# Practising tomorrows?

### Ubiquitous computing and the politics of anticipation

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A dissertation submitted to the University of Bristol in accordance with the requirements of the degree of Doctor of Philosophy in the Faculty of Social Sciences and Law

February, 2010

Word count: 79,760

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### Abstract

This thesis describes the ways in which technological futurity is a complex array of performative and proactive dispositions towards the future that are irreducible to normative and deterministic understandings of 'progress'. It takes ubiquitous computing as a significant case study because the future orientation practised in ubiquitous computing research and development is emblematic of the perpetual technological forecasting in which humanity engages. While ubiquitous computing has existed as an agenda for nearly 20 years it is still largely concerned with a future that has not (yet) been realised. In the context of ubiquitous computing this thesis argues that it is necessary to make the politics of anticipation, as the particular discursive and performative ways in which future-orientation is codified and conditioned, explicit in technology development. This thesis therefore enacts a critical framework that charts a discourse of anticipation, as the multiple means for articulating proactive future orientation, internal to which are anticipatory logics that structure and rationalise how such forms of futurity are practised. The motivation and ambit of this research is to thereby describe a politics of anticipation as the ways in which the anticipation of technological futures is codified and contested, whilst performative and multiple. Empirically, the argument is made through the discussion of interviews conducted with a range of internationally significant practitioners of ubiquitous computing research and development, which were carried out in Silicon Valley, California, in 2008. Attending to discourse, logics and emergent politics of anticipation provides a means of making explicit how our 'knowledge' of technological futures is produced. It is therefore argued that we should attend to socio-technical futurity as inherently situated in the living present, with all of its associated concerns, and allow for the indeterminacy of the future.

### **Acknowledgements**

Firstly, I would like to express my sincere thanks to my supervisors Dr J-D Dewsbury and Dr Mark Jackson. J-D was instrumental in arranging the funding that brought me into geography and had faith in my ability to pursue my own singular project. The introduction by J-D to a varied array of challenging and infectious forms of thought is a gift for which I am very grateful. Mark's calmness, thoughtful and incisive comments and good humour helped me keep my feet on the ground. This thesis would simply not have been possible without the support and dedicated guidance of these two people. Second, I am very grateful to Dr Maria Fannin and Prof. Paul Dourish, the examiners of this work, for an engaging and positive examination. Third, without the inspiration of Howard Rheingold I would not have taken the risk of embarking on the academic journey that I find myself upon, thank you Howard. Fourth, I would like to thank Alex Pang for expressing an early interest in my research and introducing me to so many interesting and useful people for my fieldwork. Fifth, the ideas that brought me to this project found their impetus in my undergraduate studies with Chris Speed, whom I would like to warmly thank for helping foster my interest. Sixth, I would like to formally thank the Economic and Social Research Council for their generous funding that made this research possible. Seventh, my thanks go to the participants in this research who inspired what is written here. This research is also haunted by the inspirational presence of Mark Weiser, 'Grandfather of ubiquitous computing', I would like to register my intellectual debt and thanks to him here, I am sure he is sadly missed.

Informally, I am really grateful for the camaraderie and friendship of my peers in the School of Geographical Sciences, especially: Aisling Gallagher, Charlie Rolfe, James Ash, James Clarke, Jose-Luis Romanillos, Julian Brigstocke, Paul Simpson, Richard Carter-White and Russell Prince. In particular the long and ambling debates conducted throughout the many public houses of Bristol with Charlie Rolfe, James Ash, Paul Simpson, Pepe Romanillos and others were immensely enjoyable. I would like to warmly thank the members of the University of Bristol cultural geography reading group who provided an intellectual 'hot house' that provided great stimulation, particularly Emma Roe and Keith Bassett. My thanks go to Prof. Jonathan Dovey for his encouragement in the latter part of this research. I am grateful to the international students involved in the Digital Cultures reading group at UWE for stimulating debate and great fun, particularly Bjarke Liboriussen, Hanna Wirman, Olli Leino and Marta Martín Núñez. My thanks also go to Rick Boehlke who kept me sane in California.

Finally, my thanks and love, as always, go to my parents Nick and Lesley, whose unflinching support gave me the belief to pursue my ambitions. And, thank you Kim, my wonderful girlfriend, for your love, your patience and your support.

This thesis is dedicated to the memory of my grandmother Audrey Joy Stanion, a joyous inspiration in my life.

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The future will be better tomorrow

Attributed to George W. Bush

### Prologue

Sal awakens; she smells coffee. A few minutes ago her alarm clock alerted by her restless rolling before waking had quietly asked, "Coffee?" and she had mumbled, "Yes." "Yes" and "no" are the only words it knows.

Sal looks out of her window at her neighbourhood. Sunlight and a fence are visible through one, and through the other she sees electronic trails that have been kept for her of neighbours coming and going during the early morning. Privacy conventions and practical data rates prevent displaying video footage, but time markers and electronic tracks on the neighbourhood map let Sal feel cozy in her street.

Glancing at the windows to her kids' rooms, she can see they got up 15 and 20 minutes ago and are already in the kitchen. Noticing she is up, they start making more noise.

At breakfast Sal reads the news. She still prefers the paper form, as do most people. She spots an interesting quote from a columnist in the business section. She wipes her pen over the newspaper's name, date, section and page number and then circles the quote. The pen sends a message to the paper, which transmits the quote to her office.

Electronic mail arrives from the company that made her electronic garage door opener. She had lost the instruction manual and asked them for help. They have sent her a new manual and also something unexpected – a way to find the old one. According to the note, she can press a code into the opener and the missing manual will find itself. In the garage, she tracks a beeping noise to where the oil-stained manual had fallen behind some boxes. Sure enough, there is the tiny tab the manufacturer had affixed to the cover to try to avoid E-mail requests like her own.

On the way to work Sal glances in the foreview mirror to check the traffic. She spots a slowdown ahead and also notices a side street the telltale green in the foreview of a food shop, and a new one at that. She decides to take the next exit and get a cup of coffee while avoiding the jam.

Once Sal arrives at work, the foreview helps her find a parking spot quickly. As she walks into the building, the machines in her office prepare to log her in but do not complete the sequence until she actually enters her office. On her way she stops by the offices of four or five colleagues to exchange greetings and news.

Sal glances out her windows: a gray day in Silicon Valley, 75 percent humidity and 40 percent chance of afternoon showers; meanwhile it has been quiet morning at the East Coast office. Usually the activity indicator shows at least one spontaneous urgent meeting by now. She chooses not to shift her work window on the home office back three ours – too much chance of being caught by surprise. But she knows others who do, usually people who never get a call from the East but just want to feel involved.

The telltale by the door that Sal programmed her first day on the job is blinking: fresh coffee. She heads for the coffee machine.

Coming back to her office, Sal picks up a tab and "waves" it to her friend Joe in the design group, with whom she is sharing a joint assignment. They are sharing a virtual office for a few weeks. The sharing can take many forms—in this case, the two have given each other access to their location detectors and to each others screen contents and location. Sal chooses to keep miniature versions of all Joe's tabs and pads in view and three-dimensionally correct in a little suite of tabs in the back corner of her desk. She can't see what anything says, but she feels more in touch with his work when noticing the displays change out of the corner of her eye, and she can easily enlarge anything if necessary. A blank tab on Sal's desk beeps and displays the word "Joe" on it. She picks it up and gestures with it towards her live board. Joe wants to discuss a document with her, and now it shoes up on the wall and she hears Joe's voice:

"I've been wrestling with this third paragraph all morning, and it still has the wrong tone. Would you mind reading it?

Sitting back and reading the paragraph, Sal wants to point to a word. She gestures again with the "Joe" tab onto a nearby tab and then uses a stylus to circle the word she wants:

"I think it's this term 'ubiquitous.' It's just not in common enough use and it makes the whole passage sound a little formal. Can we rephrase the sentence to get rid of it?"

"I'll try that. Say, by the way, Sal, did you ever hear from Mary Hausdorf?"

"No. Who's that?"

"You remember. She was at the meeting last week. She told me that she was going to get in touch with you."

Sal doesn't remember Mary, but she does vaguely remember the meeting. She quickly stats a search for the meetings held during the past two weeks with more than six people not previously in meetings with her and finds the one. The attendees' names pop up and she sees Mary.

As is common in meetings, Mary made some biographical information about herself available to the other attendees, and Sal sees some common background. She'll just send Mary a note and see what's up. Sal is glad Mary did not make the biography only available for the time of the meeting, as many people do...

'Sal's story' is an excerpt from Mark Weiser's 1991 article entitled 'A computer for the 21st century', which was published in *Scientific American*.



Figure 1.1: Ubiquitous computing research and development at the Xerox Palo Alto Research Centre, as depicted in Mark Weiser's 1991 article (Weiser, 1991, p. 67).

### Chapter 1

#### Futures of ubiquitous computing – yesterday's tomorrows?

'The best way to predict the future is to invent it' — Alan Kay, Senior Engineer Xerox PARC, 1971

#### 1.1 Introduction

In an influential *Scientific American* article Mark Weiser, then a Principal Scientist at Xerox Palo Alto Research Centre (PARC), elucidated his vision of 'ubiquitous computing' through the fictional world of 'Sal' (reproduced in the *Prologue*). As many have asserted (for example: Bell and Dourish, 2007b; Galloway, 2004), Weiser's depiction of computer use 'beyond the desktop' and as a 'part of the woodwork' spawned the research arena of ubiquitous computing (frequently abbreviated to 'ubicomp'). Mark Weiser's use of the fictional story of 'Sal' to explicate the potential future of 'ubiquitous computing' is emblematic of the imaginative future orientation inherent to technology development. It is, however, difficult to specify exactly what is variously meant by the now widespread term 'ubicomp'. As anthropologist Genevieve Bell and computer scientist Paul Dourish (2007b) note in the abstract to a paper from which I derive the title of this chapter:

Ubiquitous computing is unusual amongst technological research arenas. Most areas of computer science research... are defined largely by technical problems, and driven by building upon and elaborating a body of past results. Ubiquitous computing, by contrast, encompasses a wide range of disparate technological areas brought together by a focus upon a vision (Bell and Dourish, 2007b, p. 133).

Visions of the future are integral to our understanding of computing technologies. One need only look to the depictions of a world pervaded with technologies that recognise individuals and personalise interactions or afford detailed and apparently limitless information about any matter of interest for the protagonists in science fiction films to see the influence of how computing is and has been envisaged. This has material influence, a plethora of devices and systems now litter our homes and offices, and increasingly our pockets. The 'useful fictions' of the future visions that underwrite computing research and development play a significant role. Imaginative representations of the future may purport to elucidate futures but they also speak significantly about the present in which they are created. Expressions of the future are shaped by, and in turn shape, the present in which they are performed either as contemporary speculation or as historical artefact.

The central concern of this research is the inherent futurity mobilised in technology research and development (R&D). In particular, this research examines the forms and techniques of future thinking practised in ubicomp R&D as a proactive discourse of future orientation, which I describe as a discourse of anticipation. The two principal research questions to be addressed in this work are accordingly: how are forms of futurity produced, normalised and contested? And: how are the anticipated futures of ubicomp located in relation to the present? This research is important on two counts. First, anticipatory action is a key means by which technological experience is constituted. This thesis cuts through the veil of meta-narratives such as technological determinism to address the forms of future orientation specific to ubicomp R&D. Second, futurity arises in relations between communities of practice that seek to develop novel forms of technological experience.

The contribution of this thesis is to explain the ways in which technological futurity is a complex array of performative and proactive dispositions towards the future that are irreducible to normative and deterministic understandings of 'progress'. Ubicomp is an important case study because, while it has existed as an agenda for nearly 20 years, it is still largely concerned with a future that has not (yet) been realised. It is a manifest force in R&D despite the fact that it is still very much perpetually deferred or, in a sense, promissory. The future orientation practised in ubicomp is emblematic of the perpetual technological forecasting in which humanity engages. Ubicomp R&D touches many disciplines and spans a wide range of socio-technical research activities. Ubicomp also illustrates the types of normative assumptions that are made about how a technological future is formed. For example, the narratives of constant technological advancement and linear progress structure moral, technocratic, policy and governmental proscriptions. Articulating the messiness and ambiguity of how technological futures are imagined and deferred is key to understanding our immersion within these political and governmental rationales and being self-conscious about how our knowledges are produced.

To reflect on the futures anticipated for computing in the recent past, a history of computing must necessarily be understood, at least in part, as a history of spaces that were never created – a history of 'yesterday's tomorrows' (see: Bell and Dourish, 2007b; Bleecker, 2009). Projects inspired by such visions command impressive amounts of funding internationally and feature as a part of high-level governmental and international strategy, not least in the UK and the EU. This thesis offers conceptual resources for articulating the politics of the multiple and contested forms of future orientation practised in the development of technologies. A critical politics of anticipation concerns the emergent systems of control that are exercised in the varied and contested action and underlying logics of anticipation. Attending to this provides a means of making explicit how our 'knowledge' of technological futures is produced.

In this thesis I construct a critical framework for analysing the range of discursive and performative practices through which futures of ubicomp are formulated. In the context of ubicomp I argue that a proactive form of addressing the future can be identified as a discourse of anticipation, which in turn carries political implications. I therefore provide a means of articulating the implications of the varied and sometimes contested rationales and techniques for anticipating technological futures in contemporary research and development. Through this research, I suggest it is necessary to make the politics of anticipation, as the particular discursive and performative ways in which future-orientation is codified and conditioned, explicit in technology development. This thesis argues that we should thus attend to sociotechnical futurity as inherently situated in the living present, with all of its associated concerns, and allow for the indeterminacy of the future.

The empirical basis of this thesis is a set of interviews conducted during July and August 2008 in Silicon Valley, California, with a range of people involved in the research and development of ubiquitous computing. The Palo Alto Research Centre (PARC), as the originating institution of Weiser's ubicomp research, and the network of other research institutions in Silicon Valley made the San Francisco Bay area a logical focus for fieldwork. The field of people interviewed was narrowed by the focus on Silicon Valley, however a range of experts intimately involved in various forms of academic and commercial R&D were interviewed (see Appendix 1). Interviews were conducted with research experts in academia & private consultancy and employees of industrial research laboratories of technology corporations. The companies and individuals approached for interviews are the principal commercial research institutions for ubiquitous computing research and development, globally, with significant centres of research in Silicon Valley. Fuji Xerox, HP Labs, Intel, Nokia, PARC and Yahoo Research in particular maintain a significant research presence in Silicon Valley<sup>1</sup>. These institutions formed the main focus of study, for they support some of the most accomplished practitioners of such research. Amongst the informants interviewed for this research are the Conference Chair of the 'Ubicomp' international conference, several entrepreneurs engaged in ubicomp-related technology development and many senior researchers leading contemporary ubicomp R&D, both academically and commercially. The interviews addressed how the future is conceptualised in ubiquitous computing research and development and the practices and rationales for anticipation employed by those

<sup>&</sup>lt;sup>1</sup> See Appendix 2 for a description of the key companies explored in this research.

involved. This fieldwork explicitly opens up ubiquitous computing to enquiry as a relatively unexplored arena of geographical investigation and will be discussed in depth in the second chapter.

This chapter sketches the discursive terrain of ubicomp, with the aim not to provide a discursive archaeology of the extraordinary variety of meanings associated with the terms 'ubiquitous computing' or 'ubicomp', but to give insights pertinent to the investigation of how futurity is mobilised in such work. The account I provide necessarily leaves things out, for ubicomp-related research spans five peer-reviewed journals, four professional conferences, both academic and industrial research laboratories and many millions of pounds in research funding. In the second section of this chapter I broadly discuss ubicomp, identifying prominent discursive characteristics focussing upon key thematic landmarks by the various ways in which the 'near futures' of ubicomp are evoked. In the third section of this chapter I chart four particular ways that I suggest are commonly used to navigate the discursive terrain of ubicomp,. In the fourth section of this chapter I map out the means of future orientation that are common to the ways ubicomp is navigated and set up a means to plot a route for opening out the questions raised in the fifth section. Accordingly, and by way of a conclusion to this chapter, I will outline the structure of this thesis to demonstrate how this project moves theoretically and empirically to address the anticipatory knowledge practices of ubiquitous computing.

#### 1.2 Computing people, places and things

'The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it' (Weiser, 1991, p. 66).

"The goal is to achieve the most effective kind of technology, that which is essentially invisible to the user... I call this future world "Ubiquitous Computing" (Ubicomp) ' (Weiser, 1993a, p. 75).

In the last 20 years the idea of ubiquitous computing has been reiterated, revised and extraordinarily expanded. Starting from the premise that computing might be un-tethered from the grey boxes that sit on desks and become 'embedded in the woodwork' of everyday life, 'ubicomp' has come to signify research agendas, an eponymous conference, technical goals, an ethos and a legacy. This thesis focuses upon the future orientation inherent to all of the threads that weave together to form ubicomp. From the outset the details of ubicomp have been positioned in the future. Weiser's 'Computer for the 21st Century' popularised a research agenda in the guise of a vision that many subsequently adopted. Yet the article was doubly influential because, as Bell and Dourish (2007b, p. 133) observe, 'it also set a rhetorical tone that many have adopted'. Therefore the same concern for near futures is present in contemporary ubicomp agendas, the papers presented in conferences, and the ways in which 'advances' in the field are measured.

There are a number of common threads to the various applications of 'ubicomp' as a descriptor for research activity. These themes all somewhat branch from the first and most obvious implication of calling it 'ubiquitous'. It is worth situating the concept in its initial time-space, for when Weiser and his colleagues were experimentally developing the projects that came to make up the ubicomp project there were few affordable personal computers, no 'World Wide Web' and mobile telephones could barely fit into a handbag let alone a pocket. The initial experimental systems created as 'ubi-comp' at Xerox PARC under Weiser's leadership were fixed at three scales of device, called 'tabs', 'pads' and 'boards'. As Dourish observes, ubicomp proceeded on three tracks, which 'were known as computation by the inch, the foot and the yard' (Dourish, 2004b, p. 30), referring to the three types of device. Inch-scale 'tabs' were something akin to 'computationally enhanced Post-It Notes' (ibid.p. 30), foot-scale 'pads' were designed as what might now be recognised as 'tablet PCs', and yard-scale boards were epitomised by 'LiveBoard': 'a large-scale display... supporting multiple pens, a sort of computationally enhanced whiteboard' (ibid. p. 32). Of course these things were not supposed to exist in isolation, tabs, pads and boards were supposed to be prolific in number and scattered throughout the everyday environment:

'In the everyday environment, information continually undergoes transformations and translations, and we should expect the same in a computationally enhanced version of that environment such as might be delivered to us by ubiquitous computing' (Dourish, 2004b, p. 33).

As a descriptor for various research agendas and as a means of articulating more broadly ideas about the permeation of everyday lives and environments, 'ubicomp' has been taken up by academics, industrial researchers, technology enthusiasts, artists and cultural commentators. The growth and variety of meaning ascribed to the signifier 'ubicomp' leaves a quandary – for the terminology has outgrown the initial definitions by Weiser and his colleagues. This is perhaps understandable, for a lot of time has passed and research completed since the late 1980s. On the other hand, many people might be talking at crossed purposes. Does an 'electrical engineer' working on 'wideband power line positioning for indoor localisation' actually mean the same thing when calling their work 'ubicomp' as a Professor in a 'School of Information Technologies' investigating the privacy implications of 'ubiquitous personalised applications'? Such questions are further complicated when one attempts to list the terms for synonymous and directly related technology applications, services, research and theory objects, for example:

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ambient computing, ambient intelligence, augmented reality, blended realities, calm technology, geospatial web, harmonious interaction, internet of things, mixed reality, near field communication, pervasive computing, physical computing, radio frequency identification, seamless/seamful computing, tangible media, wearable computing...

'Ubicomp' might then be seen as so broad in definition that it is too vague. However, it may also be seen as an apparent, and perhaps understandable, desire to reduce a variety of complicated practices to a single object. In a 2006 keynote presentation at the Ubicomp conference, science fiction author Bruce Sterling stated that the reason ubiquitous computing appealed to him was due to 'the majesty of the ideas and the lyricism of the language'. It is perhaps this broadness of implication, the 'majesty' of which Sterling talks, and the 'lyricism' with which they are described that allows the diversity of disciplinary interfaces between researchers and between academia, government and industry under one term: 'ubiquitous computing'. In the next section I chart four particular themes in the discourse of ubicomp to draw out key analytic avenues. Before moving on I want to spend the remains of this section elaborating, from the theme of 'disappearance', a map of some common characteristics that loosely bind together the heterogeneous community of research and development I have thus far described.

Nearly 20 years on from Weiser's *Scientific American* article the 'ubiquity' denoted in ubicomp has taken on some particular meanings. The 'ubiquitous' nature of ubicomp, from its inception, was envisaged as the 'disappearance' of computing. The underlying premise of ubiquitous computing research was to think beyond universal devices such as the personal computer and to make computing technologies 'disappear': 'A good tool is an invisible tool. By invisible, I mean that the tool does not intrude on your consciousness; you focus on the task, not the tool' (Weiser, 1993b, p. 7)<sup>2</sup>.

As opposed to 'virtual reality' technologies, which dominated technological futurism in the 1990s, ubiquitous computing was meant to 'go beyond the machine – render it invisible' (Galloway, 2004, p. 387). Rather than requiring the (human) user to adapt to the computer, and its peculiar multi-purpose means of interaction, one of the central aims of ubiquitous computing research is for the development of computers to adapt to the users. To perform such a 'disappearance' of technology, it has been suggested by Cognitive Scientist Don Norman that 'it is time to make technology conform to the needs of people' (Norman, 1998, p. 261). In other words, to bring about useful and ubiquitous computing techniques, the devices must be conveniently at-hand and not demand special effort to utilise them. More broadly the themes of ubiquity and disappearance feature alongside what has become a normative understanding of an increasing abundance, distribution and, more recently, mobility of computing technologies in the everyday environment.

To 'disappear' into the everyday environment does not necessarily mean hidden from view. In the work of sociologist, and collaborator with Weiser at PARC, Lucy Suchman<sup>3</sup> (1987), we can see how a turn towards ethnomethodology by researchers in Human-Computer Interaction (HCI) and an exploration of philosopher Martin

<sup>&</sup>lt;sup>2</sup> Weiser goes on to say: 'Eyeglasses are a good tool – you look at the world, not the eyeglasses' (Weiser, 1993b, p. 7). However, this invisibility does not mean, of course, that the 'tool' has no effect on shaping your view of the world. Eyeglasses may have material transparency but they retain agency. As Ludwig Wittgenstein (1999, p. 45) suggests, for metaphorical purposes, we become so used to the glasses 'on our nose' that it does not occur to us to take them off. Nevertheless, the experience of the world we ascertain in concert with the glasses is qualitatively different. As Weiser goes on to suggest, alluding to Heidegger (1993) and Polanyi (1966), technology disappears in its use because you are accustomed to how you experience the world with it. <sup>3</sup> Lucy Suchman was another former Xerox PARC colleague of Weiser and has been credited with having

provided Weiser with a methodological and philosophical impetus for the idea of 'disappearance'. In particular, Suchman utilises Hubert Dreyfus' reading of Heidegger's early work (especially Dreyfus, 1991).

Heidegger's phenomenology (by Suchman in particular) led to a more nuanced conceptualisation of 'disappearance' (for detailed discussion of this phenomenological turn in HCI see: Dourish, 2004b). In her own work, contemporary to the beginnings of ubicomp, Suchman draws on Heidegger's concept of the 'ready-to-hand' as the mechanism by which equipment disappears (see: Suchman, 1985, pp. 53-54). The disappearance of technology can accordingly be drawn between Heidegger's (1977, 1993) distinction between that which is 'ready-to-hand', such as a hammer that is used as if without thought – we simply think in terms of the action of hammering, and what is 'present-at-hand', those things one must actively think about to engage with (such as when something breaks), that stand apart from what might usefully be employed:

'Just as a good, well-balanced hammer "disappears" in the hands of a carpenter and allows him to concentrate on the big picture, we hope that computers can participate in a similar magic disappearing act' (Weiser et al., 1999, p. 695).

As with other 'equipment' (following the definition formulated by Heidegger, 1993), computing devices supplement the body and are thus manipulable. Thus in our use of equipment 'when action is proceeding smoothly it is essentially transparent to us' (Suchman, 1987, p. 53): 'When we are using equipment it has a tendency to "disappear"' (Dreyfus, 1991, p. 65).

What were commonly called 'computers' at the turn of the 21st century were still rather large, relative to a human adult body, and expensive, relative to the average salary, yet the number of devices that we could reasonably call a computer was rapidly increasing. A popular understanding of an abundance of computing might be argued to stem from the popularisation of 'Moore's Law', Intel co-founder Gordon Moore's prediction that the complexity and performance of a computer chip at minimum cost would double every two years (Moore, 1965). As Weiser's PARC colleague Rich Gold (2007) points out, the constitutive nature of this apparently self-fulfilling prophecy acts at the foundation for other assumptions and thus technology developers took 'Moore's Law' to be true and started assuming it to be fact. Accordingly computing components were proliferated throughout other types of product. The success of assuming the veracity of such expectations has thus arguably become a 'normal' part of attitudes towards 'progress' in the development of computing technology. Adam Greenfield (2006) demonstrates this readiness to assume an ongoing advancement when he anticipates the impact of ubicomp:

'Ever more pervasive, ever harder to perceive... Such ubiquitous information technology... will appear in many different contexts and take a wide variety of forms, but will affect almost every one of us, whether we're aware of it or not' (Greenfield, 2006, p. 9).

As Greenfield hints, another aspect of the 'ubiquity' designed in and for ubicomp is the idea that computing technologies can/will be 'aware' of, blend into and even support many different contexts of use. 'Context awareness', as it is referred to in ubicomp literature, is another general premise of ubicomp research. Weiser (1993a) cites Suchman's work (1985) as an example of addressing how computing might support 'situated actions' (Suchman, 1987), by which Weiser meant how 'computer systems should respond to the settings within which they are used' (Dourish, 2004a, p. 20). The 'context' most frequently alluded to when context-aware computing is broached is that of location and indeed a whole host of 'locative' computing applications have emerged with the advent of mobile telephones with inbuilt access to the satellite-based Global Positioning System (for example, see: O'Grady et al., 2006; Varshavsky and Patel, 2010). Thinking more broadly to types of human activity or scenarios of use, Dourish has adeptly problematised the notion of context:

'if we take "ubiquitous computing" seriously, then we should be applying its ideas ubiquitously, not just in the relatively narrow areas of interaction with handheld and embedded devices... [Context] is not an aspect of how the technology is designed, but rather is an aspect of how that technology is used and incorporated into practices' (Dourish, 2004a, p. 29).

Finally, if (as already described) there are lots of synonyms and similar terms for the (academic and industrial) research investigated in this project – why is the term ubiquitous computing/ubicomp specifically used in this thesis? The reasoning employed here can be explained in two points: the first is the breadth of usage of the term, and second the heritage of the term. I want to begin to draw on the interviews conducted for this research to exemplify these points. The heritage of the term is expressed as a key influence by an expert informant of this research, the co-founder of a ubicomprelated start-up company 'ThingM' Mike Kuniavsky:

'Basically I use... ubiquitous computing as the um, the oldest term for these sort of ideas, and I use it for that reason. Because I think that... it's a distraction to make these kind of ... I guess it would be syntactical ah, distinctions rather than genuinely semantic ones...' (Mike Kuniavsky, ThingM).

The interviewee Mike Kuniavsky's view is emblematic of the agency the heritage of Weiser's work lends to the terminology. Other interviewees expressed similar sentiments, which were often explicitly in relation to Weiser as a form of figurehead, see the quotes below. The research conducted by Weiser and his colleagues at PARC led to ubicomp becoming a 'new field of computer science' (Weiser et al., 1999, p. 694), with an eponymous annual international conference convened by the Association of Computing Machinery and several journals using the terminology in their titles. To further explain the choice of terminology I want to close this section with some abridged quotes taken from the interviews conducted for this thesis with ubicomp researchers in Silicon Valley California (July-August 2008). I have drawn out five particular themes from the answers given to the question: 'What do you believe ubicomp means?'<sup>4</sup> These themes are: a complex of devices & systems, information environments, invisible technologies, supporting human activity, and Mark Weiser's definition of ubicomp. Across the gamut of responses to this query, I believe it is possible to see the breadth of interpretation of the term 'ubicomp', the persistent influence of Weiser's work, and the common threads of disappearance and context-awareness (as discussed above).

<sup>&</sup>lt;sup>4</sup> This question was not asked in a uniform or specific way but rather in a number of ways, thus the wording of the question articulated here is only indicative. See Chapter 2 for more on the methods used.

First, and in common with Weiser's description of the world in which 'Sal' lives, many researchers consider ubicomp to be the production and proliferation of a complex of devices and systems. In this way, ubicomp does not mean a future in which we carry around one 'ubiquitous' device but rather that we have many, as, senior researcher at Yahoo Research, Elizabeth Churchill puts it:

'I think at its blandest level, it [ubicomp] is just um, you know, computational artefacts in a physical world, whether they are, you know, physically in space or whether they're kind of personal artefacts that you carry around which means, kind of, computing power wherever you are, whenever you want it...' (Elizabeth Churchill, Yahoo Research, Santa Clara).

There is an abstraction away from 'the computer' as a type of device to 'computing' as a capacity that can be drawn upon or exhibited by particular forms of equipment. The desktop computer thus ceases to be a dominant model for the material form of computing. Several interviewees explained ubicomp in terms of this development away from the single desktop computer performing all forms of 'computation', as succinctly demonstrated by Jen King (expert in law concerning privacy and technology use, specialising in mobile technologies):

'It's definitely the movement away from the kind of desktop computing metaphor to a world in which computing power is, you know, possibly embedded in all sorts of everyday objects, that's how I think of it' (Jen King, University of California Berkeley Law School).

Whereas the desktop computer was a device which specified a location and means for doing all of the tasks that computing enables, many of the ways that ubicomp is anticipated feature an 'ecosystem' of devices and systems. Accordingly, there is an anticipated move away from general purpose computers towards specific forms of computing capability invested in particular devices, as Mike Kuniavsky suggests:

'the way that I define it [ubicomp] is [...] the larger set of ideas about the fragmentation of information processing from these monolithic general purpose devices to a broad range of ah... a broad range of specialised devices' (Mike Kuniavsky, ThingM).

This is, of course, not a shift away from computing per se, but a proliferation of devices and systems that enable access to computation in a variety of ways. The underlying grammar of computation therefore remains.

Second, some researchers shift the focus from devices to the general environment to envisage ubicomp. Accordingly, rather than thinking about computing as a capacity of a multiplicity of devices, the capacity of ubiquitous computing in general is ascribed to an environment. This is partly figured as the 'context awareness' that Weiser describes in the fictional world of Sal, what Bo Begole, senior researcher at PARC, calls 'information environments':

'[T]echnologies that let people exist in an information environment rather than thinking about controlling a device, which is more what personal computing, or mainframe computing are about, they're about controlling this computer device... and I actually think ubiquitous computing as a label implies that, so its in some ways its an unfortunate label. Because it suggests that what a person is doing is computing, and that's not what people are doing, they're doing whatever it is they're trying... to accomplish and they happen to use computers along the way' (Bo Begole, PARC).

This is figured as a reciprocal relationship, not only as the technology being 'aware' of the environment but also to consider how the environment relates to the technology. Ubicomp is therefore, in this sense, not reducible to a suite of mobile devices, as entrepreneur Ryan Aipperspach suggests, it is:

'technology that integrates more deeply into the everyday environment, and so... a lot of that up until this point has been the design of mobile devices and sensing devices... technology that is aware of the environment and who's around in it, but I think that the other half of that is actually considering how the environment relates back to that technology, which I think is as much a part of the field as the technology side of things' (Ryan Aipperspach, entrepreneur and former researcher at Intel Research Berkeley).

The consideration of this reciprocal relationship between technology and environment, with a view to developing forms of 'information environment', has led to an increase in inter-disciplinary forms of ubicomp-related research. This increasing inter-disciplinarity has led to the introduction of ethnographic research techniques and engagement with philosophies of technology use (for detailed discussion see: Dourish, 2004b). A third way that ubicomp has been conceptualised is to focus much more upon the human activities that the technologies are designed to support. Rather than assume the material format of the computer, researchers might study the types of activities that they would like the technology to support. The study of human activities and the ways in which technologies can support them, has become a significant part of ubicomp R&D, especially given the variety of technologies implicated in such research. As interviewee Scott Carter, senior researcher at Fuji-Xerox Palo Alto Laboratories (FX PAL), observed:

'[W]hereas in the past you might have started with the notion, sort of, the archaic notion of the computer box, if you were doing computer science that's what you'd start with, with ubicomp you start more with the activity... how can I support this activity and that support might come in the form of just a website, a typical desktop application, or a more mobile application or a sensor with no interface, umm, or interfaces that are basically synchronous and distributed from sensors...' (Scott Carter, FX PAL).

For some researchers this does not mean a 'disappearing' computer, it means calling the technology to the attention of users in particular ways that lend material agency to information, as Elizabeth Churchill, senior researcher at Yahoo Research, suggests:

'I think there's a whole other part of the original agenda, which is around what became, you know, the disappearing computer or calm technology or computation in the background and while I think that's a laudable goal, a lot of my work has been about... working with people to surface information in such a way that its actually usable but also configurable or interpretable in different ways, and so my interest is really about information flows, between artefacts and people, and its, sort of, broadly speaking, kind of socio-technical systems where any individual is part of an information system, um, and ubiquitous computing technologies, i.e. embedded computing, in social physical environments, is a part of that sort of overall system' (Elizabeth Churchill, Yahoo Research, Santa Clara).

Fourth, and in relation to the previous point, some researchers discuss ubicomp in terms of the ideas of the 'disappearance' or 'invisibility' of technology. For some this may be a glib understanding of the progressive miniaturisation of technology 'out of sight' but for others, including Weiser — as discussed above, this means the shrinking from conscious awareness. The negotiation of the differences in understanding here is one of the areas in which the political critique of this thesis takes hold, as I discuss in section 1.4. Invisible or ubiquitous computing is, in a sense, 'ready-to-hand', as interviewee [anonymised], former researcher at Intel Research Berkeley, explains:

'[I]t's the embedding of computers... invisibly into the fabric of everyday life. But, unlike a lot of the people who tend to see invisibility who tend to see invisibility as a material attribute of the technology, like if its really small it must be invisible... I tend to see invisibility as a kind of practice-based attribute. So it doesn't matter how small something is, if it screws up all the time and you notice it a lot its not ubiquitous... or if it's a special prototype and you have to take a lot of care of it, but that's a kind of idealised definition. In reality, I'll go along with the idea that... anything that's... more... body-worn, integrated in with architecture, or um, kind of tangibly interacted with, and not say, windows, pointer interacted with, is ubiquitous technology' ([anonymised], former researcher at Intel Research Berkeley).

Fifth, and as a final point, the legacy of Weiser's 'vision' for ubicomp remains prevalent in the understanding of the term described by those involved in R&D. For example, for some Weiser's staging of ubicomp as another 'phase', or the next 'paradigm', of computing holds true. Interviewee Jo McCarthy, Conference Chair of Ubicomp 2003 international conference and senior researcher in mobile technology R&D at Strands Lab, enthusiastically evoked this vision of 'waves' or 'paradigms' of computing:

'I very much buy into Mark Weiser's original vision about the waves of computing, uh, there was a mainframe era, the PC era, and there we're moving off the desktop and I would even say, off the laptop, because to me laptops are a minor perturbation, but as we move into more of the mobile era, and, ah, being able to situate giving new contexts, ah, I think we're just starting to scratch the surface of, ah, what might be possible' (Jo McCarthy, Strands Lab).

For some researchers it is perhaps the 'lyricism', following Bruce Sterling, of Weiser's 'visionary' agenda that expresses the sentiment of their research ethos. Interviewee Raphael Ballagas, senior researcher at Nokia Research Centre, expressed an admiration for Weiser's turn of phrase in the evocation of his research vision:

'[A] lot of people fall back to Mark Weiser's original vision of ubiquitous computing but I specifically like a particular phrasing of one of his descriptions where he says ah, ubiquitous computing is where communication technology blends into the fabric of our everyday lives, and I think that really catches the essence of what ubicomp means for me, so where there's this almost seamless

interplay between, you know, employing technologies to ah, communicate with others or to manage our everyday lives' (Raphael Ballagas, Nokia Research Centre, Palo Alto).

However, there is a risk that invoking Weiser as the authority, for some the 'godfather', for a normative agenda becomes oppressive and reduces the potential to say anything 'new'. As such the term itself becomes slippery. This was clearly expressed by interviewee Mirjana Spasojevic, former HP Labs researcher and senior researcher at Nokia Research Centre:

'[U]bicomp, in my mind, has the routes in the community that was... well, in the 90s working on handheld devices and sensors and it was a mix of ah, systems community and kind of HCI community... many people have positioned ubicomp as something that comes after mobility... so you know, we're in the mobile era but we'll get to the ubicomp era. Um... but somehow that doesn't fit it either, I mean there is the... Mark Weiser's paper which ah... one, these days, almost gets annoyed with how often it gets quoted, you know, it's the first sentence of each paper I review... like – yes [in begrudging voice], yes that's disappearing technologies and all of that... but I think the reality is slightly different' (Mirjana Spasojevic, Nokia Research Centre, Palo Alto).

As Spasojevic suggests, the invocation of Weiser's research has become a shorthand for referring to a particular normative route for research, which does not always pay head to the changing nature of the broader research agenda. Just as any other research agenda then, ubicomp is frequently seen in combination with other ideas, which is made evident by one of Weiser's former colleagues, interviewee Maribeth Back:

'I do use the label ubicomp, I do think it's a huge label. Um, I am also working in other fields now that I refer to as mixed reality, augmented reality, virtual worlds, virtual environments, I sort of think of them as a continuum, starting um, with ubicomp on one end perhaps and virtual environments on the other end, and there's all manner of systems and things in-between. And it's probably not just a single continuum it's probably a, you know, multidimensional space. I do think of a lot of, um, what I do as ubicomp, um, I was at PARC working in a Weiser's group in the 90s and, er, that was where we really sort of, a lot of the work we were doing there came out of his, you know, calm computing idea' (Maribeth Back, FX PAL).

'Ubicomp' has a peculiar agency as a means of describing particular types of future orientation towards as-yet un-actualised forms of technological encounter. The openness to interpretation of Weiser's work and the subsequent invocations of his vision marks out ubicomp as a significant addition to the ways in which we imagine technological experience.

Given the variety of the ways of understanding ubicomp, it seems reasonable to ask: how does one summarise the background to a research project when it makes up an entire agenda, or research ethos, in a different discipline? As Adam Greenfield states at the start of his book 'Everyware': 'There are many ubiquitous computings' (Greenfield, 2006, p. 11). To address this issue, and to lay out a basis from which discussion of ubicomp can proceed, in the next section I pursue four ways of mapping the relationships and meanings that constitute what is variously meant by the term 'ubicomp'.

#### 1.3 Four ways of addressing ubicomp

The 'many ubiquitous computings' (Greenfield, 2006, p. 11) are significant in number. Ubicomp carries an extensive implication of activities and agendas, there is a plethora of research that doesn't use the label but might be recognised as ubicomp and there are a wide range of companies, academic institutions and individuals engaging in research. In this section I further address the means by which ubicomp has been navigated as a discourse to enable me to set up the substantive questions this thesis will address, in subsequent sections. There are four particular ways I chart through the discourse of ubicomp, which are and have been at work concurrently: Mark Weiser's legacy, contemporary industrial research practices of ubicomp, the (multiple) naming of research agendas, and social sciences investigations into ubicomp and related technologies.

#### 1.3.1 Mark Weiser's story and legacy

2009 marked the tenth anniversary of the death of Mark Weiser, a man that many believe earned the title 'visionary'. As a Principal Scientist and subsequently Chief Technology Officer at Xerox PARC, Weiser has been identified as the 'godfather' of ubiquitous computing. In the years since his demise many of the ideas that Weiser championed have come to greater prominence. As Yvonne Rogers (2006) points out this influence has been felt across industry, government and commercial research, from the European Union's 'disappearing computer' initiative to MIT's 'Oxygen', HP's 'CoolTown' and Philips 'Vision of the Future'. All of these projects aspired to Weiser's tenet of the everyday environment and the objects within being embedded with computational capacities such that they might bend to our (human) will. Within the research community, as Bell and Dourish (2007b, p. 134) remark 'almost one quarter of all the papers published in the 'Ubicomp' conference between 2001 and 2005 cite Weiser's foundational articles' (ibid. p. 133).

The 'foundational articles' of ubicomp written by Weiser are not many in number, but are broad in the scale of their implication. Perhaps most significant is Weiser's 1991 article published in *Scientific American* entitled 'The Computer for the 21st Century', not least because it features in a popular science publication. The second reason I suggest this article is significant is because of Weiser's imaginative use of storytelling to convey his ideas, in the guise of the story of 'Sal', a professional single mother in which, as Yvonne Rogers (2006) suggests: 'we see how the world evolves around Sal's assumed needs, where computers, cameras and sensors are embedded into her world to make her life super efficient, smooth and calm'<sup>5</sup>. From this narrative, and Weiser's further explication in the 1991 article and others, we can identify three key facets of the ubicomp vision: context aware computing; ambient/ubiquitous 'intelligence'; and ambient tracking/monitoring of people and things.

<sup>&</sup>lt;sup>5</sup> This fictive frame draws upon a substantial cultural background of imagining 'super efficient' and 'calm' technologically enabled ways of living, from early science fiction such as E. M. Forster's story of monolithic automated societies 'The Machine Stops', to recent iconic Science Fiction imaginaries such as Stanley Kubrick and Arthur C. Clark's '2001: A Space Odyssey' to the 'Star Trek' and 'Star Wars' franchises.

Reflecting on the three principal attributes of Weiser's ubicomp vision we can see quite how broad the implication of the Xerox PARC ubiquitous computing agenda was

'one that speculated on a physical world richly and invisibly interwoven with sensors, actuators, displays' and computational elements, embedded seamlessly in the everyday objects of our lives and connected through a continuous network' (Weiser et al., 1999, p. 694).

One could get into the 'tomorrow's world' game of checking the specifics of technical achievements against the predictions made, but this somewhat misses the significance of these forms of future orientation. The appeal to possible futures is not significant because technologies were predicted and then realised but because of the future orientation in and of itself. Weiser's renditions of possible futures should therefore not be seen as the specification of goals (although 15 years ago certain aspects were, such as proof of concepts for multi-device wireless communications) but as the opening out of a creative space of thought. As Rich Gold (2008, p. 66), a close colleague of Weiser at Xerox PARC, pointed out the task was: 'to construct a philosophy. A Ubi-Comp *Cult*'. Gold propagated Weiser's vision of ubicomp, constructing the notion of product categories within ubicomp, by giving talks about ubicomp in many different forums and championed the 'philosophy' by placing it the heart of further research he conducted at PARC.

In the last article he published, Weiser suggested that 'calm computing [is] the goal, describing the state of mind of the user, as opposed to the hardware configuration of the computer' (Weiser et al., 1999, p. 695) and in an earlier book chapter with PARC colleague John Seely Brown:

'If computers are everywhere they better stay out of the way, and that means designing them so that the people being shared by the computers remain serene and in control. Calmness is a new challenge that [ubicomp] brings to computing' (Weiser and Seely Brown, 1997).

We can again see how an 'ideal' is set up by Weiser, just as with contextawareness, and laid out as a goal. The allure of a 'calm', non-obtrusive, experience of technology use as proposed by Weiser is predicated on the apparently simple supposition that computers might allow '[i]nformation [to] appear in the centre of our attention when needed and effortlessly disappear into the periphery of our attention when not' (Rogers, 2006, p. 404). Yvonne Rogers exemplifies the criticism of this depiction of calmness, specifically targeting the apparent 'ambient intelligence' required of ubicomp systems to achieve such 'calm' experiences of usage: 'Many of the research projects that have followed in the footsteps of Weiser's vision of calm computing have been disappointing; their achievements being limited by the extent to which they have been able to program computers to act on behalf of humans' (Rogers, 2006, p. 418). As others have pointed out, and as will be addressed in chapter 3, these types of argument stage the broader tension between R&D practices and a creeping technological determinism (see: Nye, 2004; Wyatt, 2008).

Weiser clearly set ubiquitous computing in the context of advancing progress in the broader development of computing. Ubicomp, for Weiser, was a stage into which we would advance, where '[m]achines that fit the human environment instead of forcing humans to enter theirs will make using computing as refreshing as taking a walk in the woods' (Weiser, 1991, p. 75). In a 1996 article for a New York University 'web magazine', Weiser explicitly placed ubicomp in the context of 'waves' of computing:

"The first wave of computing, from 1940 to about 1980 was dominated by many people serving one computer. The second wave, still peaking, has one person and one computer in uneasy symbiosis, staring at each other across the desktop without really inhabiting each other's worlds. The third wave, just beginning, has many computers serving each person everywhere in the world. I call this last wave "ubiquitous computing" or "ubicomp" (Weiser, 1996).

