content and so on), the above attests to the ongoing entanglements between ethnography and user-centered design mediated by users and worked on in the conference.[88] The significance of EPIC, as part my fieldwork, lies, in part, in how conference participants' accounts of users mediated these tensions. The conference also provided me with a means to appraise the practices of my core research participants against a wider expert and professional community, where certain outputs of their work were disseminated. Here, descriptions of users and method evidenced the practices of my core informants as indicative of industry-wide concerns and endeavours. It also provided me with the conditions for witnessing a different kind of enactment of the user. Whereas in previous chapters I have focussed on the role of users in the conception and development of specific technologies addressing diabetes, obesity and domestic media management, in this chapter I examine how the discipline of UCD links up with ethnography-in-design more broadly, and how these disciplinary coalitions are reproduced by way of multiple and diverse accounts of users.

Intersections, Logics & Tensions

Needless to say, the proceedings of EPIC 2006 included numerous accounts of users featuring in the participants accounts of their work: as subjects of ethnographic enquiry narrated in conference papers, as the topic of practical instruction and work related advice during the workshops sessions, and as figures visualized in conference posters. In what follows, I exemplify the tensions by which users *assemble,* during engagements between ethnography and design, by way of three contrasting dimensions. To say that users assemble is to say that ethnography-in-design is productive of objects, such as different models of people and conceptions of the social, which emerge out of the intermingling of interrelated epistemological assumptions and working practices wherein theoretical perspectives and methodological pursuits cohere. I have disentangled the tensions into three heuristic dimensions in order to emphasize the contradictions at play as the multiplicity of users are brought into the view of both commercial and scholarly audiences. In practice, however, these dimension are messily entangled, and closely related, such as the realist representation of users

[88] These entanglements and involvements are also discussed in the online mailing list and discussion group 'Anthrodesign' (see: anthrodesign@yahoogroups.com), to which many of the conference attendees are subscribed. Anthrodesign mediates conference organisers and participants planning of events at EPIC and discussions that arise as a result of EPIC. Moreover, Nafus & Anderson (2006: 232) contend that Anthrodesign is "an essential communication means within this community".

discussed in the first section, and the configuring of people-as-users, as examined in the second.

The Mediation of Real People

Perhaps the most discernable paradox mediated by accounts of users at EPIC was the contrast between direct testimonies of people and documentary representation produced by way of informants' local cultural settings, and conference participants' implicit and explicit reflections on the construction of their ethnographic reports. In what follows, I provide two examples gleaned from my study of EPIC. In the first I show how ethnographers include spoken testimony in their reports, contrasted against reflections on how these testimonies come to be made. In the second example I show how naturalistic representations of people – mediated by documentary quotes and photographs – are used to resource a practical exercise where commercial consultants instruct conference participants on how to better represent users during a workshop session.

The first example of the tension between realism and methodological construction can be discerned in the reports of researchers from two Belgian Universities (Pierson et al., 2006) engaged in a collaborative effort to formulate the technical specification for the mobile television standard DVB-H (Digital Video Broadcasting – Handheld). For their study, the researchers employ eleven 'test users' and use a combination of cultural probes (Gaver et al., 1999), qualitative interviews, forecasting and observations to study their informants' use of existing mobile phones, in order to construct an understanding of future use and future system requirements. The users include: Jeroen, a twenty-eight year old man who uses a 3G phone; Johan, a fifty-two year old man; and Pascal, a forty-five year man. The following quotes drawn from the Belgian researchers' conference proceedings illustrate their use of realist representational techniques employed to speak about 'real' people. The first quote is a test user reporting on their view of the screen size of the test device. The quote is lifted verbatim from their interview transcript and used to support an argument concerning the screen size of the expected technology:

> "*If you make the screen bigger, then the device also becomes bigger, than it isn't as mobile anymore, then you can't put it quickly in your pocket*. Johan: male; 51 years; test user" (Pierson et al., 2006: 48).

The second quote evidences the view that people are shy about the use of new technology in public:

> "*That has maybe something to do with the fact that it's maybe, that it's really new, that it isn't not yet generally adopted. In the beginning, I also had some problems with my mobile phone, to call in public*. Pascal: male; 45 years; test user" (Pierson et al., 2006: 49).

The third quote, elicited from Jeroen, speaks about viewing television on public transportation:

> "*That is really something when you're alone and when you can't talk to someone: on the train or subway. Because you don't know what to do and that you can't occupy yourself.* Jeroen: male; 28 years; own 3G phone" (Pierson et al., 2006: 49).

Now, what I want to draw attention to here is the way these quotes all serve to evidence 'real' people reflecting on their experience of the proposed technology. The quotes provide naturalistic accounts of Johan, Pascal and Jeroen as they use mobile technology in their local habitats. The quotes have a truth effect, which operates to document what 'real' people do in their local and natural lived environments. Here, the use of quotes is a means to mediate the veracity of the users and their lived experiences. The point here, following constructivist and performative accounts of representation (e.g. Lynch & Woolgar, 1990a), is that the participants' practices of ethnographic investigation and reporting work to construct realist representations of people that exist in cultural contexts. For the sake of further clarification, the quotes, which speak for the informants, have an *epistemic* quality. They serve as truth claims: that is to say, claims that state that Johan, Pascal and Jeroen actually exist in a grounded social reality somewhere other than the conference setting.

There are further key aspects of ethnographers' discourse that produces an ethnographic reality effect. First, research subjects are ascribed an identity and this usually includes a given name, such as Johan, Pascal and Jeroen. They are set in relation to other people, such as family members, peers or colleagues. Furthermore, research subjects have a provenance: they are located in geographical space. This was common throughout the proceedings, for instance, people were described as actively working or living in a geographical region, such as: Haining, in China; Aurangabang, in India (Thomas & Salvador, 2006); villages in South Africa (Jones, 2006b); the suburbs of Chicago (Metcalf & Harboe, 2006), an undisclosed Southern state in the US or Tokyo (Schiano et al., 2006). People were necessarily set in relation to material objects, including technologies, that resource the practical activities of users and, crucially, are known, interpreted and meaningful. Examples of people set in relation to technology included: the use of financial services as part of personal accounting practices (Beers & Whitney, 2006), personal computers used for entrepreneurial ends (Rangaswamy & Toyama, 2006) or for online dating (Rangaswamy & Toyama, 2006), cell phones used for personal communication (Metcalf & Harboe, 2006), buses that host opportunistic conversations (Anderson & De Paula, 2006), pharmaceutical drugs that are consumed alongside 'traditional African medicines' (Jones, 2006b). Thus, a general feature of

EPIC was the representational individuation of people (with various and varying figurative characteristics) as necessarily situated in particular socio-cultural-technological milieus.[89]

Closely associated with the quotes, however, were the methodological reflections of the researchers: descriptions of the analytic auspices under which their research was conducted and its derivation from social theory. Here, the Belgian ethnographers view their users as 'innovators', and in doing so, facilitate and field recommendations and 'creative' input into their research process, in the form of drawings and photographs produced by the test users. Furthermore, the Belgian ethnographers describe employing 'thick' and 'ethnomethodological' (ibid.: 42) descriptions to articulate the routine accomplishments of the test users. They demonstrate how, in fact, their perspective of who people are, as well as how their capacities, are assembled from an assortment of research methods, mentioned previously, and how these have been applied under the auspices of a view of users derived from the sociology of technology and consumption (i.e. SCOT and Media and Communications literature). Furthermore, the Belgian ethnographers (ibid.: 41) draw on the notion of 'thick description' (Geertz, 2000: 9) as a way to account for how their test users' reports on using the technology are construed in their written report to the conference.

What is happening here, then, is a tension between on the one hand, the inclusion of verbatim quotes evidencing the documentary-like reality of the test users and their views, and, on the other hand, the ethnographers admission, by way of 'thick descriptions', that their accounts are constructed through a combination of applied research techniques, analytic interpretation and literary practices. Accordingly, the construction of ethnographers' accounts through 'thick description' or other literary techniques tends towards an implicit realism in that the accounts assume or prioritise the verbatim statements of specific actors as comprising privileged or substantial (real) elements of that construction. In all of this, so-called ethnographic accounts show little evidence of how reconceptualisations of ethnography within contemporary anthropology have thoroughly displaced 'realism' as a premise for ethnographic accounts (e.g. Clifford & Marcus, 1986).

I draw the second example of the tension between realist accounts of people and methodological construction from my participant observation of the workshop I attended during the conference. During the conference, the attendees were given the opportunity to partake in one of fourteen workshops held during one afternoon of the conference. I attended the workshop entitled "Deep Impact: Creating Strategies for "Meaning-ness" in Research Deliverables". The workshop was organized and facilitated by employees of a prominent design consultancy and a multinational computer vendor. The workshop was publicised to conference participants in the following way:

[89] This point, regarding the way in which ethnography in the ICT industry individuates representations of people with particular properties, is also made in chapter four in relation to the in-home interview.

> "A challenge of ethnographic research is telling "the story" — the story of users and the synthesized story of meaning — vividly and persuasively to corporate stakeholders. The practice provides tools that elevate insight, but it's at the moment of sharing outside our discipline with colleagues or clients when research gains persuasive resonance or falls on deaf ears. If meaning is constructed between a researcher and her audience, how can we be mindful of the most impactful strategies for sharing our research with others? In this workshop, participants will learn, share, brainstorm and evaluate effective techniques to convey the "meaning-ness" of research deliverables to others. Participants will bring a story of a salient success or fatal failure — their choice!" (Kotamraju & Rink, 2006: 262).

The workshop was well attended, and after the customary introductions and biographical preambles we were split into groups. Each group was asked to propose and briefly investigate a topic related to the communication and dissemination of user-research to "others", most notably commercial patrons and stakeholders. To this end each group was provided with a pre-prepared worksheet prompting the groups to organize their reflections and insights around "Goals", "Challenges", and "Tools/Methods". Topics devised and explored by the groups included "So What?". Here, the workshop participants shared their practical knowledge concerning how to translate user-research into "actionable items" and how these items might relate to specific audiences.