In 'The Coming Age of Calm Technology', a book chapter co-authored with Seely Brown (1997), Weiser went on to consolidate this figuration of historical 'progress' towards ubicomp. The 'waves' become 'phases' associated with key technologies, from the

'mainframe computer', via the personal computer and the internet, to ubicomp. Weiser's rhetorical strategy, both to clearly explain the intensions of the ubicomp research project at PARC and to further an agenda, sets a tone of future orientation that has been subsequently adopted by many. By figuring ubicomp in what Bell and Dourish call a 'proximate future' (2007b, p. 134) Weiser granted license to those writing after him to appeal to that future and continue to situate ubicomp as to-come or as a goal. Abstracts or first paragraphs of ubicomp-related articles published in computer science and HCI conference proceedings and journals frequently figure technological advances in near futures that are 'just around the corner' (ibid.). In an article calling for a move beyond 'collective envisionment' towards a 'ubicomp of the present', Bell and Dourish (2007b, p. 134) highlight that 'of the 108 papers comprising the Ubicomp conference proceedings between 2001 and 2004, fully 47% of the papers are oriented towards a proximate (and inevitable) technological future'. Yet recent figures suggest Weiser's influence continues to be felt. Citations of Weiser's (1991) Scientific American article, 'The Computer for the 21st Century', numbered 81 for the period January 2007—October 2008<sup>6</sup>.

Mark Weiser's influence is still strongly felt in Computer Science literature and is still widely cited by those working in Human-Computer Interaction, ubicomp and the plethora of associated sub- agendas/genres of computing research. In his vision-led research ethos Weiser struck a balance between what we identify as fact/fiction, art/science and successfully formulated an ethos (or 'cult', following Gold) for alternative thinking about technology use. As Seely Brown (1999, p. 695) remarked in an epilogue to one of Weiser's last publications: 'For Mark, sharp boundaries between the social and the technical, between the artistic and the scientific, and between work and play never

<sup>&</sup>lt;sup>6</sup> Data retrieved from Thomson Reuters' ISI Web of Science search for articles citing Weiser (1991) on 03/11/08.

existed'. The ways in which research visions are depicted in ubicomp-related research echo this ethos, as will be demonstrated in later chapters.

#### 1.3.2 Commercial research — from 'Knowledge Navigator' to 'Layar'

Envisaging particular forms of future can be a form of commercial strategy. Ubicomp was not (and isn't now) the only 'big story' that has been told and acted upon within commercial research settings. In fact, ubicomp might be said to build upon or sit in opposition to other visions that have pushed computing research and development. For example, the 'ambient intelligence' of Weiser's ubicomp vision glosses established research goals in Artificial Intelligence (see: Russell and Norvig, 2003, pp. 1-29). Furthermore, Weiser openly sets the agenda of ubicomp in opposition to 'virtual reality' research: 'Perhaps most diametrically opposed to our vision is the notion of virtual reality, which attempts to make a world inside the computer' (Weiser, 1991, p. 66). However, tentative steps were taken into envisioning similar prospects for computing becoming widespread and blending into the everyday environment. In the late 1980s Apple produced a number of videos to depict future computer usage in the course of everyday life. In particular the video 'knowledge navigator' demonstrated a university lecturer conversing with an apparently intelligent computer 'agent' that acted as a digital personal assistant. Whilst the action depicted was situated in one room there was clear intimation that the assistant and the lecturer's data would be accessible from many locations and in many different contexts. A number of other visions set forth by industrial research institutions found visual representation in video form-HP Labs, Microsoft, Motorola, Phillips and Sun Microsystems have all produced such material in the last 15 years (the production of 'vision videos' is substantially addressed in chapter 5).

Several research initiatives emerged in the 1990s that could readily be described as ubicomp projects but that were, of course, spun according to the contemporaneous promotional agendas of the originating institutions. MIT's 'Tangible Bits' research
programme received significant commercial interest from its inception, by another 'visionary' figure Prof. Hiroshi Ishii, in the early 1990s. This notably follows in the wake of other, earlier, orientations towards 'ubiquitous' technological futures, such as the work of Myron Krueger:

'the next generation of technology will speak to us, understand us, and perceive our behaviour. It will enter every home and office and intercede between us and much of the information and experience we receive' (Krueger, 1977, p. 433).

A number of electronics and telecommunications companies (such as Motorola, NTT Docomo and Philips) produced millennial visions to inspire notions of what we would be capable of doing with and through mobile technologies in the 21st century. The mediocre upshot of such appeals to the future was the popularity amongst the press of discussing concepts such as the 'internet fridge' (for example: BBC, 2000). Nonetheless, commercial 'forecasts' and visions of the future akin to Weiser's (1991) vision of ubicomp signalled a broad propensity to engage in such anticipatory practices.

One commercial vision that gained significant press and public exposure was HP Labs' 'CoolTown' project. 'CoolTown' mostly focussed on embedding web servers into things. So, physical objects have a web address a bit like web 'pages'. Web services thus become not just things in the browser but services served by devices, places and even humans. The tagline 'people, places, things' thus became synonymous with 'CoolTown' and the ubicomp style research being conducted at HP Labs (see: Kindberg et al., 2000). 'People, places, things' alluded to the broader thinking amongst those researchers in the 'Internet and Mobile Systems Lab', which was described by one senior research scientist as 'a test bed for a future in which every person, place or thing can be connected wirelessly, anywhere in the world, through the web' (HP Labs' Gene Becker quoted in Rheingold, 2002, p. 95). The projects were not necessarily conceived as ubicomp per se. According to the same source (during an interview conducted for this research), the research team felt they were simply investigating an interesting system of control for remote devices, one based on the increasing prominence of the internet and the world wide web. CoolTown became adopted as broader corporate vision by the CEO of HP Carly Fiorina in the late 1990s. Business development units were asked to make CoolTown demonstrations and some sites were created around the world as showcases of what HP Labs believed was possible. For example, in Palo Alto (Silicon Valley, USA) the demonstration area was a small converted conference room, to demonstrate specific technology concepts (Rheingold, 2002, pp. 94-96). CoolTown was associated with 'five underlying beliefs about the future' espoused by HP Labs:

'1. Rampant diversity of mobile and embedded information products... often referred to as the vision of pervasive, ubiquitous or anytime, anywhere computing... 2. The future network environment is the web... 3. Everything has a web presence... 4. Bridging the physical and online worlds will bring the benefits of the web to... where people still live most of their lives... 5. Connected ecosystems of service providers will link together in creative and productive ways' (HP Labs, 2003).

Alongside the grandiose 'world-changing' corporate visions that have pushed ubicomp related research into prominence have been a steady stream of 'what if...' impetuses for research. Seemingly innocuous speculative questions have opened out new research avenues. For example, Apple and then IBM researcher Jim Spohrer (1996, p. 602) posed the question: 'What if we could put information in places? More precisely, what if we could associate information with a place and perceived the information as if it were really there?' The resulting project 'Worldboard' was 'conceived as a planetary chalkboard for twenty-first-century learners, allowing them to post and read messages associated with any place on the planet' (Spohrer, 1996, p. 604). It is not a great leap of imagination to see links between the Worldboard project and contemporary locationbased applications and services for sophisticated mobile phones with integrated global positioning systems<sup>7</sup>.

<sup>&</sup>lt;sup>7</sup> Recent commercial research has suggested that 78 million GPS-enabled mobile phone handsets were sold worldwide in 2008, which is forecast to significantly grow to 770 million units in 2014, representing 55% of the total sales of mobile phones (Malm, 2010).

Contemporary commercial research that might be identified as ubicomp is broad and varied. Many of the established information and communications technology (ICT) corporations have ongoing ubicomp related research being conducted in their extensive research and development labs. The location of research centres upon established areas of research excellence, such as 'Silicon Valley' and also regions surrounding high profile institutions (e.g. MIT). PARC, the location of Weiser's research, retains a 'ubiquitous computing' research group, as a part of their 'Computer Science Lab'. Intel Research has several teams working on a number of ubicomp related projects in Seattle, Berkeley and San Jose. HP Labs have researchers in Palo Alto working on research aligned with ubicomp but in 2009 laid off the whole of their 'Pervasive Computing Lab' in Bristol. Whilst IBM, Microsoft and Yahoo do not have specific research groups addressing ubicomp related research they have all significantly sponsored and invested in the field both within their R&D labs and in liaison with academic institutions.

A number of technologies might be described as commercial ubiquitous computing 'in the wild' (Carter and Mankoff, 2005), for there are a number of devices that can achieve goals such as 'context-awareness': 'Modern mobile computers [and 'smart phones'] can now take advantage of context in the same way as... the PARCTab, but with a far richer user interface... pen input and tactile buttons' (Want and Schilit, 2001, p. 32; for further recent discussion see: Want, 2010). We might therefore look to Apple's 'iPhone', Nokia's 'n-series' mobile phones and HTC's 'G1' and 'Nexus One' mobile phones (with software by Google) as examples of such technologies, given that they have built-in GPS location systems, mapping software and a variety of other sensing equipment (such as accelerometers to measure tilt angle and 'digital compasses' to measure direction). The types of spatial performance promoted by these technologies are very similar to those anticipated in ubicomp visions. Furthermore, third party developers, such as small 'start-up' companies, can develop hardware and software additions to these technologies, creating something like the 'ecosystems' HP Labs desired for their CoolTown technologies. For example, the application 'layar' (for Apple's iPhone and mobile phones running Google's 'Android' operating system) allows users to 'annotate' or 'tag' spaces (by topographically situating data through GPS coordinates) and view data and information tagged and shared by others<sup>8</sup>. Yet there remains an orientation to the near future, goals are adjusted and temporal horizons shift forward.

While very few commercial research and development projects will be actively identified as ubicomp, or one of the other synonymous terms, they will frequently be presented in the context of a similar type of vision of a future with 'ubiquitous' computing. Similarly, despite researchers understandably not using such labels in commercial promotion of their projects, when R&D projects that might otherwise be understood as ubicomp are presented at conferences or in peer-reviewed journals they may often be described as ubicomp, or feature in conferences such as the Institute of Electrical and Electronics Engineers (IEEE) 'Pervasive Computing' conference. It is to the labelling of the broad specialist agendas in and around contemporary ubicomp research that I wish to now turn.

#### 1.3.3 Agendas - ambient, pervasive, public, urban

Ubiquitous Computing research at PARC ultimately resulted in a 'new field of computer science', as Mark Weiser (1999, p. 694) highlighted towards the untimely end of his career. Indeed, one might argue that it has spawned several new fields in computer science and related research, for there are a number of (perhaps competing) agendas laid out in the guise of academic research groups, conferences and peerreviewed journals. The most prominent terms used in the above contexts are arguably: 'ambient', 'pervasive', 'ubiquitous' and 'urban', which typically precede the terms:

<sup>&</sup>lt;sup>8</sup> 'Layar' is described as an 'Augmented Reality browser' and can be downloaded to mobile phones through the 'Application Stores' for either the Apple iPhone or the Google Android mobile phone system, see: <u>http://www.layar.com/</u> (accessed: 19/02/10).

'computing', 'intelligence' and 'media'. As stated before, there are an extraordinary number of related terms used in various ways and so this is by no means an exhaustive list, but are the most widely used. Governments and international bodies have even staked claims in the arena, commissioning and issuing briefings and reports and offering funding. For example, the EU places particular prominence upon the terms 'ambient computing' and 'ambient intelligence' (Information Society Technologies Advisory Group, 2003).

Various bodies and institutions maintain conferences and journals using specific terminology, which might accordingly be considered to compete, or simply represent the diversity of disciplinary interests that coalesce around ubicomp related research. For example, the IEEE maintain the 'Pervasive Computing' journal and conference, which specifically draw a lineage to Weiser's ubicomp vision:

'Mark Weiser described a tantalizing destination just over a decade ago. In a seminal article, 'The Computer for the 21st Century,' he described a hypothetical world in which humans and computers were seamlessly united... He called this vision ubiquitous computing... Not surprisingly, the implementation attempted by Weiser and his colleagues at Xerox PARC fell short. After a decade of hardware progress, many critical elements that were exotic in 1991 are now viable commercial products... We are now better positioned to begin the quest for Weiser's vision' (Satyanarayanan, 2002, p. 2).

Equally, another significant disciplinary body, the Association for Computing Machinery (ACM) and its sub-disciplinary Special Interest Groups (SIGs), sponsor and promote the 'Ubicomp' annual conferences, with additional industrial sponsorship. Noteworthy publications in the field such as 'Personal and Ubiquitous Computing' and 'Pervasive and Mobile Computing' also appeal to visions of particular types of technological future:

"The field of pervasive and mobile computing is evolving at an ever faster rate, with a promise to bring in revolutionary paradigms for computing models as well as to change the way we think and live in the society... The goal is to create ambient intelligence where smart network devices embedded in the environment will provide unobtrusive connectivity, monitoring and services all the time, thus improving human experience and quality of life' (Das et al., 2005, p. v). Much of the research discussed and documented in these conferences and journals is pursuant to the aims discussed in earlier sections. Whereas commercial research might be measured by companies according to the number of patents registered as a result of the research, for academic research there are also imperatives to advance an agenda. All of these agendas are in some sense demarcating 'visions' and thus make specific claims for particular types of future. Communities of practice are therefore centred upon particular visions or specific agendas for acting upon those visions, institutionalised in the guise of conferences and journals.

## 1.3.4 Social sciences investigations into ubicomp and related technology development

The social sciences' engagement with ubicomp as such has been limited (see: Andrejevic, 2005; Crang and Graham, 2007; Dodge and Kitchin, 2007; Galloway, 2004). Interestingly, much of this research takes these 'visions' at face value and analyses their possible implications rather than problematising the production of such visions (for example: de Souza e Silva, 2006; Paay et al., 2007; Zook and Graham, 2007a). In geography there have been rare engagements with ubiquitous computing (see: Crang and Graham, 2007), and even then these are more often couched in broader technological terms. Following a call to 'investigate geographies of software' and the 'automatic production of space' (Thrift and French, 2002), Martin Dodge and Rob Kitchin have, together, conducted prominent work in geography around technologies related to ubicomp, particularly around the influence of programming code on the mediation and navigation of space and place (see: 2005, 2007).

Related and relevant, but more general, research in contemporary human geography has been conducted on a number of themes. For example, particularly in social and cultural geographies, issues around the urban nature of mobile communications technologies (for example: Pain et al., 2005; Sheller, 2004; Zook et al., 2004), the performance of technology use in everyday life (for example: Crang et al., 2007; Galloway, 2004; Graham, 2004) and the socio-spatial production of and with locative and mobile technologies (for example: de Souza e Silva, 2006; Mackenzie, 2005; Wellman, 2001; Zook and Graham, 2007b) have all featured. In particular Nigel Thrift's work offers broad (if at times hasty and sweeping) insight into the role of technology in performing consciousness and memory (see: Thrift, 2003, 2004b, 2005; forthcoming). Recently, an edited volume entitled 'Augmented Urban Spaces' (Aurigi and De Cindio, 2008a) demonstrates a rise of interdisciplinary efforts to address the wide-ranging scope of ubicomp and related technologies in the performance of (urban) everyday life. Aurigi and De Cindio (2008a) collected together contribuions from across several disciplines with a concern that:

'the gradual development of an enriched media environment, ubiquitous computing, mobile and wireless communication technologies, ... as a non-extraordinary part of our everyday lives, are changing the ways people use cities and live in them' (Aurigi and De Cindio, 2008b, p. 1).

In 2007 a special issue of *Environment and Planning B: Planning and Design* on the theme of 'Space, sociality and pervasive computing' was published (see: Dave, 2007; McCullough, 2007; Townsend, 2007; Dourish and Bell, 2007; Dodge and Kitchin, 2007; Paay et al., 2007; Zook and Graham, 2007a). The papers in the themed issue were from across a number of disciplines, offering tentative connections across and between research agendas, as the guest editor suggests: 'The papers in this issue suggest that we have quite a way to go before we develop a richer understanding of what is happening at the intersection of space, sociality and pervasive computing' (Dave, 2007, p. 382). Although it marked a timely review of research activities the 'Space, sociality and pervasive computing' issue presented material that somewhat privileged the importance of technical infrastructure and the specification of modes of urban development (for example: McCullough, 2007; Townsend, 2007). Many of the articles assumed a smooth and steady progress towards the ideals espoused in ubicomp

style research visions, simply affirming an unproblematic sense of progress and a normative Cartesian conceptualisation of space:

'Designing for future pervasive computing in the built environment is challenging. Inhabited physical spaces are complex and dynamic. Social interactions have an intricate relationship with the physical context in which they are situated. By adding a digital layer of information to our inhabited built environment we mediate new types of social interaction happening there' (Paay et al., 2007, p. 463).

Weiser was quick to highlight from the outset that ubicomp raises privacy concerns: 'Perhaps key among [the issues raised] is privacy: hundreds of computers in every room, all capable of sensing people near them and linked to high-speed networks, have the potential to make totalitarianism seem like sheerest anarchy' (Weiser, 1991, p. 75). A range of work across and between a number of disciplines, such as Social Anthropology, Political Geography, Human-Computer Interaction and Socio-legal Studies, has been conducted to examine and attempt to mitigate or provide policy for privacy issues regarding ubicomp technologies. Much of this work has been published in ubicomp related journals, such as *Personal and Ubiquitous Computing*, addressing both technical issues and public perception (see: Ackerman, 2004; Brar and Kay, 2004; Lehikoinen et al., 2008; Roussos and Moussouri, 2004; Schmandt and Ackerman, 2004), but, perhaps more recently, ubicomp privacy research has appeared in interdisciplinary journals with a broader scope (see: Heesen and Siemoneit, 2007; Monahan and Wall, 2007; Wood and Ball, 2006).

There is a growing amount of interdisciplinary research that straddles 'traditional' disciplinary discourses such as computer science and legal studies or cultural anthoropology to produce novel forms of research both academically and commercially. Notable work bridging the social sciences and computer science (especially 'Human-Computer Interaction') in addressing the performative nature of ubicomp as well as its future orientation has been conducted by Paul Dourish (see: 2004b; 2004a; and Bell and Dourish, 2007b). Anthropologist, frequent collaborator of Dourish, and senior researcher at Intel; Genevieve Bell has also conducted significant interdisciplinary research into the ways in which computing technologies can be and are socially enrolled into everyday practices (see: 2004; 2006; and Dourish 2007b; 2007a).

Across the four themes I have charted through the expanse of discourse, literature and practices that array to make up 'ubicomp' it becomes apparent that the futurity of ubicomp looms large as a problem. It is clear that Weiser for both practical and perhaps political reasons figured ubicomp's 'full' potential in a near future, demonstrated in the story of 'Sal'. Ongoing commercial research perpetuates this future orientation rhetorically in the presentation of particular projects and in the agendas by which the research is organised. Furthermore, existing social sciences research, on the whole, appears to uncritically accept the forecasts of 'ubicomp near-futures' produced by academic colleagues in other disciplines and industrial research labs. In the remains of this chapter I turn to the future orientation of ubicomp to set it out as the substantive problem this thesis will address.

#### 1.4 Research questions - addressing futurity

'Ubiquitous computing... encompasses a wide range of disparate technological areas brought together by a focus upon a vision' (Bell and Dourish, 2007b, p. 133).

In this chapter I have outlined how ubicomp, as both an agenda and an array of research practices, constructs wide-ranging socio-spatial concerns around living with technologies. Depending on your point of view, the condition of living in 'augmented urban spaces' (Aurigi and De Cindio, 2008a), with an 'internet of things' (Sterling, 2005), and surrounded by 'ubiquitous computing' (Weiser, 1991) represents either an opportunity or nightmare. For such a future has been variously figured positively as the 'information society' (Lyon, 1988), the 'third wave' of human 'progress' (Toffler, 1972) and negatively as the 'always-on panopticon' (Rheingold, 2002, p. 183) or a 'pervasive surveillance society' (Wood, 2008). As I have already noted, much of the social sciences research addresses ubicomp as a predominantly future oriented concern. Rather than affirm the binaries of optimism/pessimism or utopia/dystopia, the aim of this thesis is to challenge the reduction and simplification to 'big' stories and to build upon diverse existing work by geographers and non-geographers that has demonstrated that it is possible to articulate futurity otherwise, not to 'believe the hype' but still intercede. This is important because it provides a means of understanding how our apparent knowledge of technological futures is produced in practice.

In the previous section I have outlined a number of ways in which we can define ubicomp, through which it is clear that one of the key characteristics is an orientation towards a near future, as suggested above. Furthermore, from Weiser onwards, it is clear that corporate R&D largely drives this future orientation. Accordingly, before setting out the specific research questions this thesis addresses I want to make it clear that, rather than addressing the very broad totality of enterprises ubicomp might be considered to encompass, this thesis is focussed on the realm of corporate research and development in ubicomp. Therefore, in the rest of this thesis, the terms by which I use 'ubicomp' are that I am largely focussing upon corporate ubicomp R&D<sup>9</sup>.

To explore how the future of ubicomp remains as such and the spatialities that are thereby constructed, this thesis problematises the rationale of future orientation endemic to ubiquitous computing. Therefore, two principal questions are posed in this thesis. These are:

- 1. How are the rationales of anticipation inherent to ubiquitous computing produced, normalised and contested?
- 2. How are the anticipated futures of ubicomp located in relation to the present?

<sup>&</sup>lt;sup>9</sup> The specific issues raised by this analytical focus are addressed in Section 2.3 of Chapter 2.

These questions are the impetus for investigating how we proactively produce forms of technological futurity. The critical framework that facilitates this critical investigation charts a discourse of anticipation, as the multiple means for articulating proactive future orientation, internal to which are anticipatory logics that codify and rationalise how such forms of futurity are practised. The motivation and ambit of this research is to thereby describe a politics of anticipation as the ways in which the anticipation of technological futures is codified and contested, whilst performative and multiple. This thesis stages a series of encounters between the rhetoric and visions of ubicomp, the future-oriented practices of ubicomp R&D, discourses of future orientation in philosophy, and recent debates around 'anticipation', 'expectation' and 'hope' in geography and cognate disciplines. With the research questions set out, I want to move on to discuss how this thesis will address and answer the questions I have laid out above and to outline the structure of the thesis as a whole.

#### 1.5 The (near-)future orientation of ubicomp

To address the assemblage of the discourses of futurity outlined above and the anticipatory impetus of ubicomp R&D, as well as the problem of a dearth of critical analysis, this thesis makes three moves to attend to ubicomp as a discourse of anticipation. Firstly, because not all visions are the same, the locus of ubicomp futures is questioned. Secondly, there are means and modes of future orientation espoused and practised in the research and development of ubicomp produced by and with rationales of futurity that I identify as a part of a discourse of anticipation (inherent to ubicomp). Thirdly, this thesis charts a politics inherent to these various modes and logics of anticipation practised and produced in and for the research and development of ubicomp. In the remains of this section I will unpack these three analytical moves.

To identify the time-space locus of the anticipated, imaginative and/or speculative scenarios of ubiquitous computing it is necessary to navigate the first three cuts through the discourse of ubicomp outlined above. Accordingly, one of the key aims of this thesis is to highlight and problematise the proximity of such future-oriented spatial imaginaries as always just around the bend. Characterisations of 'the future' as such can vary across modes of anticipation. A key means of understanding this is put forward by Adam and Groves (2007), who describe two modes of futurity: 'present futures' and 'future presents'. Futures figured by emptying them of connection with the complex relations of the present and opening them to conditioning are 'present futures', whereas futures figured as 'a realm of latent futures in the making' (Adam and Groves, 2007, p. 17) are 'future presents'. Arrangements of present future and future present coalesce around various formations of practice. Adam and Groves (2007) situate the difference between present futures and future presents in terms of an ethics of future orientation, that there is something like 'good' and 'bad' futurity. On the one hand we have the 'bad', an 'empty' future which can be largely scripted, and on the other the 'good', a latent futurity which we all have a part in making. At the fulcrum of Weiser's legacy, contemporary ubicomp R&D and the broad agendas that perpetuate the visions we can identify a common ethos of looking to a 'good' future. The spatial production inherent to envisioning near-futures, through rhetoric and image, is examined in this thesis as a matrix for materialising those futures. This is an important analytical step because it is through those imaginaries that the forms of anticipation are lent value and may become normalised as forms of future orientation.

To explore how the proximate future remains as such, and the spatialities that are thereby constructed, this thesis navigates the discourses of anticipation that underlay ubicomp. The conceptualisation of 'discourses of anticipation' I mobilise, following Michel Foucault's (2000b) articulation of discourse, figures them as the conjunction of knowledge and practice. Anticipatory knowledge has been usefully described by Anderson (2007, p. 158) as 'not simply a given but a practical achievement emergent from [and productive of]... practices that create, know and govern possible, potential and preferred futures'. These ways of 'creating' and 'knowing' possible, potential and preferred futures construct multiple techniques for addressing the future of ubicomp. Practises of anticipation formulate different, sometimes contested, articulations of ubicomp futures, which enact the politics of anticipation I argue underpins the futurity of ubicomp R&D. The practices in question are those within the gamut that performatively produce ubicomp in academic and commercial research labs, particularly in the region of this thesis' inquiry—Silicon Valley, California. These practises might include creating imaginative representations of potential ubicomp futures in image and text, or acting out particular forms of future technological experience with prototypes or as pretend scenarios. The rationales by which such anticipatory knowledges operate can be conceived as anticipatory logics. I will suggest in this thesis that a number of anticipatory logics are crucial to understanding the anticipated futures of ubicomp, in particular: expectation, foresight and hope.

Anticipation is mobilised (not least in the production of visions of the future) but is also emergent (from the culmination of life's events, both mundane and extraordinary) as a range of dispositions towards the future. A politics of anticipation is arrived at in the negotiation of various assemblages of future orientation—from a 'Modern' appeal to progress (espoused by: Toffler, 1972; critiqued by: Latour, 1993) to futures conceived in aspirational 'hope' (for further discussion see: Anderson, 2006a, 2006b) or apprehensive risk, and invited the various means of orientating towards the future engaged by companies and institutions. Following Barry (2001, pp. 206-209) I suggest we can understand a politics of anticipation as a way of marking and coding an array of practices rationalised through anticipatory logics. However, if 'politics' as Barry (2001, p. 207) suggests refers to 'a range of forms of action and practice', which are institutionalised and become regulatory, following Foucault (1991a), then we must also understand the 'political' as distinct, in accordance with Barry's (ibid.) reading of Agamben (1993). In this case, by political I mean a 'space of dissensus and contestation which is not reducible to politics' (Barry, 2001, p. 207). In considering the practical and performative nature of anticipatory politics one must therefore give equal attention to the conscious negotiations of anticipation and to the pre-cognitive dispositions and 'technological unconscious' (Thrift, 2004c) that negotiate and extend existing experience in relation to and towards a future.

Ultimately I aim to present an account with multiple substantive and theoretical entry points and egresses such that researchers and practitioners from a variety of backgrounds and disciplines might engage with this project in different ways. The three analytical moves described above thread through this thesis to provide a narrative backbone from which six further chapters are organised. The writing strategy is such that rather than see each chapter as linearly following one from the other I hope readers can understand each chapter as a simultaneous pass through the skein of connections that coalesce to produce what is understood as 'ubiquitous computing'. Each chapter can accordingly be seen as an analogical incision via which different aspects of the same 'whole' (that is ubicomp) can be examined. A chapter discursively hinges around a particular mode of anticipation that functions as a lens through which aspects of future orientation in ubicomp can be brought into focus. In the last section of this introductory chapter I set out the structure of the subsequent chapters of this thesis in schematic detail to aid navigation.

#### 1.6 Chapter outlines

#### Chapter 2 – Fieldwork in the future? Methods for addressing futurity

This chapter maps out the methodological journey travelled to produce this project. Beginning with a comparison between the work planned at proposal and the work carried out 'in the field' the chapter moves on to discuss the negotiation necessary to engaging with a whole sub-discipline and an uncertain labour market in flux. Following discussion of the substantive issues involved in carrying out the fieldwork conducted for this project the methodological concerns of interviewing experts are addressed.

#### Chapter 3 – Locating the technological future: Expecting ubiquitous computing

In the first of four thematic chapters the aim is to set out a broad landscape of technological future orientation in which ubiquitous computing is situated. The third chapter operates in three parts. First, the role of the rhetorical scaffold of technological determinism as an undercurrent to future orientation is critically examined from ubicomp's futuristic 'mythology'. With this critical approach to technological futurity in place, alternative understandings of ubicomp's future orientation are signalled. Second, the chapter describes a discourse of anticipation as a means of understanding the proactive nature of the explicit futurity inherent to research and development practices in ubicomp. Further, in the third section, the locus of the present as a place of anticipation from which we look towards particular futures is theoretically examined through the lens of expectation. Accordingly, ubicomp is examined through the lens of a 'sociology of expectation' (Borup et al., 2006) in contemporary STS discussion of technological development. From this literature four senses of expectation are explored as a means to addressing the futurity of ubicomp, which are: 'constitutive force', 'temporal variance', 'socio-spatial variability' and 'performative imagination'. I conclude this chapter by discussing how the disciplinary function of rhetorics of futurity lies in contrast to the modes of anticipation that play out in ubicomp  $R \otimes D$ . This importantly lays out the basis of the discussion of a politics of anticipation, which runs through this thesis.

#### Chapter 4 - Methods to 'foresee' worlds of ubiquitous computing

The fourth chapter examines the practices of anticipation of ubiquitous computing in the context of communities of practice. The future orientation in ubicomp R&D is, first, investigated in relation to foresight, a particularly 'ocular-centric' mode of anticipation. "Knowledges', and 'logics' of anticipation are subsequently, and second, discussed as the conceptual apparatus that construct and perpetuate the 'proximate future' (Bell and Dourish, 2007b) of ubicomp. This analysis connects recent discussion about 'anticipation' in social sciences research with the methods of ubicomp research, which fits with an emergent agenda around futurity in human geography. Third, the conceptual vocabulary of 'anticipation', 'logic', and 'practice', is applied to the analysis of empirical investigations of ubicomp R&D to identify the specific practices and associated logics of anticipation at play. These practices and logics of anticipation are associated with particular communities of research and thus we can identify communities of anticipation. This chapter accordingly examines the practices and logics of anticipation that both support and destabilise the certainty with which the future is imagined in communities of anticipation within ubicomp. In conclusion, the multiple ways of anticipating a future world and the ways in which they discipline understandings of futurity are framed as a politics of anticipation.

#### Chapter 5 - Envisioning 'things to come': feeling the visions of ubicomp

The fifth chapter addresses the spatial production inherent to the relationship between video representation and the proposition of futurity in the development of ubiquitous computing. The principal concern is that such visions are granted further agency by virtue of the widespread reportage of their content as almost factual. This article accordingly interrogates how video-based envisioning frames research-based and public normative expectations of material, and hence social, futures through two main angles. First, the rhetoric and image of 'visions' are examined as matrices for attempting to lend material value to futures. Second, the prospective embodied interaction with and through technologies is explored as engendering 'affective atunement'. This discussion is illustrated with examples of envisioning practised by technology corporations, with particular analysis of 'vision videos'.

# Chapter 6 – The optimism of 'mapping desired worlds': Affects, historicity and regimes of hope

To address the ways in which the uncertainty of the futurity figured in ubicomp is couched in a rhetoric of optimism the sixth chapter builds upon recent work in geography and cognate disciplines around hope. An ethos of hope has been expressed in a variety of discourses, from philosophies of historical development to STS investigations of bio- and nano-technologies. Hopes have variously been thought of as the possible or 'not-yet' (Bloch, 1986) haunting the present, a way of 'embodying the conviction that the future may be different from the present' (Anderson and Fenton, 2008, p. 78), or regimes of speculation about the advancement and improvement of society and/or technology (Brown, 2005). Hope is explored in this chapter as a discourse suggestive of a historically constitutive force, and as a discussion of future-oriented affective dispositions. Building upon empirical evidence gathered from interviews with ubicomp researchers the sixth chapter offers critical analysis of a logic of hope as a means of articulating technological futurity.

#### Chapter 7 – Promising ubicomp? The politics of anticipation

To conclude this thesis, the seventh chapter folds together the multiple simultaneous 'diagrammatic' mappings of future orientation found in the previous four chapters to explore a politics of anticipation of ubicomp. Accordingly, the substantive sections systematically pursue a critical discussion about the politics of the discourse of anticipation for ubicomp in three parts. In the first section, the apparent evacuation of obligation from promised futures is discussed in terms of the forms of anticipatory action performed in ubicomp R&D. Second, the relationship between the formation of

communities of anticipation within ubicomp R&D and the constitution of relatively obligation-free claims for particular futures is explored. Third, three conceptual strata of politics and political action are examined as a means of analysing the politics of anticipation in relation to ubicomp. Moving on from the discussion of anticipatory politics, in the fourth section of the chapter I explain how this thesis has addressed the research questions laid out in the first chapter. Finally, the seventh chapter concludes by detailing the relevance of this research to broader inter-disciplinary debates and ends with a discussion of openings on to further work.

### Chapter 2

### Fieldwork in the future? Methods for addressing futurity

'What is the answer to the question? The problem. How is the problem resolved? By displacing the question' (Foucault, 1977, p. 185).

'Fieldwork is a discursive process in which the research encounter is structured by the researcher and the researched' (England, 2001, p. 210).

#### 2.1 Introduction

The purpose of this chapter is to engage with issues of methodology arising from conducting research into a fast-moving and complex field of enquiry: research and development (R&D) in ubicomp. As described in the first chapter, ubicomp signifies a broad array of research activities that can be quite diverse. Such a diversity of activities does not, however, defy the possibility of useful enquiry. In this chapter I discuss what researching the futurity of R&D in ubicomp means in the context of this thesis. I describe the research methods employed and how those methods were arrived at in the practise of my research. My principal claim is that this thesis represents an attempt to write between the empirical encounter within the field (through interviews, in this case) and the underpinning practical engagement with theory. I argue that it is a coproductive method of analysis and writing in the spirit of Isabelle Stengers' argument for 'mapping phenomena into knowledge' (Stengers, 1997, p. 117). The issue of 'mapping into knowledge' forms the critical fulcrum around which the discussion of methods turns in this chapter. To unpack the approach to research methods taken, and the specific methods employed, for this research project, the chapter proceeds in three sections. First, the methodological concern for 'mapping into knowledge' is discussed as a means of addressing 'what happens when social science tries to describe things that are complex, diffuse and messy' (Law, 2004, p. 2). Second, I provide an account of how the

design process of this project evolved. I discuss some key points concerning the problems that arose, particularly the unexpected breakdown of the original fieldwork arrangements, and the issues of method that were accordingly addressed, namely the change of methods from participant observation to interviews. Third, I discuss the specific analytical and conceptual issues of conducting fieldwork in the corporate research setting. Fourth, I pragmatically break down the details of the research methods employed as: interview method, gaining access, and ethics procedure.

To begin with the concern for 'messiness' then, we must (somewhat obviously) observe that even a relatively sustained project on a topic as broad and diverse as ubicomp must necessarily be a snapshot. Regardless of the specificity of the research questions, concerning the particular ways futurity is practised in ubicomp R&D for example, I want to acknowledge the limits inherent in the account that I will make. I want then to be clear about the terms of reference that the project represented in this thesis, and to do so by extrapolating five specific points and problems experienced in the design of the research:

First, the research project is an investigation of research and development practices in and around a field of research called 'ubiquitous computing' with the principle purpose being to investigate how futurity figures in the research and development practices and what functions that futurity performs in orienting how ubicomp is discussed as existing and possible technologies.

Second, the project is based on 22 research interviews held in Silicon Valley, California; one research interview held via the Skype internet-based audio communication service between Burlingame, California and Seattle, Washington; and one research interview held in Bristol (see Appendix 1 for a list of interviewees).

Third, the interviews were conducted using the 'interview guide' approach, 22 of the interviews were recorded using a digital Dictaphone, one interview was recorded using recording software on the author's laptop, and one interviewee declined to be recorded. The interviews were transcribed equally by the author and a professional transcriber, and manually coded by the author.

Fourth, a rigorous ethics review was undertaken by the author and approved by the School of Geographical Sciences, University of Bristol. All of the interview participants, or 'informants', gave written or recorded verbal consent to be interviewed for the purposes of this research.

Fifth, I, as the author and researcher, conducted this research as a British, male, middle class, mid-twenties, white postgraduate student, attached to the School of Geographical Sciences, University of Bristol and supervised by Drs. J-D Dewsbury and Mark Jackson.

There are, of course, other ideas, people, places, practices and things to follow in the array of connections that make up this research project. Engagements with methodology can often be reduced to the type of fairly orthodox (albeit brief) account of the research methods related above. However, is the rather dry recounting of technique sufficient to describe the practice of research? Following the quote that opens this chapter, to answer the question, we must identify the problem here, which, following John Law (2004), I contend is 'not so much lack of variety in the practice of method, as the hegemonic and dominatory pretensions of certain versions or *accounts* of method' (Law, 2004, p. 5). There has been significant documentation of qualitative social sciences methods that, over the last 15-20 years, have normalised the turn to qualitative methods (see, for example: Flowerdew and Martin, 2005; Hay, 2000; Kitchin and Tate, 2000). A bi-product of the substantial documentation and increase in teaching of such methods is that

'the 'research methods' passed down to us after a century of social science tend to work on the assumption that the world is properly to be understood as *a set of fairly specific, determinate, and more or less identifiable processes*' (Law, 2004, p. 5).

I am not calling for or seeking to subvert what have become normalised methods: after all, this project has its basis in precisely those methods in question. Neither am I setting up this thesis as a radical approach to social sciences methodology. Instead, the aim of this chapter is modest. I want to problematise how one analyses, discusses and theorises qualitative empirical enquiry, especially when the 'object of study' is itself a field of research. So, the rest of this section is devoted to laying out the research ethos that underpins this thesis as a conjunction of what Annemarie Mol terms 'ontological politics' (Mol, 1999) and Isabelle Stengers describes as 'mapping into knowledge' (Stengers, 1997).

The migration away from traditional questionnaire-based research to interviews has, in recent years, progressed into a widespread adoption of ethnographic techniques (evident in the progress reports by Crang, 2002, 2003, 2005). This has been matched by a significant increase in work explicitly informed by post-structuralist philosophy<sup>10</sup>, concerned less with the testing of hypotheses and more with the discursive and performative production of the world, as Hayden Lorimer's review of new movements in cultural geography attests (Lorimer, 2005, 2007, 2008). Thus, as Law so appositely puts it, 'the argument is no longer that methods *discover* and depict realities. Instead, it is that [we] participate in the *enactment* of those realities' (Law, 2004, p. 45). It is crucial to understand, not only of the research scientists and engineers I am studying but also reflexively of my own project, that it is in the very practice of research enquiry that we not only describe realities but also (co-) *produce* them. As Law suggests 'we participate in the *making* of those realities' that we study (Law, 2004, p. 10).

My participation in the making of the realities that I am studying can be taken in two parts. First, by my conscious intervention in the field, arranging and taking part in interviews and posing particular questions, I inevitably provoke one form of account

<sup>&</sup>lt;sup>10</sup> The growth in influence of continental post-strucutralist philosophy has been widely documented, and it broadly clear in human geography that the influence in particular of the triumvirate of Gilles Deleuze, Jacques Derrida, and Michel Foucault represents a sustained engagement with these ways of thinking. Many others have debated the value of employing this work and I do not see any need to rehearse such arguments here.

as opposed to others. By punctuating conversation about the practices of futurity with my own thoughts I am necessarily a participant in the account produced in this thesis. Second, my particular interest in the field further enrolls me into the production of the realities being analysed and discussed. I have previously participated in ubicomp research as an undergraduate, participating in the development of technologies. Furthermore, during the course of this project I have participated as a collaborator in the Pervasive Media Studio, in Bristol, which is a ubicomp research centre and, as I come to the point of submitting this thesis, I have been appointed as a Research Fellow in a new research centre that engages in the development of applications for ubicomp. I am therefore intimately involved in the co-production of the realities of ubicomp R&D. There are therefore inherently limitations to what I can say. My engagement with the field, like any other researcher, is affected by my prior experience. Equally, this experience has contributed to gaining access to experts and a detailed knowledge of contemporary ubicomp research in Silicon Valley.

At the heart of the mode of investigation discussed here is the recognition that the purpose of this project is to investigate and reflect upon the methods employed by other researchers to produce speculative realities, from a variety of disciplines yet largely in a corporate context. What is under discussion in this thesis is the mediation and negotiation of methods for anticipating futures used by various collectives of practitioners. Rather than blithely confirm the apparent authority of this process of reality creation, the task at hand is to recognize that there are many 'measures' by which research is assessed, and not all measures are equivalent (Stengers, 2000, p. 163): because we know 'the connivance of scientists with all forms of power capable of extending the scope of their judgements' (Stengers, 2000, p. 158) we must formulate means by which the legitimacy of invention can be questioned. Indeed, in attending to the multiplicity of ways in which reality is 'created' or 'measured' a 'relativity of viewpoint is essential' (Barry, 2001, p. 21). The ethos espoused here rigorously abides by the principal of remaining honest to those being researched but, at the same time, it is 'a perspective that tries to learn something from what is studied, without at the same time being in awe of it' (ibid.p. 21).

In this research there are no singular techniques prioritized over others due to an investment of normative authority through the weight of tradition. Instead, according to the ethos discussed, there is a 'method assemblage' arrived at for the project at hand: 'a combination of reality detector and reality amplifier' (Law, 2004, p. 14). This ethos is positioned against what Law (2004) calls Euro-American 'outthereness', or an unproblematised 'realism' that posits the possibility of the apolitical 'discovery' of phenomena that totally and independently pre-exist human experience. As Law (2004) notes, method is not 'just a set of techniques', indeed, for him (and for this project):

'It is not even simply about the kinds of realities that we want to recognise or the kinds of worlds we might hope to make... It is about what kinds of social science we want to practise.' (Law, 2004, p. 10)

Thus, in this project, in the 'method assemblage' mobilized to practice the 'kinds of social science' I aspire to, it is necessary to acknowledge explicitly that there is a 'periodicity' or 'duration' to the 'knowledge' arrived at and presented in this thesis. The work of Isabelle Stengers is useful in this regard, for she argues against positing the translation between 'pre-constituted and self-evident constituencies of word and world, mind and matter, subject and object' (Whatmore, 2005, p. 95), which imply the act of mastery. Instead, Stengers (1997, 2000) argues that 'evidence' does not pre-exist the 'knowledge event'. Rather, the researcher and researched, instruments and fields, all condition each other and collectively constitute that event, they are the configurations that

'string together at once all the phenomena and those who study them without distributing *a priori* what is significant and interesting and what... can be ignored' (Stengers, 1997, p. 117).

However, the phenomena being studied are not always easy to 'string together'. For example, I was present in the field for a fixed duration with only temporary access to those participating in the phenomena I have studied. Furthermore, as Steve Hinchliffe et al. suggest, sometimes the phenomena are unreliable participants in the research and so, instead, 'we have to learn to present ourselves differently to... the site [of study]' (2005, p. 655). So, in practicing this form of research it is necessary to acknowledge the variety of informants, in all forms, but also to find a pragmatic means of doing so that does not denigrate the various participants. Therefore, the important 'expert' interviewees are joined by images and texts, concepts and theories, and even embodied dispositions as informants in this research and ways of writing are found to account for them. The forms of future orientation and their representations, as objects of concern in this research, are accordingly not seen as 'narrated into being', following Hinchliffe's (2001, p. 191) reading of Stengers (1997). Instead, the decisions made in laboratories and research centers are seen as complex productions that we should attend to in their own terms and in their messiness. It is necessary to see such forms of research not as complete accounts, we have to accept that 'absences and presences are already implicated within one another in any reference [to the field]' (Hinchliffe et al., 2005, p. 655).

To understand the differing realities that are the various products of research, and to cast a critical eye over what is being 'mapped' into knowledge, Annemarie Mol's notion of 'ontological politics' is useful. Mol describes ontological politics as the difference between realities:

'It talks of *ontology*—which in standard philosophical parlance defines what belongs to the real, the conditions of possibility we live with. If the term 'ontology' is combined with that of 'politics' then this suggests that the conditions of possibility are not given. That reality does not precede the mundane practices in which we interact with it, but is rather shaped within these practices. So the term politics works to underline this active mode, this process of shaping, and the fact that its character is both open and contested' (Mol, 1999, pp. 74-75).

In relation to ubicomp we could see this as the plurality of ubicomp as manifest in various ways it is enacted as a research practice, the varying constituents inferred when the term is spoken in different contexts, and the various stories told about what ubicomp will be, in futures not yet (perhaps never) realised. So, if realities are enacted then 'reality is not in principal fixed or singular' (Law, 2004, p. 162). In the case of what is studied in this thesis, the ontological politics are rendered singular by the common sign of 'ubicomp' but are simultaneously multiple in the differing realities that are empirically enacted. For example, the various R&D practices discussed in interviews enact differing rationales of future orientation and construct different imaginative representations of the future, yet they are largely referred to as 'ubicomp'.

In a synthesis of Law (2004), Mol (1999) and Stengers' (1997, 2000) work, I have formulated a 'method assemblage' that pays attention to the various constituents that can make up a 'field', and the various ways in which accounts render some of them present and others absent. I have also adopted a 'methodical' ethos for attending to the informants' own methods for constructing and projecting realities of ubicomp not only in the present but, importantly, in to the future, rendering ubicomp multiple. The resulting 'method' derived from the ethos produced through this research project is that multiple techniques were employed, in a 'catholic' manner, such that interviews plus literature plus images plus concepts and theory were combined with a mode of writing that also espouses the multiplicity of my account. Rather than write a cumulative account, in which chapters necessarily build on the preceding chapters, the substantive part of this thesis is structured as four chapters that instead run parallel and inter-relate. The intention is not to provide a totalising account, which would, following the rationale outlined above, be impossible and misguided. Instead, the 'method assemblage' employed in this project performatively maps futurity in ubicomp R&D, making present differences in discourse and practice in the circle of concern I identify as a group of R&D concepts, practitioners, images, texts and things in-between. Following the reading of Stengers made by Hinchliffe et al., this research ethos is an attempt to 'take seriously forms of knowing that are more diagrammatic than representational' (Hinchliffe et al., 2005, p. 655).

Finally, as already suggested, the mode of writing is as much a part of the method employed in this thesis as the empirical interaction with the field. To write against a cumulative account, that asserts a linear narrative with a beginning, middle and an end, is, I argue, the logical means of representing a project that performatively maps an inter-related plurality of ways of addressing ubicomp's future. The resonance and contrast between the constituent parts of what we address as 'ubicomp' is documented in this thesis in the standard format of chapters, but I suggest these chapters perform something like what the philosopher Gilles Deleuze calls 'diagrams' (see: Deleuze and Guattari, 2004a; 2005b). 'Diagrams' are models for the formation of arrangements in that they do not assert the authority of a particular set of arrangements at the expense of others. Instead, diagrams are a performative means of articulating the multiple realities at play in what is being researched (see definition in: Barry, 2001, p. 268). As John Mullarkey observes: 'a diagrammatic depiction of a theory is one that modulates a theory, that is to say it abstracts a theory' (Mullarkey, 2006, p. 174). The diagrams allow for the same theoretical arrangements to be expressed in multiple ways much in the same way in which Barry mobilises diagrams in relation to the expression of power as alternative expressions of arrangements and techniques of power, for example through governance or discipline (Barry, 2001, p. 19). Understanding this organisation of multiple configurations of similar arrangements and techniques of research means that each of chapters 3-6 should be considered as simultaneous mappings of the same phenomena.

#### 2.2 Practical formation of the research

In the previous section I have laid out the research ethos that underlies the research project, in this section I discuss the practical formation of my research. The telling of such stories is significant to the mapping out of the process that has led to the 'co-production' of the phenomena detailed in these pages, not least because, of course, 'the best laid plans... go often askew' (to paraphrase Burns, 1994, p. 109). Indeed, as I will make evident in this account, this research project changed in substantive focus in large part because of an event: I was due to conduct a two to three month participant observation with a key member of staff, Dr Eric Paulos, at Intel Research Berkeley. Dr Paulos left the organisation less than three months before I was due to start the fieldwork, which caused me to significantly alter my research plans. So, the purpose of this section is to provide an account of the circumstances that principally contributed to how I carried out the project. Therefore, I detail the initial research design for the project, the change of circumstances in 'the field', the accordingly revised research design, and the resulting performance of 'fieldwork'.

In the initial research design for this project, specified and approved in an upgrade report submitted in September 2007, the substantive fieldwork representing the proposed empirical basis for the project was to be ethnographic in focus. The fieldwork was specified as: two months participant observation in situ with specific research projects at Intel Research Berkeley, a leading commercial research and development centre based in the San Francisco bay area. In particular, the projects at Intel Research Berkeley were under the direction of Dr. Eric Paulos and concerned the use of mobile technology platforms for gathering environmental data by non-specialist users. The principal concern of the empirical work was initially to focus on investigating the issues of designing different and novel forms of technological encounter for the near future. The over-arching research question posed was "What social and spatial assumptions are made in the development of ubiquitous computing? How are they challenged? And how do those challenges interfere with or inform the anticipated development process?" While the futurity of the socio-spatial assumptions in the R&D process was inferred, the future orientation of ubicomp was already very much at the fore of my investigative aims.

Alongside the substantive ethnographic fieldwork at Intel Research, I initially planned to conduct ten interviews with key informants, to provide signposts of the broader discourse of futurity within ubicomp R&D. The research interviewees, or 'informants', were selected from a range of institutions and organisations with an interest or a stake in the development of new technologies. Informants included researchers at other large research labs, academics, and people involved in start-up companies, many of whom formed the basis of the group of informants interviewed in the revised fieldwork plan. These interviews were initially figured as complimentary empirical material that would add perspective to a sustained ethnographic observation of research and development practice. Comparisons would be drawn between the ways in which practices were discussed and enacted.

An initial visit to Silicon Valley and the San Francisco Bay Area was conducted to confirm arrangements with Intel Research Berkeley and meet with potential informants to scope possibilities for interviews. Meetings were held at Intel Research with Eric Paulos, during and following the labs' seasonal 'open house' promotional event, and with potential informants from HP Labs and Nokia Research. A familiarisation of the current business climate was necessary to ascertain where access may be a problem. I therefore took part in meetings with industry analysts at the Institute for the Future and with respected author Howard Rheingold to discuss the existing state of ubicomp research in the Bay Area and opportunities for connecting with potential interviewees. The meetings were intended to provide openings on to the perspectives of researchers working in and with R&D groups regarding the operation of futurity in contemporary R&D practices. These initial meetings offered insights into the interrelation of different research groups, across companies and institutions, which later proved instrumental to my analysis. The variety of the people with whom I met in these initial meetings was intended to, and did, provide a number of different angles through which the substantive fieldwork might proceed. These meetings proved to be very useful when the format of the fieldwork had to change. For example, Both Rhenigold and Paulos recommended potential interviewees and provided personal introductions to researchers that I subsequently interviewed.

In April 2008, three months before the scheduled start of fieldwork, Eric Paulos, the principal informant for the research project, gave me notification that he was leaving Intel Research Berkeley in the summer to pursue a career in academia at Carnegie Mellon University. It rapidly became clear, due to a refocusing of research in the lab and issues of access that could not be resolved in the context of Paulos' departure, that the research could not be adjusted to accommodate the departure of this key contact and therefore the empirical basis of the project had to be redesigned. Drawing upon the extensive links cultivated through personal connections and resulting from the initial visit to California the empirical work for the project was adjusted to focus solely on interviews as a means of gathering 'data'. This was matched by a shift in focus from the examination of the practices of research and development (in situ) to the analysis of the discourse of future orientation that frames ubicomp R&D. Adjusting the techniques of method necessitated a change in the analytical focus precisely because the 'methods assemblage' plays a vital role in determining what kinds of account it is possible to make.

A delay in funding also had significant impact on the time available to perform research in 'the field'. The international location of the fieldwork for this project was outlined in the original project proposal and the capability to conduct this fieldwork, as with any other project, was contingent upon funding. The ESRC studentship programme allows for additional 'overseas fieldwork' funding, which enabled the substantive fieldwork for this project to be conducted in Silicon Valley, California. In the initial project specification a period of twelve weeks was identified for the participant observation, to enable a sustained investigation of the testing stages of a large project under development by Paulos at Intel Research. This period was subsequently adjusted to ten weeks to perform interviews. As with any other institution there is a disciplinary apparatus to regulate the granting and distribution of funds for research purposes. The administration and payment of the ESRC 'overseas fieldwork allowance' was devolved to individual universities in 2006. Due to administrative complications within the University of Bristol and subsequent delays in the arrangement and payment of the overseas fieldwork funds, the ten-week schedule for fieldwork was necessarily curtailed to eight weeks. This period was also pushed a month later into the summer period, commencing at the end of June and resulting in significant rescheduling of pre-existing appointments. Whilst I do not ultimately believe the administrative complications and delays negatively affected the performance of this research project, this turn of events became a contingent factor in the methods assemblage and played a part in the design of the research.

The performance of the fieldwork, between 29 June and 18 August 2008, resulted in 24 interviews conducted with a range of informants concerned with the research and development of ubicomp (see the interview schedule in Appendix 2). The majority of the interviews took place in the Silicon Valley area, which according to Finn (2002) and Vance (2007) stretches from San Francisco to San Jose, mostly following the route of Highway 101. The 'valley' is the San Mateo valley and along the path of the highway are Menlo Park, Palo Alto (the heart of the valley), Stanford (and the University that makes it famous), Mountain View (home of Google), Santa Clara (home of Intel and Yahoo!) and San Jose (home of eBay). Interviews were conducted in all of these places, in a variety of contexts; from cafes to boardrooms, and they mostly involved either eating a meal or drinking coffee. All of the informants were very happy to talk at length about their research and many offered suggestions of colleagues or acquaintances they thought I should also interview. In the process of performing the interviews, and the significant amount of driving required to get to the interview locations, there was extensive opportunity to reflect on the cultural contexts that provided a background to the research, the saturation of future-oriented thinking and the profuse optimism of the interviewees that they are making the world in some way 'better' (which I will explore in chapter 6). As both Flowerdew and Martin (2005) and Kitchin and Tate (2000) note, analysis is not a discrete activity that only happens when the researcher intentionally applies themselves to a task labelled as 'analysis', it begins within the collection of 'data' itself and continues until the last word of the paper, report or thesis is written. In this vein, just as the researcher shapes the field in description, the field shapes the researcher through the various ways in which one interacts with it. It is impossible to avoid the possibility of the effects of 'the field' on this work, it has been, I suggest, partially shaped by my eight weeks living in California.

### 2.3 Analytical and conceptual issues for fieldwork in corporate ubicomp research environments

Following on from the discussion of the logistical and pragmatic challenges faced in the empirical work for this research, in this section I want to discuss the specific analytical and conceptual issues of conducting fieldwork in the corporate research setting. I have already suggested that the specificities of researcher and the 'researched', with all that entails – including people, practices and sites, are *generative* of research findings. The specific setting of corporate research and development around ubiquitous computing with the topographic locus of 'Silicon Valley', and the San Francisco Bay area, thus plays a significant part in what it is possible to say in this research account. In this section I shall address how the responsibilities and tensions of specific sites of research activity are important to understanding the different practices of anticipation in which researchers are engaged. I will address four substantive points, in turn, that suggest how the specificities of the research participants are generative of research findings: First, the types of people who participated; second, the corporate R&D setting; third, the role of professional organisations, networks and audiences with which the research participants engage; fourth, the funding models to which the informants are subject. Finally, I use these points to discuss how these 'sites' of research potentially differ from alternative sites of inquiry.

First, then, it is important to note who the research participants are. It is clear from the list of informants, found in Appendix 1, that the majority of those interviewed are corporate researchers. Indeed, not only are many of the informants corporate researchers but many have also spent the majority of their careers in corporate (as opposed to 'academic') research environments<sup>11</sup>. For example, [anonymised] worked exclusively for Hewlett Packard (and mostly in HP Labs) between 1991 and 2008, moving between HP business divisions and HP Labs as a research manager. This strong basis in corporate research and development situates the knowledge and practices, and thus the discourses, in which the research participants operate. Of course, researchers do not necessarily stay in one place. Many of the participants for this research have moved between several other companies that commission ubicomp research, both in Silicon Valley and further afield. Two informants can serve as examples: in the last ten years Elizabeth Churchill has worked at FX PAL, PARC and Yahoo! Research in Silicon Valley, and, similarly, in the last ten years Mirjana Spasojevic has worked at HP Labs, Yahoo! Research and Nokia Research. The research participants are therefore, by and large, firmly ensconced in the realm of corporate research.

Following from this, and second, it is important to understand the corporate context of the research and development practices under scrutiny. While ubicomp

<sup>&</sup>lt;sup>11</sup> Some of the research participants did spend time in academia, Elizabeth Churchill and Tim Kindberg for example, but this experience is outweighed by their work in corporate research and development.

R & D can be said to predominantly exist within the corporate research arena, the development of ubicomp and related technologies can be found in a variety of other, academic and business, contexts—not least 'start-up' companies, as suggested in section 1.3 of chapter 1. The flow of people, ideas and methods between research groups both within and between companies is an important facet of the context of this research. As researchers move between labs so too do specialised practices and 'pet projects'. Movements of people, sometimes whole teams, and their associated micro-specialisms or methodological innovations becomes key to the circulation of ideas that aids in the production of a common frame of reference around research programmes and, indeed, ubicomp itself.

It has been demonstrated elsewhere that the circulation of highly skilled labour both within Silicon Valley and globally to and from the region has substantial economic and intellectual effects in the entrepreneurial and productive potential of Silicon Valley (see: Saxenian, 1994, 2002) and globally (for example: Sassen, 1988). However, this circulation also demonstrates the need to move beyond attending to research centres and labs, or 'institutions', as stable entities that routinely exercise power (in this case, in the production of knowledge and capital). Instead, we need to recognise 'institutions', following Latour (1999) as assemblages that make possible the articulation of research that, in turn, can be used to produce knowledge and capital. Corporate research labs are assemblages, they are spatial and temporal points at which complex relations within the networks that make up ubicomp R&D cohere. This thesis examines a moment in their coherence.

Third, in addition to the predominantly corporate context of the participants in this research, it should be noted that professional associations and conferences perform a significant role in stabilising the networks of people and ideas that make up ubicomp R&D. A number of organisations feature heavily in the context of ubicomp R&D, notably: the Association of Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE) that sponsor (respectively) the international conferences: 'Ubiquitous Computing' and 'Pervasive Computing and Communications'<sup>12</sup>. It is through conferences, professional networks and the informal networks propagated through alumni organisations or regional the propinquity of research centres that audiences for research can be found. For example, in March 2008, during an initial scoping visit, Eric Paulos explained anecdotally how research centre 'open house' days function as a means for setting research agendas sharing successes and engaging peers from across the San Francisco Bay area. Indeed, the audiences to whom researchers variously present their work are addressed differently, depending upon the 'regimes of truth' those audiences operate within, for, as Foucault (2002a) suggests, each community of practice has 'its "general politics" of truth-that is, the types of discourse it accepts and makes function as true' (Foucault, 2002a, p. 133; cf. Gieryn, 2002, on 'truth spots'). As a number of interviewees note, there is a need to frame research according to the audience, whether they are colleagues from other parts of the same company, peers at a different types of conferences, or reviewers for publications.

Fourth, the models for funding to which the research participants are subject play a significant role in shaping the methods and time scales of research. Many of the research centres and laboratories are either the research arm or a wholly owned subsidiary company for research. The funding of corporate research does not necessarily lead to saleable products and thus the calculation of a 'return on investment' is not a clear means of assessing the (capital) worth of R&D. There are therefore other implied metrics by which the 'success' or 'worth' of research are measured. Research participant, Mirjana Spasojevic, further explains these measures:

'the ways... people get measured in industrial research, its... it is papers, I mean that's one important factor, its patents, its prototypes and transferring

<sup>&</sup>lt;sup>12</sup> See the respective websites: <u>http://www.ubicomp.org/</u> and <u>http://www.percom.org/</u> (both accessed: 26/07/10).

them to business units, its... small scale deployments, and its creating... um, visibility in the press' Mirjana Spasojevic (Nokia Research Centre).

These means of measuring and quantifying the production of value—as number of journal articles published or patents filed, for example—also apply particular time pressures. This is typically a facet of the organisational pressure, the friction created by the 'institutional' translation of the various actors in the R&D assemblage into a singular 'interest' (pace Latour, 1987). As Mirjana Spasojevic went on to suggest:

'I worked at HP Labs in CoolTown and ah, a few years later I worked at Yahoo! in the mobile business unit. That was delivering, you know, [I] had to deliver yesterday!' Mirjana Spasojevic (Nokia Research Centre).

Interestingly, the corollary to such time pressures is the time horizons within which researchers are asked to operate. Again, Spasojevic sets this in context:

'[Y]es its always that ten year horizon... [laughs] researchers like to operate on a seven to ten year horizon... um, its an interesting horizon, you can make lots of assumptions, and ah... that may or not be true, or partially be true, but it gives you freedom to kind of imagine things' Mirjana Spasojevic (Nokia Research Centre).

Some companies formalise these temporal bounds of anticipatory action, for example as three to five years, seven years or ten (or more) years, which functions as another outcome of the 'institutional' role of forming and reforming identities, orientations and objectives, which Callon (1986) has called *interessment*<sup>13</sup>. Time horizons are substantively discussed at greater length in section 3.4 of chapter 3. The ways in which R&D outputs and the researchers themselves are measured are a significant element in the context of the 'field' studied in this thesis. These issues in particular mark out the corporate setting as distinct from other possible sites of study, 'start-up' companies for example.

<sup>&</sup>lt;sup>13</sup> Galloway (2010) identifies *interessement* as one of four movements in a 'sociology of translation' (pace Latour, 2005). Galloway (2010) offers further explication of this sociology of translation in relation to technological futurity.
These four issues both illustrate the significant factors that can be generative of research findings, and which also represent some of the bounds to what it is possible to say about 'the field' under scrutiny. Following from these issues it is possible to say that the participants and their related sites of practice differ from other possible sites of research in a number of ways. Corporate research centres can be staffed by particular types of people, as illustrated above, who circulate and enrol one another in communities of practice (further discussed in section 4.4 of chapter 4). The formal and normalised conventions of R&D associated with the 'institutions' of research create pressures and bounds for the exercise of R&D that also function as bounds to this research, namely the 'regimes of truth'14 formulated in the forming and reforming of networks and audiences for R&D outputs. All of these peculiarities of the corporate R&D 'site' of research for this thesis participate in the making of 'the realities' being studied (following Law, 2004). This thesis is not concerned with laying out the specificities of day-to-day activities of anticipation as researchers practise them, and subsequently how these become 'institutionalised', not least for the pragmatic reasons outlined in the previous section. This thesis offers an analytical framework for understanding the rationales and types of practices by and through which the anticipation of a near future of ubiquitous computing is produced. In addressing the points raised in this section, this research is conducted following the diagrammatic approach outlined in section 2.1. I want to now move on to discuss the specificities of the techniques used to address the field of study.

### 2.4 Addressing the field

In the previous sections I have detailed the ethos to the research 'methods assemblage' employed in this thesis and provided an account of the circumstances of going into 'the field', in this section I turn to the details of the techniques and

<sup>&</sup>lt;sup>14</sup> 'Regimes of truth' are further discussed in relation to 'regimes of hope' and the logics of anticipation in chapter 6.

traditional concerns of method. Whereas qualitative methods may have become, in Crang's (2002) terms, the 'new orthodoxy', as Kitchin and Tate (2000) observe, conducting interviews may seem relatively straightforward and unproblematic but 'there is more to interviewing than talking to people' (Kitchin and Tate, 2000, p. 215 original emphasis). The orthodoxy of which Crang (2002) speaks in large part comes from a lack of questioning of the practice of methods, therefore building on the discussion in the preceding sections, in the final section of this chapter I detail the research methods used to address 'the field'. I suggest there are three traditional concerns for the discussion of empirical methods of enquiry, which are: technique (specifically the technique of interviewing), access to the field and/or informants, and the ethics of conducting the specified research. In the next three subsections I outline the use of an 'interview guide approach' and the associated issues, how access to the expert informants was negotiated, and the ethics procedure employed.

### 2.4.1 Performing interviews: the 'interview guide' technique

The interviews conducted for this research project were all performed using an 'interview guide approach', which does not specify particular questions, or turns of phrase, but outlines a set of common themes to be covered in each interview. As Rubin and Babbie (2010) suggest:

'An interview guide is a qualitative measurement instrument that lists in outline the form the topics and issues that the interviewer should cover in the interview, but it allows the interviewer to adapt the sequencing and wording of questions to each particular interview' (Rubin and Babbie, 2010, p. 104).

This interview technique affords a means of ensuring that there is consistency across the range of interviews conducted without enforcing a programmatic system of conducting the interviews. Such flexibility is particularly important where there may be significant differences or uncertainties in the context and position of the interviews. For example: informants had varying amounts of time available, there was a diverse array of technical terminology used by different informants, and the nature of the topic of discussion (ostensibly 'the future') can lead to a lot of diversions. The themes of addressing the topic of future orientation that were used often required a process of finding the right words with which the interviewee is comfortable. The general themes employed in my notes when addressing questions were: 'expectation', 'hope', 'how far to look forward', 'prediction', 'promise' and 'visions and plans'. These themes allowed for enough flexibility in discussion to bring out a significant range of material, which features in the substantive chapters of this thesis.

The interviews were all (with the exception of one) recorded using a digital dictaphone device (specifically an Olympus WS-110 Digital Recorder). This device proved reliable and contained a storage facility that was adequate for the task. I transcribed 13 of the interviews using the free software 'ExpressScribe' with a digital transcription foot pedal. Transcription of the interviews was also conducted by a professional transcription service, employed to transcribe ten of the 24 interviews. I conducted the analytical 'coding' of the material gathered manually, by which I mean I did not use specialist software. I feel this offered greater flexibility for engaging the whole 'methods assemblage' at work, rather than over focus the analytical process in formulating a specific analytical framework. As Marcus Doel (1999) infers in his extraordinarily insightful addendum to Eric Laurier's (1999) performative exploration of the role of transcription in the research process, text can unnecessarily close the transport of meaning: 'the problem of materialisation; of matter and expression' (Doel, 1999, p. 46). I am of course aware of the many and varied forms of analytical strategy ('26' if we are to believe Tesch, 1990) but as Schiellerup (2008) observes with regard to coding software, the apparent certainty of applying the technical process, lent authority by the technology itself, can be seductive. It is necessary to let some things go in the analytical and writing processes. If the account is emergent from the co-production of the 'event' of research what emerges is a thesis that is one of what may have been many:

'Writing up involves leaving all the theses behind that could have been written in favour of this 'one" (Schiellerup, 2008, p. 169). Indeed, Rosalie Wax's cautionary observation on 'the ambiguities' of research practice seems to hold very true as I write this document:

'It's a horrible but inescapable fact that it takes more time to organise, write, and present material well than it does to gather it' (Wax, 1983, p. 131).

### 2.4.2 Access & dealing with experts

As outlined in previous sections the interviews for this project were largely arranged through existing connections I had in the San Francisco Bay area. The meetings with industry experts in my first visit to 'the field' proved invaluable in affording suggestions for possible informants and introductions to key people. A useful aspect of the technology industry per se was the use of emerging social software such as the system for propagating business links 'linkedin.com'. LinkedIn provided opportunities to introduce myself to relative strangers under the auspices of shared connections. The open nature of many of the people that work in research and development also facilitated the process of approaching people for interview. While some of the informants interviewed are experts renowned in their own field and hold relatively senior positions in the organisations in which they work, I did not experience the problems other scholars have with regard to 'elites' (see for example: Cochrane, 1998; Herod, 1999; Mullings, 1999).

### 2.4.3 Ethics

In this project I adopted the key ethical precepts for research laid out by the Economics and Social Research Council: for example, I attempted to ensure integrity and quality of research; I openly disclosed my research intentions to all research staff and subjects involved; where appropriate I have kept applicable information confidential and respondents anonymous; and I have, to the best of my ability, made clear and explicit the independence of my research and any partiality that will inevitably be present. To this end, all informants were provided with a sheet explaining the purpose of my research, where this was not possible I gave an oral summary and subsequently emailed them a copy of the information. I obtained either oral permission or written permission from informants for the use of the 'data' gathered in interview with them.

#### 2.5 Conclusion

The research ethos and the 'methods assemblage' outlined in this chapter are crucial and contingent parts of the 'knowledge event' that surrounds and flows through the creation of this thesis. My principal claim with regard to 'methods' is that this thesis represents an attempt to write between the empirical encounter with 'the field' (through interviews, in this case) and the practical engagement with theory. I have argued that this is a co-productive method of analysis, which suits this research project because of my expertise in the field and the nature of the phenomena being studied; namely the ways in which futures are articulated. Furthermore, I have argued that the mode of writing is as much a part of the method employed in this thesis as the empirical interaction with the field. Thus the 'diagrammatic' organisation of the substantive part of this thesis, in the next four chapters, should not necessarily be read as a cumulative account that seeks to provide a calculated 'truth'. Instead, this thesis performatively maps futurity in ubicomp R&D, making present differences in discourse and practice in the phenomena of proactive anticipation of futures of ubicomp. This methodology articulates an 'associative' politics concerned with the capacity of the various participants in the phenomena of study to 'band together and act in concert but in the manner of a 'swarm', rather than in consequence of some pre-figured category of political interest' (Whatmore, 2009, p. 592). As I will demonstrate in the following chapters, these communities of practice are allied to a 'minoritarian' politics (Deleuze and Guattari, 1994), in which they can produce 'in the very process of their emergence,

the power to object and to intervene in matters which... concern them' (Stengers, 2005, p. 161). Therefore, the research ethos described in this chapter opens the possibility to attend to the 'crystallisation of power relations' (Mouffe, 1999, p. 5) in the emergence of collective forms of the anticipation of ubiquitous computing futures.

## Chapter 3

# Locating the technological future: Expectations of ubiquitous computing

### 3.1 Introduction

The ways in which futures are addressed in ubiquitous computing research and development (R&D) can be characterised as a negotiation between teleological narratives of technology and less historically led understandings of the future as open. In broad terms, this tension is made present by analysis as the differences between what has been characterised as 'the pervasive sense that technologies transform us in irrevocable ways' (Sturken and Thomas, 2004, p. 4) and an understanding that 'each present opens out a multiplicity of futures' (Löwy, 2005, p. 115). It is important to unpick this overly reductive understanding of technological futurity because it elides the interesting and more nuanced ways in which futures are represented. In this chapter, therefore, I open out a 'discourse of anticipation' as a means of conceptualising futurity in relation to technology development. In the latter part of this chapter I apply this critical analysis specifically to the engendering of 'expectation', which I identify as a particular mode of anticipation within ubicomp R&D.

As highlighted in Chapter 1, ubicomp is peculiar as a form of computing R&D because it does not follow the scientific model of gradually accruing evidenced based solutions to problems as they are proposed. Instead, futures are imagined and the seemingly impossible is proposed, in the guise of technical capabilities that are not yet possible. Bell and Dourish (2007b, p. 133) aptly summarise ubicomp by suggesting it: 'encompasses a wide range of disparate technological areas brought together by a focus upon a vision'. That vision is, of course, Weiser's 'Computer for the 21st Century', but, by inference, the 'vision' can be expanded to include subsequent representations of the

future in ubicomp R&D. Yet whilst it may be unusual as an explicit step in a design process, the production of visions of the future focussed upon technologies are well established. As Michael (2003) suggests, there is a persistent impetus to look to the new and exotic as that which is familiar is rendered mundane. Technological futurism is concerned less with the material product and more with the vision:

'the interest of the stories is rooted in the anticipation that digital technology, as technology, represents the future of our... social and physical environments' (Waltz, 2003, p. 377).

Furthermore, as we will explore in the next section, the reductive arguments that technologies are not just advantageous, but inevitable, continue to be rehearsed and rehashed. Such technological determinism is perpetuated precisely because a 'general, ill-defined, but vocational sense of futurism accrues to the conception of technology in popular circulation' (Waltz, 2003, p. 377). In this chapter I present an analytical means of addressing the 'futurism' Waltz (ibid.) describes.

Before moving on with the main discussion of this chapter I want to briefly detour through precisely what I mean by the use of the term 'discourse', specifically through the work of philosopher Michel Foucault. A Foucauldian<sup>15</sup> 'discourse' can be understood as a group of statements and practices that determine the range of ways in which it is possible to represent something. Knowledge and practice meet in 'discursive formations' that Foucault describes as 'a complex group of relations that function as a rule' (2000b, p. 33). Knowledge, in this sense, is the statements, which may differ in

<sup>&</sup>lt;sup>15</sup> The reading of Foucault's work here principally concerns what has become known as his 'archaeological' work, taken from the analysis and methods found in his books 'The Order of Things' (2002b) and 'The Archaeology of Knowledge' (2000b), although it is important to note that the concept of 'discourse' is applied in Foucault's later 'genealogical' work. As Stuart Elden points out, archaeology and genealogy should not be viewed as mutually exclusive:

<sup>&#</sup>x27;Archaeology looks at truth as a system of ordered procedures for the production, regulation, distribution, circulation, and operation of [discourses], whilst genealogy sees truth as linked in a circular relation with systems of power which produce and sustain it, and to effects of power which it induces and extends' (Elden, 2001, p. 104).

substance and sometimes contradict one another. However, as John Allen insightfully remarks it is 'a certain regularity in the relations between statements that provides an unproblematic way of talking about a topic' (Allen, 2003, p. 25). Equally, a set of practices is evoked by describing a discourse, which may be discontinuous, overlap or interfere with one another but nevertheless are related and governed by what it is possible to say and think about a particular topic. A discourse is not *only* knowledge *or* practice, it is neither one or the other, it is both. A discourse contains and constitutes several conventions or rules, which govern: the production of statements; create spaces in which new statements can be made; and establish practises as the material conditions of knowledges (see: Foucault, 2000b, pp. 35-45). Discourse is 'eventalised' (Foucault, 1991b, pp. 76-78) as singular moments of 'discursive formation' (Foucault, 2000b, pp. 31-39) via which the discourse is understood at any one time.

This chapter proceeds in three parts. First, the role of the rhetorical scaffold of technological determinism as an undercurrent to future orientation is critically examined from ubicomp's futuristic 'mythology'. With this critical approach to technological futurity in place, alternative understandings of ubicomp's future orientation are signalled. Second, the chapter describes a discourse of anticipation as a means of understanding the proactive nature of the explicit futurity inherent to research and development practices in ubicomp. Further, in the third section, the locus of the present as a place of anticipation from which we look towards particular futures is theoretically examined through the lens of expectation. Accordingly, ubicomp is examined through the lens of a 'sociology of expectation' (Borup et al., 2006) in contemporary Science and Technology Studies (STS) discussion of technological development. From this literature four senses of expectation are explored as a means to addressing the futurity of ubicomp, which are: 'constitutive force', 'temporal variance', 'socio-spatial variability' and 'performative imagination'. I conclude this chapter by discussing how the disciplinary function of rhetorics of futurity lies in contrast to the

modes of anticipation that play out in ubicomp R&D. This importantly lays out the basis of the discussion of a politics of anticipation, which runs through this thesis.

### 3.2 Engaging futurity – technological determinism and ubicomp's 'mythology'

Science finds, Industry applies, Man conforms — Motto of the 1933 Chicago World's Fair

Engagement with the future is an imaginative process; it relies on tacit knowledge, which when applied to technology express an interesting problematic. Technology is perhaps the key indicator by which we measure change. As Arendt (1958, p. 144) aptly observed '[t]ools and instruments are so intensely worldly objects that we can classify civilisations using them as criteria'. For example the categorisation of human 'pre-history' into eras, such as 'Stone Age' or 'Bronze Age', and the contemporary predilection for 'revolutions' in technology development, such as the 'Silicon Revolution' (Bondyopadhyay, 1998) or 'Quantum Revolution' (Dowling and Milburn, 2003) all point to attempts to mark time by a perceived technological advancement. These 'ages', 'eras' or 'epochs' are, following Koselleck (2004), the semiotics of narratives of temporality (on 'epochs' see also: Blumenburg, 1983). However, it is a deceptively small conceptual step to shift from post-rationally identifying historical trends in the apparent influence of technologies to asserting that technologies themselves drive economic, social or political change.

In this section I want to argue for engaging with socio-technological futurity in three principal ways. First, I want to briefly address the normative discourse of technological 'progress', its basis in a historicist understanding of time, and reflect on the spectre of 'technological determinism'. Second, in what might be characterised as a 'postphenomenological' manoeuvre (loosely following Ihde, 1993; 2009; via Deleuze, 1988a; 2004), I will outline the theoretical basis for this engagement of futurity as anchored in the 'living present' (pace Hoy, 2009), at the edge of which is the future 'to come' (l'avenir following Derrida, 1994; 1999)<sup>16</sup>, a future not determined in advance but 'open' (following Adam and Groves, 2007; pace Deleuze, 2006a). Third, building upon the theoretical underpinnings previously described, I will demonstrate how it is necessary to view the future orientation inherent to ubicomp R&D as 'anticipatory', which will lead to further discussion in the next section of this chapter.

To contextualise the efforts to anticipate and traverse the future, we can start from the differentiation between *facta* and *futura* made by Bertrand de Jouvenel in 'The Art of Conjecture' (1967). For de Jouvenel (1967, pp. 3-4) past events and material things influence the present are *facta*, whereas *futura* are possibilities that have yet to be actualised. Barbara Adam takes de Jouvenal's (1967) delineation further in her own significant work on the experience of time (in particular Adam and Groves, 2007; see also: Adam, 1990; 1995). The important distinction is that 'facts are material... while the future is immaterial, its primary domain is the human mind' (Adam and Groves, 2007, p. 195). Yet this distinction can also be problematised from two directions in ubicomp, both of which can be seen as means to grant a future materiality. First, futures are rhetorically treated as foregone conclusions, particular places in time to which we are inexorably heading. We are thus asked to take specific futures seriously, and expect their particular characteristics to be rendered material. Second, futures are frequently represented in detail, as 'scenarios' to be mitigated or 'visions' to be achieved,

<sup>&</sup>lt;sup>16</sup> Whilst both Gilles Deleuze and Jaques Derrida draw upon a Nietzschian tradition of thinking about history thay arrive at rather different conclusions. Deleuze (2004) sees difference in the selective (eternal) return of affirmative repetition – the future is 'the deployment and explication of the multiple' (ibid. p. 141). Derrida differentiates between the teleological, predictable history as *le future* and the unpredictable, and for him eschatological, unexpected future *l'avenir*. The latter, affirtmative rendition of temporality as *l'avenir* is characterised as messianicity 'without messianism' (Derrida, 1999, p. 242), by which he means the possibility of radical change without the figurative agent of a 'messiah'. This 'messianicity' is built into temporality and 'temporality is a condition of the possibility of history' (Hoy, 2009, p. 165). Whereas Derrida appeals to the 'transcendental' time Deleuze appeals to an 'immanent' temporality.

which we are similarly asked to believe will become materially present. Thus, the aim of this section is to analyse the conceptual basis by which representations of technological futures are rendered as more *facta* than *futura*. In particular, I critically examine such futurity extrapolated from the regulative rhetorical framework of technological determinism, which attempts to impose a sense of inevitability by asserting a form of historical progress towards particular technological developments.

As David Couzens Hoy (2009, p. 141) suggests, in his 'critical history of temporality', the word future 'perhaps should always be followed by a question mark'. An initial distinction in understandings of futurity can be drawn between the phenomenological and the historical senses of 'the future'. This is not simply a distinction between an individual ('subjective') understanding of the future and a collective future, although, as both Adam and Groves (2007) and Hoy (2009, p. 14) suggest, it is certainly a central part of the difference. Let us take each of these senses of the future briefly in turn. In terms of the 'historical' there is also a difference between teleology and eschatology (which will be further addressed in chapter 6). Teleology denotes a historical account of the linear progress or developmental emergence of social and political events and structures towards a particular outcome or telos. Eschatology, in contrast, tends to imply a more sudden rupture (particularly in the religious sense of the coming of a 'messiah', see Fiddes, 2000), which in many cases brings about an 'end' of times, that is anticipated and yet the precise timing of that event is unknown. Historical understandings of time, tied to the assertion of a self-conscious subject, are the underpinnings of an irresistible progress 'something that automatically pursued a straight or spiral course' (Benjamin, 1999, p. 252). Hegel positioned this progress or telos as the 'Universal History', a 'universal' progress towards absolute knowledge, and/or social and political freedom.

Yet, as Hoy (2009, p. 147) highlights, whilst Hegel and Kant (in Hoy's terms) 'paint a utopian picture of universal history for all humankind... [s]keptics about this picture fear that such a hope for the future only serves to cover up the injustices of the present'. Of course, this supposition of progress has been widely critiqued, not least by Walter Benjamin who, in his 'Theses on the Philosophy of History' (2007), highlights that such a universal history requires the author to be 'outside' the temporal process of actual history as an observer. Given that we are always already *in* history its end is always in the future, which will, as far as we know, never come. Rather than a clear view 'forward' into the future, which Benjamin (2007) suggests masks the injustices of past and present, our future orientation is backward looking. Temporality, or time as experienced by humans, is 'directional even if it has no particular direction or telos' (Hoy, 2009, p. 157). For Benjamin (2007) the 'messianic' or 'revolutionary' potential held in the assemblage that constitutes each present 'opens up' the future. Through the concept of the 'continuum of progress' (Hoy, 2009, p. 157) Lowy (2005) takes Benjamin's position further, we thus arrive at the position I adopt in this thesis: 'each present opens onto a multiplicity of possible futures' (ibid. p. 115).

Despite the unpicking of transcendental teleological narratives, something like a 'universal' historical stance remains implicit in the ways in which 'progress' is discussed and recorded as, in some way, technologically determined. A 'better' world will be achieved, if not determined, by progressive technological advancement. 'Meta' narratives, such as forms of technological determinism, that are dogmatically adhered to and function as disciplinary apparatuses for regulating expectations of the future are, to borrow a phrase, 'macromyopia' (Barlow, 2004, p. 181), they constitute a singular vision. However, the seduction of narratives of 'determinism' is enduring. Langdon Winner, political scientist and influential commentator on the politics of technologies, asserted in his widely cited book 'Autonomous Technology' that there is a 'curious paradox that plagues almost all discussions of technological change' (1977, p. 46). I contend that this is still broadly true. On the one hand there is the belief that technological development progresses under its own inertia 'resists any limitation, and has the character of self-propelling, self-sustaining, ineluctable flow' (Winner, 1977, p. 46). At the same time there is a parallel but entwined belief that human beings are masters of their own technological destiny, that humans have a 'conscious choice in the matter and that they are responsible for choices made at each step in the sequence of change' (ibid.). This paradoxical state, it is indirectly inferred by many (not least Marx, 1959; see also: Ellul, 1964; Galbraith, 1974), is the condition of 'modernity'<sup>17</sup>. Of course, arguments over the ontological and epistemic status of technology, particularly in relation to our experience of temporality, have been rehearsed for over a century. There is little point in offering a potted history here, others have produced excellent detailed discussions (for example, see: Bijker, 1995; Latour, 1993, 1999; Nye, 2006).

Technological determinism, at its simplest, is the assertion that technological change both occurs somehow independently of social or political forces and that it causes or determines social change (see: Nye, 2006; Robins and Webster, 1999, p. Ch. 3; Wyatt, 2008). Yet, as suggested above, there frequently seems to be a paradoxical corollary that humans have a conscious choice in the production, which by implication is practised by a self-determined elite. Sally Wyatt, Professor of 'Digital Cultures in Development' with widely cited work on technology policy, has argued that scholars cannot simply dismiss and ignore technological determinism. Wyatt suggests we

<sup>&</sup>lt;sup>17</sup> 'Modernity' comes in as many versions as there are commentators and scholars invoking it, yet all its definitions point, in one way or another, to the passage of time. The adjective 'modern' designates a new regime, an acceleration, a rupture, a revolution in time. When the word 'modern' 'modernisation', or 'modernity' appears, we are defining, by contrast, an archaic and stable past. Furthermore, and following Latour (1993), the word is used to constitute and perpetuate a quarrel where there are winners and losers, the 'Moderns' (following Latour, 1993) and others. 'Modern' is thus doubly asymmetrical: it designates a break in the passage of time, and it designates a combat in which there are victors and vanquished' (Latour, 1993, p. 10)<sup>17</sup>. 'Modernity' is thus a rationale for regulating the understanding of the passage of time as linear. As Winner (1977, p. 46) suggests, 'modernity' in simple terms, 'means "all of those changes that distinguish the modern world from the traditional societies'''. A range of 20th century scholars attempted to articulate (pseudo) scientific 'laws' that dictate a process of linear progress determined by technological development (examples include Apter, 1965; Ellul, 1964). It is from this analytic frame that the word 'modernity' is used here.

'cannot simply despair of the endurance of technological determinism and carry on' (2008, p. 169). To conduct an alternative analysis, following Wyatt, it is necessary to 'take technological materialism more seriously, disentangle the different types, clarify the purposes for which it is used by social actors in specific circumstances' (ibid. ). We must not entirely discount technological determinism, although we should not blithely affirm it, instead, following Wyatt (2008; cf. Bijker, 1995), it is possible to chart the role 'technological determinism' (as a discursive trope) is performing. Wyatt's (2008) typology of technological determinisms is accordingly a useful analytical tool enabling us to argue a starting point from which to discuss the mechanisms of anticipation at play in ubicomp.

So, most forms of technological development, including ubicomp, get routinely promoted and questioned by various evangelists and critics and can readily be described as a discourse (pace Foucault, 2000b), by virtue of the clear meeting of knowledge and practice. As such, ubicomp is not immune from the 'meta' narratives applied more broadly to technology and society, and so there are, of course, technologically determinist descriptions and narratives applied to ubicomp. There are four types of technological determinism outlined by Wyatt (ibid. p. 167), which are: 'justifactory', 'methodological', and 'normative'. 'descriptive', 'Justifactory' technological determinism is described by Wyatt (2008, p. 174) as 'the type of technological determinism used by employers to justify downsizing and reorganisation'. It is the rationale (of technological determinism) that is employed to assert the improvement of wellbeing and 'quality of life' through technology. It can be found in government policy, it is the logic behind claims for technologically enabled 'efficiency savings' in budget reviews, and can be found in strategy documents<sup>18</sup>. 'Descriptive' technological

<sup>&</sup>lt;sup>18</sup> To provide evidence of the inherent justifactory technological determinism in policy documents, Wyatt (2008) points to the European Union Information Society Forum report (2000, p. 3), which claims: 'The

determinism, Wyatt (2008, pp. 174-175) argues, is the characterisation of technological determinism as the 'other' argument, which is simply dismissed, recognisable in the work of some branches of the STS community (Wyatt suggests Mackenzie and Wajcman, 1999; Misa, 1988; Smith and Marx, 1994). 'Methodological' technological determinism, Wyatt argues, is actually what STS scholars are, in fact, practising, whether via actor-network theory, social constructivism or innovation theory. Wyatt's provocation is 'that our guilty secret in STS is that we are really all technological determinists. If we were not, we would have no object of analysis; our *raison d'être* would disappear' (Wyatt, 2008, p. 175). Finally, 'normative' technological determinism is the supposition of technology that has become so big that it is no longer subject to human/social control. 'Normative' technological determinism is the 'autonomous technology' of Winner (1977).

Following Wyatt's (2008) schema, how might we identify ubicomp's appeal to the perpetually near, yet never realised, 'better' future? Firstly, I think it apposite to identify the early stories (particularly those propounded by Weiser, 1991) that get told about the near future of ubicomp as akin to a mythology. Whereas a significant number of mythologies are concerned with an origin, ubicomp's mythology is a means of revealing a (near) future<sup>19</sup>. Accordingly, the ongoing promulgation of ubicomp's mythology not only binds together a diverse and varied collection of research practises from ethnography (see Dourish, 2006) to network design (Tayal and Patnaik, 2004) and software engineering (Decker et al., 2005)—but also perpetuates a certain teleological sense that there is a particular type of future for which ubicomp research aims. I believe

digital economy is radically changing the way we live, work and communicate, and there is no doubt about the benefits that will lead us to a better quality of life.'

<sup>&</sup>lt;sup>19</sup> However, ubicomp's mythology also reflects back and constitutes a 'creation' of the field or sub-discipline and, indeed, the myth itself. This is not least because Mark Weiser died in 1999, with the field in its infancy, and is thus not able to answer the repeated use and adaptation of his original vision.

this 'type' of future is exemplified in the, uncharacteristically poetic, final sentence of Weiser's essay 'Computer for the 21st Century', which is:

'Machines that fit the human environment instead of forcing humans to enter theirs *will* make using a computer as refreshing as a walk in the woods' (1991, p. 75)

There is an assertive optimism couched in abstract terms in Weiser's statement, given that there is not a description of the specifics of the future to which Weiser alludes, nor when it will come. Instead we are given an allegorical vision of the 'type' of the future to expect, and we are told that it is a future that will come. Yet, even now, almost twenty years on from the publication of Weiser's vision, and a decade into the century to which he refers, ubicomp literature still refers to Weiser's ideals in the future tense, they are to-come (this is discussed further in chapter 4, see also: Bell and Dourish, 2007b). So, we can see an appeal to something like a pragmatic 'justifactory' technological determinism - if we want the benefits outlined by Weiser then we must pursue the R&D assuming that direction. However, there is also a sense in which the mythology is merely a device to evoke a looking to the future as such, rather than specifying the content of a future. In this sense ubicomp's technological determinism is 'descriptive'. We can accordingly see how the mythology functions as a discursive mechanism of the futurity that underlies ubicomp's practises. Just as Wyatt (2008) argues, then, the technological determinism at play in the anticipatory discourse of ubicomp should not be merely discounted but attended to as one of the many aspects of its assemblage.