During the workshop the facilitators handed out sets of five small cards with visual and textual material printed on both sides. Each card included a photograph of a person and an extract from an interview, as well as interpretive claims and design principles. The facilitators described the photograph and textual extracts as data elicited from research informants. They insisted the material was not "fictional", the assertion being that the content, the photographs and the extracts, were unmediated pieces of social reality obtained from 'users'. The quote, interpretive claims and design principles all referred to aspects of consumption and peoples' relationship with commercial organisations. Figures 23 & 24 show one of cards. It included a photograph of a woman, "Denise". Beside the photograph is printed "Denver" and underneath is a 'verbatim' quote. It reads: "I'm interviewing the company as much as they're interviewing me." The reverse side included printed generalizations stating what people "want" and "seek" as individuals, as well as "design principles" that are interpretive claims outlining how design and innovation actors can respond when it comes to formulating a given commodity – for example: "People want a service that is responsive." The visual arrangement of the material on the cards implies a straightforward process, from empirical data collection to interpretation followed by the formulation of design principles.

The cards served to demonstrate how knowledge about users could be reduced to a limited set of analytic insights and instructions with which 'designers' can communicate this knowledge to commercial clients. The cards also demonstrated how models of 'real' people could be mediated with a minimal amount of information, for example, a photograph, a given name, a place name and a quote would suffice. Similar to the previous example, this is done

through the combination of naïve epistemic realism, i.e., a naturalistic representation of "Denise", who really is a customer, and who believes she has a particular type of agency when it comes to involvement in the service that the company provides. That is to say, Denise has choice when it comes to the content of her relations with the company. She can "interview them", rather than being affected by its demands and requirements. Here, the quote also connotes that an informant speaks their 'truth', and this in turn can go un-mediated to clients (cf. Nafus & Anderson, 2006: 248). As such, it can be understood as a way to direct corporations to their existing and likely customers.

This example of the tension between realism and reflection, that is to say, between the representation of a 'real' person and practical methodological guidance, is specifically oriented towards the communication of ethnographically derived user-research to the demands of commercial clients. On the one hand, there are visual and rhetorical devices to ground the reality of a woman living in Denver who engages in particular consumer relationships from which interpretive claims concerning consumers are derived. On the other hand there are directives about how to construe accounts of people, so as to match the imagined demands of commercial clients. This point can be further nuanced in that the workshop participants are being encouraged to delegate 'ethnographic authority' (Rosaldo, 1986: 78), as spokespersons for users, to representational devices, such as photographs and quotes in paper presentations, pitches, meetings and so on. Thus, to evoke a user, the complexity of ethnographic fieldwork and participant observation or, for that matter, in-home interviews, must be hidden from a patrons' view: just include a minimal set of empirical indicators (name, place, photograph, and quote) to establish the reality of a user. The implication here is that ethnographic accounts must be purified into 'stories' for commercial audiences, and that the constructive nature of research (Osborne & Rose, 1999; Law & Singleton, 2005: 334) must be downplayed, if not hidden, in order to be effective, i.e., to persuade stakeholders about a given social reality.

Figure 23: the card with photograph, quote and place name.

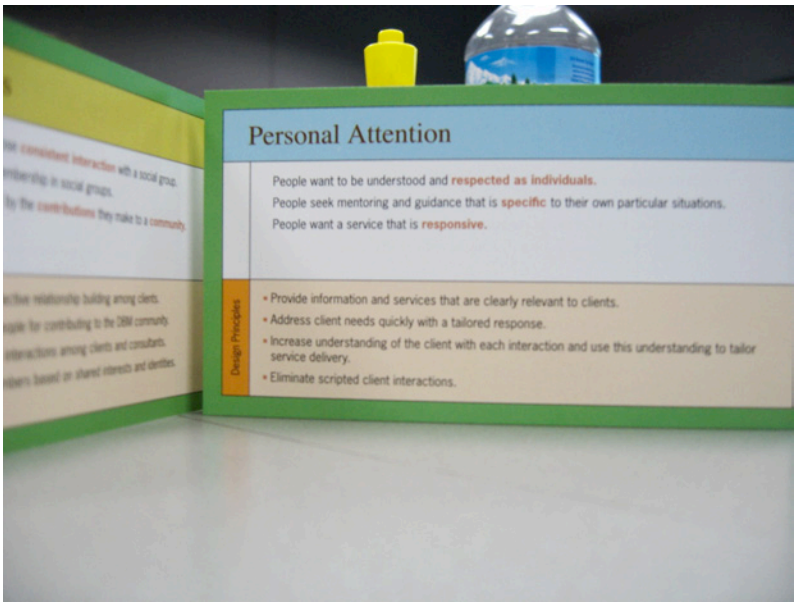

Figure 24: the flipside of the card – interpretive 'stories' and design guidance.

In the above I have highlighted two examples that serve to illustrate how users were brought into view at EPIC, by way of relations between realist rhetorical techniques and methodological construction. In the first, I show this tension at play in scholarly reports of ethnographic work. In the second, I examine how this tension operates as ensembles of innovation actors share knowledge about practical epistemic techniques, involving and

mediating users. The important point here is that not only are realist rhetorical devices prevalent within commercial ethnographic research (Nafus & Anderson, 2006), but that they are routinely allied with, and mediated by, researchers' own methodological reflection on research techniques and literary practices. Accordingly, there is a dual logic at play in the figuring of users, i.e., users are presented as grounded in reality, and in a somewhat objective representation of their setting, and yet at the same time these accounts of reality are constructed by the researchers' choice of topic, methodological approach, theoretical perspective and representational techniques.

The key question here is: how do these two seemingly paradoxical logics operate in combination with one another, i.e., how do the realist representations of people-as-users combine with their methodological and literary construction? Here, Latour's (1999b, pp. 71-95; Harman, 2009: 79) version of realism is instructive. In brief, for Latour, realism equates to a relational association between different entities, and the *strength* of reality is an upshot of the increasing build-up of translations and connections between objects, words, practices and so on. Accordingly, the user can be understood as a *circulating reference* that gains certain properties depending on the type of mediations and transformations that it undergoes. Thus, on the one hand, Johan, Pascal and Jeroen and Denise are real people living with and reflecting on their use of technology, such as mobile phones. On the other hand, accounts of Johan, Pascal and Jeroen and Denise are constructed through an amalgam of interpretive techniques and perspectives. The key point here is that in *ethnographic praxis* (ethnography applied within the ICT industry), realism and methodological construction do not cancel one another out. Rather, they combine in various patterns to strengthen the reality of the user, whether in the face of commercial audiences, who demand conclusively real markets and real consumers, purified of methodological complexity, or scholarly audiences, to whom methodological reflection is mandatory. In this way realism and methodological construction are flexible and can be made visible or invisible to suit different audiences. It is not the case that the accounts of Johan, Pascal, Jeroen and Denise are less credible because they involve the contingent combination of multiple methodologies and representational techniques. There may be internal epistemological conflict but this allows the ethnographers to link into multiple perspectives. In other words, a certain form of realism slips into the representation of users in order to prioritise certain aspects, such as the statements of human actors. That is not to say that Johan, Pascal and Jeroen and Denise are unreal, but rather different hierarchies of representation are enacted in order to meet different expectations. This resonates with previous chapters in this thesis, most notably chapter four, where I examine how an in-home interview serves in the production of knowledge about future use by way of an elderly man suffering from diabetes, and chapter five, where I examine the use of personas in design.

Prospecting Retrospects [90]

The second tension I want to draw attention to concerns the way in which knowledge of existing users is produced, and the types of futures it constructs, i.e., the relation between empirical enquiry and future guidance. This equates to the distinction between establishing the reality of users in socio-cultural contexts, and thereby grounding the representation and involvement of people in the user-centered design of actual technologies, whilst supporting and directing technological innovation more broadly. In other words, how users mediate traversals between existing and future socio-technical cultural life. This relates to a key dilemma in the relation between ethnography and design, namely how the study of existing practices can resource the anticipation and generation of new practices, or as Ehn (1988, pp. 128-129) puts it in relation to prototyping, the distinction between tradition and transcendence. As should now be obvious, my interest here concerns how users feature in attendees' accounts of empirical user-studies, and how they inform the design of future technologies. Following the previous section, concerning how users are rhetorically grounded in reality whilst methodologically constructed, I explore another key dimension of users' assembling, namely how ethnographers' accounts of people configure them as existing users of technology. I then set this against the ways in which users mobilise the future by way of guidance in the present. I illustrate these two related tendencies, between what people-as-users are and what their futures might be, using examples drawn from the conference proceedings.

The first example is drawn from the views of corporate consultants employing ethnography to help pharmaceutical companies to understand the lived experience of type 2 diabetes (Reichenbach & Maish, 2006). To ground their investigation of diabetes, as a lived experience, the researchers present a number of ethnographic cases of people managing the disease, including "Sydney" and "Alice". Sydney, according to the researchers, lives in a "major North American city", is "college educated", has worked for the most part of his life and he has access to health care in retirement. Alice is a "youthful fifty year-old professional" who "actively" manages her condition. Both accounts of people managing diabetes describe their different experiences with healthcare. Sydney is representative of people managing the disease in relation to healthcare services, and Alice is an example of self-care. Both Sydney and Alice rely on various medical technologies to manage their condition on an everyday basis.

Having explicated their ethnographically derived accounts of people managing diabetes in relation to their informants' personal experiences of managing the disease and the language they use to describe these experiences, the researchers move on to outline "implications" for

[90] I derive this title from (Brown & Michael, 2003) who employ the term in relation to the discursive construction of clinical biotechnology futures.

the discipline and "opportunities" for business. In doing so, the researchers describe how users can be 'better' mediated, by tactically drawing on mixed methods and scholarly precedents, such as reviews of relevant academic literature, in order to provide subtler accounts of people. Furthermore, the researchers argue that more 'in-depth' and impactful accounts of people can be communicated by way of DVDs, and that accounts of people can inform brand strategy, e.g., how brand opportunities are realized in relation to brand strategy. Thus, the present is rhetorically linked to the future by way of 'implications' and 'opportunities', as well as guidelines on how better to involve user representations in this process.

The second example of the relation between accounts of people-as-existing users and the futures they mediate is a report on an ethnographic study of computer use in rural India (Rangaswamy & Toyama, 2006) conducted on behalf of a multinational ICT corporation. The subjects of the researchers' study were small business owners who run "PC Kiosks" providing ICT access to rural Indians. Accordingly, their 'field' consisted of twelve PC Kiosks. What the researchers sought to understand were the various impacts of these technologies on rural communities. Their account features Baba Sawant (Rangaswamy & Toyama, 2006: 192). We are told that Baba moved to Pune, in order to set up an organization dedicated to improving computer literacy amongst the rural poor in India: "I spotted the potential of computing technologies to change the face of society. I wanted my village to be one of them." (ibid. : 192). According to the researchers' reports, Baba also created a database containing information about the citizens of Pune and used this database to identify voting irregularities. The investigators' account of Baba then moves on to position him in relation to the infrastructural development of rural India, such as road building and telecommunications cable installation, on account of his description of his village as 'semi-urban' (ibid. : 191). Here, Baba's words are taken at face value as an indication of (ICT) development. One example of this is Baba's management of an "agri-interest group updating farmers on information and markets". This brings to mind the way in which Akrich (1992b: 215) speaks of users caught up in socio-political networks, i.e., Baba is entangled into the population of Pune and with rural Indians more broadly. The 'verbatim' quote links him to a wider 'society' where he is further associated with voting citizens and farmer groups, who are themselves' tied up with agricultural and financial markets.