However, if we recognise technological determinism as a rhetorical trope and not an ontological argument, and, furthermore, if we do not use a historicism to form the basis of an engagement with futurity and adopt the principle of an 'open' futurity then we must adjust our theoretical grounding. The 'phenomenological' sense of future positions human 'understanding' as 'the projection of possibilities [which] looks ahead towards the future' (Hoy, 2009, p. 148). Following Heidegger (particularly in Being and Time 1962) an authentic 'temporal comportment' means understanding the future as a 'coming toward' as opposed to the inauthentic understanding of 'going-to' (for further explication see: Hoy, 2009, pp. 147-150). However, following Ihde (1993, 2009) and in line with broader investigations of non-representational geographies (see: Anderson and Wylie, 2009; Ash, 2009; Simpson, 2009; Wylie, 2005), I argue we can move further, towards a postphenomenological understanding of future orientation.

The spectre of a transcendental teleology remains as a lurking presence behind expositions of phenomenological sense of the future, in Heidegger's 'authenticity' or Husserl's 'transcendental ego'. American philosopher Don Ihde has sought, since the early 1990s, to explicate a 'non-foundational' phenomenological approach to understanding human-world relations (see: Ihde, 1993, 2003, 2008, 2009). Ihde's 'post-phenomenology' (1993, 2009) does not assert pre-existing subjects or a transcendental force but instead argues for 'the philosophical analysis of human-world relations-including its technologically mediated character-and the constitution of subjectivity and objectivity within these relations' (Verbeek, 2008, p. 13). Thus, to make a shift away from teleology I argue, in line with Hoy (2009) and in the spirit of Ihde (2009), a postphenomenological shift is necessary. I therefore want to briefly outline a theoretical basis for attending to how future orientation is not derived from the singular being of the 'molar' I, which remains significant rather than totalising, but from the multiple becoming of 'molecular' selves (following Deleuze, 2004; 2006a; 2006; also Hoy, 2009, pp. 158-163; Mullarkey, 2006, pp. 20-24). see А postphenomenological stance, following Ihde (2008, p. 6) is not 'subjectivistic' - 'clearly one begins with the first person but does not end with it' (ibid.). Taking this a step further, and in line with work in non-representational geographies (see: Anderson, 2006b; Bissell; Dewsbury, 2007; Wylie, 2006), the postphenomenoligical stance adopted here is trans-subjective (Dewsbury, 2003):

'Underneath the self which acts are little selves which contemplate and which render possible both the action and the active subject... it is always a third party who says "me"' (Deleuze, 2004, p. 96).

'Selves', according to Deleuze, and following Hoy (2009, p. 159), are 'larval subjects' (Deleuze, 2004, p. 99) which emerge from habits and the grounding of memory. The future, then, is something like a simultaneous 'going-to' and 'coming toward' as the larval subject projects 'forward' and the potentiality of the world is actualised in events of anticipation.

Events are singular moments of time-space when assemblages of ideas, institutions, people, places, social conventions, technologies and any other entities we might otherwise dilineate come together, they are 'precarious achievements' (to somewhat misappropriate a notion used by Law, 2002):

'An assemblage is the product of multiple determinations that are not reducible to a single logic. The temporality of an assemblage is emergent. It does not always involve new forms, but forms that are shifting, in formation or at stake' (Marcus and Saka, 2006, p. 104).

An event happens, assemblages are formed, broken and reformed, practices and politics ensue, researchers give accounts of those assemblages, and yet the event always exceeds that which is actualised (Deleuze, 2006a, pp. 86-93). Thus, in thinking through the variety of interconnections of everyday life we might engage in 'event-thinking', which 'can be understood to be part of an anti-reductionist project that seeks to describe the relations between actual things, bodies and happenings, and the independent reality of these events themselves' (Fraser, 2006, p. 129). Philosopher of science Isabelle Stengers (2000) identifies all of the constituent parties that make up (scientific) research processes as constituting 'knowledge events'. In particular, scientific evidence does not pre-exist the practices of enquiry, both scientist and object of study are '(re)constituted through the activity of research' (Whatmore, 2005, p. 95). Therefore, in attending to the future orientation of ubicomp, given a postphenomenological sensibility, I argue that we are examining events of anticipation, configured in assemblages of knowledge, people, places, practices, and things.

Through Adam and Groves (2007) modes of futurity, we can begin to chart the epistemological resources that can be mobilised to address ubicomp's future orientation. Futures figured by emptying them of connection with the complex relations of the present and opening them to conditioning are 'present futures', not unlike Heidegger's 'going-to', whereas futures figured as 'a realm of latent futures in the making' (Adam and Groves, 2007, p. 17) are 'future presents', akin to Heidegger's 'coming toward'. Arrangements of present future and future present coalesce around various formations of practice. Adam and Groves (2007) situate the difference between present futures and future presents in terms of an ethics of future orientation, that there is something like 'good' and 'bad' futurity. On the one hand we have the 'bad', an 'empty' future which can be largely scripted, and on the other the 'good', a latent futurity which we all have a part in making. Whilst Adam and Groves do give credence to future as 'futurity' that is 'both lived and living' (2007, p. 175) the future 'at the level of organised organic and inorganic matter' is lived 'in degrees of receding consciousness' (ibid. 2007, p. 175). What is perhaps diminished then in Adam and Groves (2007) concerted attempt to address 'the reality status of the future' (ibid. 2008, p. 171) is an attention to precognitive dispositions and a 'technological unconscious' (Thrift, 2004c) that extend existing experience towards a future (this will be further addressed in chapter 5). Thus in taking these analytical resources forward, Adam and Groves' (2007) 'future presents' and 'present futures' can be adjusted to a postphenomenological frame of reference, to take in the sense in which they are co-constituted in a rationale of futurity, and to include the pre-cognitive (see chapter 5).

In this thesis I am not seeking to prove or disprove ontological positions about futurity – ubicomp as a case study cannot do so and this is outside the terms of reference outlined in chapter 1<sup>20</sup>. Neither am I looking to somehow refute technological determinism as a modernist agenda that asserts a peculiar sense of historical progress, as Wyatt (2008) has suggested, we should not discount such determinism but recognise it as an element of the broader discourse of future orientation. What I am doing in this thesis is developing a model to understand what I argue is a proactive orientation towards the future, inherent to the development of technology. This allows to me more specifically address the nuanced modes of anticipation that play out in ubicomp R&D in particular ways. To describe how and why I see ubicomp's appeal to the future as 'proactive', in the next section I want to discuss these modes of futurity as figured in a discourse of anticipation.

### 3.3 A discourse of anticipation

'Life depends upon anticipation' (Husserl, 1970, pp. Part II, §9)

'It seems... the expression "knowledge of the future" is a contradiction in terms' according to de Jouvenel (1967, p. 5) and yet there is a strong impetus to make the future open to action or to make the future present to ascertain the nature of that future. A specific type of future orientation takes place in ubicomp R&D that can be understood as 'anticipation', the underlying rationale of which is, to borrow from the Oxford English Dictionary (Oxford English Dictionary, 1989) definition, variously: 'to take possession of beforehand', 'to occur earlier, or advance in time', 'to realise beforehand (a certain event)', and 'to look forward to, look for (an uncertain event) as certain'. In short, I argue, technology development, and particularly ubicomp, is innately an *anticipatory* enterprise. Ubicomp as an array of R&D activities is, of course, like many other branches of computer science, driven by problems emergent from past

<sup>&</sup>lt;sup>20</sup> For critical engagement with the ontological and epistemological arguments around temporality see Adam and Groves (2007) and Hoy (2009). For critical discussion about the function and agency of technological determinism see Bijker (1995), Latour (1987, 1994, 1999), Nye (2004) and Wyatt (2008).

data and results but further, and more importantly, it is fixed on the abstract goal of achieving a perpetually near future inspired by the mythology arising from Weiser's (1991) research vision: 'Ubiquitous computing... encompasses a wide range of disparate technological areas brought together by a focus upon a vision' (Bell and Dourish, 2007b, p. 358). The significance of the anticipation involved in ubicomp is that it stretches beyond the specification of the functions a 'future' technology to include not only how the technology would be used and by whom but also the type of world in which it would exist. This is a form of engagement with the future with which we are familiar, as Adam and Groves assert (and it is worth quoting at length):

'We learn it as children and, once absorbed, it requires no further teaching or explanation. From a very young age children are expected to be able to employ it. What will you be when you grow up? What do you think you will be when you grow up? What would you like to be when you grow up? We don't think twice about asking children about their expectations and anticipations... unaware ourselves of what might be entailed in such questions: all three of them ask the child to project herself into the realm of the not yet. All three ask her to imagine. Yet they also contain subtle differences: one asks about what will be, one what might be, while the other still assumes a causal connection between the future and desire, thus implying futures are made and there for the taking... Whatever the emphasis, however, the future in question here is the one in the mind' (Adam and Groves, 2007, p. xiii).

Anticipation, according to Mandel (2002, p. 246), is the future oriented 'ability for humans to conceptualise, to make abstractions, elaborate plans and imagine'. In this sense, anticipation, as a mode of thought, is the notion of making futures present, actually or virtually, somehow in advance. Following Adam and Groves' (2007, p. xiii) subtle distinctions between 'what will be', 'what might be', and what is desired, we can see that anticipation is a cognitive mechanism for engaging with futures. There is, however, a contradiction between a striving for stable futures and the sometimes unsettling difference of the making-present of the actual moment. Rather than affirm an ability to discern characteristics of future events, the success of which is highly improbable, I argue it is important to explore the means by which futures are characterised. Anticipation is employed here not as another all-consuming analytical category but as a signpost for a range of dispositions towards the future:

'not simply a given but a practical achievement emergent from... practices that create, know and govern possible, potential or preferred futures' (Anderson, 2007, p. 158).

Given the post-phenomenological basis outlined in section 3.2, the type of anticipation discussed here is not the process of actualising the future as such but a discourse of future orientation. As Bourdieu (2000) notes, anticipation is the addressing of a 'forth-coming', an immediate future that exists in the 'present property of things' (Bourdieu, 2000, p. 208) apprehended by acts of 'practical anticipation' (ibid.). This 'practical' anticipation is linked with, and produces knowledge (through methods such as 'foresight', see chapter 4) in, the various institutions, people and practices of ubicomp R&D to form a discourse of anticipation. Accordingly, this discourse of anticipation, like other discourses, is, following Foucault (2000b, pp. 117-120), the conjunction of knowledge and practice. However, we only 'know', or at least name, a discourse postrationally. Anticipatory discourse is accordingly 'evantalised' (Foucault, 1991b, pp. 76-78) as singular moments of 'discursive formation' (Foucault, 2000b, pp. 31-39) via which the discourse is understood at any one time. Accordingly, this theorisation of anticipation as a discourse attends to our own entanglement in the descriptive process. The exploration of the relationship between ubicomp and a discourse of anticipation 'entails that we understand ourselves not as objective observers and voyeurs but as implicated participants, inescapably responsible for [a] future in the making' (Adam and Groves, 2007, pp. 14-15).

Anticipation is different to, yet sometimes interchangeable with expectation, which in turn is different to, yet aligned with, conjecture and prediction, presumption, prognostication and speculation (and many others). It would be a mistake to offer some kind of typology to this vocabulary but I would like to sketch some reasons for using the term 'anticipation'. Firstly, and simply, as a noun formed from a verb, anticipation has an inherently active sense. Secondly, and notably, there exists a literature on various ways of understanding futurity and particularly anticipation. A small but significant amount of work has been conducted in human geography explicitly on the ways in which futures are and have been figured and attempts have been made to engage with futures (for example: Adey, 2009; Anderson, 2006b, 2007, 2010d; Budd and Adey, 2009; Evans, 2010; Kitchin and Kneale, 2001; Kraftl, 2007; Macnaghten, 2010; Pinder, 2001, 2005). Furthermore, complex interactions between past, present and future have been broadly addressed in human geography regarding diverse calls for the, what Anderson (2010c, p. 4) terms, 'anticipatory-utopian orientation to better futures' (for example: Braun, 2005; Harvey, 2000; kinpaisby, 2008; Wolch, 2007).

In cultural geography, specifically, an agenda for addressing geographies of anticipation has been opened up by Ben Anderson, regarding the development of nanotechnology (2007) and the practices of pre-emption and preparation of and for climate change, disease pandemic and, particularly, acts of terror (Anderson, 2010c, 2010d). Anderson (2010c) suggests a novel vocabulary for understanding what I have called a discourse of anticipation, within which he describes 'logics' and 'practices' of anticipation. In short, and through a Foucauldian discursive lens, practices of anticipation are human cognitive and material engagements with the world that attempt to give content to futures, and logics of anticipation are the codified reasoning by which actions and statements to address particular futures are ordered in the present. I suggest that logics and practices of anticipation are always already in combination in the discourse of anticipation but get applied in particular ways of taking place, something like 'sub-discourses' that apply to particular ways of thinking about anticipation, what I have come to think of as 'modes' of anticipation. Indeed, in the next section I will discuss 'expectation' as a mode of anticipation.

In broader scholarly enquiry, there are a number of ways in which the proactive nature of anticipation has been conceptually articulated in ways that serve to demonstrate their variety of durations and the conscious and, perhaps, pre-cognitive function of anticipation. For example, in Heidegger's early work (in particular Being and Time 1962) the essence of the human, the phenomenological 'there-ness' of being in the world, that he terms *Dasein* 'does not simply sit back and *await* the future, but actively *anticipates* it by going out and doing something about bringing it about' (Hoy, 2009, p. 201). Indeed, in a similar sense, Berthoz and Petit (2006, p. 69) suggest that anticipation is 'an implicatory mode of being that gets ahead of what is, that posits what is to be in advance of its arrival'. In contrast, Merleau-Ponty (2005) understands this future orientation as 'anticipatory retrospection' (Hoy, 2009, p. 72), a view of the future based upon past experience, with time acting as a mobile setting:

'time, in our primordial experience of it, is not for us a system of objective positions, through which we pass, but a mobile setting which moves away from us, like the landscape seen through a railway carriage window' (Merleau-Ponty, 2005, p. 488).

More recently, it has been argued that there are a diversity of cerebral mechanisms of anticipation (see Berthoz and Petit, 2006) from the level of the sensory receptors themselves in the brain (ibid. p. 63; see also: Connolly, 2002; Damasio, 2000) to the force receptors in muscles (ibid. p. 64) and the cognitive processes of judging distance (ibid. p. 65). Furthermore, Berthoz and Petit (2006, pp. 69-70) argue, in a similar sense to Connolly (2002), that anticipation is of increasing significance in contemporary life. With examples from stock market trading Berthoz and Petit (2006, pp. 67-68) describe the emergence of 'neuroeconomics' as the collaboration between neurophysiologists and economists (see also: Lee, 2006) in the study of risk taking and other anticipatory practices in financial institutions.

Having unpacked my use of the term 'anticipation', in the remaining part of this chapter I want to quickly apply these conceptual tools to the aspects of futurity that 'expectation' reveals, as a trope. The following section proceeds through a synthesis of critical appraisal of contemporary (largely STS oriented) literature and the results of empirical enquiry. Recent discussion around a 'sociology of expectation' are thus used as an analytical tool to make a first pass through the discursive assemblage of ubicomp's future orientation, which in combination with subsequent chapters begins to build a framework for understanding the politics of anticipation of ubicomp R&D.

### 3.4 Ubicomp's 'sociology of expectation'

'Expectation' as a discursive trope and a means of analysing future orientation has risen to prominence recently in interdisciplinary literature that has been termed a 'sociology of expectation' (see: Borup et al., 2006; Brown and Michael, 2003). It has been more broadly addressed through a sustained inquiry by Reinhart Koselleck, a professor of the theory of history (see: Koselleck, 2002, 2004). Expectation, as a mode of anticipation, is betwixt and between the lived and material present and the anticipated future. Expectations exemplify the way in which anticipatory action is between and across both the distantiating of futures from the present and opening them to conditioning, as 'future presents' (Adam and Groves, 2007), and, latent futures in the making, as 'present futures' (Adam and Groves, 2007). There is both 'nothing to be done', as Beckett's (1988) Estragon attests, and, following Deleuze, 'the deployment and explication of the multiple, of the different and of the fortuitous' (Deleuze, 2004, p. 141). Expectation has been examined and discussed as a sociological concern, a practice and an effect, that has been particularly studied by scholars working within the arena of the history of science or STS. Such research has therefore included economists, historians, philosophers and sociologists concerned with the sciences and technology. More specifically, a 'sociology of expectation' has emerged as a research agenda with the aim of developing 'an analytical vocabulary for understanding... complex interactions between tools of prediction, discourses of the future and the shaping of the present'

(Brown and Michael, 2003, p. 6)<sup>21</sup>. In general, this research has situated the discussion of expectation as 'an integral part of human agency' (Borup et al., 2006, p. 288) such that 'the general conception of the future, and accordingly the structure of expectations, has changed over historical timeframes, with the discourse of technical *progress* as a typical modern phenomenon' (ibid. original emphasis). As suggested by Brown and Michael (above, 2003) expectation is also strongly tied to 'visions' of the future (which are further addressed in chapter 5).

Much of the way in which this discourse of anticipation is rationalised in management and social studies of technology is predominantly representational, with a few key exceptions – to which I shall return later in this section. Expectations are also ascribed significant agency; for the 'sociologists of expectation' they are productive of particular futures and inherent to processes of innovation:

'[E]xpectations can be seen to be fundamentally generative, they guide activities, provide structure and legitimation, attract interest and foster investment' (Borup et al., 2006, pp. 285-286)<sup>22</sup>.

Building on this understanding of a 'sociology of expectations' (Brown and Michael, 2003; Borup et al., 2006) the purpose of this section is to critically assess the role expectation plays in the anticipatory discourse of ubicomp. Accordingly, four themes in contemporary studies of technological expectation identified by Borup et al. (2006) in their editorial on 'the sociology of expectation in science and technology' will be

<sup>&</sup>lt;sup>21</sup> The 'sociology of expectation' was principally derived as a research agenda from a research network led by the Science and Technology Studies Unit (SATSU) at York University (SATSU, 2008). Amongst the research resulting from that network, examining the role of technological expectation, have been studies on neural computing (Guice, 1999), gene therapy (Sung and Hopkins, 2006) and pharmacogenomics (Hedgecoe and Martin, 2003), pharmaceutical technologies (van Merkerk and Robinson, 2006), the nascent 'hydrogen economy' (Eames et al., 2006), and nanotechnology (Lösch, 2006; Selin, 2006, 2007).

<sup>&</sup>lt;sup>22</sup> Borup et al. (2006, p. 286) go on to say of expectations that: 'They give definition to roles, clarify duties, offer some shared shape of what to expect and how to prepare for opportunities and risks. Visions drive technical and scientific activity, warranting the production of measurements, calculations, material tests, pilot projects and models. As such, very little in innovation can work in isolation from a highly dynamic and variegated body of future-oriented understandings about the future'

synthesised with analysis of empirical data. The four senses of expectation explored as a means to addressing the futurity of ubicomp are: 'constitutive force', 'temporal variance', 'socio-spatial variability' and 'performative imagination'. This section provides a twofold analysis of the sense of expectation inferred by the 'sociology of expectation' introduced above and its pertinence to the ways in which expectation is discussed in the articulation of futurity in ubicomp.

To begin this twofold analysis, then, I turn first to 'expectation as constitutive force' (Borup et al., 2006), which is identified as the manner in which expectations as epistemic formations attract 'the interest of necessary allies', define roles and build 'mutually binding obligations and agendas' (ibid. p. 289). Borup et al. (ibid) go on to suggest that within an expectation there is another, an 'expectation that the enunciator should justify their future-oriented claim'. However, as Borup et al. (ibid) note, using the work of van Lente (2000), the utterance of expectation 'does not necessarily create accountability' (Borup et al., 2006, p. 289). Whilst the proposition of an expectation does prompt responses, the collective nature of technological expectation has a role to play. At a general level expectations are one means of brokering relationships: 'it would be hard to picture the formation of technology developments and innovation without some kind of shared, though flexibly interpreted, cluster of guiding visions' (Borup et al., 2006, p. 289). This is evident in empirical findings from the broader field of ubicomp related development. As Yuval Koren (CEO of successful start-up company Eye.Fi) observes, there are a set of assumptions that prefix 'vision', and, in particular, a set of assumptions peculiar to a community of practice, in this case Koren identifies Silicon Valley:

"they [potential investors] actually said that this is so obvious and inevitable that everybody else is going to do it for you ... I think some of that, maybe some of that is because we were talking to people in silicon valley and people just assume the future and they assume it will happen much quicker than it really does... but the consensus is just as often wrong as it is right, and maybe it was right but its no longer right, but people stick with it because they've got used to spouting whatever, whatever it is" (Yuval Koren, Eye.Fi) A lone individual does not institute an expectation. Instead, expectation is produced within a relation; it emerges from relations between not only humans but also humans and other entities. Diffuse assemblages of developers, investors, business people, marketing specialists, and many others simultaneously inculcate one another and, perhaps, a broader consumer market into expectation.

Related to the 'constitutive force' of expectation, the validation of anticipatory work also presents a challenge to researchers, for there is rarely a stable material entity derived from leading edge R&D. Instead, researchers ask colleagues, both within R&D and more significantly in 'business development' units, to exercise their imagination to 'fill in the gaps'. Legitimation is difficult, and known to be difficult (for example, how do we define 'better'? – this is further addressed with regard to 'hope' in chapter 6), and therefore, according to Borup et al. (2006), hardly required. This lack of a required legitimation opens a space for more speculative future claims, such as those inherent in the development of ubiquitous computing. However, there are some norms to this process, within ubicomp R&D. There is an inherent expectation internally, within R&D environments, for particular types of method for generating novelty. The 'validation' process carries expectations for the ways in which prototypes will be tested and how and when user feedback may be sought:

"there's kind of norms about how you do research and how you validate research, umm, not necessarily about what you make, so I think you're free to come up with what you want, umm...but there's some expectation for convincing someone else that your idea is a good one, which involves building and testing and user feedback... umm, which I agree that once you get to a certain point is very important, ah, because you do want to make things very useable and people would want, but there's not always acceptance of that early stage work of... where the goal is just the idea and inspiring someone else to have another idea and so on." (Ryan Aipperspach, Entrepreneur)

As can be seen by Ryan Aipperspach's comments, the validation process, and the expectations of a particular methodology, lies somewhat in tension with the early stages of speculative work. In a sense, the closer the future into which a product may have to

be delivered, the more regulatory the expectations become. Subsequently, the notion of the temporal 'horizon' of anticipatory work can be an interesting problematic.

Like many other forms of technology development, the projections into the future that are made for ubicomp R&D practises, and particular projects, imply a temporal horizon, a particular length of time cast forward into the future that acts as a reference point. One of the assumed norms to which the interviewee Yuval Koren referred above, I suggest, is the time horizon within which R&D projects operate. As Mirjana Spasojevic (Nokia Research, formerly of HP Labs) observes, this norm is widely assumed:

"[Y]es its always that ten year horizon... [laughs] researchers like to operate on a seven to ten year horizon... um, its an interesting horizon ah, you can make lots of assumptions, and ah... that may or not be true, or partially be true, but it gives you freedom to kind of imagine things... in a much freer way than your six months, two years" (Mirjana Spasojevic, Nokia Research).

Varying temporal horizons might thus be negotiated across the portfolio of research conducted by an institution, group, or individual. The lengths of time it may take particular types of people to adopt or adjust to the technologies being developed becomes an issue, and certain assumptions (and thus expectations) must be made:

"I think, I personally operate in two {time horizons} – one which is the... holy shit we've gotta get stuff done in the next three months horizon [laughs] there's a lot of that! Um, and then the second one is... um... what... the second one is somewhat demographic, like... for me, kind of the horizon is kind of split between, kind of, what I think are happening among these demographic groups... and each of them has a different trajectory" (Mike Kuniavsky, ThingM).

As Mike Kuniavsky suggests, the projection forward can be multivariate. Different 'trajectories' are plotted for various groups in order to formulate strategies for an arc of development. For Kuniavsky (and his start-up company ThingM), the temporal horizons, and associated paths or trajectories that lead to them, are not necessarily defined by particular schedules, whereby specific events are plotted to occur at certain times or on certain dates. Instead, these horizons and trajectories are relative to one another, as Kuniavsky goes on to explain:

"The baby-boomers have a different one from the Gen X and they have a different one from the ah... you know, from the millennial, or however else you might want to describe the um... the other generations and... and so I don't think in terms of what's the world gonna be like in 20 years from now... I think like what is going to happen to these groups ... I think about what's gonna happen in these various groups, um... not with a schedule in mind but just kind of... I think that's too awkward... its kind of what are the general things that are going to happen... because everything is essentially a question of um, where people are on the various adoption curves of the various technologies, so nothing happens at specific point, it happens in waves... and those waves emerge at various places... in various groups, so... there's not point there's just a kind of thing that happens, and its gonna happen to some people, its already happened to some people, its gonna happen to some people five years from now, some people ah, it might not happen to other people for 10 years, because of who and where they are... I'm not particularly interested in figuring out when ... the big spike in the adoption curve happens, its gonna happen at some point." (Mike Kuniavsky, ThingM)

More broadly, in the mythology of ubicomp (as covered in section 3.2) there is an indefinate temporal horizon 'of the proximate future, the future just around the corner' (Bell and Dourish, 2007b, p. 134 for further discussion see chapter 134). The elasticity of the temporal horizon might thus only be understood in retrospect, in considering past anticipations. As [anonymised] (formerly of HP Labs) observed in interview, the sense of 'radical' change does not necessarily take place within planned time horizons, instead it can be observed in hindsight:

"if electricity became pervasive, um, and it did – it was a fundamental technology capability, it really over time... you know, became, well obviously — its so embedded in absolutely everything, and its really one of the first, you know, pervasive technologies, I think you could say, um... I don't think it felt like a revolution, as it was being implemented, it was definitely something that, you know, sort of proceeds by small steps, many small steps over time and... um, results in a very transformative change but over a long enough time horizon that it no longer feels like — wow, the future! Only in retrospect can you say — wow, things really have changed in the last 50 years. And I think a lot of the same things will be true about 'ubiquitous computing', so-called, right?" ([anonymised], formerly of HP Labs)

What is evident from the opinion of this informant is that futurity can often be framed in terms of the past. This resonates with Hoy's (2009) explanation of Merleau-Ponty's (2005) theorisation of futurity. Merleau-Ponty frames the formation of attitudes towards the futures as '*anticipatory retrospection*, which projects the future backward into the past in the very act of looking forward to what is coming next' (Hoy, 2009, p. 72). We can see then that, as Merleau-Ponty (2005) argued, anticipation can work in retrospect. Expectations are thus innately tied to the present where they are felt and from which they issue, a 'temporal horizon' is viewed from the present.

Moving on to the second theme in the 'sociology of expectation', 'temporal variability', according to Borup et al. (2006, p. 290), describes the variability of the phenomenon of expectation over time. For some (e.g. Geels and Smit, 2000a), the initial claim on the future is 'set high in order to attract attention from (financial) sponsors, to stimulate agenda-setting processes (both technical and political) and to build "protected spaces". By which we might presume Geels and Smit (2000a) mean an effort to stabilise a particular aspect of the future to which one wishes to make claim. Furthermore, early technological expectations are often overly simplistic, abstracted from the complex links within which the resulting material products and practices will be entangled, and so tend to exhibit a technological determinism (Borup et al., 2006, p. 290; cf. Bingham, 2005).

The other important aspect of the temporal variability of expectations identified by Borup et al. (2006) is characterised by Brown et al. (2003) as 'disappointment'. The credibility of whole industries, companies and individual engineers and scientists has been damaged many times by disappointment, a failure to live up to expectations. As Borup et al. (2006, p. 290) suggest: 'the anticipation of a future is 'rarely proportionate to future outcomes'. This temporal variability is particularly evident in ubicomp R&D, such that the future expected is perpetually proximate. For Weiser's (1991) vision ought to have arrived, if there was some kind of linear causal 'progress'. Yet, as noted in chapter 1, the 1991 article is still very often quoted in the preamble of contemporary ubiquitous computing literature (Bell and Dourish, 2007b). Surprise is the corollary to the disappointments that may arise from 'temporal variability'. An expectation not being met does not necessarily lead to disappointment. The 'shock of the new' can result from something that departs so radically from our expectations that we have to significantly adjust our understanding of the world. This 'disjunctive' (Koselleck, 2004) sense of novelty is not necessarily sought because it takes significant marketing to 'educate' consumers about the potential value of such a novel technology. However, surprise can and does play a role in the prototyping process. Through experimentation with an interactive screens project (tied to online social networking services), Joe McCarthy observed that surprise became an integral aspect of the iterative process of design:

"I've been surprised in a number of ways each time we do a deployment, and its key to manage other peoples' expectations and its also key to manage my own expectations, but we need also to be able to respond, so once people kind of adjust their expectations and so people say 'oh, this is cool this big screen can sense and respond to me, well respond to me damn it!' So, that was one of, sort of, the reasons that with the Nokia system we decided, well, rather than just showing one picture at a time, lets just build a collage of photos of everyone around here, so now if you, kind of, get near the display you don't have to wait your turn, so to speak, its going to pick a picture out of your pool right away and slap it up there somewhere so you get that immediate kind of feedback."(Joe McCarthy, Strands Labs).

This managing of expectations folds into the design process, as von Hippel (1988, 2005) has argued, 'innovative' products and systems are co-produced with the consumer/user of the product or system. It is in the coming together of the human user, as an embodied individual, and the technology that expectations are tested and perhaps adjusted. Tying this back to earlier stages of R&D, and the setting of expectations in the production of a 'vision', the impetus to 'manage' expectations comes not only from the explicit aims or objectives, or from the 'mission statement' but also from the implicit, un-stated, expectations that arise in the ongoing nature of development:

"I think expectations are a funny, a funny beast. Um... because... every project is started with these sorts of sets of stated and un-stated expectations and then designers end up continuously managing them... I try to work through the expectations by delivering something very rough, very early. And then that way, a - it looks rough, so there's the polish sort of removes the expectations of finish, and then do it soon... [waiting for fire engine to pass] so that if I'm really going in the wrong direction, um... we can all have it out immediately. I do subscribe to the fail early philosophy. But that's hard, that's a very hard discipline" ([anonymised], formerly of Intel Research Berkeley).

The management of expectations is thus clearly linked to the 'doing' of the project the visions of the future attached to specific projects arise in the performance of *doing* research and development. Whether explicitly addressed or not, expectations arise in the 'doing'. The proactive nature of anticipatory discourse, and the ways in which expectations emerge from the associated practises in ubicomp R&D, means 'failure' is not necessarily an end in itself. Instead, failures are steps in the process of developing a project and, crucially, adjusting the expectations of all concerned, as made evident by the above interviewees.

The third theme of 'expectation studies' (Borup et al., 2006, p. 292) is 'sociospatial variability'. Socio-spatial variability here quite crudely describes the variation of expectations and future uncertainties between different groups involved in technological development. We might reasonably expand this to include all of the participants entangled in the various assemblages that array themselves within and around practices of technological development. For some (Borup et al., 2006; Brown and Michael, 2003) expectations exact and/or affirm an authority on different groups and in different ways. This authority can be related to asymmetries in access to the information on which expectations are based, for example in the difference between information made public and kept private (Mackenzie, 1990). We need only note here that companies such as HP, Intel and Nokia produce high-quality and attractive visions enacted in promotional videos that do not reveal the pragmatic detail of what they are planning to actually produce as products (such practises of envisioning and the videos produced are addressed in detail in chapter 5).

Fourth, we come to Borup et al.'s (2006) final theme: 'Imagination, materiality and embodiment', which offers significant overlap with recent and wide-ranging research in human geography. The proto-discussion raised in Borup et al. (2006) and further articulated in Brown and Kraft (2006) hints at themes around how we might understand expectations as an anticipatory knowledge given the limits to representation raised in discourses of non-representational geographies (Dewsbury et al., 2002), (Thrift, 2000, 1996, 2008b). There is a sparsity of investigation, in what Borup et al. (2006) identify as 'expectation studies', around the relationships between the discursive, material and embodied natures of expectations. Some notable exceptions exist (see: Brown and Kraft, 2006; Michael, 2000). For example Michael highlights the imbricated character of expectations:

'The performativity of these representations does not take place in some abstracted, a-material domain. It is conducted in material settings, where bodies and texts, for example, come into contact or close proximity at least' (2000, p. 33).

What we can see then is the beginning of an inter-disciplinary coalescence of ideas around the situated-ness in the world of actions and activities, emotions and feelings, and amongst them our expectations. In parallel, for example, significant amongst issues of embodiment, in recent research (Anderson, 2006a, 2007; Dewsbury, 2000, 2003; McCormack, 2002, 2003; Thrift, 2004a; 2008b), is the investigation of 'affect' – the body's pre-cognitive and impersonal capacity to affect and be affected. Here, Anderson (2007) highlights the role of affect in anticipatory knowledges, pointing to Massumi's (2005, 2007a) work on the importance of 'fear' in military strategies for 'pre-emption' (to which we will return in Chapter 4):

'Affect is not just one mechanism among others. It is a component of passage between mechanisms, orders of phenomena and modes of power ... it [is] central by being interstitial' (Massumi, 2005, p. 7).

Affects, in this context, are the embodied capacities of the state of 'betwixt and between' of expectation. Affects are the future-oriented feelings of thought that span the possibilities of both 'future presents' and 'present futures' (Adam and Groves, 2007). The possibilities of the future loom over the waiting present, and yet, within and alongside the creeping shadow of the possible are sparks of potential, the 'double possible' (Deleuze, 1998). This 'double possible' is interstitial: 'the possibility that an event, in itself, is possible, might be realised in the space under consideration: the possibility that something is realising *itself*, and the possibility that some place is realising *it*' (ibid. p. 163 additional emphasis). I will further address this embodied sensibility for potential events in chapter 5.

To review and consolidate the four aspects of expectation discussed in this section I want to quickly apply them to an example from empirical findings. Joe McCarthy, experienced researcher in ubicomp, provides an interesting case study, an ongoing project he has personally championed across three different research environments (Intel Research Seattle, Nokia Research Centre Palo Alto, and Strands Labs Seattle), which he describes as 'proactive displays'. Proactive displays are, according to McCarthy's personal website:

'large computer displays augmented with sensors that can detect people nearby and show content relating to those people. A proactive display creates a bridge between a person's digital content, such as a personal web site or online photo collection, and his or her presence in the physical world. The goal is to enable us to easily share the richness of our digital lives with our neighbours in physical space, creating new opportunities for greater awareness and interactions by bringing the benefits of virtual communities into physical communities' (McCarthy, 2009).

We can see how the four themes of expectation play out in the development of 'proactive displays' in a number of ways.

First, the expectations that surround the 'proactive displays' project have been constitutive in two respects: they are tied to the material format of concepts and prototypes; and they are tied to production and shifting of temporal horizons attached to the project. The expectation that something like Weiser's original schema of different scales of device, and particularly the interactive 'boards' Weiser (1991, 1993a) discussed as loci for collaboration, threads into the material format of 'proactive displays'. However, the envisaged uses are different:
'the boards were used for very shoulder to shoulder collaboration if you will, whereas the work that I've been doing has been trying to create technology that's more on the periphery and not so much looking to engage you in being useful for urgent or important tasks or information, but more stuff that will still, sort of, enlighten or enhance your experiences, umm, but not a substitute for the more focused collaboration' (Joe McCarthy, Strands Lab).

Perhaps one of the strengths of this implicit appeal to Weiser's foundational ideas for ubicomp is that the project was readily translatable from one institution to another. We can intuit that the temporal horizons for the development and intended delivery of 'proactive displays' changed in various ways as the project was moved initially from Intel Research to the Nokia Research Centre and on to Strands Lab. In a sense, the temporal horizon, for 'proactive displays' is, alongside much of the rest of ubicomp R&D, the proximate future. The first prototype was installed at the 'Ubicomp 2003' conference and prototypes have continued to be rolled out, yet a 'final' product remains illusive. This can be partly attributed to the migration across institutions but is also indicative of the perpetually proximate future of ubicomp, as McCarthy himself states:

'I do feel like I have a vision and its something that has been driving me for something like the last 10 years' (Joe McCarthy, Strands Lab).

Second, the temporal variability of the expectations concerning 'proactive displays' are twofold: surprising interactions between users and the devices were observed in the early prototyping phases and, according to McCarthy, these have folded back into the rationale for continued development. The adaptation of the system and its use in combination with other complimentary technologies was a surprise for relatively early prototypes:

'a couple of surprising things that happened there were people started using [photo sharing website] Flickr for feeds... you could also just specify generic search terms and Flickr photos with those tags would start appearing in the collage when you were nearby, and people started appropriating this and, so, one time someone came up with a Star Wars theme, and they typed in Star Wars and said show me pictures of Star Wars when I came by, then someone else saw that and came up with the Bourne Identity... so there was this contagion effect, where these kinds of things happened, but I never anticipated that there'd be this sort of playful use, someone else used the Finnish word for snow as a tag, and ah, so anyhow – there were all these uses that I would never

really have anticipated that added value. There were also some things that we found that people didn't like, so we had this button so that you could vote on pictures that showed up on the display so that you could vote up or down and I discovered that, oh, people don't like when people vote down – people don't like to vote down and they don't like to see when other people are voted down' (McCarthy, Strands Lab)

In McCarthy's description of surprising adaptive uses of the 'proactive displays' prototypes he infers that the development process is intertwined with adaptation, with the testing of the 'voting button' occurring directly in response to surprising use of the technology. Furthermore, creating prototypes according to the visions you have as a researcher is a negotiation with the unexpected:

'it's a delicate balance between wanting to allow enough room to maneuver so people can 'abuse' or use things in new ways but not so much so that, ah, it doesn't happen... I can never, almost by definition, I can't anticipate the unanticipated uses, but umm, so I do try and build in something that allows us to back pedal or compensate or react quickly to, um, unanticipated things, and, sort of, [create] a backup plan to protect against really unanticipated and very offensive uses' (Joe McCarthy, Strands Lab).

Development practices in this case are thus inherently an adaptive mechanism for dealing with and managing expectations. In the case of location specific technologies such as 'proactive displays', this management of expectations is often tied to the specific groups of people.

So, third, proactive displays are location specific and each installation is in many ways peculiar to the place in which it is situated such that there is socio-spatial variability of expectations throughout the prototyping process. A key point here is that the early phases of prototypes were conducted with what may be considered 'expert' or 'early adopter' groups. 'Proactive displays' were installed in research environments and at conferences, therefore the expectations of the community of test users are likely to be qualitatively different from those of 'lay' users.

Finally, the emotive and embodied responses to technologies that require a significant sharing of what might be considered personal information emerged as an issue to be negotiated in regard to 'proactive displays'. For McCarthy, the fearful

responses to the technologies he develops comes from a broader set of imaginative representations of technology. In particular, the dystopian renditions of pervasive technologies constantly 'snooping' on private citizens featured in the range of expectations that become attached to this type of research and development:

its fairly rare for me to give a presentation and not be asked if I've seen the movie 'Minority Report... another question that frequently comes up, again across audiences, is... people always want to know, again at Accenture we had infrared sensors all over the place, so people wanted to know, if you have a sensor in the bathroom?! I don't know why this always came up, but it always came up. There was that kind of fear dimension, umm, and so there's always these privacy concerns, umm, anytime one's going to talk about using technology to detect or identify people in a space and then respond in some kind of meaningful way' (Joe McCarthy, Strand Lab).

Particularly strong feelings attached to negative expectations may become key factors in a research strategy, for example: people might involuntarily recoil from the technology given expectations of personal intrusion. Indeed, a mechanism for addressing precisely these emotive issues emerged at Intel Research. McCarthy sceptically describes an 'Experience Sampling Method' that was employed to address the feelings of users in situ:

'they had a simple application on a mobile phone that would pop up something and ask someone to say, you know, would you be willing to reveal where you are right now to your spouse, your friend, your boss whatever else, and then they extrapolated from that' (Joe McCarthy, Strands Lab).

We can see, then, that reconciling the abstract anticipatory actions of research and development with the visceral responses of potential users prompts difficult questions for researchers. Managing expectations is not simply about managing the ways users expect to be able to use a technology but it is also, in a broad sense, an obligation to deal with a broader discourse of the desires and reservations users may have about such technologies per se.

To conclude this section I want to address an underlying theme that can be problematised for critique in the characterisation of expectation documented in some of the 'sociology of expectation' literature explored here. There is an alignment of futureoriented claims with perceived shared values, or the contrast of those claims with undesirable outcomes. As Berkhout (2006) suggests, expectations that are codified, communicated and thus shared as 'visions' 'seek in some sense to create a *normative space* in which they can exist' (p. 309 original emphasis), which, Berkhout goes on to suggest, is necessary because 'novelty can only seem plausible if it has a chance of being widely accepted as good' (ibid.). There is, therefore, an implication of the alignment of expectation with an implicit moral attitude. This raises interesting questions for the study of anticipatory discourse in technology development – how are the politics of anticipation derived? In the final section of this chapter I review the analytical lens of the 'sociology of expectations' literature in terms of the discourse of anticipation laid out in section 3.3. I draw conclusions on the role of 'expectation' within the anticipatory discourse of ubicomp and signal how this raises to the fore a politics of anticipation, to be further developed throughout this thesis.

#### 3.5 Conclusions

Three steps were worked through, in this chapter, to lay out the rudiments of a framework for analysing what forms the future orientation of ubicomp takes and how they are arrived at as discursive objects. First, a theoretical basis for engaging with the future has been laid out as distinct from historicist understandings of temporality. In attending to the future orientation of ubicomp, given a postphenomenological sensibility, I argued that temporality and an engagement with the future can, and should be addressed through the telling of 'molecular' stories, rather than attempting to affirm 'meta' narratives such as 'technological determinism'. Second, I set out a discourse of anticipation, following Foucault (2000b), which is the conjunction of anticipatory knowledge and practices, as a means of dealing with the enacting of futurity with reference to technology development. Thirdly, I applied the literature described as a 'sociology of expectations' to assess the role 'expectation' plays in the

anticipatory discourse of ubicomp R&D. Accordingly, four themes in contemporary studies of technological expectation (loosely following Borup et al., 2006) were synthesised with analysis of empirical data. I have argued that it is important to unpick overly reductive understandings of technological futurity because they elide the interesting and more nuanced ways in which futures are represented. With regard to expectation as a mode of technological futurity I have described several aspects of that nuanced engagement with ubicomp's future(s). As such, expectation is an emergent faculty that finds its particular outlet in the discursive phenomena of assumptions made about the future, the implication of temporal horizons, and in the ongoing management of expectations in the reference to ubicomp's (perpetually) near future.

The future orientation inherent to technology development comes with theoretical 'baggage' in the form of the meta-narratives that have been attached to technology use and its apparent influence (or otherwise) in society. To address this, I have argued that the means of describing, and in some way attempting to make present, the future comes from a diverse range of actors. Our temporalisation, the making of time (experiential time, not biological or cosmological time), is derived neither from a transecendental ego nor a grand historical force but from trans-subjective experience (further discussed in chapter 5). However, we should not utterly reject historical narratives such as 'technological determinism', for they do have an agency. Instead, following Wyatt (2008) I have identified the discursive function of technological determinism as it appears in the discussion of ubicomp, fulfilling both a 'descriptive' and 'justifactory' role.

Second, and as laid out in preceding chapters, the principal attributes of ubicomp R&D, the proactive addressing of the future and the relative proximity of the future(s) being addressed, situate ubicomp in a discourse of anticipation. I have described a discourse of anticipation as the conjunction of practical ways of addressing futures and knowledge of futurity (for example: the rhythms of biological time, economic timetables and a sense of risk) that in some way constitute those means addressing futures. By outlining this discourse as 'anticipatory' I have not sought to affirm anticipation as a catchall analytical frame. Neither have I applied a peculiar discursive scaffold, under the label 'anticipation', to the case study of ubicomp. Instead, my project is applying a postphenomenological approach through the identification of a discourse of anticipation to analyse the deliberate and proactive ways in which futures are both addressed and attempts are made to make futures present in ubicomp R&D. Building on the work of this chapter, I will continue to analyse and describe the particular modes of anticipation, and how they are enacted, that play out in ubicomp R&D as an inherently future oriented array of activities. Ubicomp is a paradoxical anticipatory enterprise because it projects into the future and that futurity seems to overwhelm any goal or target that is specified, yet the achievement ('making present') of specific futures remains a specified goal and expectations are recurrently engendered. The anticipatory nature of ubicomp is perpetuated through its mythology that maintains a proximate future as perpetually deferred. There is accordingly something like an expectation of a world in which ubicomp exists but there is not a linear timeframe specified by which that vision may be concretely achieved.