On a broad note, what these various accounts of the entrepreneurial activities of rural Indians invoke is a hitherto unexplored market territory for the researchers' patron. That is to say, a market no longer defined by agricultural industry. Furthermore, the researchers' draw on Appadurai (1991, 1996) to articulate how their user-oriented fieldwork can be held as an exemplar of local practices enmeshed in wider socio-political processes, implying that ethnography can be deployed as an instrument with which to render people located in emerging and dynamic economies, such as India. More specifically, accounts of existing ICT

practices in India serve to demonstrate the anticipated uptake of ICT technologies in rural India, and the particular cultural entrepreneurship that might arise in this context.

In both accounts of users, we are witness to a representational process where people are transformed into users. This is a key and routine process that is common across the proceedings at EPIC, whether in papers, workshops or posters.[91] That is to say, the reality of people is established in relation to their various encounters and dealings with technology. One upshot of these efforts, where ethnography intersects with design, is to effect a change in the 'ontological imagination' of corporations. For Barry et al. (2008: 36), this equates to the conception of commodities as sociotechnical assemblages. For the purposes of this thesis, however, the efforts of ethnographers working in industrial contexts has been to effect a change in how people-as-users are conceived. That is to say, existing people are viewed as micro-social actors embedded within a particular local cultural context in relation to various sociotechnical networks. Sydney, Alice and Baba are cases in point. In short, the view that industrially produced objects are assemblages has a converse in how people, as the users of designed artefacts, are imagined.

The view that users are 'socio-cultural-technical' assemblages, at least rhetorically speaking, has an import on how ethnography relates to design. In this chapter, and in chapter four, I show how ethnography interfaces with the way in which design is carried out, and seeks to intervene in future practices. If users are viewed as situated and enmeshed in heterogeneous relations, then products and services will have to respond to this version of the social in ethnographers' accounts. Here, the ontological change in the imagination of the ICT industry brought about by corporate ethnography takes place along two dimensions: what reality is and who people are (retrospective), and what reality could be and what people really want (prospective).[92] As I have argued throughout the substantive chapters of this thesis, user-centered design involves various shifts between the existing and the yet to exist. In chapter four, for example, I examine in detail how 'ethnographic' data was produced and deployed in order to prospect existing medico-technological practices. In the previous chapter (6), I distinguish between *distal* and *proximal* users, in order to better grasp how users were employed to mediate the making of a health and fitness technology in the present, as well as to rhetorically envision future obesity-related scenarios.

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[91] Arguably, this can be seen as part of a more widespread technique within so called capitalist economies of commodity production where existing actual consumers are transformed into 'virtual consumers' through management theory and models of action (Miller, 1998: 205).

[92] Here, the distinction between retrospective and prospective is not to be confused with Garfinkel's (1967a: 41) understanding of peoples' use of past experience and common anticipatory understandings as played out in ordinary action. In chapter four I also employ these terms to better grasp my informants use of sticky notes as they explore technological opportunities associated with diabetes. I use the terms here to point to the relation between empirical reflection and future expectations.

The Particular and the Abstract

The final tension I draw attention to in this chapter is the relation between the particular and the abstract. That is to say, drawing on my reading of Button and Dourish (1996: 24), the way in which ethnography relates to design in relation to the alignment between specific practices and concrete technologies, and the way in which ethnography serves to sensitise design to more general social processes. This relates to another aspect of the changing role of ethnography in design, which is no way a single linear movement, where its application includes its deployment in system specification and evaluation – a shift from foundational concerns with ethnomethodology and the study of situated and organized action in particular settings, to the critical interpretation of everyday cultural life, consumer culture and more broader cultural interpretation (Bell et al., 2005: 154; Crabtree et al., 2009: 880).

In the following examples I show how the distinction between the particular and the abstract plays out in relation to three modes of doing ethnography-in-design: (1) the design of specific concrete technologies; (2) reflections on how ethnographic research can be applied and conducted in relation to design; and (3) how ethnography supplies design with conceptual understandings of sociality. It should be obvious by now that each example draws out a different aspect of how users mediate the relationships between ethnography and design.

One example of how ethnographic studies were used to inform the design of specific technologies can be witnessed in reports by 'user-researchers' working for the U.S. bank Wells Fargo in the design of online financial services. Their research included sixteen participants who all produced a one-week journal of their 'financial management activities and also made collages or drawings of their attitudes and emotions toward money and banking' (Beers & Whitney, 2006: 141). The user-researchers also conducted 'in-home' interviews and visits (ibid. : 141) with the participants, in order to collect further data on their economic and financial practices. Consequently, the user-researchers used this data to make models of online financial services in order to design new features and functionality into their online services. This example serves to demonstrate how an ethnographic study of users is employed to inform the design of a concrete technology i.e. an online banking service.

As well as informing the formulation of specific designs, ethnography was also deployed in order to inform and improve designers' working practices. A conference paper by an independent consultant (Jones, 2006a) exemplifies how ethnography is deployed to inform specific design practices featuring the representation of users. The paper sets out how a more 'effective' relationship between ethnography and design can be achieved by way of 'experience models'. For the researcher, experience models are visual representations that aid design practices by clearly summarising the key analytic aspects of the people involved as representative of end-users. Quoting Jones (ibid.: 97), "An experience model not only tells a

story, it is an explanatory and developed in a way that has implications for strategic action". As such, experience models are visual artefacts that combine ethnographic data and analytic interpretation to produce a diagram of a user's experience over time. Now, the important role about the experience model, as a representation of a user, is the specific practices it mediates. For Jones, these include: shared knowledge about a user, a device with which to identify where design can intervene in a user's experience and a device that can be used by others' involved in product development. In this way, Jones mediates between the particulars of ethnographic data and the abstracted characterisation of user experience that can be used in design processes.

EPIC also included proceedings in which ethnographers sought to sensitise designers to different conceptions of people-as-users. On this score, two contributions in particular addressed the issue of the individual-as-consumer, as reportedly imagined in corporate settings. The first (Thomas & Salvador, 2006) drew on field studies conducted in China and India in order to argue that people-as-users be viewed in their "complete" complex socio-cultural-technological relationships, and that this view be authentically represented in the design process. The second (Anderson & De Paula, 2006), drawing on participant observation conducted in Brazil, brings attention to collective experiences in "transitional" temporal episodes, such as bus rides. Their argument addressed the belief that research into collaborative practices is under-explored (despite the relative successes of CSCW I might add) and that ICT-related products and services should be reconceived in relation to collective users, temporarily located in time and place. In doing so the ethnographers argue for an understanding of the social as a temporal, as well as geographical space, that plays host to transient sets of individuals. Furthermore, their perspective of the social is substantiated by reference to everyday technologies, such as public transportation and mobile phone technology as examples of how designers might engage with this view of the social as a basis for innovation. The two examples above have in common the way in which particular ethnographic studies can resource the formulation and deployment of particular abstract notions of society.

The purpose of the examples included above is to illustrate how users mediate tensions between the specific and the general, the particular and the abstract. In the first example, I described how users mediate the design requirements of an online financial service. In the second example, I demonstrate how representations of users mediate specific design practices, as well as working processes more generally, where ethnography-in-design connects to other working groups within commercial organisations. In the third example, I show how conceptions of users as social groupings serve to make relevant the conceptual and abstract work of ethnographers to product and service development: in other words, how

ethnographers deploy sensitising concepts (Crabtree & Rodden, 2002: 72) in order to effect a transformation at the level of design and corporate strategy.

Discussion: ethno-user assemblages

In chapter four I examined how user-involvement was accomplished by way of an in-home interview, which, I argue, is a prevalent user-research technique derived from ethnographic reasoning. In my literature review I make the point that the engagement between ethnography and design has a grounding in CSCW, with its ethnomethodological approach to understanding peoples' practical and collaborative workplace activities, and how computer and information systems can be designed to support such practices. One upshot, I argue, of the engagement between ethnography and design, is the conception of the user as a situated socio-cultural actor involved in the knowing and meaningful use of technologies and other material artefacts in relation to other such users. In the following discussion, I reflect on the contradictions I witnessed at EPIC 2006 in relation to reported tensions within HCI literature that exist in the application of ethnography in design. I then characterize ethnography-in-design as a *rhizomatic* state where multiple *ethno-user-assemblages* emerge to address economic and commercial purposes, and the scholarly production of knowledge.

As Crabtree and Rodden (2002: 70) note, the role of ethnography in systems design, as framed and practiced in early efforts, was to inform and clarify the specific functions and services – 'requirements' – that a system should provide its users. Here, workplace studies would conventionally be employed in the initial stages of design to support the clarification of initial requirements of a given system.[93] One problem associated with this was the way in which ethnographic accounts of practice were simplified and abstracted in order to meet the demands of systems design. Since these early engagements, the application of ethnography in systems design and the ICT industry has, in places, undergone considerable change (Bell et al., 2005; Cefkin, 2009a; Crabtree et al., 2009). The reconfiguring of ethnography to design practice has a number of aspects. Broadly speaking, the utilisation of ethnography in technological development has expanded beyond academic and commercial research purposes. Here, the outcomes are viewed as concepts, rather than concrete products or services oriented towards the user as consumer. Furthermore, ethnography has enlarged its presence within commercial contexts, as evidenced in the volume 'Ethnography and the Corporate Encounter' (Cefkin, 2009b). The 'New Corporate Ethnography' (Cefkin, 2009a: 3) can be understood as the linking up of the tradition of, and developments in ethnographic research applied in systems design, and anthropological knowledge allied to corporate

[93] Foundational studies of work practices include the study photocopier design and use (Suchman, 1987b), London Underground train control rooms and controllers (Heath & Luff, 1992), air traffic controllers (Harper & Hughes, 1993), stockbrokers (Heath et al., 1993), engineers and systems designers (Rogers, 1993), civil servants (Bowers, 1994), software engineers (Button & Sharrock, 1994), and workers in the printing industry (Bowers et al., 1995).

strategy, including product and brand development. Here, ethnography as applied in industry links up with marketing and publicity as well as corporate strategy associated with innovation. A case in point is the example of collective users situated in time-spaces described above. Where once the term corporate ethnographer referred to the study of corporate culture, now the term, at least in my field site, commonly refers to ethnographers working within an industrial or corporate context, involved in product and corporate strategy.

Another aspect of the changing role of ethnography in design is how its input into design processes has enlarged from resourcing the identification and definition of specific features of a system, to the investigation of relevant and viable research topics and areas. As noted above, Crabtree and Rodden (2002: 72) describe this as the production of 'sensitising concepts' which identify issues and opportunities to which research efforts can be directed. The remit of corporate ethnographers in my field, such as the conference organizer introduced at the beginning of this chapter, exemplifies this mode of ethnography. The corporate ethnographers I had contact with conducted studies in diverse geographic locations such as Africa, India and Latin America, and undertook research into technology-related topics such as healthcare, currency, mobility and consumer identities. Crucially, their objective was, and is, to effect a change in the corporate imagination concerning the way in which technology is used in ordinary life, and to bring into view hitherto unrealised markets and consumers. One upshot of their efforts, according to Barry et al. (2008: 36), has been to change the 'ontological imagination' of the corporation in conceiving products as sociotechnical assemblages. This reflects and corresponds to the arguments that I am pursuing in this thesis towards the conception of users as assemblages. In short, the view that industrially produced objects are assemblages has a converse in how people, as the users of designed artefacts, are imagined. Here, I differ from Barry et al. in identifying two ontologies at work, a retrospective ontology in which people-as-users play out, and a prospective ontology in which people-as-users are imaginatively reconfigured in the present, along with their associated market.

This brings me on to another related aspect of the changing role of ethnography in design, where its application has moved beyond its deployment in system specification and evaluation. In identifying and promoting so called 'sensitising concepts' and abstract design topics, ethnography has taken on a more expanded role in technological research. This has brought about an engagement between ethnography and design-related innovation as an exploratory enterprise. Thus, what ethnography has effected, alongside the change in how corporations imagine their products, is the way in which the 'social' is understood. In conducting exploratory research, the role of ethnography is to bring into view new territories of sociality where technology is imagined in relation to 'real' world situations. Here, ethnographic knowledge mediates sociality as qualitatively 'thick', complex and intimately tied

to place, as well as abstractable to cultural practices more generally. The intentionally and industrially produced products of a corporation can thus be imagined in micro-cultural localities, as well as scaled-up markets.

Arising out of the ongoing commitments and developments between ethnography and design are a number of key tensions, not least the role of ethnography as either a practical input into the making of concrete technologies, or as an instrument for strategic commercial exploration. Firstly, what counts as ethnography in design is a contested matter. An example of this are the methodological issues surrounding, and analytic orientation to, fieldwork (Button, 2000: 325). For example, Button brings to light various methodological issues surrounding fieldwork, while Crabtree et al. (2009) are openly critical of many alleged studies of naturally occurring action. Secondly, there is the tension between the scholarly production of ethnographic knowledge and the instrumentalization of applied ethnography to meet commercial demands. The audiences and patrons associated with both pursuits employ different agendas linked to different forms of accountability and economic support (Jordan & Lambert, 2009: 104). The third tension I want to call attention to, related to the previous, is the relation between accounts of existing social life based on empirical reflection and claims, and assertions about what social life could be. In other words, and in reflecting the present study, this equates to the distinction between establishing the reality of the user, and thereby grounding their representation in design, whilst supporting and directing technological innovation, which is concerned with configuring future social life. Here, the ontological change in the imagination of the ICT industry brought about by corporate ethnography takes place along two dimensions: what reality is and who people are (retrospective); and what reality could be and what people really want (prospective).

Now, given the developments and tensions examined and discussed above, another important analytic insight can be made about the burgeoning interests surrounding ethnography-in-design, manifested in EPIC and, for example, the mailing list Anthrodesign. This insight concerns how professionals from a variety of disciplines and backgrounds develop a shared but disparate concern with ethnography-in-design, and the sorts of shared beliefs, notions and practices that emerge in these processes. Here, Hajer's (1997: 58) notion of *discourse coalition* is particularly relevant to describe a grouping of heterogeneous innovation actors (individuals representing different disciplinary traditions, different organisational forms and modes, etc.) that share identifiable practices and a particular set of *story-lines* by which different discourses are brought into alliance. In other words, ethnography-in-design can be understood as a loosely shared way of thinking about, talking about, representing and involving users across academic and commercial pursuits. Here, story-lines refer to the practical reduction of complex and esoteric discursive elements into simple narratives that can gain traction to actors from different epistemological and disciplinary traditions (Hajer, 1997:

63), in order to fit their work into a particular epistemic configuration, such as ethnography-in-design. The routine deployment of the notions of 'situated' and 'thick description' being cases in point, as are naturalistic verbatim quotes included in participants' reports of their work. Indeed, users may also be grasped as tropes that mediate particular story-lines. Interestingly, the notion of 'stories' was widely used at EPIC to describe the reflections of research informants (e.g. Metcalf & Harboe, 2006), the representational practices of conference participants (e.g. Wakeford, 2006), and to stress how fieldwork and research could be better communicated to stakeholders unmoved by the theoretical and methodological issues and commitments of those involved in ethnography-in-design (e.g. Jones, 2006a; Reichenbach & Maish, 2006; Thomas & Salvador, 2006; Tunstall, 2006).[94]

Although Hajer's approach is a fruitful way to grasp the interminglings of ethnography and design, ethnographers and designers, academic and commercial interests, it fails to get at how users assemble out of such discursive practices. Perhaps, then, a way to characterize the various relations enacted through ethnography-in-design is to use the image of the 'rhizome' (Deleuze & Guattari, 1988: 6; Deleuze, 1993: 29). Here, the various epistemic practices and genealogies of ethnography and design can become entangled with one another in innumerable ways and points of intersection, giving rise to new issues, new market territories, new assemblings of users, whilst cutting off or leaving redundancies to wither or regenerate. Martin (1997: 137) has used the notion of rhizome to describe how ethnography can be used as a method to capture the erratic and non-linear relations between science and culture. Turned back onto ethnography and its application in the ICT industry, the image of the rhizome is useful here in that it emphasizes how different design traditions and orientations within HCI and different ethnographic perspectives link up to form models of the user. This is not a linear process of progression, like paradigms (Kuhn, 1996), where new epistemic practices render preceding precedents redundant, such as ethnomethodology. Rather, development and change is complex and multifarious, where the seemingly bygone can be re-connected into emerging practice to delineate new routes (or roots). Thus, the question is not to view ethnography and design as singular and distinct disciplines: i.e. what ethnography supplies design, or what design gains from ethnography. Instead, and as I have tried to grasp in this chapter, the key questions concern the entanglements that are occasioned in ethnography-design engagements and what gets produced at these sites and moments of coalition.

On this score the conceptual and heuristic notion of *ethno-user assemblage* might better work to understand the rhizomatic interrelations and interweavings between ethnography and

[94] Indeed, the view of ethnography as a literary practice involving the narration of persuasive stories has been explored by various eminent ethnographers (e.g. Clifford, 1986; Geertz, 2000: 15)

design out of which users emerge.[95] First, the term 'ethno' is suggestive of the complex practices by which knowledge about individual and collectives of people are produced in relation to their local cultural circumstances, as well as the conceptual and methodological perspectives that condition the production of this knowledge. This includes the production of truth claims mediated by the documentary style of representing people. It also includes the production of people-as-users through the emphasis placed on informants' situated sociotechnical and cultural practices. Viewed as such, the different models of people-as-users serve to resource the prospective practices of designers, whether in the specification and making of particular technologies, or the opening up of new imaginative social horizons that act as a prospective context to which designers and innovation actors can direct their efforts. In connecting *ethno* to the term assemblage I want to emphasize the way in which users emerge out of different combinations of these intersections. Furthermore, to say that users assemble suggests that they are continuously gaining different properties and capacities, based on how and where they come into view, and to whom they come into view; whether to resource the actualisation of specific technologies or to sensitise innovation actors to new abstractions and new futures; whether to support practical communication, as in the workshop, or to reflect on the politics of doing ethnography within industry.

Conclusion: The Dimensionality of Users

After all, and as the conference organiser knowingly put it, I wasn't the only conference member witnessing and reflecting on the practices of the ethnographers at EPIC 2006. As this chapter has shown, the conference participants embodied various disciplinary perspectives and institutional affiliations straddling academic and commercial agendas. In addition to the various forms of professional reflection and development, in the form of paper proceedings and workshops delivered and witnessed by those practicing ethnography-in-design, there were also others like myself, treating the proceedings as a sociological object.

In sum, I have argued that the relations between ethnography and design are far from simple. They resist reduction to specific issues and discussions, concerning, for example: ethnography's epistemological grounding; questions of method or analytic preoccupations; its politics of representation, or how and where ethnography feeds into different user-centered design processes. What I have pointed to, however, are the ways in which the different tensions and paradoxes that exist in the engagement between ethnography-in-design combine to assemble users in order to meet the demands of varied audiences. Drawing on Strathern (2002: 311), ethno-users have dimensionalities which mobilise socio-cultural actors and

[95] Admittedly I draw inspiration for this notion from Irwin and Michael's concept of the *ethno-epistemic assemblage* (2003: 119), contorting it to my own specific ends. With this notion Irwin and Michael explore the heterogeneous coupling of knowledge production, truth, locality, and how these are variously contested.

processes in different ways. For audiences invested in academic and commercial product development, ethno-users assemble to mediate the practicalities of research, communication, and technology making, as well as the management of future socio-cultural expectations. For audiences pursuing the development of a discipline's knowledge, be it cultural anthropology or perspectives on applied ethnography, users serve to mediate differing models of and perspectives on culture and sociality. In other words, users assemble to mediate different realities. What should be clear from this is that academic and commercial agendas are not separate. Rather, there are common and often shared endeavours that cut across the two, blurring this rather awkward distinction.

Finally, throughout this chapter I have indicated where particular analytic points and arguments link up with previous chapters. Overall, this chapter serves to demonstrate how the conference provided another distinct site in my fieldwork where multiple versions of the user served to mediate relations between the social and the technological. This chapter also shows how ongoing developments in, and engagements between user-centered design and ethnography are resourced by different models of users that mediate the actualization of technologies, the management of expectations, and the cultivation of HCI and user-centered design in different contexts, i.e., ethnography-in-design is about not only making sociotechnical objects and futures: it is also about reproducing itself.