Third, an analytical vocabulary for understanding aspects of future orientation in technology development has been formulated under the sign of 'expectation', which has a bearing upon how we might engage with the discourse of anticipation surrounding ubicomp. A 'sociology of expectation' has been described as an model for understanding how expectations operate and vary according to key parameters. I have applied this model, critically, to the case study of ubicomp R&D by running an analysis of the parameters of a 'sociology of expectation' in tandem with an exploration of how expectation features in the anticipatory discourse of ubicomp. Whilst Borup et al.'s (2006) rendition of a 'sociology of expectations' offers some useful analytical tools to explore how the products of discourses of future orientation operate, it provides little analytical purchase upon the impetus for the expectations, for example: how and why they were formulated. The expectations are somewhat treated as static objects for study, albeit situated in a complicated network of relations (with the notable exception of Brown and Michael, 2003). To open out a discourse of anticipation I feel it is necessary to further examine the rationales behind how the future is addressed, and it is to those we will turn in subsequent chapters.

Ubicomp, as a set of research and development practices, invokes a particular type of future, which is located by implicitly drawing upon particular assumptions and mobilised by rationales such as expectation. The descriptions and possible attributes of the futures addressed in R&D both as the objective of a project and as the apparent biproduct of an objective do not settle, they continue to be manipulated and are frequently (and serially) deferred. The attempt to purposefully 'locate' the future that a project is ostensibly trying to achieve is thus somewhat paradoxical. Whilst the describing of a particular situation in which the technology under development might operate is necessary to inspire and in some way validate a project, it is also important for that frame of reference to remain elastic, such that other contingent factors can be taken into account. Expectations, like all other aspects of the discourse of anticipation I have identified, remain anticipatory.

# Chapter 4

## Methods to 'foresee' worlds of ubiquitous computing

### 4.1. Introduction

'The best way to predict the future is to invent it' — Alan Kay, Senior Engineer Xerox PARC, 1971

Various iterations of Weiser's 'vision' (1991; see also: 1997, 1998) have continued to be a touchstone for ubiquitous computing (ubicomp) research and development (R&D). Anticipatory action, including imagining, performing and planning futures, has played a significant part of the development of ubicomp. The imagination, proposal or playing out ('as if') of particular applications, forms or renditions of ubicomp are bound up with the construction of futurity<sup>23</sup>. They imply anticipatory knowledge of the role of particular technologies in a future, and that future is constructed as near at hand. Yet they also play a part in broader abstract narratives that propagate a research ethos of looking to a near future. It is therefore important to investigate the actions that render that future-oriented spatial imagination proximate. The geographical significance of ubicomp R&D is therefore twofold: first, the construction of new forms of technological spatial encounter, second, and the focus of this chapter, the proposition of possible worlds by particular communities of practice using various logics of anticipation. This chapter examines the logic underlying ubicomp's implicit discourse of anticipation, which situates the means and modes of future projection that play out in ubicomp R&D. Accordingly the analytical focus is the anticipatory action inherent to ubicomp R&D practiced in particular groups and technical reasoning that underlie how material futures are imagined and built.

 $<sup>^{23}</sup>$  As we will see in chapter 5 the products of such anticipatory action are frequently materialised as text and video-based representations that are significantly tied into ubicomp R&D.

To explore how the proximate future of ubicomp remains as such and the spatialities that are thereby constructed, an encounter is staged between 'visions' of ubicomp and recent debates in geography and cognate research around anticipation. In particular, I shall be drawing on the conceptualisation of discourses of anticipation as the conjunction of knowledge and practice, as outlined in chapter 3. More specifically, in this chapter, I argue that there are accordingly rationales, 'anticipatory logics', that underlie anticipatory action. There are many forms or modes of anticipation that might be identified according to particular discursive arrangements (as illustrated throughout this thesis) but 'foresight' is the particular mode of anticipation explored in this chapter. Amongst the many methods discussed and practised to 'foresee' futures for ubicomp I argue there are two particular logics of anticipation, with associated practices, that feature in the anticipatory action of ubicomp R&D. These logics are explored in the second section of this paper as rationales that define repeatable means of instantiating the conditions and sense of anticipation inherent to ubicomp. I argue that we can understand a politics of anticipation as a way of marking and coding an array of practices rationalised through anticipatory logics. However, if 'politics' as Barry (2001, p. 207) suggests refers to 'a range of forms of action and practice', which are institutionalised and become regulatory, following Foucault (1991a), then we must also understand the 'political' as distinct, in accordance with Barry's (ibid.) reading of Agamben (1993). In this case, by political I mean a 'space of dissensus and contestation which is not reducible to politics' (Barry, 2001, p. 207).

The logics for a proactive thinking of futurity, intimately concerned with technology, come to an influential fruition in the discussion and representation of ubicomp. The proactive nature of this anticipation is exemplified by Weiser's (1991) story of 'Sal' (reproduced in the Prologue) that helped launch ubicomp on the cusp of the 1980s and 1990s as a new arena of research. However, the narratives that emerge do something more than tell stories, they propagate a mode of collectively thinking

futurity. Ubicomp, as Bell and Dourish (2007b, p. 142) point out, has been very successful on two counts. Firstly, as a research endeavour it has become not only a topic in its own right but also 'a central aspect of the research agenda for many other areas of computer science research' (ibid. p. 142). Second, as a broader technological vision, Weiser's (1991) model of 'a single person making use of tens or hundreds of embedded devices networked together—is a reality for many people' (Bell and Dourish, 2007b, p. 142). The 'arrival' or making-present of this future, Bell and Dourish (ibid.) suggest, has been somehow missed, ostensibly because it is not as clean and ordered, instead it is 'messy'. It is on this point that our analysis parts ways, for I will argue, following Massumi (2007a, 2007b), that anticipation remains as such and, indeed, propagates itself. I do not doubt that Bell and Dourish (2007b) are correct in their suggestion that technologies that may be categorised as ubicomp exist, but that is a different proposition from the actualisation of a projection or vision of the future.

To investigate anticipatory action in and for the development of ubicomp, the argument proceeds in three steps. The future orientation in ubicomp R&D is, first, investigated in relation to foresight, a particularly 'ocular-centric' mode of anticipation. "Knowledges', and 'logics' of anticipation are subsequently, and second, discussed as the conceptual apparatus that construct and perpetuate the 'proximate future' (Bell and Dourish, 2007b) of ubicomp. This analysis connects recent discussion about 'anticipation' in social sciences research with the methods of ubicomp research, which fits with an emergent agenda around futurity in human geography. Third, the conceptual vocabulary of 'anticipation', 'logic', and 'practice', is applied to the analysis of empirical investigations of ubicomp R&D to identify the specific practices and associated logics of anticipation at play. These practices and logics of anticipation are associated with particular communities of research and thus we can identify communities of anticipation. This chapter accordingly examines the practices and logics of anticipation that both support and destabilise the certainty with which the future is imagined in communities of anticipation within ubicomp. In conclusion, the multiple ways of anticipating a future world and the ways in which they discipline understandings of futurity are framed as a politics of anticipation.

## 4.2. Actively apprehending worlds

Imaginative renderings and 'what if scenarios for particular futures play a significant role in ubicomp R&D. Portrayals of possible worlds, communicated both in written and video form, align people and projects with particular agendas. Prospective depictions and descriptions of particular types of future, especially as videos, also act as a means of prototyping, not only for proposing scenarios of uses for particular technologies, but also for expounding possible worlds in which such technologies are common place (this is specifically addressed in detail in chapter 5). These stories and scenarios produce influential spacings of people, places and things in relation to technology. The emphasis of the visual nature, particularly in representations of possible futures of speculative technologies such as ubicomp, has swayed the popular conception of novel computing technologies and efforts to programme the rollout of devices and associated infrastructure, intentionally or otherwise.

A detailed imaginative description of a particular type of future, in the context of the investment of both emotive aspiration and pragmatic planning, attempts to concretise a 'tomorrow' today, to render it actionable. Forecasts rest in rhetoric and image, which, when recorded, are depthless, insofar as they have little phenomenological purchase, yet they have 'epistemological depth' in the extraordinary capacity for humans to subjectively construct and represent, in a 'visual imaginary' or "mind's eye". This imaginative capacity is an 'intuition: a thinking feeling' (Massumi, 2002b, p. 134)<sup>24</sup>. When consciously (post-) rationalised, predominantly in a Cartesian manner (cf. Crary, 1992, pp. 25-66; Pickles, 2004), this 'feeling of thought' is figured within normalised discourses of 'vision'. As Jay (1994, p. 1) suggests 'even a rapid glance at the language we commonly use will demonstrate the ubiquity of visual metaphors', and 'foresight' is certainly amongst them. The Greek conceptualisation of infinity for Jay (ibid.p. 25) came from thinking about the extensive range of eyesight. The apparent ocular capture of distant lands 'seemed to grant the viewer the all-important "prospective" capacity of foreknowledge' (Jay, 1994, p. 25). Indeed, if the ability to see over great distance afforded a spatial apprehension of what may come next then, in ancient understandings, 'foresight could be and was translated into temporal terms as well' (ibid. p. 26). Thus the 'prospective' capacity of foresight was granted a pseudo-biological status as well, it is a sight of the 'third' or 'inner' eye.

However, the modern application of the visual metaphor of 'foresight' does something more. It alludes to projection - a proactive rendering visible or manifestation. The prospective rendering of a future as a 'what if' scenario or a 'blue skies' vision, as means of foresight, has been suggested to perform a set of particular functions: 'mapping a possibility space'; becoming a 'stable frame for target setting and monitoring progress'; and 'acting as... narratives and moralities that bind together communities of interest in practice' (Berkhout, 2006, p. 305). Indeed, particular anticipatory practices are performed as a part of ubicomp R&D, rationalised through associated 'logics', as a means of 'apprehending' futures in which ubicomp play a central role<sup>25</sup>. For Berkhout (2006) there is an explicit relation between the (utopic) ideological assumptions of depictions of the future and their attractiveness (further addressed in relation to 'hope'

<sup>&</sup>lt;sup>24</sup> Massumi (2002b) makes it very clear, however, that this is not an externally-oriented feeling of *a thing* but rather the feeling of *thought*: 'Not feeling something. Feeling thought – as such, in its movement, as process, on arrival, as yet unthought-out and un-enacted, postinstrumental and preoperative' (p. 134).

<sup>&</sup>lt;sup>25</sup> These logics are addressed in section 4.4.

as a mode of anticipation in chapter 6). However, given that a linear progress cannot be asserted, as Anderson (2010c, p. 14) observes: 'the future as surprise can only be rendered actionable by knowing a range of possible futures that may happen, including those that are improbable'. Thus foresight, in the context of ubicomp as an array of many research agendas and institutions, is inherently multiple.

The implications of the metaphor of sight are, therefore, that the evocation of a future must be rendered visible somehow. The historical understanding of the capacity of foresight, which 'frames' and 'maps', constitutes and conditions the anticipatory practices of different groups through a specificity of description. This representational specificity can, deliberately or otherwise, mask uncertainty: futures are apparently foreclosed, and doubts can be cast aside. Representation is thus key to the ways in which anticipatory action is exercised to encourage particular ways of thinking futures. We must therefore understand representation as performative; it is a form of practice that is enacted. Statements of foresight, like any discursive statement, following philosopher Brian Massumi's reading of Deleuze and Guattari (2004b), are a 'performative use of language' (Massumi, 2002a, p. xviii). Each representational framing of foresight accordingly transforms the state of affairs, bodies or material arrangements in their utterance. The performative is therefore 'a direct avenue for the passage of expression into content' (Massumi, 2002a). As Mike Michael, writing on 'contested futures', suggests:

'Representations of the future are from the outset engaged in a sort of preemptive argumentation over whether the projected state of affairs leads to good or bad' (Michael, 2000, p. 30).

At the same time, such anticipatory action must be based on a readiness to identify alternative possibilities, which may lead to radically different futures playing out (Anderson, 2010c). Those performative projections may subsequently become discursively aligned with a particular perspective on desirable attributes for a future.

The implied valence of the application of foresight is fittingly illustrated by (former) British Minister of State for Transport Stephen Ladyman's rationalisation of the Department for Transport's 'Foresight' programme: 'We can either stumble into the future and hope it turns out alright or we can try and shape it. To shape it, the first step is to work out what it might look like' (Randerson, 2006, additional emphasis). Specific forecasts are necessarily 'rhetorically oriented toward stressing the good (by limiting discussion to those aspects of the project deemed "important" or central)' (Michael, 2000, p. 30). Forecasts and imaginative projections are, intentionally or otherwise, attempts to delimit future-oriented arrangements and practices by 'downplaying the bad (by neglecting to discuss aspects [of the potential future] deemed "irrelevant" or "tangential")' (Michael, 2000, p. 30). However accidental or deliberate, by representing a future, one attempts to narrow the potentialities of what is to come. The implications of this circumscription are mitigated by virtue of the fact that any anticipation of the future typically has a finite duration. A forecast or an imaginative representation is tied to the present in which it was created: visions of the future 'date', they are perhaps realised or fail, or they fall out of favour.

The exploration of practices of forecasting, and grounding or specifying, futures provokes questions over the agency of the various actors involved: do groups actively coconstruct these visions of the future? Or are 'stakeholders' (cf. Brown et al., 2000b) merely coerced into orthodoxy? If the aim of such practices of foresight is to facilitate decision-making, we must posit that there is a foreclosure of potential choices. Considered in terms of the practices of government, there are obvious parallels with Foucault's (1991a, 2007) understanding of governmental reason here. The ways in which research funding is channelled demonstrates, perhaps, the power of the 'programmatic' rationale of foresight<sup>26</sup>. Furthermore, the forecasts and imaginative representations that are supposed to translate between the space of anticipation and the time-space of potential futurity mask and warp according to the desires of those that create them. The experience of technological failure (Geels and Smit, 2000b; Graham and Thrift, 2007) or cancellation before production (for example, the cancellation of the BAC TSR2 aircraft: Law, 2002, pp. 143-162) provides a significant demonstration of the differences between an anticipated, even intended, future and the actualised outcome. As (interviewee) Marijana Spasojevic of Nokia suggests:

"in the purely research arena we write so little about failures, we can't write a [conference] paper about a failed experiment ... you've got to show that its positive and, yes, people really want this, but the failures are the ones [the projects] that are so telling, and so important" (Marijana Spasojevic, Nokia Research).

The 'constitutive' agency of the production and proliferation of representations of the future in and through R&D is key to the institution, development and storytelling of ubicomp. This form of agency is performative; it is enacted in the utterance of statements.

Following the example of a recent *Ubiquitous and Personal Computing* article by Bell and Dourish (2007b), I want to briefly unpack the narrative production of ubicomp. The anticipatory impetus for ubicomp was present from the outset, as Bell and Dourish (2007b) assert, in the shape of Mark Weiser's 'foundational' article, entitled 'The Computer for the 21<sup>st</sup> Century' (for a cultural studies perspective, see also: Galloway, 2004). Weiser's (1991) description of computing devices for (and in) a proximate future came out of an interdisciplinary experimental approach at the Palo Alto Research

<sup>&</sup>lt;sup>26</sup> In ubicomp research, as with any other research community, the specifically directed channelling of funding resources is evident in the specification of research agenda, examples from the 'Ubicomp' 2007 conference being: ad-hoc connectivity of devices and systems, context-awareness (particularly location awareness) of devices, privacy and disclosure of information in systems, seamless, or 'seamful', integration of infrastructure.

Centre (PARC). Weiser's (1991, 1998; 1999) vision, and subsequent experiments, positioned ubicomp technologies not in fanciful or outlandish scenarios but rather in apparently 'everyday' office or home life (Galloway, 2004, pp. 385-388). Those involved in this early ubicomp research set great store by both imagining futures by depiction through storytelling (cf. Gold, 2007, pp. 36-41) and by constructing simulations of future computing environments (cf. Want et al., 1995; Weiser et al., 1999). This latter, 'time machine' (Bell and Dourish, 2007b, p. 134), approach required significant investment and resources and certainly captured the imagination of scientists and engineers who took the research forward. In 2008, over 15 years on, Weiser's (1991) vision is still often presented as continuing such a 'looking forward', despite the arrival of the 21<sup>st</sup> Century, to which Weiser (1991) referred, having come and gone. As Bell and Dourish point out:

'citations to Weiser's article are often phrased not so much as a 'look backwards' but rather as a collective 'look forwards'; that is, instead of saying 'back in 1991, we thought that...', they say 'Just as Weiser suggested in 1991, we are soon to enter a world where...' themselves' (Bell and Dourish, 2007b, p. 135).

The centrality of a 'proximate future... just around the corner or over the horizon' (Bell and Dourish, 2007b, p. 134) in Weiser's (1991) foundational vision of ubiquitous computing, and the manner in which it continues to live in the writings of contemporary researchers<sup>27</sup>, continually places its achievements out of reach, while simultaneously eliding current technological practices. The framing of ubicomp as 'to come' allows researchers and technologists to 'absolve themselves of responsibilities for the present' (Bell and Dourish, 2007b, p. 134) – the problems are described as

<sup>&</sup>lt;sup>27</sup> By Bell and Dourish's (2007b, p. 134) reckoning, 51 of the 108 papers that made up the 'Ubicomp' conferences between 2001 and 2004 were specifically oriented towards a 'proximate (and inevitable) technological future' (ibid. p. 134). Indeed, Bell and Dourish (ibid. ) suggest that of all of the papers published in the Ubicomp conference between 2001 and 2005, almost a quarter cite Weiser in reference to his vision.

'implementation' issues that are or *will be*, essentially, someone else's problem. The distance of an envisioned future from the present connotes a relative activity of that future – both in one's ability to affect its production and the ways in which that representation of a future can perform. As Michael (2000, p. 25) suggests, the relative distance of a represented future can give rise to different treatments and strategies:

'A future represented as far distant can be used to warrant slowness of action, but it can also draw the charge that it serves in a tactic of delay. A near future can warrant swift action, but it can also attract the accusation that it is no more than opportunism on the part of the actor who gains from some sort of 'scare' or other' (Michael, 2000, p. 25).

The relative proximity of the future frequently represented in ubicomp research, from the outset, has certainly prompted significant action – for example, it has resulted in the production of a lively and varied research community. Yet not only *was* the future of Weiser's vision proximate, it remains so, as do the futures of subsequent and related visions of ubicomp. I suggest, following Massumi (2007b), that the knowledge of what is anticipated remains aniticipatory: 'A past anticipation is still an anticipation, and will remain having been an anticipation for all of time' (ibid.). The implication of this remaining anticipation is that visions of the future have duration, they are realised or replaced, whereas the actuality of the present always contains the potential for surprise.

The differences between ubicomp and the 'foresight' practised by corporations and governments are arguably twofold. First, the majority of foresight practices are reductive because they are specific and tied to agendas for mitigation, for example governmental foresight is explicitly concerned with *risks* which must be pre-empted or prepared for (see, for example: Brown, 2007; DEFRA, 2006). However, the aim of the practices of foresight associated with ubicomp is also to open up possibilities, 'new' interactions with technology. Second, exercises of foresight are calculatively derived almost entirely from expert (frequently politico-economic) forecast and opinion, using 'programmatic' techniques such as 'horizon scanning' or 'scenario planning'. Whereas ubicomp research is different, insofar as it often strikes an uneasy balance between maverick imaginative representation and the (orthodox) prototype development cycles of research labs.

The running together of imaginative and experimental practices of anticipation is clearly demonstrated in high profile public facing projects such as Microsoft Research's 'Being Human: Human-Computer Interaction in the year 2020' (Harper and Selin, 2007) and IBM's recent futuristic 'A Smarter Planet' agenda (IBM, 2009). IBM tie together existing research programmes (already translated into business projects) with less specific, more imaginative, aspirations. For example, the aspiration to produce smarter cities and governments means:

'a world where digital intelligence can be embedded not just in individual things, but also across entire systems, impacting everything from traffic flows to electric power to the way our food is grown, processed and delivered... [C]onsider what's coming: sensors, cameras, cars, shipping containers, intelligent appliances, RFID tags by the hundreds of millions – all becoming interconnected. This will enable new, highly flexible ways of interacting with customers, employees, patients and citizens from any device, anywhere.' (IBM, 2009, p. 11)

In the Microsoft report ambitious anticipatory claims are made for growths of 'technodependency' (ibid. p. 40) and 'hyper-connectivity' (ibid. p. 43) in the 'shifting boundary between computers and humans' (ibid. p. 36). These forecasts are situated alongside experimental case studies, such as gesture-based computer interfaces (Harper and Selin, 2007, pp. 16-17), 'smart fabrics' utilising 'Organic Light Emitting Diodes' (ibid. p. 18) and the remote collaboration of multiple young musicians each with numerous (electronic) instruments and devices (ibid. pp. 47-48). None of which is very different from the world in which Weiser (1991) situated 'Sal'. Indeed, as we will see in section 4.4, in the broad scheme of ubicomp R&D, imaginative practices of projection and speculation are often complemented by experimental and performative practices of playing out 'as if scenarios.

To understand how anticipatory action in the mode of 'foresight' functions here we must understand the ways in which it is revealed in the practices of ubicomp R&D. Furthermore, as I will argue in the next section, there are logics of anticipation by which those practices operate. Such anticipatory action is based in a historical situation of the presumption of particular forms of anticipatory knowledge being both possible and accessible. Indeed, foresight has an intellectual history as a form of anticipatory knowledge and practice that threads through theological and supernatural beliefs, and governmental techniques. Therefore in the next section I will deal with the constitution of anticipatory knowledge and develop an analytical vocabulary of 'logics' and 'practices' to enable a way of addressing the multifarious rendering of the future in technology development, and particularly ubicomp R&D.

## 4.3. Anticipatory knowledge and logics

In his 2006 book *Everyware: The dawning age of ubiquitous computing*, Adam Greenfield extrapolates, with striking certainty, our future of living with ubiquitous computing from the apparently commonsense view of an increasingly technologised everyday life:

'Ever more pervasive, ever harder to perceive, computing has leapt off the desktop and insinuated itself into everyday life. Such ubiquitous information technology "everyware"—will appear in many different contexts and take a wide variety of forms, but it will affect almost every one of us, whether we're aware of it or not' (Greenfield, 2006, p. 9)<sup>28</sup>.

This passage discloses the issue that this chapter seeks to address: the certainty with which the technological near future is frequently addressed. This certainty is achieved by the adoption of various strategies for engaging with the future, which are figured here as 'anticipation', as set out in chapter 3.

In relation to the practices of R&D in ubicomp, I argue that, as a discourse, anticipation is performed according to a range of logics, interior to its thinking, through which

<sup>&</sup>lt;sup>28</sup> It is worth noting that Greenfield plays with this certainty throughout his book and concludes by identifying the limits to addressing with any certainty the future of Ubicomp: 'These principles [he has suggested for design] are necessary but not sufficient: they constitute a beginning not an end' (Greenfield, 2006, p. 257).

attempts to stabilise particular futures play out. In this section I will outline the 'knowledges' associated with anticipation, particularly related to governance, which can be read through recent discussions in geography, and cognate disciplines, about calculation (Elden, 2006, 2007) and fear (and pre-emption) (Massumi, 2005, 2007a, 2007b). From these debates, and building upon recent work by Ben Anderson (2010c), I suggest we can identify 'anticipatory logics', which function as repeatable means of instantiating the conditions and sense of anticipation, not only in governance but also in other forms of anticipatory action, such as R&D. Furthermore, I will signal how these logics are partnered by and inform specific practices of anticipation.

There are many ways we describe a restless inclination towards the future. One ought to be careful not to elide the nuance in meaning realised in the many ways we use our vocabulary for future orientation. As established in chapter 3, it would be a mistake to offer some kind of typology to this vocabulary but I would like to sketch some reasons for using the term 'anticipation' in this context. Within contemporary human geography Anderson has formulated an agenda for the study of 'anticipatory action' (2010c, p. 4) to question how 'the future' is being related to and how futures are 'known and rendered actionable' and 'to thereafter be acted upon'. Anderson (2010c, 2010d, 2010a, 2010b) addresses anticipatory action principally in relation to undesirable circumstances, such as the mitigation of terrorism, disease pandemic and natural disaster. However, these conceptual tools can also be brought to bear on aspirational forms of future oriented action, in this case ubicomp R&D. There accordingly exists a nascent literature that can be rudimentarily classified through the themes of anticipatory 'knowledge' (Anderson, 2007, 2010c, 2010a; Shields, 2008), anticipatory 'governance' (Anderson, 2007, 2010b; Barben et al., 2007) and anticipatory 'logic' (Anderson, 2005, 2010c; Kraftl, 2008). In this section I will discuss these related concepts and move on to develop an explanation of how the concepts of 'anticipatory

logics' and 'anticipatory practices' can elucidate how futures are addressed in ubicomp research and development.

The apparent apprehension and understanding of futures in particular contexts can be described as 'anticipatory knowledge'. Such 'knowledges' have origins in divination and clairvoyance (Anderson, 2007, p. 158), and have been historically linked to mechanisms of governance, for example - the 'haruspices' of ancient Rome advising the emperor of the most auspicious course of action (see: Thomson de Grummond, 2006). Whether or not we choose to believe the resulting predictions, clairvoyance continues today in various forms and remains practised as knowledge claims made about the future, for example through astrology. On the other hand, we might also describe scientific practices of climate and weather modelling as anticipatory knowledges, which have significant agency. As a result of the associated predictions, we feel we *know* what the weather will be tomorrow and that average global temperatures will continue to rise.

A further question is raised over the status of anticipatory 'knowledge' when it becomes enrolled into folk mythology. Attitudes towards the future are not commonly held discretely. Instead, many of us splice together 'useful fictions' from scientific, religious, literary and philosophical means of addressing the future. These fictions are often inspired by (and occasionally inspire) future oriented scientific research. Shedroff and Noessel (2008) illustrate how Science Fiction can be a powerful influence on design, including the perceived potential utility or need. For example, the 'Xenotran Dynamic Sand Table' was commissioned and built for the U.S Army Topographic Engineers Unit inspired by the fictional portrayal of a dynamic three-dimensional topographical mapping table in the film 'X-Men' (Shedroff and Noessel, 2008). As Kitchin and Neale (2001, p. 20) suggest, Science Fiction literatures: 'inspire and articulate emerging popular geographical imaginations'. From such splicing of scientific forecast and imaginative elaboration are derived apparent 'knowledges' of future situations.

Various implementations of anticipatory knowledge are tied to forms of risk aversion, for example the risks of urban flooding, of financial loss or of global climate change. Risk, as an anticipatory knowledge, can thus be seen as calculable and collective, and (particularly in relation to insurance) in some senses capitally constituent (Ewald, 1991, pp. 201-206). The intention of risk-related anticipatory knowledge is to identify and mitigate 'exceptional' circumstances that happen to us. Yet, whereas scientists may provide specific bounds of probability, a potential turn of events is often rendered, either by accident or design, as a certainty in the popular press (cf. Hollingshead, 2008; Jasny et al., 1999). Many forms of anticipation are tied to a sense of 'progress', which can imply a singular narrative of the passage of time, a time that However, much of ubicomp operates within a different sense of happens to us. anticipation, that of the production of possibilities. It is a difference evident between the experimental ethos of computer science pioneer Alan Kay's quote that opens this chapter, and the risk-averse concerns of Kay's management: "What was the future going to be like and how can [we] defend against it?" (Don Pendery, Vice-President of Xerox in 1971, cited by Markoff, 2005). Indeed, Weiser was upholding similar values to Kay, both senior researchers at PARC (though not simultaneously), in his perhaps more imaginative rendering of the future.

Plans and programmes are constructed on the basis of certain types of anticipatory knowledge, especially by governments, in the attempt to direct futures. The 'system of knowledge-power' produces objectives that are the things (to be) controlled by being wanted for the desired future (Foucault, 2007, p. 42). Exercises in programming attempt to address the complexity inherent to notions of an unscripted future by masking that complexity, in favour of goals and targets that can be measured. Programmes, following Foucault (1991b, 2007), result in a disciplinary apparatus, which necessarily focus on that which may be controlled, and attempt to mask what lays outside of control. Whilst programmes and their resulting governmental apparatus can assert a conventional mode of anticipation they remain one of 'a set of diverse realities articulated onto each other' (Foucault, 1991b, p. 81), all producing a different sense of futurity:

'The difference between envisioned aims of a program and its actual effects does not refer to the purity of the program and the impurity of reality, but to different realities and heterogeneous strategies' (Lemke, 2002, p. 56).

Following Elden's (2007) further discussion of the programmatic nature of 'governmentaility', in Foucault's (2007) lecture-based explication, it is argued that one can understand modern modes of government as founded on a 'programmatic' logic or Such calculative 'governmental reason' (2007, pp. 286-289) codifies, 'calculus'. quantifies and thus accounts for the various elements of society not only in the present but also, and more pertinently, towards particular ends. The anticipatory nature of governmental reason makes the state the strategic objective of 'that form of calculation, and that form of intervention called politics: politics as *mathesis*, as rational form of the art of government' (ibid. p. 287). Statistics was born as the technology of this anticipatory governance: 'a common instrument to both the balance of power and the police, because both are concerned with the forces and resources of states' (Elden, 2007, p. 573)<sup>29</sup>. However, statistics has been developed to become, for some, the instrument of articulating the fundamental uncertainty of a concrete world around us, the risks and probabilistic contingencies, that has frequently 'slipped through the meshes of the scientific net' (Whitehead, 1938, p. 25).

What we can see, then, is a move beyond the prescriptive calculus of  $18^{th}$  century governmental modes of addressing *the* future, towards accepting the

<sup>&</sup>lt;sup>29</sup> Statistics as a programmatic calculus provided a basis for the disciplinary regimes Foucault (1991b, p. 80) highlights as 'calculated, reasoned prescriptions in terms of which institutions are meant to be reorganised, spaces arranged, behaviours regulated'. Noteworthy here is that the 'calculus' of statistics comes etymologically from the German *Statistik* (Shaw and Miles, 1979) or 'state-istics' (Crampton and Elden, 2006, p. 682) and underwrote the technologies of 17<sup>th</sup> and 18<sup>th</sup> century governance, which for Foucault (2007) constituted 'the essential content of the sovereign's knowledge' (ibid. p. 274).

contingency inherent to any futurity. Perhaps nowhere has this been more applicable than in relation to nascent technology development. With the emergence of Genetically Modified Organisms (cf. Bingham, 2006, 2008) and nanotechnology (Anderson, 2007; Shields, 2008) there has been overt reference to the application and development of forms of 'anticipatory governance'. Whereas futures have long been addressed by governments through statistical calculation, 'anticipatory governance' in contemporary discourse explicitly embraces the inherent contingency of futurity. Indeed, in recent Science and Technology Studies literature, anticipatory governance, as it is discussed in relation to nanotechnology (Anderson, 2007; Barben et al., 2007; Selin, 2006; Shields, 2008), is figured as

'based on more than sound analytical capacities and relevant empirical knowledge: It also emerges out of a distributed collection of social and epistemological capacities... For, although action and outcomes are emergent qualities of human choice and behaviour, they rarely, if ever, proceed from certainty or prediction... Anticipation implies an awareness of the co-production of sociotechnical knowledge and the importance of richly imagining sociotechnical alternatives that might inspire its use' (Barben et al., 2007, pp. 991-992).

There has been, however, an alternative model of anticipatory governance that plays on precisely that disposition towards risk as a means of coercion. Fear has long been an effective means to subdue a particular group. In the case of recent anti-terror measures, governments have employed the possibility of unspecified threat, in this way 'knowledge' is destabilised – for 'a threat is unknowable' (Massumi, 2005, p. 35). The basis for an anticipatory governance founded on fear is indeterminacy. If the origin, target and timing, perhaps even the likelihood, of a threat is unspecified, its apparent imminence can be maintained and mobilised to justify action. A 'future cause' for response, a threat, is thus identified and a (potential) future is granted an effect in the present:

'Fear is the palpable action in the present of a threatening future cause... You leap into action on a level with the potential that frightens you... You turn the objectively indeterminate cause into an actual effect so you can actually deal with it in some way' (Massumi, 2007a, p. §18 original emphasis).

A logic, whether deliberative or emergent, evidently underlies both the divination of 'anticipatory knowledge' and the programmatic calculus of 'anticipatory governance'. Massumi (2007a, 2007b) describes the radical form of anticipatory governance enacted, by the Bush administration, as a co-productive 'logic of preemption' (Massumi, 2007a, p. §13). 'Pre-emption' because the logic dictates that one acts before a threat has even emerged (ibid. p. §13) and 'co-productive' because, as Massumi (ibid. ) suggests, '[t]he most effective way to fight an unspecified threat is to actively contribute to *producing* it' (p. §16 original emphasis). Massumi (2007a, 2007b) addresses pre-emption as an 'operative logic' of future orientated fear. Populations might be controlled by the disquietude of a looming possible threat, a threat that self-perpetuates:

'An operative logic is a productive process that inhabits a shared environment, or field of exteriority, with other processes and logics. It figures in that field as a formative movement: a tendency toward the iterative production of its own variety of constituted fact' (Massumi, 2007b, p. 17)

#### 4.3.1 Anticipatory logics

If logic is the codified or structured reasoning through principles of valid inference (following the definition found in: Oxford English Dictionary, 1989) then 'operative logics', following Massumi (2007b), are those that include in that structure of reasoning the means for extending themselves. Modes of anticipation, I think, are perpetuated by operative logics. Evidence for this 'operative' function can be found in Massumi's (2007a) example of pre-emption, the iterative production of governmental measures and targets, and also, perhaps, in the self-perpetuating nature of forecasts and projections in technology research (to which we will return later). Furthermore, I suggest that the instantiation of anticipation in particular is performed through 'anticipatory logics'. What might accordingly be identified are frameworks through which 'acceptable' or 'credible' means of addressing the future are qualified. The programmatic application of statistical techniques and the propagation of threat to prompt recourse for action demonstrate the application of the discourse of anticipation as logical constructs for governance.

This mobilisation of anticipatory (and operative) logic is not, however, necessarily peculiar to anticipatory governance. Anticipatory logics are also evident in the qualification of 'credible' means of asserting knowledge or making predictions about futures. In laying out starting points for thinking through how anticipatory action happens, Anderson (2010d) identifies logics of anticipation as intimately tied to practices of anticipation. An anticipatory logic, for Anderson (2010d, p. 6), is 'a programmatic way of formalising, justifying, and deploying action [related to the future] in the here and now'. Similarly, Winner (2004, p. 37 original emphasis) describes the rationale of anticipating futures for technologies as asserting action: 'the operative verb tense in projections is *will*. These things *will* happen'. Yet, as the variety of mission statements for technology research programmes attest, there is a cacophony of competing futures that, apparently, 'will' happen.

In particular, the figuring and discussion of futures in ubicomp R&D, considered as the mode of anticipation 'foresight', relies upon particular anticipatory practices that are rationalised by corresponding logics of anticipation. This mechanism, or 'mode of anticipation', for addressing futures and rendering them apparently actionable lies at the heart of how the future is figured in the spatial imagination of ubicomp. As one (former) HP Labs researcher suggested:

"A[t] an industrial research lab your job is to think about and develop technologies that could lead to interesting opportunities some time in the future, so, almost by definition, you're always working in a future tense" ([anonymised], formerly of HP Labs).

In relation to the multiple nature of (plural) representations of possible futures that are produced in R&D, it is perhaps something like a future 'subjective' tense, insofar as the premise for the anticipatory forecast is 'given the perfect world for our technology, this is

what should happen', which might be somewhat removed from what is otherwise anticipated for the future.

To probe the inter-related logics and practices of anticipation that constitute the staging of proximate futures for ubicomp I turn to an exploration of how practitioners describe the future oriented processes in which they engage. These examples both demonstrate and distil the differences of the mode of foresight as played out through ubicomp, signalled in the argument above. If, following oft-quoted author William Gibson, there is a belief amongst those involved in ubicomp that 'the future is already here; it's just not very evenly distributed' (Gibson, 1999; cf. Bell and Dourish, 2007b, p. 141; Harper and Selin, 2007, p. 83), we must surely ask if this collective sense of futurity and its various instantiations is self-perpetuating. In the next section of the chapter I explore the anticipatory practices and the logics of anticipation through which they are rationalised. In particular, communities of practice are analysed as forming around and producing logics and practices of anticipation.

## 4.4 Communities of practice, communities of anticipation

Ubicomp research does not, of course, exist in a vacuum; it takes place in a variety of organisational contexts. More specifically, various communities of practice, which sometimes span organisational boundaries and are largely self-selecting, form around the identification of particular commonalities. These impetuses for the formation of groups are not necessarily market opportunities, they often stem from research for its own sake. In corporate R&D, such impetuses can be: the context of the workplace – often the 'research group'; common research traditions – often tied to methodologies; funding opportunities; and specific research agendas – often tied to conferences. An example in the corporate context addressed in this thesis could be a community of practice can be formed from shared interests being galvanised into a programme of research, such as the original work on ubicomp at the Xerox Palo Alto Research Centre

(PARC). Again, a community of practice can arise from shared concerns for specific topics of enquiry, for example the 'Ubiquitous Computing' conference (under the direction of the Association of Computing Machinery) in 2007 had three 'subgroups' that focused upon: 'experiences', 'sensors', and 'systems' (Krumm et al., 2007). Just as ubicomp R&D taken as a whole is inherently anticipatory, so too are these communities of practice.

The purpose of this section is to examine the practices and logics of anticipation of ubicomp in the context of these communities of practice. Following Anderson's (2010c) call to attend to 'the presence of the future' in relation to the 'living present' I chart the logics and practices used in ubicomp R&D to negotiate that very futurity. However, in contrast to Anderson's (2010c) discussion of futurity I argue that anticipation is not only practised in terms of a threat. A broader reading of anticipation is necessary to attend to the 'operative' logic of the various and nuanced ways in which anticipation is practised. Such a 'catholic' reading of anticipation facilitates the analysis of the performative practises of foresight, and other modes of anticipation, and the particular communities of practise that are formed around them. This section accordingly proceeds in three parts: first, I will quickly outline communities of practice in corporate ubicomp R&D that have formed around some of the commonalities described above. Second, I will focus upon three important practices of anticipation that emerge from empirical evidence: imagining, enacting and specifying futures. Third, I address what I see as two logics-fabulation and invention-that rest within these practices and situate them in the broader discourse of anticipation.

## 4.4.1 Communities of practice

There are many ways that a community of practice can be formed, as I signalled in the introduction to this section. I want to quickly outline an example of particular groups that illustrate how such communities form and to signal how they are inherently future oriented in outlook. We can look to the example of 'branded' conferences. Within the broad reach of what can be understood as ubicomp research there are many relevant conferences in which to publicise and share one's work. The Association of Computing Machinery (ACM) holds the 'Ubicomp' international conference, the Institute of Electronics and Electrical Engineers (IEEE) sponsors the 'Pervasive' international conference and, following the European Union's 6th framework, the 'Ambient Intelligence' European conference. Indeed, these conference communities explicitly state 'visions' for particular types of future that should arise from the research presented, as the editors of the 2009 'Ambient Intelligence' conference assert:

'While the Ambient Intelligence vision was initially conceptualized as a reply to technological developments that enabled the embedding of intelligence in electronic environments with a focus on information, communication and entertainment applications, the vision has not been agnostic to the rising needs in society. Today, the Ambient Intelligence vision represents also a holistic approach to technology-supported health and wellbeing systems' (Tscheligi et al., 2009).

Furthermore, as I have already suggested, within these conferences there are particular topics of interest that galvanise a group of researchers, for example the ubicomp conference has 'subgroups' (see Krumm et al., 2007). Of course, participation in one community of practice does not preclude participation in others, for example in 2007 John Krumm, Senior Researcher at Microsoft Research, was on the Programme Committees of the: 'Workshop on Artificial Intelligence Techniques for Ambient Intelligence', the 'International Symposium on Location and Context Awareness', the 'International Conference on Pervasive Computing', and the 'International Conference on Ubiquitous Computing'<sup>30</sup>. I suggest that it is within these communities of practice that anticipatory action takes place, specifically through shared practices of anticipation.

<sup>&</sup>lt;sup>30</sup> This information was retrieved from Dr. John Krumm's website for his professional activities, available from: <u>http://research.microsoft.com/en-us/um/people/jckrumm/</u> (accessed: 19/01/10).

A key element to participating in several communities of practice must be, therefore, the negotiation of the different emphasis or value placed on the types of future being anticipated. Just as with any other form of research, researchers in ubicomp have to negotiate the differences in desired outcomes for their research, which are anticipated by different actors – research centres, funders, peers, users and many others. For example, researchers employed by commercial institutions must negotiate between the corporate 'values' asserted by their employer, their own aspirations as researchers and the normative values that have become concretised in the discourse of their field. As Rafael Ballagas, of the Nokia Research Centre, suggests, participation in a community of practice involves the negotiation of values that directly play into the practices of anticipation you employ:

'do the [corporate] values influence my... interpretations of the future, I would say... probably not... it doesn't effect the way that I extrapolate into the future about how technologies might disrupt the solution space. Right? But it does, these values definitely do affect ah, you know, whether these solutions address problems that, you know, meet the values in a certain way. ... so, you try to steer what... solutions you think are worth investing time on, based on, you know, how well it fits the values of your company, or of yourself. Yourself primarily, but also the company you work for, so you can get a paycheck. Right? ... so I think its very much about values, in terms of ah, the designs, like, designs I think inherently reflect the designers value. Um, but the vision of the future that led to that design does not necessarily ah... give... reflect... the values don't necessarily get reflected into those ... I think its just anticipating trends, and taking those trends to the extreme... to kind of put yourself in a place mentally to ah, to come up with these solutions.' (Rafael Ballagas, Nokia Research)

The corporate values expressed by an institution, such as the Nokia Research Centre, perform a loose disciplinary action upon research and yet the principal concerns of the researcher appear to remain fidelity to personal values, which might also be shared in other communities of practice. The discourse of anticipation is enacted here in negotiation between the various actors trying to exercise power. This, largely implicit, negotiation in the practices of research is a struggle over what the agreed terms of what can be said about the particular futures anticipated in a project. So, I turn now to consider the practices of anticipation that I have identified in ubicomp R&D.

#### 4.4.2 Anticipatory practices of ubicomp

Anticipatory action involves rendering futures apparently actionable. Anderson (2010c) uses the slightly awkward phrase 'the presence of the future' to signal how anticipatory practices 'do more than gather the knowledge necessary to know futures' (Anderson, 2010c, p. 16). Anticipatory practices are a means of establishing the presence of what has not happened and may never happen, an 'indeterminate potentiality' (Massumi, 2007a, p. §13). As Adam and Groves (2007) argue, 'future presents' and 'present futures' are frequently embodied, experienced, told, imagined, performed, wished, symbolised and sensed. However, making futures present, following Anderson (2010c) is somewhat paradoxical. Futures are apparently made present as objects such as reports on trends, stories or models, and are felt as anxieties, fears or hopes but futures do not cease to be absent insofar as they have not and may never happen. My focus in the following paragraphs is on three practices of anticipation that demonstrate this paradox: imagining, enacting and specifying futures.

#### 4a. Imagining futures

Desired, feared or uncertain futures have long been made present through acts creative fabulation, including folk practices of storytelling and, particularly in relation to technology, science fiction (see: Dourish and Bell, 2008; Kitchin and Kneale, 2001; Rose, 2000), as well as more formal techniques of foresight such as horizon scanning, scenario planning and visioning (see: Brown, 2007; Lösch, 2006; Meadows and O'Brien, 1998; Winner, 2004). As Anderson suggests, the outcomes of processes of imagination are 'a question of creating affectively imbued representations that move and mobilise' (2010c, p. 19). Imaginative renditions of possible futures can be ambiguous in purpose and, as Dean Eckles of Nokia Research suggests, it is important for the researchers that create and use them to ask themselves what that purpose is:

'these visions form some kind of future scenario, are the visions that are meant to be, are they exemplary of some kind of desired future? Or are they actually, they can be feared futures... or [they] can just perhaps be considered, for the sake of research, for articulating a domain' (Dean Eckles, Nokia Research Centre)

Consider briefly the story of 'Sal' with which Mark Weiser illustrated his vision for ubiquitous computing in the 21st Century (reproduced in the Preface of this thesis). Consider also the scenarios that illustrate the openings of articles and papers in ubicomp research. They are employed as a means to draw in the reader, to evoke a particular type of future and to persuade others that it is of value. For example, in the opening to Välkkynen et al.'s chapter describing the advent of 'physical browsing' using mobile devices a future scenario is offered as the most efficient means of introducing the suggested 'interaction paradigm':

Joe has just arrived on a bus stop on his way home. He touches the bus stop sign with his mobile phone and the phone loads and displays him a web page, which tells him the expected waiting times for the next buses so he can best decide which one to use and how long he must wait for it. While he is waiting for the next bus, he notices a poster advertising an interesting movie. Joe points his mobile phone at a link in the poster and his mobile phone displays the web page of the movie. He decides to go see it in the premiere and clicks another link on the poster, leading him to the ticket reservation service of a local movie theatre' (Välkkynen et al., 2006, p. 61).

Not only are futures imagined in story form but they are also imagined in images through videos to portray the vision of a future attached to particular projects, or simply to suggest that a group or an institution has the capacity for vision (these types of video are the subject of analysis of chapter 5). These representations can become a doubleedged sword, as an informant suggests:

'in the particular setting of research that needs to be justified or funded by somebody, ah, a vision is useful because its, again, it provides that powerful, sort of, visual shorthand, that can get a funding agency or a company excited about something, right? Which is good, because it keeps the money flowing, right? But you know ... well, you can kind of get it wrong that way too, right?' ([anonymised], formerly of HP Labs).

Imaginative representations of the future can become a powerful 'visual shorthand', as [anonymous] suggests, but they can also become too static and outlive their usefulness.

However, imaginative renditions of potential futures can be a device for rallying a particular community of practice to certain ends.

Consider one final example of the deployment of practices of imagination; a set of 'visions', produced by PARC, that describe a future of 'harmonious interaction' with and through technology that would allow people to

'communicate, learn, share, create and access information, as well as interact with objects in the physical environment, spontaneously and effortlessly as they go about their everyday lives' (Begole and Masuoka, 2008, p. 635).

The vision of the future represented here draws heavily on an analogous comparison with characterisations of 'Eden' as a perfect environment in which to live. As we learn from the principal author of this 'vision', it is not one but, in fact, several imaginative representations of a possible future that fit together:

'the harmonious interaction is really just an umbrella vision really and the three sub-dimensions in that are more what we pay attention to on a day to day basis: pro-activity, natural interaction and ubiquity. And within those we also have sub-projects within it, so like the natural interaction, there's a piece of that which has to do with making it easy to use your mobile device and there's a piece of that which has to do with using sensors to detect your needs and then that feeds into the pro-activity too, you know, having detected something then satisfying that. And that's more at the level we operate, when we're planning things out, ok so, we've said – here's this umbrella objective, here's the three ways we're going to attack that problem, because the problem is not concrete enough to solve directly, its just this, as you say, you know, quite amorphous goal, so here's are three strategies, here's our three bets, on how it'll be accomplished within whatever, and that's what we focus on, day to day' (Bo Begole, PARC).

The imaginative representations, or 'visions', thus become tools that allow for the direction of particular strategies in day-to-day practises of R&D. In the case of Begole's group at PARC, a community of practice is co-opted into particular forms of action through the sense of direction provided by the imaginative representation of a future. Imagination is used in practise not to predetermine the future but to open up spaces of possibility into which established practices of development can be directed.

#### 4b. Enacting futures

Futures are also apparently made present through practises that stage the possible through some form of acting, gaming or pretending. Here the potential future of technology use is made present and rendered actionable 'as if an as-yet unmade technology is, instead, a finished product. 'As if futures are created through particular forms of play-acting that create 'anticipatory experience' by arranging material objects or environments 'as if' they are, in fact, the desired technology in finished form. Several techniques have been developed to facilitate the production and enactment of 'as if future technologies, including 'lightweight' or 'paper' prototypes and 'Wizard of Oz' techniques (Dahlbäck et al., 1998; Salber and Coutaz, 1993; Snyder, 2003). 'Paper prototypes' involve using rudimentary sketches on paper of a particular interface for a technology that user is invited to interact with alongside a researcher who performs the interaction 'as if' they were the computational elements of the technology. 'Wizard of Oz' techniques for prototyping are methods for simulating the use of a technology by giving a user an apparently operational device that is, in fact, being manipulated remotely by a human, for example acting as an 'intelligent user interface' (Dahlbäck et al., 1998). These techniques are somewhat linked to imagination but use the capacities of embodied interaction more explicitly. They have several functions, but are principally employed in the context of experimenting where there is significant uncertainty. Although the techniques for enacting futures differ in detail, they all generally involve staging the use of a specific possible technology in a particular context.

Let us briefly focus on one particular researcher's experience of using practices of enacting futures to differentiate this practice from imagining and specifying. 'Lightweight' or 'paper' prototypes can be used to rapidly create an experience of using a technology 'as if' it were a functional device. According to Snyder 'paper prototyping' is 'a widely used method for designing, testing and refining user interfaces' (2003, p. 3). Proponents of paper prototyping suggest it offers a fast means of providing a reasonably 'deep' experience of a potential technology with the ability to rapidly iterate through versions of the design (see: Beyer and Holtzblatt, 1999; Snyder, 2003). However, in light of the experiences of Scott Carter, of Fuji-Xerox Palo Alto Lab (FX PAL), it is evident that the potential futures enacted are not always desired:

'I did some experiments using lightweight prototypes of umm... that is paper prototypes of um, peripheral displays and sensing systems and I found it... um... I found that... well there are two problems... the direction I went in once I had actually started getting some interactive technology into peoples' hands ended up being so drastically different from any of the scenarios that I built beforehand that it seemed not as important to ensure that scenarios are all that great, you need to have some general direction of course and some idea, but you need to not be married to it and not take it too seriously... because you really don't know what it is you've actually done until you've put it in play.' (Scott Carter, FXPAL)

The potential for alternative futures that have not been previously anticipated emerges from the participation of the user. This can, of course be productive of different forms of anticipatory experience and it raises interesting questions about the disciplinary action of the discourse of anticipation that sits behind such practices. For example, such practices may question the stability of the set of statements that govern what is sayable about the future but also demonstrates the means by which space is made for new statements to be made or, in this context, enacted. Interestingly, an alternative version of this technique was also discussed as an evolution of the practice of enacting futures within the R&D practices of the informant:

'Sketches are exploratory, sketches are... you're just trying to get a handle on an idea, you have no real comparison... you would get, ah, you know rely more on, say, focus groups, but again probably with people who were, have a lot of experience, not just some random user communities. ... in many cases, you would, ah, just create a variety of different designs and then have people evaluate them and... you'd always use people who have lots of experience doing this... not using people who're developing it but people... from outside, just like you would with a design critique, and have them come in and evaluate these different platforms' (Scott Carter, FXPAL).

Striking in this description is the allusion to (re)taking control of the action by 'experts', the 'people who have lots of experience' control of the validation of the potential future to expert opinion. A particular community of expertise is thus invoked as a condition of the practice of anticipation. So, while the space of enactment may provide an occasion for experiencing how a future technology might be used, it is also a space in which potentiality is somewhat wrestled over.

## 4c. Specifying futures

If the other two practices of anticipation are broadly creative, in the normative sense of utilising the imagination or play, then the third, and final, practice of specifying is broadly programmatic. Practices of specifying future technologies are the most orthodox means of generating new technologies or novel applications. These practices are also the least concerned with the identification of possible future 'worlds' in which the technologies may be used. There are, of course, established and widely used methods for identifying 'problems' and 'needs', which originate from engineering methodologies, specifications of which can be found in many Human Computer Interaction (HCI) textbooks (for example: Sears and Jacko, 2008; Sharp et al., 2007). Solely pragmatic 'solution identification' techniques can be seen as a-temporal, they are not tied to a particular type of future, according to the considerations of the designers they could be transplanted into any time. Futures re-enter practices of specification in R&D through 'global' variables are taken into account in the techniques of specification, for example the types of user, the location of use and other worldly contextual information. The 'User-Centred Design' techniques originating from more 'orthodox' HCI is still widely practiced as a part of ubicomp R&D. User-Centred methods for specifying particular scenarios of technology use were expertly summarised by a senior researcher at the Nokia Research Centre:

'I mean... you could describe the process like this – number one, ah, who is your user? That's the first question that you ask yourself. And then, number two, ah, what task are you trying to support? Or what problem are you trying to solve... for that user? And then, once you have those two questions answered you can start to design a system to address ah, the user and that task, or address that problem for that user. So, you might be able to characterise that as, you know, problem centred design. Where I have these problems and I have a problem space and what types of technologies or solutions can I apply to improve
the situation for these users doing these tasks? Ok? And ah, very fundamental to this user centred design is this notion of um, applying ethno-methodological approaches to understand how the user goes about... these tasks or dealing with these problems today' (Rafael Ballagas, Nokia Research)

Futures are not explicated but inferred in the process of specifying multiple scenarios. This process does not specify a single technology, or a single version of a technology. Neither does this form of User-Centred Design specify one particular means of performing a potential task. A 'potential design space' is thus constructed, within which the various specified factors can be adjusted and 'gaps' can be identified and qualified in relation to potential needs. 'Families of solutions' can be produced in this way, which give multiple dimensions to potential future ways and means of using technologies. This is further explained by Rafael Ballagas, of Nokia Research:

'to really break down ah, the... the set of solutions into – what are the critical dimensions for which these solutions can vary to create somewhat of a design space, a potential design space. So, once you identify these dimensions, um, you can actually group existing designs along these different dimensions, but you can also identify gaps... where existing designs don't necessarily ah, exist, or designs don't necessarily address these needs. And once you identify these gaps you might be able to propose solutions that you feel can fill these gaps, or another thing that you can do with these kind of design space approach, is identify families of solutions, and then kind of ah, predict properties of one solution based on the properties of another solution... and both of those I think are very useful in kind of, generating interesting and useful research ideas... concepts' (Rafael Ballagas, Nokia Research)

It is thus in the multiplicity of options and variables that are described and quantified in the array of specified scenarios that the potential of a future is made present.

### 4.4.3 Anticipatory logics of ubicomp

Within the discourse of anticipation for ubicomp R&D, foresight as a mode of anticipation situates particular practices that open potential futures to be rendered apparently actionable. Interior to these practices are logics that regulate how practices of anticipation are enacted. Following the description of the three practices of imagining, enacting and specifying futures, I will now address the logics that I believe facilitate their function. I have already suggested that anticipatory logics are coherent and repeatable means by which action in the present on the basis of the future is coded and conditions for a sense of anticipation are instantiated. A logic upon which forms of action are based 'exceeds any specific case in which futures are acted on, and yet is continually being reassembled in attempts to govern different domains of life' (Anderson, 2010c, p. 26). An anticipatory logic is the disciplinary mechanism by which statements about 'the future' are conditioned and the presence of specific 'futures' is apparently rendered. I focus here on two: fabulation and invention. Some logics of anticipation may be co-opted into or originate from idealist or ideological scripts, for example 'pre-emption' in relation to the war on terror (see: Anderson, 2010c; Massumi, 2007a). In contrast, the logics by which those who practice R&D attempt to gain foresight carry less rhetorical baggage. They are certainly political, however, insofar as the logics of fabulation and invention rationalise claims over particular types of future. The goal of these logics of anticipation, then, is to produce and develop the potential for novel forms of technological encounter. In the remaining part of this section I will outline the properties of the two anticipatory logics.

First, I have used the word 'fabulation' to describe a rationale for imaginatively creating attributes and stories for particular types of future. We might, just as easily, talk about a rationale of 'story telling' or 'imaginative representation', however, 'fabulation' offers some specificity in definition. Following the Oxford English Dictionary we can understand 'fabulation' as 'to talk or narrate in *fables*' (Oxford English Dictionary, 1989), which in turn are fictitious narratives or statements, or short stories 'devised to convey some useful lesson' (ibid). 'Fabulation' as a means of garnering foresight of possible, probable or preferred futures is a prevalent logic within practices of anticipation in computing R&D and, as described throughout this thesis, central to how the broad community of ubicomp researchers understand their own work. As Bell and Dourish (2007b) suggest, reflecting on the influence of Weiser's originating research 'vision':

'the same concern with technological futures continues to feature in the ways in which ubicomp research agendas are framed and in which technological advances are motivated an measured' (Bell and Dourish, 2007b, p. 133).

There are thus elements of fabulation in many practices of anticipation for ubicomp, for fabulation is at the heart of the production of 'useful' fictions. These fictions are the stories told to introduce a set of ideas, as demonstrated by Bo Begole (Senior Researcher at PARC) in 4a, as well as the 'fictive frames' (Dourish and Bell, 2008) that facilitate the 'as if user interaction in 'lightweight prototypes' (see: 4b). Fabulation is the logic that legitimises storytelling as a valid research practice, it is the set of rules that enable 'fictional' statements about the future, within the discourse of anticipation.

Second, 'invention' is the most well known, and perhaps the greatest catchall, of logics. However, I am applying the term in a specific sense here, following James Utterback's (1994) distinction between invention, as 'ideas and concepts for new products or processes' and innovation as the 'reduction of an idea to the first use or sale' (Utterback, 1994, p. 193). Thus, in line with David Nye's (2006) explication of the concept, invention is significantly different in rationale from innovation, invention does not necessarily stem from the 'eureka' moment, neither does it provide a certain route to fame and fortune, instead it is the rationale of curiosity. Specifically, invention is the logic by which novelty is recognised and extrapolated into a potential future, as Andrew Barry suggests:

'what is inventive is not the novelty of artefacts and devices in themselves, but the novelty of the arrangements with other objects and activities within which artefacts and instruments... might be situated in the future' (Barry, 2001, pp. 211-212).

Ideas are struck upon and developed using techniques, such as those explored above, to formulate possible worlds. To return to the example of the opening quote of this chapter that exemplifies the experimental ethos of computer science pioneer Alan Kay 'the best way to predict the future is to invent it' (see: Markoff, 2005). Following philosopher Isabelle Stengers, we might understand invention as a 'passion of creating new possiblity' (Stengers and Zournazi, 2002, p. 248). Invention is accordingly a motiviating rationale for activities such as prototyping and in the specification of 'solution spaces' to map out possible technologies.

Fabulation and invention are both means of guiding action that function through practices of anticipation to make futures apparently present and thus actionable. The anticipatory logics of fabulation and invention both attempt to elicit a sense of foresight. In this section I have demonstrated how the 'presence of the future' is constructed and actions are made upon that assumption in the guise of particular forms of anticipatory practice. Through the imagination, enacting and specification of futures, possible, probable and preferred worlds of ubicomp are produced in the communities of practice within ubicomp R&D. I have discussed how ubicomp R&D consists of communities of practice that form and adapt to particular means of addressing the future, thus they are also 'communities of anticipation'. In the final section of this chapter I draw conclusions on the interaction of practices and logics within the anticipatory discourse of ubicomp and signal how this raises to the fore a politics of anticipation.

### 4.5. Conclusions

I have suggested that forms of anticipation in research remain anticipation and I argue that by looking at the rationales, or anticipatory logics, that are used in their instantiation, through particular practices, we can examine the ways in which futurity is thereby produced. A key tenet of the attempted 'foresight' practised in ubicomp is, I argue, an 'operative logic' (Massumi, 2007a) of forecasting. Anticipation, and particularly forecasting, is an iterative process. Anticipatory action has a duration, as discussed above, but it is motivated by an 'operative logic' because their ethos inherently perpetuates further anticipation. I argue this perpetuation of anticipation is situated within and motivated by particular communities of practice. I want to

conclude, therefore, with some remarks about a politics of anticipation. I have already suggested, following Barry (2001), that a politics of anticipation is the coding of practices rationalised through anticipatory logics. The formations of communities of anticipation, suggested above, offer a starting point for drawing out such codings of anticipatory practices. We can therefore identify two aspects of a politics of anticipation.

First, the practices of foresight are politically productive because they inspire and provoke debate about the direction of research and possible uses of what might otherwise be considered 'value neutral' technologies. In this sense it might be suggested that technological R&D has an innate political value. Interestingly, similar concerns have spawned an associated literature for 'value-sensitive design' (Friedman, 1997). Who adopts responsibilities for arbitrating and deciding such directions, and how, constructs specific communities of practice, such as 'ubiquitous' perhaps vs. 'pervasive' or 'ambient' (although often these delineations are overly simplistic), which, Barry (2001, p. 207) notes, has the capacity to restrict the space of the political. However, whilst 'visions' such as Weiser's 'Computer for the 21st Century' have a regulatory effect on the ways in which practices of anticipation play out, the discourse of anticipation allows for more subtlety. The statements through which we can describe, and attempt to make present, particular types of future contain variety that allows for the potential of difference in the repetition of 'operatively' perpetuated anticipation.

Second, a politics of anticipation plays out between different groups, what I have identified here as 'communities of anticipation', which seek to discipline, or exercise power over the articulation of the future for ubicomp. We are not speaking here of politics associated with conventional institutions of government. Instead, following political philosopher Ernesto Laclau (1996), we can understand politics as not grounded in the traditional entities often presumed to exercise power. I argue that, in the case of a politics of 'making futures present', we can find a basis for anticipatory politics in the emergence of communities of practice. Whilst there is certainly validity in contemporary critiques of political discourse that it can be become 'narrowly empirical in its focus on formal political institutions' (Barry, 2001, p. 199), it is important to ask and perhaps rethink what these 'institutions' are, of anticipatory action in this case. The communities of anticipation that form around particular practices become institutions of another kind. They 'institute' meaning in the process of 'making futures present' and only last as long as those processes last. The driving momentum of this process is the collection of anticipatory practices described in this chapter, which are the means by which people are persuaded towards particular futures. This 'persuasion' is the unifying 'point in which the 'reasons' for a belief and the 'causes' of the belief constitute an inseparable whole' (Laclau, 1996, p. 116). The politics of anticipation is the playing out of 'persuasive' anticipatory action, enacted in anticipatory practices; rationalised through anticipatory logics; and enrolled in communities of anticipation.

As a final brief detour, and drawing on recent work by Bingham (2005, 2008), I want to touch on a particular danger in relating anticipation to progress. A key point in this context is that 'progress' is not only reductive, but also according to Latour (1993), progress is a regulatory meta-narrative, imposed by its proponents 'the Moderns'; who 'have a peculiar propensity for understanding that time passes as if it were really abolishing the past behind it' (Latour, 1993, p. 68). My concern, then, is that we need to be mindful that in the relation of discourses of anticipation with discourses of progress, it would not be difficult to conflate them. The assumptions upon which practices of foresight are based may well be technologically deterministic, and so antipolitical. However, the nuance of the productive potential of anticipation in the variety of its performance as a set of practices, such as the practices of *imagining, enacting* and *specifying* futures for ubicomp, can be obscured by such well-rehearsed arguments. By focussing on the practices of anticipation attached to ubicomp R&D, I argue we can look understand the 'meta' narratives of progress as one of many parts of the discourse of

anticipation. Rather than privilege specific representations of the future, we should accordingly address the ways in which particular communities of anticipation form around assemblages of practices for rendering the future apparently present.

Inspired and troubled by the various ways in which particular types of future for ubicomp are, and have been, forecast (as well as by work such as: Anderson, 2007; Bell and Dourish, 2007b; Bingham, 2008; Galloway, 2004), in this chapter I have described a politics of anticipation. It is not difficult to see how the practices of anticipation can become programmatic, when arranged on 'macro' levels by large corporations for example, but, I think, there is always space for nuance and dissent that leads to a departure from such a regime. The sense in which our collective futurity is seemingly enrolled into normative conventions of an ongoing technological 'progress' is perhaps disciplinary or 'anti-political'. Through the imposition of conventional descriptive 'meta' narratives alternative futures can be somewhat 'coded' out of the ways the future is made present. However, it is the possibility of difference inherent in the fact that anticipatory logics and practices operate in the present, upon never actualised 'proximate futures', that leaves intact the open potential of 'future presents'. This is precisely why, I think, Weiser's (1991) vision for ubicomp has endured. By looking at the logics and practices via which anticipatory action is performed I argue it is possible to examine the ways in which our knowledges and practices of technological anticipation construct our collective sense of futurity.

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# Chapter 5

# Representing 'things to come': Feeling the visions of ubiquitous computing

### 5.1 Introduction

"[T]o successfully navigate the many uncertainties facing us in the future, businesses need to have a North Star... I believe one of the best ways to articulate this vision is to immerse ourselves in an inspirational view of what the world could look like five, 10, 15 years from now" – Stephen Elop, President of Microsoft Business Division, 27th February 2009

Anticipatory action to 'make futures present' often yields discursive and material products, in the form of reports, stories and, of particular interest here, images. In the previous chapter I illustrated how the futurity of technology R&D, and particularly ubiquitous computing (ubicomp), takes place through particular anticipatory practices. These practices, and particularly those invested with imagination, produce representational media such as text and images, including video. In this way, detailed depictions of possible worlds of technology use are produced alongside, and often instead of, materially manufactured prototypes. In this chapter I specifically address the practice of producing videos depicting imagined futures. I argue such videos are the means and media of rendering the presence of a future, which is explored as the videos produced to These videos, by being watched, re-script the 'indeterminate depict 'visions'. potentiality' (Massumi, 2007a, p. §13) of the future by instantiating the performative establishment of the presence of what has not happened and may, in fact, never happen. For example, as illustrated in the opening quote, in February 2009 Microsoft's Stephen Elop espoused a means of future orientation, which he suggested is core to the company's strategy, through the medium of video. At its heart lies a process of foresight: literally and figuratively 'envisioning' a future.



Figure 5.1 Image captured from Microsoft Office Labs' "Future Vision of Productivity" vision video (source: screen capture by the author). Images included with permission from Microsoft.

Stephen Elop empirically demonstrated what he meant by 'an inspirational view of what the world could look like five, 10, 15 years from now' (Elop, 2009) in the guise of a video entitled 'Future vision of productivity'. The attendees of the business conference at which Elop spoke saw a man stood in front of his office window, on which were displayed schematics from a current project (see: Figure 5.1). With a gesture the man sweeps them away, sits down at a desk and begins to manipulate data and visualisations of information associated with tasks and people with his fingers and change perspective with movements of his hands. Here is a world in which every surface is potentially a screen, where one can seamlessly interact with large amounts of information, which are apparently accessible from anywhere and everywhere. A world in which information about anything can be called up at any time, in any place, using a plethora of devices and systems by relaxed and confident citizens of that world. Indeed, at the heart of this 'vision' is the framing of a citizen/subject whose world is effortless. The stories constructed around these technologies rest in tension with attempts to demonstrate the technologies as though they are products. This tension invites questions about how 'visions' such as Microsoft's 'Future vision of productivity' attempt

to make a future present and what politics ensue from (re)presenting specific types of future in particular ways.

The imaginative construction of technologies as 'visions' (their 'figuration' of a future) is important in our understanding of technology. If, following the Oxford English Dictionary, a vision is 'the action or fact of seeing or contemplating something not actually present to the eye; mystical or supernatural insight or foresight' (Oxford English Dictionary, 1989) then the aim of this chapter is not to affirm or refute the veracity of that action but to examine it as a means of making futures apparently present. The focus then is not the optical character of 'vision' per se but the means and representation of anticipation. The following chapter accordingly has three aims: first, to introduce the videos that qualify anticipation of particular forms of technological encounter as artefacts of representation produced in the efforts to represent future computing technology. As images in video form, I refer to 'artefacts' because these discrete products of human activity have an ambiguous status. Both consumers and producers treat them as a kind of commodity with a peculiar value, but they are also objects to be 'read'. Second, I intend to analyse the representational practices of future orientation by which the artefacts in question are produced. These artefacts undergo interpretation and, I argue, in that process lend some materiality to the potential future being represented. Third, I address how forms of future orientation encourage a familiarisation and embodied disposition towards proposed futures. In so doing, this chapter attends to the role of our sensuous perception of 'visions' and their representational objects constructed to elicit future orientation.

The representations of possible futures examined in this chapter are pervaded with computing technologies that enhance and support most of our everyday lives, which can be characterised by the broad narrative of ubicomp. We can see that, whilst Microsoft do not label the vision described above as ubicomp what Elop describes is a vision of a world with ubicomp. This chapter focuses on the representational artefacts of videos produced principally by technology companies to expound visions of the future. For shorthand purposes, and with no intention to proclaim a 'genre', these videos will henceforth be referred to as 'vision videos'. These representational artefacts are distinct because of their ambiguous status, they are not quite advertisements but also are not entirely fiction. The content of the videos has a basis in contemporary industrial research and yet what is depicted (in the form of technological devices or systems) is frequently not yet possible. Such videos have featured prominently throughout the course of computing research, with influential examples such as Apple's 'Knowledge Navigator' (see: Bergman et al., 2004; Houde and Hill, 1997; Tognazzini, 1994).

This chapter will concentrate principally on two noteworthy examples of vision videos: HP Labs' 1999 video for the 'CoolTown' project and Microsoft Office Labs' 2004-2009 'Future vision of...' series of vision videos (the most recent being that described above). These videos have exhibited popular influence by attracting widespread comment online. More importantly, they have a particular resonance in contemporary computing research, they represent significant movements in the commercial research conducted by two world-leading technology companies and might thus be considered canonical examples. HP's 'CoolTown' project was a headline initiative, stemming from HP's extensive R&D arm 'HP Labs', to push forward a vision for what computing would become. 'CoolTown' represented a multi-million dollar investment into a particular business strategy exemplified in the vision video. While it was not explicitly aligned with Weiser's vision for ubicomp 'CoolTown' exhibits similar attributes and the work produced under that moniker was later presented at ubicomp conferences. Derivative work from the 'CoolTown' agenda has since been explicitly positioned as ubicomp or 'pervasive' computing, such as the 'm-scapes' locative

multimedia platform<sup>31</sup>. The Microsoft Office Labs 'Future vision of...' series began in 2004 as articulations of how Microsoft Research envisaged the integration of emerging technologies into the Microsoft rationale of experiencing technology. The series of videos has developed into a means of proselytising an ethos of technological development and the types of devices and systems that should produce. While it is certainly possible to see significant overlaps with extant Microsoft technologies, such as Microsoft's 'Surface' touchscreen interface and 'Kinect' gestural interface, these videos are, I argue, much more than a vehicle for selling specific devices. As Ian Sands, Microsoft's 'Director of Envisioning' states in an online interview, the process for producing vision videos is directed as a means

'to really kind of wrap our heads around what's possible, what's plausible, and what technology roadmaps exist over that time frame [5-10 years]... we look for problems... and we identify which technologies are best suited to start addressing some of those problems, and we have... fun brainstorming with lots of people around the company to kind of imagine inspiring, thought-provoking ways that... start to illustrate what those futures might look like' (Larsen, 2009)<sup>32</sup>.

Vision videos are very similar to many other forms of moving image. The representational techniques utilised in these vision videos illustrate that such artefacts of imaginative practice are not unique. Yet what marks out 'visions videos' from other forms of video is their political ambiguity. They are both 'fun' imaginative artefacts of entertainment and serious investments in the attempt to make particular futures present. The distinctive property of vision videos is the blurring of an apparent commitment to forms of action towards a particular future with imaginative fabulation.

<sup>&</sup>lt;sup>31</sup> The 'm-scapes' platform will be withdrawn from active support by HP on 31st March 2010 following a shift in research focus. The website that supports the platform is registered at: <u>http://www.mscapers.com/</u> (accessed: 24/02/10) until that date, thereafter 'm-scapes' will not be an active software platform.

<sup>&</sup>lt;sup>32</sup> The text of this quote was transcribed by the author from footage in the video interview with Ian Sands, Director of Envisioning at Microsoft, conducted by Larry Larsen (2009).

I argue this 'blurring' affords the production of anticipation without clear obligation to deliver what is envisioned.

The ambiguous status of these artefacts of imaginative 'vision' allows vision videos to operate as entertainment, fiction for its own sake, but equally to introduce and demonstrate particular concepts or functions, acting as a form of 'prototype'. Vision videos are 'paratextual', following Nigel Thrift's (2004b) reading of Gérard Genette's work (1997). A 'paratext' is '[m]ore than a boundary, or a sealed border, [it] is, rather, a threshold that 'constitutes a zone between text and off-text, a zone not only of transition but also of transaction' (Genette, 1997, pp. 1-2). Drawing on familiar literacies of technology use and everyday life, vision videos, as 'paratexts', connote action towards particular futures without necessarily committing to that action. Accordingly, to address the aims of this chapter, I problematise the production and reading/viewing of 'vision videos' not as trivial but as situated within a socio-technical 'politics of anticipation'. If politics is a range of forms of action that mark and code practices (following Agamben, 1993; Barry, 2001) then anticipatory politics are those forms of action that mark and code practices that evoke and produce futurity. In this chapter I suggest these forms of action lie in a political tension between the exercise of power, to claim and enact certain types of future, and the negotiation of desire, understood as the sub- and super- personal impetus that calls us to 'look forward'. In particular, I stage this discussion at the scale of the body, in relation to the 'micro-politics' of 'affect', which is a substrate of neurological and biological activities that form the basis for feelings (Damasio, 2000; see also: Connolly, 2002). It is to that 'prospective' and 'precognitive' embodied experience that I relate the anticipatory function of vision videos, which I argue imbue an anticipatory sensibility figured in and through the body.

Anticipation is mobilised (through the production of visions, as well as in marketing and entertainment) but is also emergent (from the culmination of circumstances that produce the events in life, both mundane and extraordinary) as a range of dispositions towards the future. A politics of anticipation is arrived at in the negotiation of various associations of future orientation and invited in the competing forecasts and visions of technology companies. Characterisations of 'the future' as such can thus vary across modes of anticipation. In contemporary life, we are familiar with a foreboding attitude towards the future, exhibited in practices of precaution, preparedness and prevention that seek to define and regulate potential risks (see: Anderson, 2010c, 2010d). Yet there are also aspirational and confident attitudes towards the future that support inventive practices of anticipation, such as imagining in representational forms of image and text and enacting scenarios 'as if' particular types of future come to pass. The politics of anticipation is thus situated in the tension between the articulation of what Adam and Groves (2007) call 'future presents' and 'present futures'. Futures figured by emptying them of connection with the complex relations of the present and opening them to conditioning are 'present futures', whereas futures figured as 'a realm of latent futures in the making' (Adam and Groves, 2007, p. 17) are 'future presents'. Arrangements of present future and future present are negotiated in the production and interpretation of vision videos.

This chapter stages the tension between video-based envisioning as the normative frames of research-based and public expectations of futures and emergent technological anticipation through two steps. First, the representational formats of 'visions' are examined as apparently lending material value to futures and thus efforts to give them direction in the present. Second, the prospective embodied interaction with and through technologies is explored as engendering anticipated sensations of technological experience based on pre-existing bodily knowledge. This chapter therefore examines how 'vision videos' operate in relation to science 'fact' and science 'fiction' constructing precisely this politics of anticipation in the efforts to render a form of future present. Conclusions are drawn around the nature and agency of the spatial imaginary co-constructed in image and words to elicit a future-oriented embodied atunement, both by ostensibly 'credible' R&D and more 'fanciful' entertainment practices.

#### 5.2 Representations of futures: the rhetoric and image of 'vision'

'Visions, images and beliefs cannot sharply be demarcated from knowledge. Far from being dangerous illusions or utopian projections, visions are a precious resource, an intangible asset, that may help to provide the necessary (but typically missing) link between knowing and doing' (Nowotny et al., 2001, p. 232).

The anticipation of what is to-come, the apparent understanding behind the 'vision', has been described elsewhere as 'anticipatory knowledge' (Anderson, 2007, p. 158): 'a practical achievement emergent from... practices that create, know and govern possible, potential or preferred futures'. Forecasts envisioned rest in rhetoric and image, which constitute a 'visual imaginary': 'When the future can no longer be expected to follow on neatly from the past, then imaginative means must be employed' (Brown et al., 2000b, p. 8). We can see how the prevalent use of terms such as 'foresight' and 'vision' in the appeal to imagine the future (particularly our future with technologies) is arguably founded in an 'ocularcentrism' (Jay, 1994, p. 29). This emphasis on the visual is inherent in how we describe future orientation and speculation, which can 'be construed as the rational perception of clear and distinct forms with the unclouded eye of the mind or... the "vision" of the seer' (Jay, 1994, p. 29). However, it is not 'ocularcentrism' or 'vision' that is the focus of this chapter, but how the imagination is used to evoke futures in practices of 'envisioning', which I argue are techniques of anticipation.

Rhetorically, visions have been figured as 'goals', 'targets' and 'destinations' throughout computing R&D, and especially in ubicomp. In the 19 years since the publication of Mark Weiser's vision of a 'Computer for the 21st Century', it has been canonised as an 'origin myth' and repeatedly cited as a target for development (cf. Galloway, 2004; Bell and Dourish, 2007b). This appeal to a sense of 'progress' has been

explicitly stated in several places, but is perhaps most forcefully in the first issue of the

IEEE journal *Pervasive Computing*<sup>33</sup>:

'Mark Weiser described a tantalizing destination just over a decade ago. In a seminal article, 'The Computer for the 21st Century,' he described a hypothetical world in which humans and computers were seamlessly united. The article's opening words are memorable: 'The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.' He called this vision ubiquitous computing. Its essence was the creation of environments saturated with computing and communication yet gracefully integrated with human users. When articulated, this was a vision far ahead of its time—the hardware technology needed to achieve it simply did not exist. Not surprisingly, the implementation attempted by Weiser and his colleagues at Xerox Parc fell short. After a decade of hardware progress, many critical elements that were exotic in 1991 are now viable commercial products: handheld and wearable computers, wireless LANs, and devices to sense and control appliances. We are now better positioned to begin the quest for Weiser's vision' (Satyanarayanan, 2002, p. 2).

The production of vision videos, however, does not imply this peculiarly linear sense of concretised progress. Instead, it is an attempt to produce forms of anticipatory knowledge in the present, for it is the 'see it to believe it' logic that rests behind their production. The assertion of visions is deliberately beguiling and in those assertions there is an insistent call for us, as an audience, to apparently participate:

'imagine, just imagine all of the wonderful applications for this technology, including the many compelling applications for the work environment, authoring and editing digital content is as easy and natural as having a conversation... That's where we're heading' (Elop, 2009)

These forms of evocation perform a particular function by conditioning certain kinds of material expectation, we are asked to imagine our use of these technologies in particular material contexts. Yet, these representational artefacts do not frame the technologies and the worlds in which they are situated as a goal. Vision videos lack specificity, instead they imply forms of technological encounter that might come from qualitatively

<sup>&</sup>lt;sup>33</sup> If debates in the Social Studies of Science and Science and Technology Studies have driven home one argument more than any other it must be that scientific 'discovery' and technological development are problematic (see, for example: Latour, 1987, 1993; Law, 1994; Marvin, 1988; Stengers, 1997, 2000). Any normative concepts of 'smooth' or 'linear' progress must be questioned, for the depressingly prevalent discursive framework of technological determinism remains at large (see: Bingham, 2005; Latour, 1993).

different technologies, or perhaps never come at all. It is in this ambiguous form of controlling action being engaged and yet no apparent obligation to deliver the technologies as such being asserted that a politics of anticipation plays out.

Given the persistent call to *envisage* what our future, enhanced by computing, will *look* like, it can be no surprise that there is a significant history of vision videos in computing R&D. One of the most significant early examples was Apple's 'Knowledge Navigator', produced in 1987, in which a Professor interacts with an 'intelligent' device to organise his appointments, research and teaching<sup>34</sup>. As Tognazzini (1994; cf. Bergman et al., 2004) notes, 'Knowledge Navigator had a profound effect on Apple and the industry'. It inspired many companies to illustrate and publicise a future vision and Indeed, Tognazzini was himself involved in the production of another direction. significant vision video, produced by a division of Sun Microsystems, entitled 'Starfire', concerning office workers using elaborate touch-screen workstations. During the same period key players in the fledgling mobile telecommunications industry also produced vision videos. In the early 1990s Motorola imagined a technological world ten years in the future entitled '2000 A.D' and AT&T, alongside a future-oriented advertising campaign, created an elaborate vision video: 'Connections'35. In 1995 Microsoft CEO Bill Gates published the book 'The Road Ahead' which was accompanied by a CD-ROM with a set of video scenarios depicting various ways in which everyday life would be 'revolutionised' by computing technologies. Today, vision videos can now be found easily through popular video-sharing services on the internet. It is even possible to 'share' the Microsoft video described at the opening of this chapter by 'embedding' it on

<sup>&</sup>lt;sup>34</sup> Apple produced at least one follow up vision video, in 1988 here was 'Grey Flannel Navigator' in which less sophisticated technology is set in a more complicated narrative of workers at multiple locations.

<sup>&</sup>lt;sup>35</sup> It is interesting to note that at the same time elaborate depictions of computing technologies were the central premise of popular cinema, for example in the film 'The Lawnmower Man' in 1992, 'Jonny Mnemonic' in 1995, 'Existenz' and 'The Matrix', both 1999.

one's own blog or website<sup>36</sup>. The distribution of research visions beyond the research seminar or press conference has become significant in technology companies' efforts to demonstrate 'vision'.



Figure 5.2 Image captured from HP Labs "CoolTown" vision video – A medical emergency mitigated by wirelessly connected sensing technologies (source: screen capture by the author) © Hewlett Packard.

Ubicomp's over-arching vision of computing capabilities spread throughout the everyday environment has been a central thread to many computing visions in the last 20 years. Vision videos in that time have depicted many common ubicomp themes: an 'ecosystem' of different computing devices with unlimited interconnectivity, devices sensitive to the context of their use, and location-based systems (see: Dourish, 2004a; Norman, 2006; O'Grady et al., 2006). Beyond the specific merits of the technologies themselves, vision videos map value on to the future 'world' in which the technologies are depicted. Almost all vision videos concerning ubicomp type technologies present apparently 'good' or positive futures. Given that technology companies produce the

<sup>&</sup>lt;sup>36</sup> The video shown by Stephen Elop quickly found its way on to the *YouTube* video sharing service, which allows users to copy and paste the appropriate mark-up code (as do many other video services), which describes the video content, into their own code for a website or blog. See: http://www.youtube.com/watch?v=HvA9IA7\_5FE (accessed: 18/06/09).

majority of such videos, this can be no surprise. The positive nature of the depictions of futures is not always unqualified; the narrative device of a 'crisis' is frequently used to demonstrate how the technology will help, for example in relation to medical emergency (see: Figure 5.2).

Both Bell and Dourish (2007b) and Bleecker (2009) assert ubicomp bridges the apparently serious scientific visions of anticipated technologies of science 'fact' and what is identified (and sometimes casually dismissed) as entertainment science 'fiction'. Science 'fact' in this regard can be thought of as the rigorous and methodical yet intensively speculative nature of ubicomp research and development (R&D) practised in academic and commercial research labs. Science 'fiction' can make similar proposals yet cast them in terms of entertainment and fantasy. We can also recognise the various ways in which such imaginative practices interrelate, creating impetuses for research and influencing the aesthetic vocabulary of contemporary cinema and fiction (see: Kirby, 2008, 2010). The vernacular of ubicomp, as evidenced in the Microsoft example, is familiar – it is shared with the fictional frame of Science Fiction imaginaries (see: Bleecker, 2009; Dourish and Bell, 2008; Shedroff and Noessel, 2008).

The image of future visions as such, depicted in video, can be seen to perform futurity in certain ways: images stylise the content of the vision in familiar visual vocabularies and give detail to imagined socio-technical activity to lend it material authenticity. This is not least achieved because commonly used cinematographic methods are employed to construct a coherent representation of possible worlds. For example, camera angles and specific shots direct the viewer's gaze and propel a narrative. Performances are necessarily different because the role of the image is to depict particular forms and actions that centre on the use of technology. The balance of story and schematic demonstration can therefore be skewed towards illustrations of how the proposed technologies may work. The technologies are depicted as being used by people 'like us' in the familiar surroundings of offices or homes to contextualise and normalise the idea of their use. Angles of shot and modes of cutting are arranged in vision videos to direct the eye of the viewer towards the depiction of technology use (see: Figures 5.5 and 5.6), whereas in traditional cinema that technology use is more likely to be a plot device, a means to advance the narrative. As viewers we are, therefore, enrolled into reading images as 'sets' or 'communicative spaces' (Lösch, 2006). These 'communicative spaces' both limit and enable what is communicable about the envisaged future (Lösch, 2006, p. 394). The literal and discursive framing enacted by vision videos, as 'communicative spaces', thus control or at least form the bounds of the viewers' anticipation. These modes of framing create a finite set for each scenario and yet infer an outside world beyond the frame in which this technology continues to exist, which gives the vision credibility: 'the frame refers to what is around the frame, a spatially and temporally contiguous 'unseen' that may, in its turn, subsequently enter the frame and so become actualized as a seen/scene' (Doel and Clarke, 2007, p. 905). The world of the vision cannot thus be totally alien. It relates and, in fact, is constituted in the present (see: Michael, 2000) which we occupy. The extension of the imaginative world is frequently achieved through the familiarity or banality of what is performed inframe (using refrigerators and watches for example, see: Figure 5.3). Accordingly, the encouraged extrapolation 'beyond the frame' is a relatively easy imaginative step.

The narratives employed in vision videos are in large part devices to freight a demonstration of the idea of technology. Vision videos are diegetically designed to denote the seamless integration of proposed technologies into a recognisable world. Simultaneously, the producers of vision videos must also want the connotation to be that the company has an abundance of 'vision'. As a former HP 'CoolTown' researcher suggested in interview, part of the implicit message of a vision video is that the company is engaged in 'thought leadership' ([anonymised], Formerly of HP Labs). Indeed, the same terminology is used by Ian Sands, Director of Envisioning at Microsoft, when describing the creation of the 'Future vision of productivity' video (see: Larsen, 2009).

In almost all cases, to lend validity and familiarity, the narrative is wrapped in a broader premise, for example placing the technology in an everyday context of health, manufacturing, or education (see: Figures 5.3, 5.4 and 5.5). In rendering trivial the presence of such technologies in worlds like our own, visions also arguably trivialise the exercise of envisioning. While vision videos are clearly for promotional purposes, the intertextuality of visions (see: Doel and Clarke, 2007, p. 891; Pickles, 2004, pp. 159, 174), their situation in (and propagation of) a broader aesthetic vocabulary, arguably does something more than advertisements. The precision of the image can be seen as a discursive exercise of rendering the ephemeral idea visually 'true'. Vision videos entertain but also imply that the material arrangements depicted are likely to be actualised.

Vision videos, as imaginative representations of possible futures, are 'discursive formations', which are sets of statements and rules that specify what it is possible to say (Foucault, 2000b, pp. 31-39). In terms of these representations of possible futures, these discursive formations condition what it is possible to say about the technological future. Visions videos are thus situated in a discourse of anticipation that disciplines and structures the way future orientation takes place in the living present. Specific visualities of illustration and simulation are a part of the rules for making-visible in particular ways, regularising objects, thematic choices and concepts in 'discursive formations' (Foucault, 2000b, p. 38). These formations offer internally consistent 'worlds', even beyond the frame the 'spatially and temporally continguous unseen' can enter the frame to be 'actualised as seen/scene' (Doel and Clarke, 2007, p. 905). The assumptions on which each vision is predicated therefore remain faithful to the temporal situation of the present in which it is authored, they represent a 'present future' (Adam and Groves, 2007). Futures as conceived in visions, and represented in artefacts such as vision videos, can therefore date, which is abundantly evident when viewing older vision videos. I argue, following Massumi (2007b), that the anticipatory knowledge of what is

envisioned remains anticipatory: 'A past anticipation is still an anticipation, and will remain having been an anticipation for all of time'. This is evident in how the image and idea of 'futures' are recycled. For example: in an explanatory video concerning the 'Future of Productivity' vision video<sup>37</sup> Microsoft Office Labs' 'Head of Envisioning' Ian Sands describes digital transcription services and meeting management services very similar to those promoted in Apple's 1988 'Grey Flannel Navigator' video twenty years earlier.

The particular use of vision videos in ubicomp (and related) research is symptomatic of the largely un-acknowledged place of such research at the blurred edges between science 'fact' and science 'fiction' (Bleecker, 2009; Dourish and Bell, 2008). Science 'fact' in this situation is the design, specification and testing of a technology (the device or system and its functional components), whereas the science 'fiction' is the imaginative leap to possible scenarios or worlds in which idealised versions of those technologies might exist. The knotting together of science fact and science fiction lies at the heart of ubicomp researchers' appeal to a near future. As previously mentioned, visions are often set at a relatively proximate temporal horizon, around 10 years in the future (e.g. Motorola's '2000 A.D' and NTT Docomo's 'Vision 2010', cf. Brown, 2007; Meadows and O'Brien, 1998), HP suggest 'CoolTown' is "just down the road" and Microsoft position their 'future vision' videos as "a glimpse ahead". The principal upshot of this 'knotting together' of science fact and fiction (in visions) at the heart of ubicomp (Bleecker, 2009) is that ubicomp exists in representations of a future perpetually deferred:

'postulating a seamless infrastructure is a strategy whereby the messy present can be ignored, although infrastructure is always unevenly distributed and messy. An indefinitely postponed ubicomp future is one that never need take account of this complexity' (Bell and Dourish, 2007b, p. 140).