Chapter 8.
Conclusions and Implications

Introduction

In this final chapter, I recall the three questions that I raised in the beginning of this thesis. To recap, these questions concern the detailed examination of UCD practice in relation to: (1) the form and identity of users; (2) the roles played by users in design practice; and (3) the emergence and eligibility of prospective people-technology arrangements for product development. Methodologically, I have addressed these research questions by identifying and tracing the multiple occasioning of users in UCD: how they come into being, co-exist and endure (or not). I consider the implications of my study of the enactment of users within UCD with the conceptual device of *user assemblage* – in part corresponding to the view that HCI technologies are sociotechnical assemblages (Suchman et al., 2002: 175; Barry et al., 2008: 36). Accordingly, I draw out key analytic themes that cut across my case studies and demonstrate how users come into being, how they are composed and how they operate and co-mingle in the design process. This, I have argued, reframes the question of user involvement, from the problems associated with the identification, reification and representation of pre-given human traits to questions concerning the emergence of new sociotechnical actors with new capacities, capabilities and new ontologies. In this conclusion I summarize the implications of my ethnographic study in light of the reframing of the user and I consider the broader implications for design and social theory, as well as policy preoccupations and trends.

User Assemblages

In chapter two, I introduced the term *user assemblage* as a conceptual tool that I have operationalized in relation to my analysis of the enactment of users in the field. As I mentioned in the introduction and elaborated in my substantive chapters, I derive aspects of the assemblage from the work of Deleuze and Deleuze and Guattari to define what user assemblage conveys and its usefulness in understanding UCD.[96] In what follows, I return to the user assemblage as both a conceptual device and analytic outcome of this thesis.

For Deleuze and Guattari, assemblages operate in two key interrelated modes, or 'axes' (1988: 88). First, assemblages comprise two distinct but interoperating processes. On the one

[96] Although awkward, I believe it is important to distinguish between the work of Deleuze and Deleuze and Guattari.

hand, the *machinic* refers to the intermingling of 'bodies', 'actions' and 'passions' that constitute an assemblage. Thus, the composition of an assemblage includes material entities, as well as forces and processes. Assemblages are also made up of 'acts and statements' through which the constituent elements communicate and interoperate with one another and other entities. This is likened to a 'semiotic system, a regime of signs' (ibid.: 504), which is at play, for example, in how attributes of users express particular qualities of subjectivity, sociotechnical practice and sociality.[97] Thus, an assemblage is a co-functioning of material arrangements and semiotic expression. Furthermore, in co-functioning the assemblage is more than its parts. The 'MAN-HORSE-STIRRUP' (Deleuze & Parnet, 2002: 69) is a symbiosis of heterogeneous parts that, in the form of mounted cavalry, does more than the sum of its parts. Likewise, the daily exercise prototype (DEP) assemblage does more than, say, the multi-modal sensor board (MSB), where, for example, sensing capabilities are variously coupled to aspects of routine fitness to create new in-situ person-technology-fitness configurations.

Second, assemblages are composed of arrangements of interoperable components and modes of expression that occupy and serve in the emergence of spatial and temporal territories. The related terms *territorialization, deterritorialization* and *reterritorialization* describe the processes in which assemblages are arranged in space and time – which are an upshot of an assemblage's formation. Such arrangements of becoming can be stable in process, and reproduce a defined region, i.e. processes of territorialization. However, during processes of change and becoming, assemblages exist as deterritorialized and unstable. In undergoing change reconfigurations of content and expression are brought about where new stable assemblages emerge as reterritorialized entities. This can be illustrated by way of the 'juridical assemblage' (ibid.: 80), where the accused (a particular territorialization) is brought to trial (deterritorialization) and then transformed into a convict (reterritorialization). Or, as in chapter four of this thesis, where an elderly diabetic man is interviewed at home (territorialized) and deemed a non-user (deterritorialization) but then data derived from the interview is re-ordered to produce a refigured user (reterritorialization). Crucially, in occupying particular concrete spatial and temporal milieu, user assemblages are contingent and situated in local cultural settings.[98] As Michael and Irwin note, in relation to the public understanding of science (2003: 119), this connects the concept of assemblage with sociological traditions where knowledge is viewed as *situated* (Haraway, 1991: 111), and practices, evoking ethnomethodology (Garfinkel, 1967b; Suchman, 1987b: viii), are *indexical* to the context in which they take place. That is to say, doings and knowing can only be

[97] See (Deleuze & Guattari, 1988, pp. 111-148) for an extended discussion of expression in relation to semiotics. Crucially, there are many interweaving 'regimes' of expression, semiology being just one, which are performative and inseparable from non-linguistic processes. Two examples serve to illustrate this: the haptic qualities of materials and the symbolic operations of computer code.

[98] See also (Deleuze & Parnet, 2002: 134) for an illustrative example of processes of territorialization concerning tools and the places and subjectivities they make possible.

understood by reference to when and where they occur. However, it must be made clear, despite the illustrations above, that assemblages are not just located in human-centered processes, as I will show below.

Now, this somewhat glossed outline of the concept of the user assemblage is important for this study. On the one hand, I am elaborating the theory on the basis of my empirical work, showing precisely how user assemblages operate for UCD. On the other hand, it provides a way of generalising to other empirical cases – for example design process more broadly, and other modes of making users in relation to commodity production and policy developments set out in the introduction. The concept *user assemblage* emphasizes the temporal aspects of design practice, especially user involvement in the speculation and management of sociomaterial futures, as in the practice of prototyping for example. On this score, processes of territorialization help me to better grasp the future oriented practices of designers, as well as the temporal capacities of users. An example of this is how users operate to stabilize human traits in alignment with features of technology, and how such orderings of sociotechnical properties can be re-ordered or reconfigured, i.e. deterritorialized and territorialized.

This brings into play temporality as another important facet of user assemblages and as a particular function of territorialization. Deleuze and Guattari use the notion of *lines* (1988: 505) to describe how assemblages are constantly in the process of becoming. Assemblages can be characterised in terms of three lines: *molar*, *molecular* and lines of *flight* (ibid: 204). In brief, molar refers to dominant and well-defined political and economic states (in the sense of both a large collective body and its particular condition), and the molecular as the collectivisation of constituent elements. Here, for example, the deployment of inventive risk discourse, discussed in chapter six, can be understood as a mechanism which aligns the molar techniques of government health initiatives with the molecular bodies of ubicomp-enhanced individuals. Lines of deterritorialization, or *flight*, however describe how in change assemblages open up new prospective territories, new future possibilities in the present. What I find especially useful about this aspect of user assemblages, and what Deleuze and Guattari insist upon (1988: 504), is that there are multiple and diverse lines of flight – many different ways a user assemblage, in both its content-form and expression, can transform. Like Gibson's (1979) notion of *affordance*, the concept of user assemblages points to various contingent capabilities and tendencies to act in the yet to come.[99] The implications of this view of users – as process – are particularly useful in relation to *ad hoc* design practice. As such, path-dependencies and 'natural' technological trajectories, so ingrained in the imagination of technological change in the culture of my field site, can be rethought as patternings of change, which include openings and ruptures to unexpected and radical change. Not that such ideas of change were entirely

[99] See (Gaver, 1991) for the notion of affordance in relation to HCI. For an account of its uptake in HCI see (McGrenere & Ho, 2000).

foreign to my informants, who would routinely invoke notions such as 'disruptive technologies' (citing for example: Bower & Christensen, 1995) to advocate unforeseen or unlikely opportunities and markets for microprocessor applications. Often my informants would pithily express such beliefs in the phrase 'silicon play'.[100] For UCD, one such implication is that the multiplicity of bodies (taken in their broadest sense, like actors in ANT), technologies and communicative acts that are arranged in and around a prototype, for example, all have the potential to be become something new.

This emergent and processual feature of assemblages indicates that they can be stable, as well as contain the potential to morph and change into something new. The *capability* of assemblages is an important point as it clearly distinguishes this approach from ANT's preoccupation with *capacity*, i.e. what something does in the present rather than what it can do. For Latour, argues Harman (2009: 28), actor-networks are fully deployed at all times. There is nothing other than that which is empirically present. Thus, actors have capacities and competencies in the moment, which says little or nothing about how users configure futures in the present. Furthermore, actor-networks speak of heroically constructed and managed networks that are more often than not oriented around a particular obligatory point of passage and ultimately the capacities of a particularly strong and influential actor. User assemblages, however, have capabilities and potentiality – relational attributes generated amidst the interplay of their constituent components and semiotic processes that are contingent and multilateral. Thus, a *user assemblage* in process has the potential to be reconfigured to meet multiple points of passage as a routine phenomenon in design practice. Although the potential of actors remains a problem for ANT, the role of expectations in UCD, especially as visually and materially configured in user assemblages, is something that I work towards here. Following Robert Cooper, who also draws on the concept of the assemblage in relation to mass production, objects and bodies imply and embody future actions. As such, persons and artefacts:

> "require their *con-verses* in the external world in order to work, produce and reproduce: the arms and legs of a chair *con-verse* with the arms and legs of its human occupant, the lip of a cup *con-verses* with the human lips that drink from it . . . The understanding and definition of the human agent as essentially purposeful and self-directive now takes second place to agency as the general collection and dispersion of parts and fragments which co-define each other in a mutable and transient assemblage of possibilities and relations." (Cooper, 2001a: 25, emphasis in original)

In this way the capability of a user assemblage can only be understood in terms of their interactions with and between contents and expressions. An example of this is how the positioning and proximity of the post-it notes *Blogs and Online Groups* and *Support*, examined in chapter four, served to bring into view prospective online lay support groups.

[100] Designers routinely deployed the term 'silicon play' to speculate on the imagined scale of prospective microprocessor markets.

The term user assemblage therefore attunes my analysis of users to my research questions and arguments in the following ways. It has enabled me to foreground the role of non-humans in design practice. Accordingly, the various identities and capacities of users are not attributed to nor concentrated in pre-existing and embodied human actors. Likewise, neither are they attributed solely to the play of discourse or the determinants of technological change. They are inextricably interwoven. The notion of user assemblage also addresses the way in which users occupy, or 'territorialize' contexts of design practice, situated contexts of use and prospective social and cultural practices, as well as the interdisciplinary knowledge production of the design team. For me, user assemblage denotes the additive and relational processes by which instances of users emerge in design practice: a hopeful logic of association and envisioning that connects up people, place, technology and knowledge in various forms of practice.

Although I use the concept of *user assemblage* as a conceptual resource to better grasp the emergence and heterogeneity of users in the design process, derived from my ethnographic data, I have been selective with my use of certain concepts from the complex corpus of Deleuze and Deleuze and Guattari. In insisting on it as a conceptual and heuristic device, I would like to think that my use of assemblage doesn't slip into being a 'dead metaphor' (Marcus & Saka, 2006: 106). Rather, I take seriously and modestly Deleuze's advice to treat these concepts as 'tools' (1977: 208) which I use to gain analytic traction on users-as-process, and which have proved to be both pervasive and elusive. That is to say, I am persuaded to become a 'user' of these concepts rather than a reader. Of course, one weakness in this study concerns how other concepts in the work of Deleuze and Guattari might be put to use: for instance, concepts such as *Body without Organs* (Deleuze & Guattari, 1988: 150) and *faciality* (ibid.: 168), which might serve to further develop my understanding of user assemblages. Such theoretical shortcomings, however, indicate research directions. In the following, I summarise how users emerge and operate as part of practices of representation, expectation and anticipation, accountability, scale and socio-material innovation and invention.

Representation

Perhaps the foremost import of this study, of designers' various enactments of users, concerns representational practices – the local, material activities of designers that operate at the core of UCD, and that are examined throughout this thesis. The 'performative idiom' (Pickering, 1995: 10) explicated in STS, and ANT in particular, addresses the agency and involvement of representational objects in design. This applies to UCD in two main ways: the participation of people in the design process and the related depiction of people (properties and qualities), technologies, contexts for use, service infrastructure, institutional capacities and relations, as well as expert techniques and methods etc. Further, a performative approach to

representation connects the local and indexical basis for representational production in design to criticisms of realist epistemes. Accordingly, representation in design has a political dimension concerning the representation of actors' interests, at the expense of others. This includes the various ways in which users 'needs' are configured, and how they align with designers' research interests and corporate strategy. It also has an aesthetic and affective dimension, in which artefacts are formed and enhanced with particular qualitative and para-discursive attributes (visual, symbolic, tactile etc). In UCD, as examined in this thesis, the two dimensions of representation are at play within disciplinary endeavours and interdisciplinary engagements. Accordingly, visual practices are occasioned at the intersection of disciplinary techniques and epistemic commitments.

Broadly, these can be framed along disciplinary lines including the representational practices of designers and social scientists, as well as engineers and computer scientists. In chapter four, for instance, designers and design researchers collaborate to variously render techno-diabetic networks around the figure of an elderly man. Here, a diabetic-user undergoes a series of representational transformations in compositional form and temporal extension, by which he is variously involved in the design process as a user and non-user. The rendering of the putative housewife, in chapter five, shows how pre-existing genderscripts can be recovered and combined with focus group data as well as found visual material, to serve in the re-assembling of a prospective user: a user that is variously staged, materially and semiotically, to members of the project team, stakeholders and prospective consumers. Rather than functioning as boundary objects at the 'interface' of disciplinary viewpoints, suggesting that disciplinary efforts arrive to meet others and in doing so remain unchanged, these chapters demonstrate that at points of representational entanglement in UCD, new users emerge, with novel and heterogeneous properties and capacities, that in turn provision disciplinary actors with new resources, new figures around which to build, demonstrate, evaluate and understand interactive technologies, as well as novel socio-cultural realities. Thus, hybrid users – as emergent – continually occasion the practicalities of interdisciplinary work and come into being as a consequence of these ad hoc practices. As emergent, users figure in ongoing practical development, as well as part of pitches, demonstrations, scholarly representation of work and various other forms of communication. This point can be illustrated by way of the DEP examined in chapter six. Here, various forms of user representation (sensing technology, software algorithms, trial participants' and students' bodies, body-mass indices, behavioural models) are brought together to produce a new representational object, namely datasets of past activity that format situated activity in the present. Moreover, these forms of representation inform, give rise and correspond to the design of a garden GUI. In this example, quantitative, qualitative and sensory modes of representation work together to produce new objects.

In the various ways described above, representation in UCD works to *synthesize* the various, and seemingly incompatible, epistemic practices of designers, engineers and social scientists. Moreover, it also works to render existing knowledge, technical capabilities and social circumstances into future material and semiotic visions. Accordingly, representation in UCD can be understood, drawing on Deleuze and Guattari, as *machinic* and *enunciatory*. That is to say, methods and procedures for involving people and representing them in the design process, the skilled technical practices of building technologies and visual artefacts, as well as the semiotic processes techniques through which users feature in innovation and creative practices. To be clear, this view of representation differs from the view of scientific representation captured in the notion of the boundary object: where the meaning of scientific objects changes according to situation, but their composition remains the same. In contrast, representational objects in design change both in composition (machinic) and meaning (enunciatory) when locally synthesized. As such, the notion of assemblage provides analytic traction on such processes of representational becoming and synthesis.

Moreover, representation in UCD can be understood as the enactment of multiplicity. In my studies of technological development, in chapters four, five and six, I examine how users serve to bring into play various subjectivities, for example, individuals to various types of collectives. Of particular relevance here is the housewife persona as a visual artefact in continual becoming which operates to draw in housewives of varying race and gender who are members of various types of collectives, from household to demographic. Thus, user assemblage captures this snowballing of subjectivities mediated by a user. Furthermore, users also serve to mediate multiple realities. In chapter seven, for example, I examined how ethno-users mediated different models of reality to different audiences. For some audiences, preoccupied with product development, users prioritise evidence of real people 'out there'. For others, such as more scholarly audiences, users are a medium for reflecting on the implicit and explicit methodological and epistemological construction of socio-cultural context.

As such, a principal expressive function of users is how they function as visual assemblages – visible *diagrams* of relations between situated practices, technologies, collectives and infrastructures of service provision, where bodies are figured in relation to and as an upshot of all manner of heterogeneous associations. This calls to mind Deleuze's (1999: 36) discussion of the diagram as a visible assemblage in relation to the work of Foucault, especially the notion of the panoptican (Foucault, 1991: 205).[101] As I have shown in empirical detail, user representations render visible the (often invisible) variables by which putative users are configured. Here, for example, I have described how user representations variously include

[101] Notably, whereas Foucault's panoptican manifests power, discipline and repression, these are only possible and minor aspects of visual assemblages which are predominantly characterised by creative change (Deleuze & Guattari, 1988: 531). This point also discussed in relation to the deployment of inventive risk discourse in chapter six. See (Barry, 2001: 150) for a related account of the user of interactive science museum exhibits and the concept of the diagram.

(often in combination) interview data, addictive behaviours, body mass indices, in-situ sensor data, family 'needs' and 'goals', discursive political tropes and ethnographic subjects amongst other elements. Moreover, these variables are also constituted in relation to the artefactual landscapes of situated practice, as well as economic and political relations. Taken as such, user assemblages schematise diverse knowledge practices across disciplinary boundaries and epistemic encampments. The multiple models of ethno-users discussed in chapter seven being a case in point. In this view, user representations, as visual assemblages, are visible measures of interdisciplinary knowledge practices. They diagram (display the relations between) the technologies, techniques, knowledges and processes that combine to constitute a user. For all intents and purposes user assemblages are the antithesis of the *black boxes* of STS, which remain inconspicuous during successful operation. In contrast, user assemblages operate to make conspicuous their contents. If the technologies of UCD can be likened to concrete assemblages then user assemblages, in many cases, are complementary arrangements that schematise sociotechnical entanglements – serving to render technologies, interests and agendas coextensive with socioeconomic conditions.

Expectations and Anticipation

A notable thread throughout this thesis, and a key aspect of the enactment of users in UCD, are innovation actors' implicit and explicit preoccupation with anticipating and managing future sociotechnical and economic arrangements. In this context I find the notion of user assemblage an especially useful device with which to understand how designers and users enact futures in the present. Examples of this, in this thesis, include how user-centered designers construct, contest and deploy visions of future health care delivery, physical fitness regimes, gendered management of digital media in the home, and local Indian ICT entrepreneurship, in the present. That is, it serves to sensitise my analysis to how user-centered designers and associated innovation actors routinely engage with futures – as performed, managed and contested. As Brown and Michael (2003: 4) point out, there is need for social scientists to engage with the future (rather than looking into the future) as an analytic object, which, until recently (e.g. Brown et al., 2000b), has been somewhat of a deficiency in ANT accounts of science and technology.

Analogous to the multiple path-dependencies and interests served by technologies, evidenced in post-Marxist studies of technology, are the manifold determinations and pathways served by users. Here, for example the assortment of users allied to the DEP, in chapter six, demonstrate the multiplicity of temporalities at play in prototyping a new technology. On the one hand, distal users serve to depict a particular future healthcare context for the technology; on the other hand, the designers and trial participants – as proximal users – configure the technology in relation to immediate practicalities such as

disciplinary preoccupations and organizational demands. In this way, user assemblages work in the modelling, intersection and alignment of multiple sociotechnical networks in the present that work to build on epistemological developments in HCI and align with corporate strategy, and thereby reconfigure future networks. Thus, the various combinations of users and prototypes in chapter six function to delineate multiple vectors of becoming, which work along dominant disciplinary and corporate lines, as well as creative lines, to affect obesity.

One temporal feature of the enactment of users is how they are occasioned over time. In chapter six, for example, I describe how the staging of the persona using the software program PowerPoint sequences the attributes of the user over time. This stands in contrast to the poster representation of the persona, where all its components are simultaneously on view. In that chapter I also describe the involvement of distal and proximal users during the development of the DEP. Associated with the prototype is the discursive construction of future users (users situated at a temporal distance to the practices of the designers and the prototype) in the present, as well as the mobilization of proximate users who resource the assembling and demonstrations of efficacy of the technology. Thus, the user assemblages associated with the DEP have temporal expressions (in the form of distal users), as well as the spatial organisation of practical contents (proximate users) in the present. The temporal extension of users, enacted in the present, is also a feature common to the other cases of this thesis – for example in chapter four I describe how aspects of user data derived from an interview were recombined to visualize prospective practices. This is one example of how designers routinely enact speculative reconfigurations of everyday practice – in this case as part of efforts to design a health maintenance technology that addresses calculations of risk associated with populations.

Another time-related feature of user assemblages is their role in what, after Henderson (1991: 455), might be called the directionality of design. In chapter five, I describe how the persona operates as a visual device to strengthen the reality of a technology and the technological conditions of the future. Furthermore, directionality towards the future also involves assumptions and expectations concerning scale. That is, how the individual user in the present stands in for, or helps in the modelling of prospective collectives of users, such as populations.