<sup>&</sup>lt;sup>37</sup> See the Microsoft Office Labs' blog article "A walk through the productivity future vision" (http://www.officelabs.com/Lists/Posts/Post.aspx?ID=77) accessed 01/04/09.

This is politically significant because it is emblematic of the disciplinary function such 'visions' perform in the popular understanding of technology. The imagined, idealised, futures of vision videos solidify the future as a step on the way to potentially achieving such worlds. It is substantially by the virtue of these apparent glimpses ahead that the present, in its material forms is justified. For some, this justification becomes necessity. Therefore, one should enrol into this aspiration, and buy the soon-to-belaunched device more widely advertised by HP or Microsoft, because we are compelled to believe that is the way the future is developing. Once you buy, and 'buy in', to the current technology zeitgeist, then you are part of the material and always deferred present-future evoked by vision videos. Hence, for the technology companies, the videos and we the consumers become profitable investments.

To analyse vision videos is to attend to both 'the representational imperatives of narrative and the non-representational imperatives of the affective-performative [the felt sensations]' (del Río, 2009, p. 15). The contrast between physically material prototypes and the intangible portrayal of technologies in vision videos might be thought considerable. However, a common rationale arguably sits behind the apparently disparate activities. Following Suchman's (et al. 2002) description of the action 'prototypes' afford as physical 'performative artefacts', by virtue of being quite literally 'technologies-in-the-making' (ibid. p. 164), an alternative characterisation of vision videos may be suggested as a form of prototype. There is, accordingly, a resonance between the two characterisations of vision videos: artefact and representation. Both physical prototypes and 'video prototypes' perform in the present with the aim of establishing the 'viability and possibilities of a nascent technology' (Kirby, 2010, p. 5). A physical prototype has a more immediate material intensity in the present and yet both the physical and the image-based are 'performative materialised artefacts' (Michael, 2000, p. 35), for they both demonstrate and describe actions and functions, and thus render connections with existing technical knowledges. Indeed, there is a

significant, if small, academic literature around the concept of 'video prototypes' (for example, see: Bardram et al., 2002; Halskov and Nielsen, 2006; Vertelney, 1989). Interestingly, pragmatic concerns have been raised when such 'prototypes' are tested with the same scientific rigour as physical artefacts: 'In some situations where we have used the virtual video prototypes it has been difficult for people to distinguish between what is possible to implement today and what *might be possible* in the future' (Halskov and Nielsen, 2006, p. 231 additional emphasis). In a different vein, and to address their *discursive* traits as 'performative artefacts', we might consider vision videos as 'diegetic prototypes' (Kirby, 2010). Figured by Kirby (ibid. p. 5) as cinematic portrayals of future technologies to 'demonstrate to large public audiences a technology's need, benevolence and viability' (formulated by 'scientific consultants' with a particular desire for such technologies to be featured), it is a short step to apply the notion to the content of vision videos.

It is important to remember then that it is always already a biased vision of the future being depicted in vision videos. Amongst the motivations for production is always a desire to further a specific agenda in the present. Just as with the examples in Science Fiction cinema highlighted by Kirby (2010), the people and institutions that develop the depicted technologies in vision videos 'have a vested interest in conveying to audiences that these fictional technologies *can* and *should* exist in the real world' (ibid. p. 9 original emphasis). Connections are made between different types of technologies together with existing devices and systems, as well as applications for those collections of technology. For example, the child in Figure 5.3 uses a device akin to a watch with various screens and other objects in the setting of a family home. Appropriate behaviours for using the technologies depicted are also inferred, which I cover in the next section. Vision videos express an agenda not only for different forms of technology development, in the present, but also for the kind of world in which that technology

might exist. These imaginative representations of particular futures are value-laden and contingent upon the interests of the producers. While there is a representational specificity to what is depicted, the viewer also brings a set of knowledges from their personal experience of technology use, therefore the performance of anticipation is a juxtaposition of the object of representation and the viewer in a particular moment. So, if these videos, as artefacts that stitch the ephemeral to the material, are more than marketing tools and perform something like the role of a 'prototype' then they have a performative capacity. The representation of visions (rendered in video form) thought performatively, as an (interstitial) act of making-visible, acts upon the body: 'the representation of the future, conceptualised as a performative *materialised* artefact shapes the 'present' in which it performs' (Michael, 2000, p. 34 original emphasis). More than an ephemeral feeling of anticipation, the specific demonstration of function and use of proposed technologies arguably demonstrates producers' attempts to elicit embodied dispositions towards novel devices and systems. In a sense, vision videos are prospective 'paratexts': "invisible" forms which structure how we write the world but which generally no longer receive attention because of their utter familiarity' (Thrift, 2004b, p. 585). Forms of embodied disposition can be rendered material in the bodies of viewers because they appeal to the paratextual nature of what is depicted. Vision videos depict potential modes of technological encounter in lucid detail, as if they are achievable in the present moment, and thus, I argue, inherently appeal to 'new modes of reading/writing the world... in the pre-cognitive rather than the cognitive domain' (Thrift, 2005, p. 464). It is to that 'prospective' and 'pre-cognitive' embodied experience that I turn to next, to explore if, and how, vision videos imbue an anticipatory sensibility figured in and through the body.



Figure 5.3 Image captured from HP Labs' "CoolTown" vision video – A child learns proactively using computing facilities embedded in multiple devices (source: screen capture by the author) © Hewlett Packard



Figure 5.4 Images captured from Microsoft Office Labs' "Future Vision of Manufacturing" vision video – two frames in sequence demonstrating a gestural interface shot 'through' the screen (source: screen capture by the author). Images included with permission from Microsoft.

## 5.3 Feeling to-come: prospective embodied experience

Through the analysis of the projection of potential future experiences in this chapter I highlight how particular orientations of the body towards and with technologies are depicted. Let there be no doubt that I am not seeking to affirm a means by which technology companies are indoctrinating consumers into particular sensibilities for technology use. In this section I want to discuss six aspects of vision videos as 'performative materialised artefacts' (Michael, 2000), which imbue the anticipation of particular embodied experiences of technology. I argue the manipulation of sensuous dispositions through imaginative representation can be usefully described as a particular type of 'affective' apparatus mobilised in the production of vision videos. This 'affective' apparatus, I suggest, is the ways that images can and do affect the whole body in a variety of biological, emotive and sensory ways that are not only determined by the historical moment in which they were produced (Doel and Clarke, 2007; Massumi, 2002b).



Figure 5.5 Image captured from Microsoft Office Labs' "Future Vision of Personal Healthcare" vision - a teleconference in which a doctor manipulates data through gestures. (source: screen capture by the author) Images included with permission from Microsoft.

There is no one definition of affect. It has been and is being used quite differently by a variety of scholars in a number of traditions (cf. Clough, 2000; Damasio, 2000; Terada, 2001; Thrift, 2004a), and thus it is important to take a brief detour through defining the use of the concept here. 'Affect' in this chapter is taken to be simultaneously a physical phenomenon, immediate to the body, and an impersonal 'force' of feeling. I turn to William Connolly's (2002) reading together of Deleuze's 'Spinozist' philosophy of experience (see: Deleuze, 1988b, 1990) with contemporary neurological research (such as: Damasio, 2000; LeDoux, 1996). From this theoretical juxtaposition, two important facets of affect are that it can take the form of 'a substrate of feeling' that creates 'as if body loops' (Damasio, 2000, pp. 280-282) and 'background feeling' (Connolly, 2002, pp. 170-171). Affect, and by extension our conscious sensation and emotion, Damasio (2000) argues, does not require conscious thought. Substrates of neurological and biological (for example cardiovascular and hormonal) activity form the basis for feelings, but they do not always result in feelings; they exist as 'potential patterns of activity' (Damasio, 2000, p. 79). These substrates can play out patterns of somatosensory activity that are something like 'internal simulation' of sensation 'as if the feeling was consciously felt. This is useful in theorising how a prospective bodily 'attunement', or 'background feeling', may be formed by vision videos. As Ash (2009, 5) and Dewsbury (forthcoming) both assert, these affects are expressed p. physiologically, such as 'goose bumps' or blushing, and are thus *material* as well as experienced sensorily (such as what one comes to understand as the feeling of 'fear'). The appeal to embodied experience thus orientates present understandings and the impetus for possible future bodily dispositions is seeded.



Figure 5.6 Image captured from Microsoft Office Labs' 'Future Vision of Productivity' vision video depicting specific haptic interface interactions (source: screen capture by the author). Images included with permission from Microsoft.



Figure 5.7 Image captured from Microsoft Office Labs' "Future vision of productivity" vision video – touch sensitive interfaces are a part of every surface (source: screen capture by the author). Images included with permission from Microsoft.

Turning to my first point, the type of human subject, the entity that 'experiences' the anticipated future, that is envisioned does aesthetic work, both by inviting us to identify with the figure of that subject (Michael, 2000, p. 26) and with setting the terms of experience in reference to a body. To be a participant in a ubicomp future is apparently to be confident and calm and always capable of taking control, facilitated by technology. This is prevalent in ubicomp visions of healthcare. Both HP, in a segment of the 'CoolTown' video, and Microsoft, in their 'Future Vision of Personal Health', illustrate calm healthcare professionals with the right tools always at their fingertips (see: Figure 5.5). The represented bodies of vision videos are not the 'elusive, fragile, and temporary becomings of our lived bodies' (Dewsbury, 2000, p. 482) but stable and homogeneous mannequin-like forms. As Dourish and Bell (2008, pp. 10-11) suggest, difference is largely elided in visions – for example: we rarely, if at all, see those with differently able bodies<sup>38</sup>. However, just as Michael argues, such marginalised identities 'can be transformed into counter-subjects of the future in the process of argumentation' (Michael, 2000, p. 27)<sup>39</sup>. To give a somewhat generous reading, either for expedience or simplicity's sake, viewers are implicitly asked to attune themselves to a simplified, somewhat idealised, embodied subject. The figuration of the subject is certainly problematic for the above stated reasons, and yet - if the motive of visions videos is to draw in the user, there is a certain sense in which the 'bareness' of the figures might allow us to project onto them. For example, the characters in Microsoft's 'future vision' videos do not audibly speak. The actors are attractive but unremarkable and they use their bodies to demonstrate the technologies and punctuate the

<sup>&</sup>lt;sup>38</sup> Further useful discussion of the depiction of differently able bodies in cinema and in contemporary performance that may be relevant to analysing the identity politics issues inferred here can be found in Darke (1998) and Kuppers (2003).

<sup>&</sup>lt;sup>39</sup> Whilst the politics of how bodies are represented and identified is important (for valuable discussion of this see: Butler, 1990, 1997), it is not the task at hand to critique the identity politics of vision videos and there is not space here to do justice to such an argument.

demonstrations with obvious yet reserved expressions of pleasure in using the technology (for example, see: Figures 5.3 and 5.4). The videos depict figures through whom it is relatively easy to imagine our own use of that technology, or even imagine living in that 'future' world.

Second, the various modes of dissemination of vision videos result in audiences being found and finding their own way to view them. Vision videos have been shown to business audiences by executives of technology companies to substantiate their corporate vision and direction (for example, Carly Fiorina, former CEO of HP, see Hewlett Packard, 1999; and Stephen Elop, President of Microsoft Business Division, see: Elop, 2009) but are also available online (both from company websites and online video services) to anyone with an interest. Audiences are thus constituted and constituting in relation to the videos themselves, and whilst the interpretation (inculcated, subverted or otherwise) is a social political concern (further discussion can be found in: Rose, 2007; see also: Gillespie, 2005) it is to the micro-politics of bodies that I would like to turn.

To move on to the screen-image itself, and as a starting point, examples of the depiction of embodied action can be addressed somewhat pragmatically. Close-ups that depict specific modes of technology use render in detail hands touching surfaces or precise gestures (see: Figures 5.3, 5.4, 5.6 and 5.7). The nature of the representational 'prototype' is not schematic. It does not illustrate technical specifics, rather it is practical, what is illustrated are practices of using the technology. There are of course alternative readings of the images and scenes, as with other experiences audiences bring their own background and context to their viewing, but through the persistent demonstration there is also a significant inculcation into anticipating technologies specifically like those represented. The vision of technology depicted in video is 'internally consistent'. It works in a relatively familiar way (drawing on existing technology) and adheres to its own internal rules as well as the rules of the world rendered on screen. As former MIT scientist, technology entrepreneur and Hollywood

'science consultant' John Underkoffler, in an interview with David Kirby (2010), suggested of the gestural interface he designed for the film *Minority Report*:

'I think the lay audience look at the technology in the film and say "Wow. Okay, I see how that works. I think I could operate that myself in fact. I learned how from the film' (Kirby, 2010, p. 18).

As noted above, the extrapolation beyond the frame draws a thread between what is seen in the image and the unseen, which the imagination fills in, as Underkoffler suggests. More specifically, the close-ups of hands touching surfaces invite sensorial imagination, for example: how much friction there is between fingers and surface or how much manual work or dexterity is required (see: Figures 5.6 and 5.7). In Figure 5.6 we see a character using a touch sensitive surface display, which he manipulates with relative ease using apparently effortless and flowing movements of his fingers and hand. We can see that the same anticipatory action, to elicit familiarity with a proposed form of technological interaction, is used in telling the story of a blockbuster movie and in a vision video. What is figured in these images is an expression of the possible, which in his analysis of cinema philosopher Gilles Deleuze (2005a, pp. 100-101) suggests can be generated by a proposition, in this case the sensation of embodied technical interaction. This 'vision', whilst created in a specific moment in time, abstracts the sensuous quality from a 'state of things' yet retains a specificity that conditions the ways in which that type of encounter can be anticipated. It is here that the bodily aspect of the politics of anticipation plays out, the conditions for prospective embodied encounter are seeded by particular forms of attunement.

My third and fourth points concern the micro-politics of affect. So, third, we can posit how the content of the image can affect. The material capacity to construct an image comes together with the phenomenal experience of the viewer to produce an experience of a world on the screen: 'in viewing the image we can draw upon our embodied experience to feel [what is depicted] proprioceptively even though we are not feeling an actual [object]' (Ash, 2009, p. 13). Images thus produce multiple affects through the viewers drawing upon their own experiences to 'flesh' them out. Scenes of interaction depicting the gestural interaction of a 'user' moving fingers across a surface (see: Figures 5.6 and 5.7), suggest a tactility that, from experience, the viewer can bodily comprehend. The viewer is asked to think 'as if' we might be using the technology. This bodily comprehension can be distinguished by the viewer from past experience and thus anticipate further similar, yet different, experiences as something novel or future oriented. The power of the existing devices that facilitate this bodily comprehension, such as Apple's recently launched 'iPad', is that they change the bodily expectation of technical interface. Indeed, Jonathan Ive, Senior Vice President of Product Design at Apple, invokes this type of futurity in a promotional video for the 'iPad': 'millions of people are going to be instantly familiar with it; they're going to know how to use it. In many ways, this defines our vision, our sense of what's next'40. The same literacy of inferred futurity plays out in vision videos. The material expression of sensation through the image of vision videos produces an idea or sense of futurity but not 'the future' as such. More broadly, if affects are inter-corporeal forces then the image of bodies in movement and the depiction of certain actions and responses are fundamentally different from a co-present performance of another actual body.

Fourth, as previously asserted, the prior experience of the viewer is important in constructing these visions (see: Clough, 2000; Thrift, 2004c). The depictions of gestural and haptic interaction with technologies (see: Figures 5.4-5.7) relate to experience of actual embodied interaction. As Dourish (2004b, p. 145) suggests: 'interaction is already embodied in current systems, and so we can find elements of the embodied interaction perspective in current practice'. This embodied interaction can be anything from the tapping of the keyboard clicking of the mouse to movements of a handheld device (such as the Nintendo 'Wii' games console) and gestures captured by camera

<sup>&</sup>lt;sup>40</sup> The text of this quote was transcribed by the author from footage in the Apple iPad promotional video (available from: <u>http://www.apple.com/uk/ipad/ipad-video/</u>), accessed: 27/01/10.

(such as Microsoft's recently released 'Kinect' gestural interface for their games consoles). Even if not experienced first-hand we have been co-present with people using haptic and gestural computing technologies, such as the Nintendo 'Wii' games console and the Apple iPhone, or even the 'mundane' touch-screen interface in an ATM or carpark payment machine. Radical visions of 'new' technological futures might be alien to the viewer, due to a lack of a frame of reference, or they may rely so heavily on illusion that the fictive nature of the vision becomes fantastical. Forms of attunement in the alignment of embodied dispositions towards prospective technology use are accordingly generated through the careful ways in which the phenomenality of the envisioned technology is depicted. Whilst the producers are clearly aware that it is possible to elicit affects through the techniques they use, there is not a direct correspondence between intended effect and the affects actually experienced.

Affect is contingent on the full gamut of the surrounding context of, in this case, the viewer and is specific to the moment of experience but draws upon a wealth of experience engrained in the body. The 'attunement' proposed here is between how the viewer anticipates particular forms of technology use may feel and the depiction of 'future' technology use in the videos. It is this attunement of 'background feelings' that generates the various associated senses of futurity and subsequently familiarity. Markers are thus etched into bodily dispositions, 'somatic markers' that can be culturally mobilised and operate 'below the threshold of reflection; [they mix] culture and nature into perception, thinking and judgement' (Connolly, 2002, p. 35). It is through these somatic markers brought about in the performance of viewing, between the representational construct of the image and the viewer's body, that we are materially enrolled into anticipation. Affects perform a 'micro-political' role because they are at the level of the body and its constituent parts. The *anticipatory* micro-politics of vision videos plays out in the bodily comprehension and thus attunement to potential

technological experiences. In this way vision videos can affectively discipline potential future technology use through present bodily dispositions.

As demonstrations of the technologies, the videos are akin to 'prototypes' because they 'diegetically' walk the viewer through functionality (see: Kirby, 2010). However, it is the rub between the apparent and the anticipated that must be explored here. Vision videos appear to operate in a mode opposite to that of 'magical' illusion<sup>41</sup> – there is deliberately very little mystery to the depiction of the experience of using the technology. For example, gestural interfaces are carefully and closely shot to illustrate how one will potentially use such technologies. Shots are tightly focussed on specific body movements and detail how the technology responds (see: Figures 5.1, 5.6 and 5.7). Yet there are also aspects that are definitely illusory, in the case of the Microsoft visions there is no explanation given of how every surface can possibly be a screen. The groundlessness of these unexplained aspects of the vision asks questions of the present rather than projects into the future. The rub between the emergent potential of the viewer's interpretation and the 'somatic markers' that emerge from viewing exceed the sum of the rhetorical work of the vision. Vision videos act in and upon the present, and, according to Michael (2000, p. 33), 'elongate' it. In such a reading of the videos it is their sensational aspect which matters, drawing on existing and past understandings of similar types of technology to elicit affective responses.

Following from this, and as a fifth point, familiarity is engendered in the appeal to a 'technological unconscious' (Clough, 2000; Thrift, 2004c). This unconscious, as such, should not be thought of as an over-coding narrative but rather as a 'desiring production, an assembling that is grasped in its effects' (Clough, 2000, p. 61). Whilst

<sup>&</sup>lt;sup>41</sup> In the sense that magical illusion relies on the tenets of miss-direction, distraction and concealment to provoke an experience of what one might otherwise deem impossible, from prior experience of the world (on optical illusions see: Crary, 2001; for discussion of the perceptual vs. the neural nature of illusory phenomena see: Thompson et al., 1999).

the diegetic rendering of technologies might be thought of as 'lines to set off from' (ibid.), which merely point to future action, the embodied attunement to potential technological interaction takes place in the viewer at the moment of viewing, in the present. The technological unconscious is the embodied cognition that is inherently worldly, its content is 'the bending of bodies with environments to a specific set of addresses without the benefit of any cognitive inputs' (Thrift, 2004c, p. 177). The technological unconscious is not solely an abstract element of mind but is the product of our co-evolution with our environment, it is a substrate of 'assured encounters, and therefore unconsidered anticipations' (Thrift, 2004c, p. 175). What are thereby constructed are 'spaces of anticipation' (ibid) not concerned with what it might be like to use the technology at some unspecified future moment but extending existing experience to engender familiarity with the potential future. This is achieved by asserting 'correct' juxtapositions between human and non-human actors that 'allow things to arrive and become known' (ibid. p. 175). These 'correct' positionings are signalled in the very specific portrayals of technology use in vision videos. For example, there are close framings of precise movements made by actors (see: Figures 5.4-5.7) to demonstrate how 'we will' use such technologies.

The perception of a sense of futurity, or 'the instant recognition that a technology is going to change my life in ways that I can scarcely imagine' (Rheingold, 2002, p. xi), emerges from the embodied attunement that coalesces from the narrative and image of ubicomp visions combined with the proprioceptive disposition of memories and the 'technological unconscious'. The videos' potential to effect the technological unconscious thus marks it as a form of 'zone of indiscernibility' (Deleuze, 2005b, p. 16). This 'indiscernibility' is not only, or necessarily, between human and animal, as in Deleuze's (2005b) provocative analysis of Francis Bacon's paintings, but also includes the mediating potential of technology and technical relations. Whereas Bacon's images connect humans to our animality (Deleuze, 2005b, pp. 15-19), the explicit and 'hyper
real' depictions of technology use in vision videos connect the embodied, potentially animal, human, which is already technical through tool use (see: Mackenzie, 2002), to prospective modes of technical being. If the 'degree of "concretisation"... is the *technicity* of a technology' (Mackenzie, 2002, p. 14) then the zone of indiscernibility is a means by which technicity is enacted in relation to anticipation of future technologies. Thus, to somewhat bastardise Deleuze's conceptual tool, the zone of indiscernibility of the images that play with and within the technological unconscious is a mechanism of passage between the 'background feeling' of the unconscious and the conscious sensation of feeling. Following Deleuze (1988b, 1995, 1999) the impersonal, precognitive provocation of 'affect', the 'background feeling', pushes toward perception (or 'percepts'), concretised in emotions, bodily sensations, thought and action. When successful, this renders the sensation or feeling of anticipation, towards the emotive, haptic, sensorial nature of the prospective future, but it remains an emergent and uncertain translation (Stivale, 2006; see also: Connolly, 2002, pp. 32-36).

If vision videos in some way 'prototype' technologies (for example diegetically, see: Kirby, 2010), and a prototype is a movement towards some 'thing', it is also a movement towards a practice constituted in a field of technical relations (Mackenzie, 2002). The technical objects defined in the envisioning and development practices of ubicomp can accordingly be thought as events, in this way 'what is represented as 'new' is in fact the capture and containment of the processual mode of existence in technology' (Mackenzie, 2003, p. 5). The reality status of the technologies envisioned is blurred, on the one hand they are imaginative representations an on the other they are lent material purchase in the ways in which bodies somewhat anticipate their use. The bodily performance of the anticipation of technical use is emergent and thus situates that anticipation in a moment. The envisaged technology is therefore an *event* of anticipation (following: Fraser, 2006; Deleuze, 2006a). An event can cast forward further anticipation and peculiar senses of familiarity with other technologies that are either

proposed or manufactured, thus the event of anticipation has a 'wake' that stretches into future presents. The familiar aspects of the technologies depicted in visions of ubicomp, founded in a technological unconscious, are evocative as something like anticipated 'affordances' (Dourish, 2004b, pp. 118-119)<sup>42</sup>, which are properties of environments that afford technologically-enabled human action. Embodied skills, both extant and prospective, depend on a coupling of perception and action (ibid. p. 120). Such skills are, according to Polanyi (1966), exercised close by or 'proximally' when dealing with the immediacy of the world and 'at a distance' or 'distally', both in time and space. Thus, the 'proximal' phenomena, our experience of technology use day-to-day, are the means by which the 'distal', in this case the notion of using the envisioned technology, is achieved (Dourish, 2004b, pp. 120-121). Furthermore, as already suggested, the 'distal' (as anticipation) reciprocally has a part in constituting the present. The performance of this knowledge is heterogeneous - 'it operates on many levels, at once material and semiotic' (Michael, 2000, p. 35), the meaning of visions neither defines the 'future present' nor forecloses action upon it in the present moment.

It is no doubt possible to portray the examples of vision videos discussed here, and the intentions of those that produce them, as based in a 'Whiggish technological determinism' (Thrift, 2004c, p. 181), but I think that would elide some of the subtler properties of what emerges. As Thrift (2004c, p. 182) suggests emergent knowledges of 'sociotechnical mediations [are] constantly in genesis that stabilise the collective' such that new technological literacies are evoked as the difference in repetition of existing technical knowledge and sensibilities. The future orientation enmeshed with the 'technological unconscious', as described, forms a basis for our developing understanding of technologies. This unconscious is not directly scripted, it is not enacted as the causeand-effect model of subliminal inference, but it is situated in a politics of anticipation

<sup>&</sup>lt;sup>42</sup> This holds true, I argue, specifically if an affordance is understood as 'a property of the environment that affords action to appropriately equipped organisms' (Dourish, 2004b, p. 118).

whereby the bodily dispositions of anticipated technological encounter may be conditioned. Yet, and it is important to stress, the technological unconscious evolves and whilst particular forms of embodied attunement may prove successful it is no guarantee they will not be adjusted in the ongoing performance of technical knowledge and bodily sensibilities. The purpose of this section was to explore how the viewer grounds the experience of the vision video in the 'background feelings' and embodied attunement enrolled through 'vision video' production techniques.

## 5.4 Conclusions

This chapter has deconstructed the simplistic notion that visions represent goals to which we are moving/working towards and highlighted the ways in which vision videos act within and constitute a present. To address how vision videos can produce the affects of anticipation this chapter critically reviewed the rhetoric and image of 'vision', in section one, and, in section two, explored the means by which embodied knowledges of technology use (for 'not-yet existent' technologies) can be engendered. If the future as such is not operated upon and remains potential, yet to be resolved, then vision videos are clearly not depictions of the future. If we don't simply interpret vision videos as the instantiation of goals or the construction of a temporal horizon to which we orientate the present (rather like: Koselleck, 2004; cf. Pickering, 2004), then we can understand them as artefacts in/of the present that form and are formed by relations from which can emerge anticipation. Vision videos are accordingly 'performative materialised artefacts' (Michael, 2000, p. 35) that mediate between a sense of 'present future' and 'future present' (Adam and Groves, 2007). As 'performative materialised artefacts' vision videos are productive of a sense of futurity that 'encapsulates the inescapable reaching out of the ever present' (Adam and Groves, 2007, p. 175), the rub between present future and future present. There is evidently intention behind some, but not all, of the relations formed. The specificity of the content of the visions-things

*will* work in a certain way—and the manner in which visions are asserted illustrates how claims are made on the future. To illustrate this we can return to Microsoft Executive Stephen Elop's speech:

'contextual and anticipative [sic.] insight relates to how people will derive insight from information, information will be increasingly contextually relevant, enabling search, discovery, and analysis based on user profiles and intent' (Elop, 2009)

Intentions are, of course, not always carried through, neither are they necessarily successful. To read vision videos merely in terms of the intentions of the company and individuals that produce them is to elide the constitutive significance of 'not-knowing' in subjective experience (Dewsbury, 2007), and to ignore the less defined, and less certain, affects these performative artefacts have.

To advance the discussion of a 'politics of anticipation' I want to work through two ways in which we can interpret such a politics: first, politics as the exercise of power; and second, politics as the negotiation of desire. We can analyse each in turn with regard to how they can articulate the negotiation of 'present future' and 'future present'. Firstly, then if we read a politics of anticipation in terms of the exercise of power then we might think about vision videos as vehicles for asserting authority and thus laying claim to the future. A normative 'technologically determinist' reading of vision videos might see their content as goals towards which companies are specifically working, largely driven by economic imperative (Galbraith, 1974). Visions can become institutionalised and thus be seen as regulatory (Foucault, 2007), insofar as they can be figured as programmes—which are 'sets of calculated, reasoned prescriptions in terms of which institutions are meant to be reorganised, spaces rearranged, behaviours regulated' (Foucault, 1991b, p. 80; see also: Rabinow, 2003, pp. 39-40). The rationale here would be the calculation of the future as 'present future'. We might read the video as the object of a rhetoric of anticipation (Eagleton, 1986, pp. 206-207). Obversely, if we understand visions as representational constructs of a 'future present', then power is less

clear-cut. The 'mechanisms of power' (Foucault, 2007, pp. 1-2) emerge from, and are an intrinsic part of, the relations in which the performative artefact of the vision is situated. The power of the vision, or rather its artefact, is the effects it has on the technological unconscious, and these effects are emergent. The anticipatory action enabled by vision videos is akin to an affordance (pace Dourish, 2004b, p. 118). Rather than a property of the environment, an anticipatory affordance is a property of the body that affords action should that body become appropriately equipped. Anticipation therefore remains as such and can be propagated (Massumi, 2007b).

Secondly, we can read the politics of anticipation as the negotiation of desire. In this sense I suggest desire can be figured in two ways: as the presence of an absence in the present that infers the future (akin to a Hegelian sense of desire, see: Kojève, 1980); or the 'pre-personal' push of a world that is becoming; the impulse that carries us 'forward' (Thrift, 2000, pp. 216-217; pace Deleuze, 2004). According to the former desire comes forth from an implicit state, such that 'everything has, in a sense, been here all along' (Butler, 1987, p. 24). Desire according to the latter is the 'sub- and super-personal' production of reality even though 'social representation and belief deprive us of much of that reality ex post facto' (Holland, 2005a, p. 54). Future orientation, not as a determinate state but as an openness to potential, is a strong underpinning of the means by which the world is performed. Desire flexes in constant tension with the necessary rational push for description and representation. The performative aspects of vision videos as artefacts are entwined with the technological unconscious and it is here that a politics of anticipation as the negotiation of desire For it is the technological unconscious, that pre-personal substrate of operates. unconsidered anticipations (Thrift, 2004c, p. 177), which affords 'new senses of sense [to] become possible built on the new frames of anticipation and forms of memory that can show up and be touched in and by events now' (ibid. p. 188). Perhaps the most important effects they have are therefore interpretations of the present, there may be no

conscious working towards particular goals nor a conscious expectation but as iterations of technologies ebb and flow, apparent 'advances' are not a surprise, they are already bodily familiar. As McCullough (2004, p. 261) suggests: 'the success of design is arrived at socially', or in this case between the viewer and the communicative space of the video. As viewers we are enrolled into a community of anticipation, insofar as we familiarise ourselves with an anticipated form of technological experience, but the specificity of that unconscious familiarity becomes peculiar to the viewer only when it is made personal in cognitive action. The space of the technological unconscious, and the forms of unconsidered anticipation therein, is 'within a signifying chain as the instability of all iterability' (Butler, 1991, p. 28), which, for Butler (ibid), is the iterability of difference in the performance of identity. As such 'the unconscious, is not 'in' the body, but in the very signifying process through which the body comes to appear' (ibid). Not only tool-use but our imagination of technology is therefore inherent to the technological unconscious, always and already filtered through 'cultural markers inscribed in visceral process[es]' (Connolly, 2002, p. 34). Thus, in the envisioning of ubicomp: 'Cultural questions, then, are prior to, not consequent to, design practice' (Dourish and Bell, 2008, p. 12).

To conclude, it is important to explicitly highlight that this kind of analysis cannot be about drawing schematic deductions. As has been demonstrated throughout this chapter, there are contradictions to how vision videos function, they attempt to and proceed to illicit affect in certain ways, they offer stories about a near future, based upon past experience and are constituted in (and constituting) a present. Vision videos can also elide the future by blurring present science 'fact' and 'fiction' through the combination of specific affects evoked from pre-existing experience (for example with contemporary technologies that have many facets of the functionality represented, such as the touch-screen on the iPhone) with the groundless illusory images of currently impossible technologies that remain unexplained. The ambiguity of the orientation of vision videos towards either a 'future present' or a 'present future' leaves them at once significant as 'performative prototypes' and trivial as entertaining 'fictions'. It is these contradictions that are of interest and worth foregrounding. A technological unconscious engenders a sense of familiarity with apparently novel 'advances' in technology development. I have suggested (building on Thrift, 2004c; Clough, 2000) that a technological unconscious situates the future orientation of ubicomp demonstrated by 'vision videos' as representational and discursive artefacts. By unpicking the ways in which a politics of anticipation plays out in the artefacts and articulation of future orientation this chapter has highlighted the ongoing development of a technological unconscious that significantly contributes to how we understand our evolving use of technology.

# Chapter 6

# The optimism of 'mapping desired worlds': Affects, historicity and regimes of hope

#### 6.1 Introduction

Hope springs eternal in the human breast (Pope, 1950, p. 26).

The worlds evoked in visions of ubiquitous computing futures figure a 'harmonious interaction' (Begole and Masuoka, 2008) between people and technologies, beyond the ideal representation of functionality and use. Visions of ubicomp like many other visions of technological futures, posited as both 'scientific' and 'science fiction', are optimistic. The ubicomp variously envisioned from Weiser onwards contributes (if not constitutes) a 'better' future. The purpose of this chapter is to examine how we might analyse the judgement of 'better' futures to understand the discursive logic by which this optimism is derived, particularly as a means to lend certainty to the near future. Just as we colloquially say that we 'look forward' to desired (sometimes indefinite) outcomes, the 'looking forward' with optimism which underpins ubicomp can be characterised broadly as 'hope'. This is not to say that there is 'a single mode of hoping, or a proper object of hope' (Anderson and Fenton, 2008, p. 77), either in general or particular to ubicomp. However, because 'hope' is identified as a peculiarly optimistic and extra-subjective mode of anticipation and it features in the rhetoric of future orientation in ubicomp R&D, I suggest it warrants further analysis. The aim of this chapter is to critically examine understandings of hope as ways in which the apparent value of a 'better' world can be rhetorically freighted to apparently make futures present.

The future orientation inherent to ubicomp is not just tied to the specificity of the technological visions evoked, or to the pragmatic practice of setting goals, but also to a rhetoric of optimism. There is a strong sense of 'looking forward' to a somehow 'better' technological future that pervades how ubicomp R&D is both talked about and practised. The 'proximate future' (Bell and Dourish, 2007b, p. 134), which is always just 'ahead' or 'around the bend', is 'not-yet' but, by implication, is 'on the way'. In this chapter hope is broadly theorised in two ways. As a verb, it is posited as a rationale for anticipating the future. As a noun hopes are discursive objects that frame and materialise the imaginaries and potential timespaces to-come. Thus, to address the ways in which an uncertain future is met with optimism in ubicomp R&D this chapter conceptualises an anticipatory logic of hope. Equally there is a plurality of 'hopes' expressed in ubicomp research that in some sense refine and define the characteristics of a 'better' world. These hopes are conceptualised in this chapter as discursive objects, which operate as linguistic frames for referring to discrete moments or specific sociospatial arrangements in an anticipated near future. By analysing hopes as discursive objects this chapter makes evident their 'operative logic' of self-perpetuation. Furthermore, understanding hopes as discursive objects affords critical insight into the ways in which the apparent value of a 'better' world can be rhetorically freighted to apparently make futures present. Statements of hope can condition what is anticipated, they can code the possible, foregrounding some desires whilst eliding others.

Recent interest in forming an agenda for discussing an ethos of hope has opened an arena for thinking about and through the 'institutions', 'practices' and 'spaces' of hope. As Anderson and Fenton (2008, p. 77)<sup>43</sup> suggest: 'a range of thinkers has (re)affirmed hope as a necessary political and ethical virtue, especially in times of militarisation, neoliberalism, and turbo capitalism'. A significant theme of the literature

<sup>&</sup>lt;sup>43</sup> In early 2008, the journal *Space & Culture* published a special issue focussing on the 'Spaces of Hope', for which Anderson and Fenton wrote the editorial, looking to affirm the multiplicity of 'hopes and hopings' (Anderson and Fenton, 2008, p. 79) and pushing for an attention to 'the contingent provenance and occurrence of hopes and how those hopes open up the here and now to elsewheres and elsewheres' (ibid.p. 79).

highlighted in such recent discussions is that hope is figured as stemming from tragedy. In this chapter I demonstrate that ubicomp R&D exemplifies an alternative optimism that is not a moral salve or form of redemption but a form of striving to materially make manifest the ideals expressed. Beyond this, hope, understood as constitutive and emergent from relations of hoping, is productive. I use the term 'productive' here to describe the creative potential of what are simultaneously pre- and post- personal potency. Production in this sense is not tied to the manufacture of something specific, but an involvement in, or impetus for, the emergence of thought and the actualisation of a present moment. The event of hope, and the act of hoping accordingly *does* something: 'In one place, hope might mobilise resources, secure legitimacies, or defer justice. In another, hope opens up the present, enables bodies to keep going, or becomes part of a new form of belonging' (Anderson and Fenton, 2008, p. 78). Furthermore, following Zournazi (2002), any exploration of hope is synonymous with investigating our future orientation—or in my own terms an examination of the knowledges or practices of anticipation—under the sign of 'hope':

'hope may be that force which keeps us moving and changing – the renewal of life at each moment, or the 're-enchanting' of life and politics – so that the future may be about how we come to live and hope in the present. Hope may lie in our personal circumstances, or it may be in the call for different ways of thinking about political activity' (Zournazi, 2002, p. 274).

In this chapter the examination of hope accordingly brings to light the discursive operation of hope as a means of ascribing potential value, the identification of 'better' futures, without necessarily having to specify how that value will be derived.

In this chapter, analysing how hope functions as a means of future orientation in the development of ubicomp demonstrates how the uncertainty of futures is discursively turned to the advantage of those seeking to promote ubicomp technologies as capable of producing 'better' futures. This chapter's exploration of hope in ubicomp R&D accordingly proceeds in three steps. Firstly, the distinction between 'hopes' as discursive objects and 'hope' as an anticipatory logic is explored. Hope conceptualised as an anticipatory logic is subsequently, and second, broken down in three ways: firstly, hope as narrative and historical device; secondly, 'regimes of hope' as the conceptualisation of investment in and a political economy of hopes; and thirdly, hope as sensation – as a means of understanding the future-oriented manner and modes of the diverse ways in which we can be affected. Conclusions are drawn around the negotiation of these various forms of hope as an anticipatory logic. A critique of how these conceptualisations substantively address empirical evidence of future orientation in ubicomp practices is also offered. Finally, this chapter closes by arguing that expressions of hope are a means of articulating technological futurity and should be considered in the context of a politics of anticipation.

# 6.2 Hope(s) – anticipatory ethos and discursive object

'The present is pregnant with projective future states' (Shields, 2008, p. 130).

To set the scene of the substantive discussion in this chapter I address the twofold nature of hope. I argue there is a rationale that situates our thinking of hope as a means of future orientation and so, in the following sections, I identify three ways hope, when thought as a mode of anticipation, might be critically understood. Hope is inferred through the optimistic nature of particular types of statement made in the discussion and promotion of technologies. To begin the analysis, at a basic level 'hope' is both articulated as an action of thought and as its object. This can perhaps be best illustrated by example, consider the following statements I have constructed to illustrate the two ways hope may be understood:

- "We hope that you will see this device released in the market in the near future".
- "To see this device used in the home environment is definitely one of our hopes".

What is illustrated by the first sentence is that as a verb (to) 'hope' is mobilised as a rationale for anticipating general aspects of a proximate future, which in some way relies on some extra or outside action. The second sentence demonstrates that as a noun 'a hope' is a discursive object that frames a discrete yet non-specific time-space to-come. These various discursive objects are, following Foucault (2000b, p. 32), 'statements' that collectively form a particular discourse of hope.

A 'hope' (noun) can be described as the grounds for optimism, for a belief that something good may happen, following the OED (Oxford English Dictionary, 1989): 'Expectation of something desired; desire combined with expectation'. Hopes can be at once personal and private and collective and public: 'Our hopes must be tempered with the caution of history—but with our hopes go the hopes of all mankind' (Kennedy, 1963). This might be a personal aspiration (often shared or based in collective values), such as 'swimming with dolphins', in which the timeframe may not be specified, but there is the possibility that a means of making the 'hope' an actuality can be found. Similarly, discrete future times-paces are thought, and desired, in the development of novel technologies. As I demonstrate in Chapter 5, aesthetically sophisticated visions of near future socio-spatial situations are envisaged in image and video without specific reference to a timeframe or explicitly identifying such visions as goals.

Hopes are thus constituted as such by virtue of an indeterminacy or complexity that renders other forms of anticipation invalid. It has been argued (see: Brown, 2005; Moreira, 2004) that central to the expression of a hope is '[a]n ideograph... a high order abstraction, representing collective commitment to a particular but equivocal and illdefined normative goal' (McGee, 1980, p. 15). In this context the ideograph would be the denotation or inference of the broader complex material vision of ubicomp. We can see how 'ubicomp', considered as an ideograph, carries an array of claims on the future that are broadly thematically similar but the 'ideograph' concept does not give us a means of incisively analysing how the claims work. To examine hopes, following Foucault (2000b), as 'statements' (discursive quanta) we can understand them in relation to dreams and/or fears, the desire to attain an ideal or the desire to escape a threat (see: Anderson and Fenton, 2008; Zournazi, 2002). Statements of hope with regard to ubicomp may be generalised and refer to unspecified material arrangements but nevertheless they have agency. By figuring hopes as statements I argue we may identify the linguistic practices of thought that we use to identify a desired (discrete) future time-space arrangement. The ideas or ideals that each statement of hope relates to are irreducible to language (Foucault, 2000b, p. 49). For example, in 'The Computer for the 21st Century', Weiser (1991) expresses that he hopes the advent of ubicomp will make the use of computing (as a capacity inherent to the environment) 'as refreshing as taking a walk in the woods' (ibid. p. 75). With this statement Weiser indirectly invokes a complex array of ideas and values, from the technical value of equipment that 'disappears' to the variety of ways in which 'a walk in the woods' might be valued. This is the agency of hopes as discursive statements. A hope expressed is vague, no plan or programme could easily be formed to achieve it, and many contingent factors might obscure a path by which the hope might be achieved  $^{44}$ .

If hopes are statements that freight abstract and ill-defined goals that nonetheless have agency, we might identify the discursive rationale by which those statements operate as hope – an anticipatory logic. I am exploring a less specific rendering of anticipatory logic here, in the guise of hope, than the particular logics of 'fabulation' and 'invention' discussed in chapter 4. The relative openness of these statements, their equivocal and slippery nature, belies the fact that such flexibility harbours their force. For 'hopeful' action, just as in relation to foresight, demonstrates the characteristics of an 'operative' logic. We can accordingly re-read Massumi's understanding of an operative logic of fear in terms of hope, thus hope is

<sup>&</sup>lt;sup>44</sup> Of course, the desire that produces the hope may simply be less than serious.

'a productive process that inhabits a shared environment, or field of exteriority, with other processes and logics. It figures in that field as a formative movement: a tendency toward the iterative production of its own variety of constituted fact' (Massumi, 2007b, p. 17).

We can accordingly see how, as an anticipatory (and thus 'operative') logic, hope, and the statements by which it operates, is the practice of power intimately tied to the desire to 'know' the future. The statements of hope thus self-perpetuate particular forms of future orientation, which have been identified as 'regimes' of hope (see: section 6.2.2).

There is for many an ethos of hope. Such an ethos differs from other forms of anticipation by reference to forces outside of the subject. We accordingly posit hope as a value attached to a desired future, perhaps an end-point; hope as an imperative for the present to create or attend to better futures. Significant amongst the narratives of such an ethos would be a Christian consolation and expectation that, no matter what befalls us<sup>45</sup>, eternal life awaits after death. Aside from such eschatological hope, we might understand hope variously as: 'the realm of anticipatory consciousness'—daydreams and fantasies; 'wishful images'—fairy tales, popular fiction, theatre, dance and cinema; 'outlines of a better world'—predictions of medical advancement or economic growth; and government strategies (Anderson, 2006b, p. 694; see also: Anderson and Fenton, 2008; Bloch, 1986). Hope, understood in these ways, is figured as an orientation towards the future that is founded in significant forces outside the realm of the subject that may aid us, as subjects, to anticipate the future confidently. This understanding of hope provides a powerful rhetorical tool:

<sup>45</sup> Some argue that it is only the 'faithful' that can expect to be 'saved' in God's judgement, citing the book of Revelations on the 'final judgement' (Ch. 20), however according to the Gospel of Matthew (Ch. 19) and Paul's letter to the Romans (Ch. 6) it is possible for everyone. It is interesting to note that many of the eschatologically concerned denominations, for example 'Restorationist' and 'Adventist', or radical movements within and outside of the Christian church or religion draw delineations according to what one is entitled to 'hope' with respect to 'eternal life' and 'salvation' (cf. Bebbington 1995 Ladd 1996).

'Hope in the face of difficulty, hope in the face of uncertainty, the audacity of hope! In the end, that is God's greatest gift to us, the bedrock of this nation, a belief in things not seen, a belief that there are better days ahead' (Obama, 2004)

This optimism does not need to be specified in an object, rhetorically it is a means by which a 'better' future may be invoked without the need to specify how or when it may arrive.