Frequently allied to the enactment of users in the design process is the practice of prototyping and vice versa. Accordingly, this thesis is littered with accounts of actual technologies in the making, where I have argued that prototyping is a material and semiotic form of experimentation, and where competencies and expectations are assembled in the present. To my mind this evokes Garfinkel's (1967b: 57) breaching experiments in which the background assumptions of people engaged in everyday situations, especially in relation to conversational processes, were subject to breakdown and disturbance. For Garfinkel,

breaching was a means to explore the fragility and maintenance of situated social order by bringing about disorder through 'deliberately modifying scenic events' (ibid.). Though, on occasion, prototypes also purposely breach situated social order, they act in a very different manner, not least through intervention in material, as well as semiotic in-situ processes. For Garfinkel, breaching acted to break down social order and disappoint people's normative expectations, which inevitably required some form of repair. Prototypes, on the other hand act to reconfigure social order in a constructive manner. They break open, rather than break down. They enthuse rather than disappoint. They enrol, mobilize and conscript heterogeneous allies as a means to strengthen the expectations they embody, and support the competencies they promote, rather than antagonize their users. Prototypes thus redefine expectations with concrete prospects of future relations in the present that require construction, not re-construction to pre-existing norms or relations.[102] In this way, user assemblages, entangled with prototypes, act as socio-material scripts for the future (cf. De Laat, 2000) – artefacts which in practice embody explicit technological promises and future trajectories. However, contrary to de Laat's assertion (ibid.: 200) that futurology is concerned with 'macro-evolutions', my study of UCD (viewed as a set of techniques for managing the future) demonstrates how users traverse macro and micro scales – across populations' and individuals' situated practices, for example. In the following section, I will expand on how users criss-cross and blur these conventional sociological registers.

On this note, users act as devices of and devices for persuasion. Proximal users, such as prototype trial participants and statistical representations of populations serve to persuade stakeholders about the effectiveness of a technology and its coupling with a prospective user group and market. Similarly, user representations were deployed in the conference as part of a pedagogical workshop to demonstrate the effectiveness of user-involvement in innovation, as well as to substantiate the value of the techniques of user-centered innovation in industry. Thus, users act not only to persuade stakeholders about the viability of particular sociotechnical futures, they also act to demonstrate the procedures and methods by which such futures might be attained, i.e. by involving and representing users.

In sum, UCD can be viewed as an increasingly advocated approach for managing innovation and future risk modelled around user assemblages. Furthermore, in its coupling with the mass production of silicon microprocessors within the context of a multinational corporation, this understanding can be nuanced as efforts towards structuring a technologically enhanced world that endures into diverse futures as knowable and material configurations in time and space (cf. Cooper, 2001b).

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[102] See (Mann et al., 2003; Crabtree, 2004) for alternative accounts, also drawing on ethnomethodology, of prototype technologies as experimental breaching devices.

Scale

Another important feature of user assemblages that has arisen out of my analysis is processes of scale. Historically, the social sciences have been engrossed with questions of scale, whether associated with a host of dualisms including the micro and macro, the local and global, the empirical and the theoretical. In such ways, scale conventionally addresses proportion (and its measurement), and also touches upon issues of temporality, which I have discussed in relation to user assemblages above. In my ethnographic study, and by virtue of being seen through the lens of the user assemblage, scale is not a given nor is it something to be disputed and corrected. Rather, scale was a practical preoccupation of my informants and was occasioned in practice, not least through concerns about 'silicon play'. This performative understanding of scale, as a practical, local and contingent accomplishment, addresses how different scalar modalities are produced by way of the routine activities of designers. As has become obvious, the concept of the user assemblage implies that the multiple doings of scale in design are, in part, enacted in relation to users. Accordingly, users themselves, enact different forms of scales.

In this light, individual and collective subjectivities co-function in user assemblages. That is to say, users simultaneously traverse the micro and macro, whether as visual representations or as embodied instruments for system evaluation. The re-assembling of the diabetic non-user is one example of how the medico-technological practices of a prospective population of people suffering from chronic disease can be speculated on, by way of the reconfiguration of individual and individuals' attributes. In the case of the DEP, scale is not concentrated around an individual user, but occasioned in various ways by way of multiple users. Thus, the expected population of people suffering from obesity is constructed from different degrees and scales of measurement, such as the construction and evaluation of field trial participants in association with the prototype student test-users producing data for the MSB. The reterritorialization of the persona as a soccer mom occasions an individual and a family unit, as well as a highly gendered consumer group. Moreover, my analysis of the persona also serves to show how user assemblages can also sit somewhere between the individual and the collective the human and the non-human, and the fictional and the real. This in-betweeness is the upshot of various processes of scale incorporated into the persona, which function by virtue of its ultimately fictional character. Likewise, my examination of ethno-users in chapter seven demonstrates how users can also mediate the particularities of practice, as well as abstracted socio-cultural concepts.

Users also performed scale to meet the changing demands of practical design work and its communication to audiences. This can be seen in how the ergonomic dimensions of adults and children were invoked during practical discussions in which the designers sought to

determine the physical dimensions of the kitchen media system, particularly in relation to the extent to which the wall mount allowed the screen to be moved. In contexts where the KMS was communicated to stakeholders, however, alignments between the market potential of the KMS and the capacity of housewives to manage domestic media were occasioned. In short, different contexts demanded different enactments of scale related to a given user representation. In a similar way, my analysis of EPIC 2006 demonstrates how users can mediate different modes of doing ethnography-in-design – i.e. as a resource for system design and building, as well as a means of sensitising peers and patron organisations to different socio-cultural realities. Both examples further demonstrate the analytic effectiveness of the notion of user assemblage and what makes the concept an empirical outcome. In each instance, the user assemblage occasions the formatting of different sociotechnical networks, whether in terms of the physical dimensions of a technology to meet the anatomical demands of bodies, the formatting of stakeholders' expectations by invoking the characteristics of a demographic category, or the prioritisation of different modes of reality. Using the terminology of assemblages, the different deployments of scale can be understood as different territorializations. On the one hand, users are deployed to deterritorialize how management, the corporation, strategic partners and peers view the future, by, for example, invoking inventive risk discourse to reconfigure the prospects of a particular health future. On the other hand, users are deployed to practically territorialize the feature set of a particular technology, as in the case of both the DEP and the KMS. That is to say, the properties of the users and the features of the technology both define the identity and capacity of one another. Thus, in practical design work, which includes both the building of technology and the dissemination of sociotechnical visions, user assemblages serve to territorialize the *machinic* practices of designers and the technical composition of technologies, as well as their *enunciatory* work in aligning others to their interests. Crucially, these two processes, the machinic and the enunciatory, often operate simultaneously across and in-between different scales in design practices. This can also be illustrated in reference to the KMS where the upshot of the debate between the design team about the role of the housewife in the family led to a particular view of interactivity, and how specific details of how the KMS user-interface worked to support the overall vision presented in the design team's PowerPoint presentations. An important point to make here, regarding the territorializations that users perform, is that they are not simple shifts from stability to instability, rather, they afford different modes of stability. To the design team and during *machinic* design practices, a persona might be contingent and open to change, and therefore act to deterritorialize the model of the user being developed, as well as the system requirements of the technology. To stakeholders, however, the persona formats – by *enunciation* – a relatively fixed set of alignments across multiple scales. An example of this is the PowerPoint outlining the designers' vision for the KMS. Here, the persona operates to format,

or territorialize, a particular future, whilst being deterritorialized during further practical design work. A further point to be made here is that the different configurations, or territorializations, of users are not successive or time ordered. Users' identities and capacities do not accumulate over time to a point at which they are complete.

Here, a related point can be made following my discussion of inventive risk discourse in chapter six. I am persuaded, drawing on Foucault (1998: 140), and Deleuze and Guattari's criticisms (1988: 531), that user assemblages commonly contain processes of *biopower* – prospective intervention and regulation of a given population, both human in terms of public health and longevity and non-human, in terms of mass produced commodities for example.[103] With the notion of inventive risk discourse I have tried to show how socio-material practices, such as the deployment of a health and fitness prototype, are entangled with discourse, where the technology is made accountable to corporate strategy, disciplinary agendas and broader policy. Such an understanding of design practice, as the prospective alignment of bodies and technology with political issues, broadly framed, and the agendas of commercial organisations and government, strikes me as an important topic to be developed in future research subsequent to this thesis.

Scaling might also be a way to think about how users co-exist with one another. In the cases of the kitchen technology and the fitness technology examined in this thesis, what is apparent is the way in which multiple users are entangled in the development of the technology. How, for example, users involved in the qualitative demonstration of the fitness prototype co-mingle with the students demonstrating the efficacy of the sensor board. These entanglements, where users are deployed to evaluate different aspects of the technology, demonstrate how scaling can work in terms of the entanglement of different user assemblages around a particular technology. In this case, and the others I have examined in this thesis, users occasioned in practice have a propensity for entanglement, where, for example, clearly incompatible epistemologies, such as local ethnographic insight and market generalisation, can co-exist. Here, I am thinking about the different modalities of ethno-users discussed in chapter seven.

The co-existence of users also brings to the fore the multiple units of measurement that are deployed as part of user assemblages. Although I have argued that scale refers to much more than linear scales of ordered magnitude, such measurements and ratios do operate and have efficacy as part of user assemblages, and vie with other enactments of description. One such example of this is the obesity related technology examined in chapter six. Here, different temporalities associated with various technological and social processes converge, including:

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[103] Foucault (1998: 139) distinguishes between *anatomo-politics* and *bio-politics* as two poles of the modern governance of life. The former refers to the disciplining and optimisation of docile bodies and the latter describes the regulation of populations. To be clear, the notion of the assemblage does not limit interactivity and users enactments to processes of control, power and resistance (Deleuze & Guattari, 1988: 531). See (Deleuze, 1995: 180) for a related discussion of 'control societies' in relation to the ICTs.

demographic projections operating in relation to qualitative data; microprocessor development schedules combined with obesity forecasts; the professional agendas and calendars of the HCI community; the daily routines of users, such as disease management and; the time-dependent measurement of sensor data. Such temporalities are at play and are incorporated into the timelines for constructing the various aspects of a prototype, which, themselves, are embedded within and emerge as part of corporate strategy and the dynamics of ICT markets.

Analogous to the scaling between individual and collective users – a prominent feature of UCD – are the extensions and magnifications entailed in prototyping. How, that is, prototypes signal mass production, distribution, marketing and publicity, retail, support and servicing, and so forth. This demonstrates how scale is not simply a ranked and ordered hierarchy in size but an increase in intensity, scope and disposition of technologies. The assumption of prototypes is that local changes to a singular technical object affect the prospective efficacy of commodities and services, such as interactive systems for consumers and patients. That is to say prototypes imply mass production, unit volume, and widespread service provision indicating a machinic scaling up. Following Cooper (1999: 115), the prototype can be understood as a copy awaiting the original. Like the repetition implied by the prototype the user assemblage also repeats. An example of this is the uptake of the Microsoft persona by my informants suggests a certain repeatability, or iterability, within the user assemblage where novel figurations of future sociotechnical practice are created through appropriation and transformation.

Related to economic, industrial and consumer scaling implicit in prototyping are the exaggerated beliefs of the designers in the efficacy of the final product to engender extensive social change. Such beliefs are prominent, for example, in efforts to change people's experience of managing a chronic disease for the better, in sociotechnical efforts to stem the impending obesity epidemic by consolidating families' media management into the routine activities of housewives, or by corporate ethnographers who engender a transformation in the corporate imagination through methodological innovation where users are figured as situated social actors. Thus, statements of social change enacted during the routine practice of user-centered designers enact a change themselves. Here, the expressive function of the user assemblage is at play. Such 'incorporeal transformations' (Deleuze & Guattari, 1988: 80) evoke performative understandings of language and its ability to bring about change.

On a practical level, user assemblages also function to enrol and align innovation actors and stakeholders to a given technological project and vision. The persona, for example, mediated the management of different viewpoints held by designers and engineers concerning the subjectivity of the housewife. The arrangement and ordering of post-it notes also demonstrates the situated micro-management of viewpoints and interests, where prospective

medico-technological networks were tentatively occasioned in the process of drawing together heterogeneous aspects of diabetes, including, but not limited to, practical, ergonomic, mechanical, and software-related associations. In addition, user assemblages also serve to conscript stakeholders both rhetorically and pragmatically to sociotechnical visions, underwritten by prospective microprocessor production. This includes corporate actors, such as Microsoft who would be expected to provision the operating system for the KWP, and government agencies such as the U.S. Department of Veterans Affairs, a key customer for medical technologies. As such, user assemblages mediate the linking up of all kinds of actors of various scales and diverse interests.

In these, and various other ways, users work across different scales, including quantitative systems of measurement, as well as qualitative degrees of relationality. In design practice, users emerge out of and format scales of time and space etc. This fact is both made expressible by the notion of user assemblage and, in a sense, forces the notion to exist. In other words, my study of users as they emerge and operate in design practice requires an adequate term to better understand the co-existence and dynamics of seemingly incommensurate logics of scale – something I believe the notion of user assemblage captures. In these various ways, this thesis begins to engage an emerging sociological interest in scale (e.g. Yaneva, 2005; Jensen, 2007; Latour, 2010).[104] The topic of scale is a potential research theme through which to develop analysis of UCD and users.[105]

Accountability

In chapter seven I examined how ethnographers working in industry, some of whom worked alongside my core group of informants, communicated accounts of their work to peers. On the one hand, in the setting of the conference, the ethnographers are staging accounts of people-as-users encountered in the field. On the other hand, the ethnographers were making accountable their work to an expert peer group. For Strathern, accountability is a key feature of interdisciplinary research, in which knowledge practices must be made 'visible and explicit' (2004: 70). Although such practices are explicitly addressed in chapter seven, the accounting practices of innovation actors, mediated by users, are also present throughout the thesis. Examples of such practices include the techniques employed by designers to make prospective users, such as housewives or those suffering from chronic diseases, accountable in the design of prototypes or the employment of test subjects to evaluate and demonstrate a technology, such as the activity recognition system discussed in chapter 6. As such, practices and technologies of accountability were manifestly present throughout the design processes I

[104] This topic was also the subject of a workshop entitled 'Scalography' held on the 8th July 2009 at the Saïd Business School, Oxford University.
[105] On a more reflexive note, my consideration of scale also raises the question of how this thesis scales up and in whose hands it finds itself and to what end.

studied, and not simply restricted to demonstrating value upwards within an ordered management hierarchy. Rather, accounting takes places in all manner of settings to all manner of involved parties who need to be accounted to, whether colleagues, peers, stakeholders, audiences, publics and so forth. Accordingly, a noteworthy feature of UCD is the role users play in practice of accountability.

In this light, a key aspect of users is how they operate as audit devices.[106] One example of this is how 'society' is drawn into the corporation via design endeavours mediated by users, whether through in-home interviews, the trialling of technologies, the assembly of personas or the study of people as socio-cultural-technical actors. Another example is how users serve to make explicit the work of designers and the value and efficacy of technologies, which can also be presented and assessed in the context of institutional and interdisciplinary settings, such as various the HCI forums. In UCD, users are held accountable by way of the methods used to construct them, but once constructed those representations become the means by which designers account for decisions about technologies, and account for their own continuing value to their employers and to expert HCI communities. As such, users make visible the work of designers across peers, including colleagues within workgroups and to management as well as to stakeholders, prospective consumers, and audiences in settings outside the organisation and the discipline.

Moreover, as a shared object of interdisciplinary work, so to speak, the user facilitates the reporting and monitoring of cross-disciplinary work. If the user is viewed as a dynamic assemblage, rather than a boundary object, its capacities are responsive to situated demands and requirements, which can be prioritised in various different ways. In chapter seven, for example, I examine how users mediate the different demands placed on ethnographers working in the ICT industry. Here, the user assemblage serves as a visible index of knowledge, work practices and technical efficacy – wherein the practical contents of ethnography-in-design and UCD are explicitly expressed. Last, but not least, users have also served in making my own work accountable, both in my capacity as a designer and as an ethnographer. On the one hand, the demands placed on me as an intern designer, whilst conducting the fieldwork informing this thesis, largely concerned my capacity to work with and on users. On the other hand, the analysis of users derived from data produced during my fieldwork has made my work, in the form of this thesis, accountable to my supervisors, examiners and readers.

UCD, User Assemblages and Inventive Practice

In sum, I have argued that the enactment of user assemblages in UCD brings into play practices of representation as performative, the socio-material management of expectations in

[106] See (Power, 1996, 1997; Strathern, 2000) for studies of practices of auditing and accounting as a key feature of contemporary institutional knowledge production.

the present, various means of occasioning and traversing scales, as well their pliability with regards to doing accountability. I have also described how aspects of these processes can, at times, be at play concurrently. Now, given this, there are a number of general implications for design practice, social theory and policy that I will outline here as a way of closing this thesis and opening up future research directions.

The open acknowledgement of non-humans in user-centered design processes as active actors that interweave, and emerge with the human, has underwritten this thesis. As designers tacitly appreciate, this is accomplished in practice, but is the exception rather than the rule within the mainly essentialist discourse of UCD and HCI more broadly. As I have argued, the discourse of user-centeredness still relies upon fixed and bounded categories, such as the human and the technological. Clearly, then, I am arguing that a change in how people-as-users are conceived and rhetorically enacted in the design process will contribute to a more nuanced reflection on practice. More importantly, however, I believe that the pre-disposition to view people as emergent socio-technical ensembles, and therefore as users that are assembled and synthesised in design, rather than advocating pre-existing human needs, will result in more effective and meaningful outcomes for the figuring of patients, families and domestic collectives, citizens or any of the sites in which UCD is exercised, for that matter. In this way, this thesis corroborates and builds on the four points Callon (2004: 8) details concerning the significance of 'hybrid collectives' (a notion somewhat similar to that of user assemblage) in participatory design. To re-iterate: (1) human agencies are formatted in design; (2) human agency is diverse and a consequence of particular sociotechnical orderings; (3) the practice of design means shaping human agency and not responding to it, and lastly; (4) discussions about agency must include an appreciation of the preceding, in order to responsibly define the (ethically) desirable type of human agency. That said, my use of the notion of assemblage suggests that it is not only human agencies that are territorialized in design. There are other (non-human) agencies that are acted upon, such as interactive services, organisational capacities and interrelationships and so forth. This, perhaps, is the crucial contribution of the notion of user assemblage: as a means to decentre the visions and practices of designers from a human-centered society.

Invoking Callon brings me to the contribution of this thesis to sociology and social theory. In this thesis, I have allied concepts and theories concerning multiplicity with the empirical techniques of ethnography, and brought these to bear on UCD, as practiced. That is to say, I have applied these concepts and theories to UCD as it is practiced as an agency formatting and world-building endeavour. In this regard, I contribute to growing studies of design, from STS and particularly ANT perspectives, which attend to practice. My contribution highlights the role of users as imbroglios of the human and non-human, as well as processes of becoming and emergence in design – figuring new material-semiotic agencies

and capabilities. Taken forward, I believe that what might be characterised as 'process theory', exemplified by the work of Deleuze and Guattari, Michel Serres, Alfred N. Whitehead as well as the work of feminist STS scholars (e.g. Haraway, 1996; Mol, 2003; Suchman, 2006), can be further worked with, and into, design practice and empirical accounts of design, as well as other substantive fields in which users feature. Furthermore, and as feminist scholars of technology assert, in their accounts of sociotechnical gendering, I foresee the notion of user assemblage being usefully applied to other sociological lacunae within user studies.

For the purposes of government policy, my ethnographic analysis points to the utility and effectiveness of user assemblages as instruments of tactical and strategic initiatives, where 'creativity' and 'innovation' are viewed as key. Much like the shift in corporate strategy of my host organization to a generalized, 'human-centered' approach to innovation, policy advisors are also re-imagining the social in terms of local settings and qualitative processes, as well as a demographic domain. In this context, it is no surprise that UCD and users are being deployed with increasing enthusiasm by think tanks, such as DEMOS (Wilkie & Michael, 2009), and how, somewhat diluted, user-centered approaches to design are being advocated and applied to strategic policy initiatives and front-line service provision. For example, the activities of service design consultancies (e.g. Parker & Heapy, 2006; Bradwell & Marr, 2008) and the UK Design Council (e.g. Cottam & Leadbeater, 2004; Cottam et al., 2004), working with local and national government, public sector agencies and NGOs in the UK. In this context, user assemblages can be understood as devices for the mixing and management of qualitative subjectivities and statistical collectives coupled with localised, national and global futures. In this new regime of 'social' design, for example, operations of scale, anticipation and accountability are particularly salient. Under detailed analysis, what I previously characterized, following Marres, as the regime of design marking contemporary western life, can be better grasped as a plurality of design *regimes,* in which different versions of the user are configured and deployed, affecting different sociotechnical articulations – UCD being a case in point.

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