It could be argued that hope is a fanciful delusion based in a desire to see certainty for which there is no evidence. We might accordingly hesitate in thinking of hope as a logic of anticipation, for many of the attributes described above are arguably irrational, and yet there is undoubtedly a structured reasoning through principles of inference. In the case of hope, however, it is a very broad reasoning, which is founded in a speculative realm of thought that includes gods (see: Fiddes, 2000; Sanderson, 2008), providence and the super-natural (or some alternative transcendent 'Other'). Yet, as I demonstrate in the rest of this chapter, hope features prominently in discussions about the future conceived in ubicomp R&D. At its most distilled I want to suggest that the idea of hope is a capacity to change, and in extremis, in the context of technology development, hope is the potential for the future-oriented thinking of R&D to change the world. I argue that there is not a hope specific to ubicomp but, importantly, there is an underlying rationale for 'hope' that is mobilised within ubicomp R&D. This critical analysis points to the invocation of hope as a discursive practice that aligns particular projects with a broader ethos of value without having to be specific about how that value is judged.

Hope is not necessarily co-constructed with discourses of meta-teleological enterprises and predictions, such as eschatological narratives or the ideas of 'Progress' of modernist movements, but as Sanderson (2008, p. 94; see also: Harvey, 2000; Mandel, 2002) suggests: 'The language of hope and the language of progress are implicitly related', as 'progress' is 'a focus on the realisation of future aspirations in the pattern of the present' (ibid. p. 95)46. This historical positioning, or 'historicity', of hope is addressed in the next section. However, I would like to signal an interesting contrast between theorisations in the literature of hope and what I want to show from empirical work. In a significant proportion of the academic literature concerned, hope is figured as stemming from tragedy, particularly in the work of geographer Ben Anderson (for example: Anderson, 2006b; 2006a; see also: Anderson and Fenton, 2008; Bloch, 1986; Fiddes, 2000). Echoing the Judeo-Christian consolation of the hope for a messiah or for resurrection, Anderson's theorisation of hope stems from a value judgement that a tragedy has befallen a particular group but grounds for thinking circumstances can and will be better are affirmed:

'In the shadow of a hopeless world, thinking and feeling with hope promises a way of disclosing moments or instances in which things could become otherwise. In the absence of a telos or ultimate ground that would guarantee hope, a secular practice or ethos of hope becomes a way of embodying the conviction that the future may be different from the present' (Anderson and Fenton, 2008, p. 78).

I will return to addressing the inherent political manoeuvres that underlie the assumptions of how such value judgements are formed in a later section. The contrasting position I suggest is encountered in practices of envisioning and the hope(s) they convey for technology development, and in particular ubicomp. For in these visions the starting point is not a tragedy, hope is already plentiful and so becomes a process of continuing to hope. As [anonymised] candidly illustrated in our interview, hopes are the proposition and sedimentation of universalising ideas:

"so many of these big well-funded agendas are based on these grand 'in the future we'll all have jetpacks' style visions. Where the jetpacks are kind of symbolic of freedom and individuality and autonomy and... I kind of find myself shifting in my seat a little nervously and... not really clear if I feel ok about advocating jetpacks for everyone. Maybe they don't want jetpacks... I'm pretty clear that most people might not want jetpacks... and San Francisco is of course the land of the universalising libertarian future, um... the beautiful world in

<sup>46</sup> Sanderson (2008) makes the comparison between messianic hope and the notion of progress in the context of development studies but I suggest it is applicable more broadly.

which we'll all be... own our own companies, work from home... drink coffee in beautiful cafes and, you know, have any, I suppose, debilitating illnesses to worry about that... would destroy our lives in some way, um... you know, San Franciso's visions are very... lots of San Franciscans are very good at big visions" ([anonymised], formerly of Intel Research Berkeley).

Ubicomp is, in many ways, the product of an optimism that many see as synonymous with a Northern Californian outlook, which, as seen in the above, can be viewed with both an admiration and scepticism. Another informant set out this viewpoint explicitly in these terms:

"I think there's... if you look at the history of ubiquitous computing, as it is... as a product of Xerox PARC culture, which is a product of um, in many ways, Northern California technology counter culture...um... the... um, I mean, Google's a part of that too... Google is a product of that same environment. Um, as is to some extent Apple, um... and all of them share ah, a fundamentally positivist view of the world. Um, and that comes from the... um, essentially from the... human potential movement that started in the 50s and 60s in this part of the world. Ah... it has at its core a very ah... it has at is core the... this very kind of humanist notion that people can make themselves and the world better and the way that they do that is through technology. You know, whether that technology is new kinds of meditation, or um, or one of the technologies embodied in computer hardware" (Mike Kuniavsky, ThingM).

As Kuniavsky suggests, social and political movements, as well as national economic arrangements, have been identified as broader narratives that frame the optimism for the future apparent in ubicomp R&D. The context of Northern California, and Silicon Valley in particular, should certainly be acknowledged here, although a detailed socio-historical account of the region is outside of the remit of this work<sup>47</sup>. Two movements in particular are worth signposting in this regard. The first is the level of Cold War era investment into technology development facilities in and around Silicon

<sup>&</sup>lt;sup>47</sup> Silicon Valley has proven to be a popular site of study and site of imaginaries. For example, Archaeologist Christine Finn's (2002) 'Artifacts' details the changing fortunes and changing material landscape of Silicon Valley in the wake of the 'dot com boom' and subsequent 'crash'. Douglas Coupland's (2004) novel 'Microserfs' tells the fictional story of Silicon Valley co-workers in a start-up company. Also, the relationships between counterculture movements and the birth of Silicon Valley are charted in a number of books, notable examples are John Markoff's (2005) 'What the Dormouse Said' and Fred Turner's (2006) 'From counterculture to cyberculture' (see also: Cheek, 2000; Malone, 1985; Packard, 1995).

Valley, led by a significant growth in Stanford University in the 1950s and '60s. As O'Mara (2007) highlights, the value placed in the Silicon Valley model led to its material character, the architectural styling and landscaping, being copied across the globe. The 'better' or desired world evoked here is strongly framed by the American ideals, which formed one side of the epistemic context of the global political economic standoff of the Cold War (for detailed analysis see: Kenney, 2000; and particularly: Leslie, 2000; Sturgeon, 2000). Second, a social movement arose within the broader 'counter-culture' sensibility, also in the 1960s, which focussed on the potential of technology as a means to incite change. Turner (2006, 2007) charts the rise of the transformation of counterculture values into a cyberculture movement that clearly overlapped and influenced the growth of computing R&D in Silicon Valley in the 1970s and, indeed, influenced researchers at Xerox PARC (see: Markoff, 2005; Turner, 2006, pp. 109-113). The desired world such movements were attempting to map was framed by the cultural values of the 'new communalist' counterculture movement (see: Turner, 2006, pp. 3-5), which are still evident in the ideals of 'peer-to-peer' technologies (Turner, 2006, pp. 249-262). These broader articulations of hope located in Silicon Valley offer a cultural and social context in which the development of future visions of ubicomp arose.

Hope can, of course and as shown above, signify different aspirational forms of anticipation. As Shields (2008, p. 135) suggests, we lack a 'nuanced vocabulary' to address the various modes of experience we seek to describe and explain with the concept of hope. Shields (ibid) seeks to distinguish between what he identifies as three modalities of hope, which he ties to theorisations of affect (to which we shall return in section 6.2.3), but which I feel can be extrapolated more broadly as a means of analysis: First, there is the immediate sense of hope that we feel in the moment of the present but 'project[s] near and distant futures' (ibid), strongly linked to emotion and behaviour. An example in ubicomp R&D might be a sense of optimism felt in the practice of R&D when a problem is solved or researchers make a step towards a goal. Such experiences or expressions of hope may not have a direct object and are arguably difficult to attribute to a particular cause. Second are 'dispositions towards the future' (ibid), which is a future deferred to a distant time-space and realised incrementally. We might understand these to be structured orientations towards the future that are somewhat distant. Third, hope can be '*dunamis*', derived in ancient Greek by Aristotle, 'potentiality' or 'potency', which Shields (ibid. p. 129) states can be 'actualised by a conjunction of disparate forces or in the coming together of a political community around an issue'. If such a potentiality can be called upon then claims are continually made in its name, the most forthright of which have been described as 'regimes of hope' (which are addressed in section 5.2.2).

Shields (2008, pp. 129-130) usefully distinguishes between two linguistic legacies, one from the Greek 'dunamis', derived by Aristotle, and the other from the Latin 'potentia'. Dunamis, according to Shields (2008, p. 130), refers to 'a potentiality already present, already "here" and has a genealogy via Aristotle, who used the term politically, and St. Paul, who used the term to signify the 'holy spirit' or 'hope for what we do not see' (Romans 8:25). Potentia is somewhat more distant in its reference to a timespace, 'distant in time and space but nonetheless not severed from the activities of the present' (Shields, 2008, p. 130). Shields' (2008) three branches of hope (as affect) can, I suggest, be generalised and combined with other literature on hope (principally from geography and Science and Technology Studies) to chart three modalities of hope, considered as an anticipatory logic. I have identified these three modalities as: first, hope as a historical force; second, 'regimes' of hope, which have been identified as the investment of desire and expectations into particular speculative projects; and third, returning to Shields' (2008) and Anderson's (2006a) work, hope as an affect - 'a category including but not circumscribed by emotions, moods, and feelings' (McCormack, 2007, p. 359).

The rest of this section therefore proceeds in three parts. Firstly, hope is explored as a historical device, espoused across a gamut of theological and secular scholarship considering themes of eschatology and utopia. In the second section 'regimes of hope' (Brown, 2005), identified as a future-oriented regulatory tendency, will be discussed in relation to the political tensions present in the pairing of factual claims for the present and desired claims for the future drawing on further emotional and cultural resources. Hope has also, more recently, been discussed in terms of the autonomous modes of learning, as bodies in-relation, and the capacity to affect and to be affected: '[escaping] confinement in the particular body whose vitality, or potential for interaction, is' (Massumi, 2002b, p. 35). The third section will therefore deal with discussions of hope as an affect.

#### 6.2.1 The historicism of hope

Any examination of hope concerned with the concept of hope as a temporally bound phenomena, especially in a Western European context, must, arguably, contend with the associated themes of eschatology and utopia. Eschatological hopes are founded in a faith that the end is certain. It is an orientation towards the finite, and the finitude of the world is understood in relation to an infinite God, and through that transcendent God we can hope to transcend the limit of death ourselves, in the guise of a 'heaven' or 'eternal life'. While I acknowledge that many religions assert eschatological hopes, given the Anglo-American context of ubicomp, and the situation of the associated R&D activities in a Western (and particularly American) late capitalist system, I focus here principally on the Christian sense of eschatological hope (further exploration of the links between Capitalism and Christianity in the USA can be found in: Connolly, 2008). This Christian hope is described by some not as a distant sensation but as an embodied disposition: 'Eschatology, as a part of Christian spirituality, therefore is embodied in the hope of the "here and now" of the Christian's embodied subjectivity' (Sanderson, 2008, p. 96 citing ; Moltmann, 1965, p. 16). The distinctive eschatological aspect of Judeo-Christian theology is its 'messianic character' (Sanderson, 2008, p. 96). The character of the Biblical messiah, both of the 'Old Testament' bible (or Hebrew Tanakh) and Christian 'New Testament', is a figure of hope:

'who brings restoration of loving relationships and the embodiment of peace to all relational contexts. The messianic character of hope, relationally embodied, is therefore not substantiated through the linearity of time but by a transformative entry into current time and space by the messiah' (Sanderson, 2008, p. 96).

In Christian theology then, the figure of Jesus Christ, as the 'Son of God', has guaranteed a form of salvation by 'conquering death'. Hope is accordingly embodied in the figure of the 'risen' messiah in two ways. Firstly, as a 'victory over death', in which through the resurrection we can hope to rise to new life48. Secondly, as an ultimate victory at an 'end of time', in the second coming of the Messiah to bring about a renewal of the world (for example: a 'new kingdom', such as a 'new Jerusalem' or 'Sion'). There are powerful teleological narratives that historicise and story the impulses of desiringproduction, the 'fixed form of desire subjected to [and affirming] a socially-authorised belief (Holland, 2005b, p. 66), here in the guise of religion.

Stories told, that evoke hope demonstrate the seemingly perennial struggle to rationalise the pre-personal and pre-cognitive productive force of 'desire' (qua Deleuze and Guattari, 2004b) forging anticipatory logics which can become normalised. In the case of a Christian theological logic of anticipation, 'hope', or 'trust in God', lies at the heart of the affirmation of Christian doctrine. The final lines of the Nicene creed<sup>49</sup>, the accepted dictum of faith recited in all Eucharist services of the major denominations of

<sup>48 &#</sup>x27;Jesus said ... "I am the resurrection and the life. Whoever believes in me, though he die, yet shall he live, and everyone who lives and believes in me shall never die' (John 11: 25-26).

<sup>&</sup>lt;sup>49</sup> The Nicene creed, or Creed of Nicaea, was purportedly adopted as the accepted profession of faith in the 'First Ecumenical Council' in 325 A.D. It is granted significant importance in the Church of England, the Orthodox Church, the Roman Catholic Church, and majority of Protestant denominations (see: Jeffrey, 1992).

Christian faith, pronounce this hope: 'We look for the resurrection of the dead, and the life of the world to come' (The Archbishops' Council, 2000, p. 173). An ethos of hope therefore lies at the heart of the eschatological narratives of Judeo-Christian faith. A related understanding of an ethos of hope as a 'metahistorical language' (Sanderson, 2008, p. 94) is also woven into the language of, now secularised, historical narratives, such as the 'development' of countries.

A variety of dreams or visions of a 'better' society and plans to realise utopian ideals might be figured as 'spaces of hope' (Harvey, 2000; Anderson and Fenton, 2008). As such a space, 'utopia' has often been figured as a city (e.g. Fishman, 1982; Hall, 1988), with the possible archetype of Sir Thomas More's literary vision, first published in 1516, of 'utopia' as an island with a mighty city, inhabited by something like the 'perfect' society. In-common with the Judeo-Christian tradition of a paradise as a distinctive place to which all 'good souls' may depart after their tribulations in this, temporal, world, the figure of utopia as a place is also, traditionally, 'not-yet' or to-come (cf. Bloch, 1986). There are, of course, many ways (for example, Bloch, 1986; Fishman, 1982; Hall, 1988; Kumar, 1991; Levitas, 1990) in which we might understand the concept of 'utopia', and this rests outside the realm of the work at-hand. However, as a form of spatial imagination, and following on from the trajectory of Chapter 4, we can see how 'visions' and their representational constructs, such as video and text, are specific modes of mapping out desired worlds in a particular utopic sense – the ordering of the possible. A number of informants for this research expressed explicitly utopian ideals that are metered and blended with the pragmatic restraints of developing a product. An emblematic example came in discussion with Joe McCarthy, formerly a developer at Nokia and since a serial entrepreneur. The idealism that motivates the forms of future vision or anticipated technological experiences are a part of the negotiation of valuing particular forms of future:

"... I also think that most of us are trying to right wrongs, you know, its this problem centred - oh, well if only things could be this way, and life would be better, I think that many of us are driven by that, umm, although there are some people, and maybe its primarily the privacy folks, who are trying to protect against future wrongs, and trying to obstruct or otherwise get in the way of these things... umm so I do think that I'm, um, an idealist, and I do think that many people who are pushing the boundaries in many respects are sort of envisioning a possible future scenario and working to achieve that" (Joe McCarthy, Strands Lab).

The expression of 'if only things could be this way' as a motivating factor in certain forms of R&D practice demonstrates the idealism, or 'utopian' hope that can situate particular ways of attempting to make particular futures present.

I want to briefly focus, following Harvey (2000), on utopias as 'possible spatial orderings', as 'spaces of hope' (ibid. pp. 159-163). It has been suggested that More's mythical island of 'Utopia' can be considered as a form of 'spatial play' (Marin, 1984; cf. Harvey, 2000). Through this 'spatial play' one of many possible spatial orderings is selected 'as a way to fix a particular moral order' (Harvey, 2000, p. 161). The particularity of order, or discipline, in such grand hopes and visions is perhaps their undoing. A 'particular moral order', no matter how ideal, requires an authority and restrictive form of governance. As Foucault (2000a) has suggested, the creation of any grand visions for society inevitably throws up a tension between the multiplicity of imagination and the singular nature of authority. 'Spaces of hope', as Harvey (2000) would have it, are 'heterotopic' (Foucault, 2000a) modes of spatial play, of 'mixed, intermediate experience' (ibid. p. 179; cf. Harvey, 2000, p. 163). Visions can thus be made up of multiple hope 'statements', which are not just words but also images and various other media for conveying ideas, that may sit, perhaps uncomfortably, alongside one another 'heterotopically', which is evident in Joe McCarthy's comments in the quote above. The competing visions produced in image and text, under the umbrella of ubicomp, by various research groups and companies also demonstrate how packaging hopes in a vision can be a political play, which will be discussed further in the next section.

The creation of visions, and the 'spatial play' practised in the hopes espoused, in ubicomp R&D illustrates the negotiation of issues of governance that many ubicomp researchers see as inherently necessary to such anticipatory practices. For some, there is a tendency for ubicomp futures to be framed negatively, in terms of the rapid loss of privacy in a 'surveillance state' (for example: Wood, 2008) and, in the opposite extreme, the undermining of government by self-organisation through technology (for example: Kelly, 1998), both of which over-simplify in favour of proposing particular futures with certainty. As Mike Kuniavsky (Director of a ubicomp start-up company) suggested in our interview, the 'mapping' of a desired future world in terms of the present is the attempt to project on to a moving target, because time moves through the present, and the present itself moves through time:

"... I think that ah, when people ask me, for example, about the... potential tyrannies of ubiquitous computing technology, you know the ah, loss of privacy, the accountability of governments and um, and their relationship to the collection of data, um... I think that ah... all of the negative predictions are generally Malthusian in their nature, where they don't take into account the, ah... malaeability and felxibility of ah... society. And they're essentially mapping a scenario on to today's world that likely won't exist, because the world will have changed by the time the technology has changed and the negotiation between people, and between people and their governments, will have um, will have, in general, a fairly positive view of people being able to negotiate that, with themselves and with their governments..." (Mike Kuniavsky, ThingM)<sup>50</sup>

<sup>&</sup>lt;sup>50</sup> This negotiation of apparently 'good' and 'bad' futures proposed and contraposed has been variously articulated as utopian and dystopian narratives that circulate in the broad discussion of ubicomp as a set of ideas:

<sup>&</sup>quot;I think we... we as a research community started out as ah... fairly optimistic about all these sort of everyday things that could be made better um... I think in more recent years people, you know, counter proposed well there's equally many ways in which the world could be made worse, um, both from a technological infrastructure standpoint as well as just from, sort of, the obvious surveillance state issues and so forth right? So, the fine grain tracking and recording of every activity and making it sort of cross-referencable and searchable and persistent um... has its benefits but it also has lots of potential downsides, so... so, we kind of have this, you know, we went from a kind of utopian naïve vision to, you know, something much more of dystopian vision and um, you know, somewhere the truth lies in the middle, right?" ([anonymised], HP Labs).

Ricoeur, in exploring discourse and the 'surplus of meaning' (1976), argued that narratives 'express human desire' (Fiddes, 2000, p. 40), and that as 'an *overflowing of surplus* of being, human existence is *oriented forwards in a passion to be*, and this is the *true basis of hope*' (ibid. 2000, pp. 40-41). For Fiddes (2000, p. 41), Ricoeur's (1976) 'surplus' expresses human being as possibility itself, 'and out of this fecund capacity the imagination can create genuinely new possibilities which are not simply repetitions of the past and present... [but] refer to a reality which is yet to come and which they help to create' (Fiddes, 2000, p. 41). An excess of possibilities in the future, despite an ultimate finitude, is also where Bloch (1986, 1998) situates hope. The 'not-yet' for Bloch (ibid. p. 341) is the locus of hope:

'[N]ot only hope's affect (with its pendant, fear) but, even more so, hope's methodology (with its pendant, memory) dwells in the region of the not-yet, a place where entrance, and above all final content are marked by an enduring indeterminacy' (Bloch, 1998, p. 341).

This not-yet, it seems, can be read two ways. Firstly, as a possibility, the sense-making after the fact that holds the future ever as such: 'produced after the fact, as retroactively fabricated in the image of what resembles it' (Deleuze, 2004, p. 263). Secondly, as a potential, by which we can understand a 'topos of the not-yet' not only as a question of temporal extension of present into future but also as

'thinking of space as animated (im)possibilities, potentialities and virtualities – some of which we find in the past life of spaces, some which can be predicted to occur in the future, and some which are impossibilities "to come"' (Anderson and Fenton, 2008, pp. 78-79).

Bloch (1986) occupies an uneasy theoretical ground in which he simultaneously proposes a future-oriented realism, which might be rationalised as purely *possible*, and yet appeals to an excess, which can be thought as potential. Bloch's (1986) 'realism' describes a world in which 'everything living ... has an atmosphere around it; everything real in general, because it is life, process, and *can be a correlate of objective imagination*, has a horizon' (ibid. pp. 223, additional emphasis). The 'hope for the knowledge of life' (Bloch, 1986, p. 286) that pervades this dialectical historical 'realism' is, in Bloch's own words, 'the mediated *future science* of *reality plus the objectively real possibility within it*' (ibid. pp. 285, original emphasis) and 'all this for the purpose of *action*' (ibid. ). This imperative for human action, a revolutionary imperative - following Marx's (1978) 'Theses on Feuerbach', is the aim of:

'realising that which is actually possible but does not yet exist, [with] the greatest exertion by the revolutionary individual between the status quo and the hoped-for potential to be realised, possibility suffused with hope' (Mandel, 2002, p. 253).

However, the 'prospective horizon' that Bloch describes (ibid.) also appeals to an excess, which might be read as potential (qua Deleuze, 2004): 'the unconcluded motion of unconcluded matter' (Bloch, 1986, p. 223). It is this later reading that has been espoused by Anderson (2006b) in descriptions of Bloch's (1986) project striving for an 'immanent utopianism' (Anderson, 2006b, p. 701). Moving away from the 'historicism' of Bloch's (1986) materialism, towards an open temporality of immanence, Anderson (2006b) defines his reading of Bloch's (1986) utopianism as

'a means of transformative intervention in immanent utopic processes that strives to give and find hope through an anticipation of alternative possibilities or potentialities' (Anderson, 2006b, p. 703).

Hope, in this sense of 'immanent' utopianism, is a movement without a necessary direction (contra historicism). According to this somewhat complicated line of argument, there is thus no hope peculiar to the future orientation of the development activities of ubicomp. This 'immanent' ethos of hope, or basis for 'utopic geography' (Anderson, 2006b, p. 706), complements Massumi's (2002; following Deleuze, 1988b) theorisation of an 'open threshold' of the 'present in passing' in which we can participate in a collective process of 'affecting and being affected' (Massumi and Zournazi, 2002, p. 213), which will be explored in section 6.2.3. This focuses upon the feeling or sensation of hope as a motivating factor for any form of action, and thus not peculiar to activities such as ubicomp R&D per se. Such a feeling of hope is situated in

the moment that the sensation takes place. However, before turning to discussing hope as an 'affect', in the next section I want to critically examine the ways in which hope can be viewed as the investment of prospective or emotive value into particular projects. A 'political economy of hope' has been posited by a number of scholars, who suggest the competing 'regimes of hope' are formed, particularly in high-stakes technology development.

## 6.2.2 Regimes of hope

A point of friction between theorisations of a pseudo-visionary historicity of hoping(s) and the visceral immediacy of affective hope is the recent discussion of 'regimes of hope'. Amongst STS literature exploring a 'sociology of expectations' (see further discussion of this in Chapter 3) the trope of hope, in relation to truth, has been explored, particularly in relation to experimental research into new medical treatments. For example, in research into experimental surgery (Moreira and Palladino, 2005) 'regimes of hope' are identified as: 'the view that better treatments are always about to come, being tested, in the pipeline. More specifically, research and development is justified by the promise of finding miraculous cures for debilitating diseases' (ibid. p. 67). Similarly, a peculiar *telos* is manufactured in the speculative practices of 'biobanking' (Brown and Kraft, 2006), for example: 'where parents elect to pay for the storage of their newborn's cord blood' (Brown, 2005, p. 332).

Critical engagements with case studies around biotechnologies, such as stem cell research, theorised in terms of 'regimes' of truth and hope postulate political tensions present in medical capabilities and future aspirations<sup>51</sup>. A 'political economy of hope'

<sup>51 &#</sup>x27;Hope scales' utilised in oncology treatment, to assess whether or not patients match up to the presumed levels of 'positivity' about their potential recovery, have also been examined as a 'calculative naturalisation and objectification of hope in the form of personal will and volition to overcome pathology' (Brown, 2006, p. 2).

(Delvecchio-Good et al., 1990; Novas, 2005) has been accordingly suggested<sup>52</sup>. Brown (2005, p. 332) notes that there is a 'corporeal material character' to such an 'economy of hope', for example in 'the establishment of... new contractual arrangements whereby patients make their bodies and patient records available to pharmaceutical innovation in return for expected benefits' (ibid. p. 334). I suggest the equivalent 'corporeal material character' (ibid. ) of ubicomp R&D is the ways in which prospective users open themselves to be studied in the development of new forms of technological experience. We might also consider the forms of embodied attunement elicited by imaginative representations of ubicomp to be a part of this 'corporeal material character', as discussed in chapter 5. The tension in these 'political economies of hope', then, is the tension between a 'regime of truth', which 'entails an investment in what can be known', and a 'regime of hope', which entails an investment in 'what can be' (Moreira and Palladino, 2005, p. 67). For Brown (2006, p. 13) this is a tension in 'the broad relationship between facts and values'. Yet the arrangements between patients and researchers are something more than 'hope' as an uncertain orientation to the future and suggest a sense of obligation that brings us closer to expectation or promise.

If we were to look for examples of 'regimes of hope' in ubiquitous computing research we might identify research projects such as Intel's 'Participatory Urbanism'. Resources and expertise are provided to a test user group, who may benefit from and become enthusiastic about the experimental device or service. Future use scenarios are conceived and imagination is invested, both by researchers and aspiring users. Intel researchers provide examples of future scenarios such as the following description of a use of air quality sensing:

<sup>52</sup> Literatures exploring 'political economies of hope' have been particularly related to medical technologies, such as oncology treatment (Delvecchio-Good et al., 1990; 2003) but also around the collaborative links between pharmaceutical companies and patient advocacy organisations (Novas, 2005).

'Tyler lives in Lagos, Nigeria where his family often cooks indoor using charcoal. Tyler's son suffers nearly every two weeks from respiratory problems. However, the government just received another award for outstanding regional air quality. Tyler checks his mobile phone's sulphur dioxide sensor and realizes that several hazardous level measurements were taken about two weeks ago. Tyler compares his measurements to others shared online and realizes the problem occurs during indoor cooking using freshly cut wood. Tyler alerts others with similar measurements to the problem and successfully petitions the government to provide new cleaner sources of cooking fuel based on his and others reported measurements' (Intel, 2007).

This example demonstrates the contradictory expression of value in such hopes. A Western name is given to a Nigerian citizen, 'Tyler', who is presumed to have a rational and objective understanding of a complex policy system, in this case air quality, that 'Tyler' is presumed to have the means to access and affect. There are many political issues that may be raised with regard to this example that would be the subject of an alternative analysis of such literature. Quite apart from these obvious issues, this story is emblematic of the optimistic extrapolation of futures from existing technologies inherent to a broader movement of 'Citizen Science', which has grown in influence in ubicomp R&D through former Intel (Berkeley) researcher Eric Paulos (see: Paulos et al., 2008b; 2008a). Paulos, and other researchers at Intel, developed a programme of research that is

'directly focused on the potential for emerging ubiquitous urban and personal mobile technologies to enable citizen action by allowing open measuring, sharing, and remixing of elements of urban living marked by, requiring, or involving participation, especially affording the opportunity for individual citizen participation, sharing, and voice' (Paulos et al., 2008b).

The future projection at the heart of the 'Participatory Urbanism' Paulos espouses has the aim to 'enable citizens to act as agents of change' (Paulos et al., 2008b) through their use of consumer communications technology (such as mobile phones) as data gathering equipment. This overt desire to 'change the world', wrapped up in the 'regime' of hopeful speculation around Citizen Science, came through very strongly in interview: "I'm really hopeful, I mean, technology it's also... even the sort of citizen science stuff I'm really hopeful about because I can see huge ways to make just life more... democratic, I can see people having better lives, like in developing regions and being able to participate more in, you know, um... economies and in sort of forming um... sort of political alliances, and sort of just... massive participation on levels that we've never seen, so... I'm hopeful about the world in general and it's hard to think about a global scheme like that, you can't attack it as big kind of massive problem...I have a luxury of being able to choose a lot of things that I work on, and I'm completely... you know, honest about the fact that's not true for most of the population, most people are not in that situation. So, I feel this extra burden to have to kind of, well... I sort of should also be thinking and speaking for a lot of people who don't have that opportunity" (Eric Paulos, Intel Research Berkeley).

Extrapolations from existing examples of the apparent benefits of technological

systems, again largely focussed on mobile telephones, are used as a means for drawing

hope for these forms of research in general. The ways in which examples of the 'positive

impact' of such technologies are mobilised is illustrated by one Nokia researcher's story:

Rafael: "I think that... technology in general is a hopeful enterprise. And that we've seen dramatic improvements in the quality of everyday lives because of technology, but there's so clearly a huge gap to fill, a huge, you know, a long way to go... and ah, I think there are a lot of examples now of... how ah... you know, just the, the possession of the cell phone can economically and socially benefit ah, tremendously in third world countries, as an example. Ah, so there's an example of a fisherman coming back from sea with his catch and using SMS to decide..."

Sam: "Negotiate which market, yeah..."

Rafael: "...would be the best location for him to bring the fish in, or um... ah, local farmers, you know, exchanging ideas and exchanging um, information about local pests, or um, crop yields, basically, because of... better facilated communication, or... children given better access to education, you know information I think is central to a lot of our societal progress and access to that information" (Rafael Bellagas, Nokia Research Center)

Both of the stories told by Intel and Nokia to evoke hopeful dispositions to the future, through potential technological empowerment, assume a normative form of rational actor as the basis for human decision-making. This lies in contradistinction to recent discussions of the embodied, pre-cognitive and performative forms of knowledge and relation to the world described as 'affect', to which I will return in Section 6.2.3.

The investment on the part of the company funding the research is often temporary and the aspirations for the future are inherently left unfulfilled, which is the nature of hope. Indeed, those hopes can be concretised to the point of normative expectation, not unlike the contemporary reliance upon the apparent facticity of Moore's Law in computing R&D<sup>53</sup>. The product of such hope is ambiguous. Broadly speaking, unlike the conceptualisation of hope stemming from tragedy, I suggest the mode of making communicable a 'betterment' or improvement of the world represented in these examples stems from a striving to envision or make evident what is not (yet) possible. Just as in other forms of technology research, there is something of a disparity between the apparent 'truth' of pragmatic development in ubicomp and what is valued, 'hopefully'. It became apparent from interviews that comparisons are sometimes made by those in ubicomp commercial R&D with their academic research colleagues, citing the relative differences in pressure and risk but also the freedom to 'hope', as another Nokia researcher demonstrates:

"So I think simultaneously there's a sense that there's this huge possibility, huge hope for what we can do and that we're in a position to actually do it as opposed to those academics, you know, right, that's one of the main appeals of being in industry research is that hey I'm going to get to, I don't have to, you know, work on products so much, but I'm going to see the things that I do influence or show up in products that are gonna effect millions of people, that's appealing to a lot of people. So I think there's that hope, but there's also this cynicism of knowing that it's really hard, right, and a lot of times it fails, whereas in academia I think there's less of a sense of that it's hopeful researching in that way, I don't know. It's tricky" (Dean Eckles, Nokia Research Center).

The normative 'facts and values' assumed here leave little room for the 'affective facts' of Massumi (2005), for example, and largely serve to essentialise hope as a teleological force. For if 'hope' does serve to further a historical progress towards a particular goal and a circumscribed 'regime of hope' is the vehicle that mobilises that

<sup>&</sup>lt;sup>53</sup> Moore's law, as discussed in chapter 1, formulated by Intel co-founder Gordon Moore suggests that the complexity and performance of a computer chip at minimum cost would double every two years (see: Moore, 1965).

process, does a 'regime of hope' necessitate intentional thought? And can 'regimes' be modest? Expressing 'regimes of hope' ties hope to a univocal future orientation, which belies the variety of 'events' and 'spaces of hope' (Anderson and Fenton, 2008). Whilst the hopes that arise around particular projects may not be deliberately elicited, in the form of explicit marketing and propaganda, the fact that they do arise frequently incites those involved in a project to attempt to propagate them. If hope is a collective experience it does at some stage require intention in its propagation. Stories, such as the fisherman or farmers (above), and visions, such as those explored in Chapter Four, are the devices by which this (attempted) propagation of hope is practised.

A 'regime of hope' implies a particular socio-spatial scale. In the case of 'Participatory Urbanism', it is the scale of the city and communities therein – who, it is hoped, will act collectively in response to the information made available by the proposed technology. In this sense, according to Brown (2005), the concept of a 'regime of hope' can serve as a useful analytical device to posit a broad-scale

'shift away from a debate premised on an authoritative, factual and evidential discourse, toward the language and authentic symbolism of hopeful, futureoriented values' (Brown, 2005, p. 332).

This has a particular analytical purchase on large and highly valued projects such as stem-cell research, and perhaps to a lesser extent ubicomp, which, for example, receive significant levels of public funding and operate at the level of institutions of government and commerce.

Whilst there are examples of national scale projects, particularly those that are government funded, acting something like a hegemonic 'regime of hope', Brown (2005, pp. 334-335) highlights the emergence of what might be conceptualised as 'political economies of hope' (see: Delvecchio-Good, 2003; Novas, 2005). As these authors have noted, economies of regimes of hope 'are inextricably linked to capitalisation' (Brown, 2006, p. 336) as well as success in achieving funding and policy support by institutions. We might accordingly, albeit tentatively, chart the competition, for example, between projects that are given 'brand' names, such as Intel's 'participatory urbanism', Hewlett Packard's 'CoolTown' or Microsoft's 'Future vision of manufacturing', as an economy of regimes of hope. However, such a political economy of regimes of hope operates at the level of institutions, such as governments, funding bodies and corporations; there is little account taken of subjective difference. Some recent discussion of hope has addressed it as a force that produces relations on a more immediate and 'micro' scale (for example: Thrift, 2004a). This cuts against monolithic economies of hope expressed in terms of normative values. Therefore, in the next section I want to turn to recent theorisations of hope in terms of the pre-cognitive or unconscious force, or 'substrate of feeling' (following: Damasio, 2000, pp. 280-282), I will discuss hope understood as an 'affect'.

#### 6.2.3 Affecting hope

'Hope is memory that desires' - Honoré de Balzac

To think hope as a disposition that emerges from affect one must first understand that: 'there is no stable definition of affect' (Thrift, 2004a, p. 59). It has been argued in geography, by Anderson (2006a), that to think through the implications of hope as affective, particularly through Deleuze (2004a; 1988b), we must think it as emergent, as the actualisation of potential: 'Hopes provisionally emerge from within sets of relations and encounters that make up processes of hoping, as does a source that gives hope or in which hope can be placed' (Anderson and Fenton, 2008, p. 78). Thus, we cannot chart a specific origin of a hope, merely register and probe acts of hoping as 'the untimely moments redistributing what has come before and what is yet to come' (Dewsbury, 2000, p. 480). As Anderson (2006a) has said: 'there is an intuitive understanding that hope matters because it discloses the creation of potentiality or possibility and thus involves... "a postulate that reality overflows all possible reckonings"' (ibid. pp. 733-734; citing Marcel, p. 86). Hope as affect can accordingly be identified as a pre-personal force (beyond individual 'reckonings') and a rationale that stretches beyond the bare facts of the moment. It is an attunement not only to a future that one has envisaged but also to a collective sense of futurity. Hope is thus something of a collective experience, which is not to say that each person feels it identically, but Anderson's (2006a, p. 741) argument is that 'flows of hope... take place as transindividual affectivities which move between bodies'. Yet affects as such are not tied to bodies, and it is argued that hope as emergent from affect does not necessarily stem from the human:

"The life or career of hopes is never a matter of an individual act of hoping. Hope is a relational phenomenon precisely because processes of hoping are always already scored across a range of human and nonhuman materialities" (Anderson and Fenton, 2008, p. 78)<sup>54</sup>.

How and in what ways the experience of hope as an expression of affect 'opens up a break or interruption in life is an open question' (Anderson and Fenton, 2008, p. 78). For Anderson and Fenton (ibid) the consequence is that 'hopes are fragile. Hopes break, fall apart, disappear, can be damaged, are lost and remain unrealised'. Such 'affect', as a synchronously pre- and post- personal capacity (according to Massumi, 2002b), exceeds the explanation of the present; yet we are compelled to describe it, and thus, for Anderson (2006a, p. 747):

'The disposition of hope is best defined as a relation of suspension that discloses the future as open whilst enabling the seemingly paradoxical capacity to dwell more intensely in points of divergence within encounters that diminish'.

The three 'affective modalities' of hope outlined by Shields (2008, p. 135) illustrate the various ways hope is used to signify such forms of future orientation:

<sup>54 &#</sup>x27;affect is autonomous to the degree to which it escapes confinement in the particular body whose vitality, or potential for interaction, it is. Formed, qualified, situated perceptions and cognitions fulfilling functions of actual connection or blockage are the capture and closure of affect' (Massumi, 2002b, p. 35).

- 'immediate forms of affect, which are tightly linked to emotion and behaviour here and now (panic, flight)' (Shields, 2008, p. 135), which are also twofold as a 'being affected - affecting'<sup>55</sup>, yet compel the projection of futures, forging
- 'dispositions towards the future (abstract hope as *potentia*)' (Shields, 2008, p. 135), which might be understood as Anderson's (2006b) 'immanent utopianism', which are also different from
- 3. 'affects based on outcomes, past experience and everyday habitus... (hope as *dunamis*, which just needs to be actualised)' (Shields, 2008, p. 135).

According to Shields (ibid. ), these understandings of hope can be contrasted based 'on the way in which they project a future and locate it near or far from the current context' (ibid. ), that is to say – the modes of spatialisation and temporalisation they engender.

Hope elicited in the immediacy of affect, considered in light of an understanding of affect as a capacity of 'being affected-affecting' (Anderson, 2006a, p. 735; cf. Massumi, 2002b) can be understood, following Shields (2008, pp. 128, original emphasis), as 'the flow *between* emotional states as when a person might say their "heart leapt" on seeing a friend'. As Massumi (2005) has explained, using a study of fear and terror, immediate forms of affect can be understood as 'affective facts': 'what is an affective fact? The mechanism is quite simple: Threat triggers fear. Fear is of disruption. The fear *is* a disruption' (pp. 36, original emphasis).

How the circulation of affect produces an immediacy in hopes and hoping is somewhat outside the purview of this thesis, for it requires a different, more ethnographic methodology, and such dispositions of hope are difficult to access except in a reflexive way. Affective *potentia* (potential), understood through Bloch (1986, p. 238),

<sup>55</sup> Being affected-affecting describes the transpersonal capacity of affect, to be affected 'through an affection' and to affect 'as a result of modifications' (Anderson, 2006a, p. 735), such that 'when you affect something, you are at the same time opening yourself up [pre-consciously] to being affected in turn' (Massumi and Zournazi, 2002, p. 212).

'repeatedly makes the initial root... of processively continuing appearance on a new level, with newly latent content': *potentia* is 'a latent capacity... abstract and marked by absence' (Shields, 2008, p. 130). Finally, according to Shields' (2008) schema, hope as the immanent potentiality or 'potency' actualised, the *dunamis*, is the 'conjunction of disparate forces or... the coming together of a political community around an issue' (ibid. p. 129).

Philosopher Elizabeth Grosz identifies a model of the future in *potentia* as 'the direction forward as the opening up, diversification, or bifurcation of the latencies of the present which provide a kind of ballast for the induction of a future different, but not detached, from the past and present' (Grosz, 1999, p. 41). If the optimistic attitude referred to as 'hope' by a number of informants in ubicomp research and design is affectually derived, it might be best described as between *dunamis*. Consider the ways the optimism of ubicomp is generalised by the industrial design expert Nathan Shedroff:

"for the most part engineers and developers too, even the curmudgeonly ones are working in an industry that's all about making something new for the future. And the context for most of that, you know, I don't know why anyone would get in that kind of position, if they wanted to make bad things for the future, I mean truly unintentionally, or intentionally bad things, right, so designers tend to be optimistic, they tend to be very future oriented, they fill their worlds with things that are just slightly or quite always into the future, um, and I think that most humans tend to be hopeful about the future if for no other reason that they just don't wanna be depressed all the time" (Nathan Shedroff, California College for the Arts).

The anticipatory logic of hope allows for an equivocation and vacillation between *dunamis* and *potentia*, which when targeted on a future that is not too distant and yet is never achieved, demonstrates the means by which ubicomp has proven to be such a successful set of visions. This is rather different from Anderson's (2006a, p. 747) description of 'becoming hopeful' as different from 'becoming optimistic'. Indeed, the empirical evidence gathered here casts doubt on Anderson's (2006a, p. 748) supposition that '[t]o being from hope ... is to *supplement* this understanding of excess [in the movement of affect] by incorporating a sense of the tragic'. Anderson (2006a; see also: 2006b) follows
Ernst Bloch's (1986) melancholic theorisation of hope as sensing the forefront of processes and simultaneously holding 'the condition of defeat more precariously within itself (Bloch, 1986, p. 341)<sup>56</sup>. The understanding of affect discussed here suggests that there can be no 'hope' peculiar to any one activity. There can accordingly be no affective hope peculiar to ubicomp R&D, given such an understanding. Instead, the sensation of hope is derived from the event in which it forms, it is peculiar to the various actors caught in that moment.

Despite the undoubtedly careful work of those scholars exploring hope as a disposition emergent from affect, it is important to sound a cautionary note. As Dewsbury (forthcoming) suggests: 'There is a danger of sounding and indeed becoming... gnomic when talking, writing and thinking through affect. It is too sweeping a concept for too little actual empirical detail'. We must recognise that affects actualise on a 'molecular' level: the involuntary tension of muscles, the shortening of breath and the raising of hairs on the back of the neck when confronted by an object of phobia, for example. Affects are relations between terms, not the predominance of one body over another: 'it is foremost the relationship produced as affect and not the individual, and their perspective, that matters' (Dewsbury, forthcoming). And yet, there is something like an 'affective contagion' (Thrift, 2008a) that can take place, for example the 'infectiousness' of a yawn. Here we might think of the politics of affect as a 'microbiopolitics' (Thrift, 2004a, p. 71) or a 'neuropolitics' (Connolly, 2002) of 'bodybrain-culture relays' (Dewsbury, forthcoming), in which affective dispositions of hope might be produced, both inadvertently and with some intention, through processes of 'accumulation' of hope (Anderson, 2007, pp. 160-162) as affective 'contagion'. In seeking to think through hope via the concept of affect it is critical to attend to this 'microbiopolitics' (Thrift, 2004a, p. 71) of many and various 'events of hope' and hopings

56 This precarious 'condition of defeat' (Bloch, 1986) resonates with the implied inherent threat of failure highlighted by Dean Eckles of Nokia Research Center (see the quote in section 6.2.2).

(Anderson and Holden, 2008). However, as discussed above, what I feel is evident from this discussion of hope stemming from affect, particularly by Anderson (2006a), is an implicit assumption of particular value judgements around what are 'good encounters' and what exactly constitutes, and how we recognise, 'something better'. In the following conclusion I seek to address the discourse of hope, and the question of the implied judgements of what is 'better', in terms of a politics of anticipation.

### 6.3 Conclusion

In this chapter I have examined the anticipatory logic of hope as a means of framing the anticipation of 'better worlds' in ubicomp R&D. In the first section I discussed hopes as statements of future orientation that freight the imaginative from the present into a time-space to come. However, underlying these discursive statements, I argue, is an anticipatory logic that facilitates the propagation of claims for 'better' futures. Three particular modalities of hope were explored in the second section as hope: historically situated; exercised in regimes; or the outcome of affective dispositions. A historical situation of hope either as eschatological desire or as teleological narrative has no more analytical purchase in the ways in which hope is articulated in ubicomp R&D than other contributing factors to the affective disposition from which the feeling subtends. Rather than a specific *telos*, or a desried world held at some distance, as with Shields' (2008) potentia, I have suggested that the hope expressed by researchers in ubicomp is more akin to what Shields (2008) refers to as *dunamis*. Competing statements of hope operating in a broader aspirational discourse of ubicomp can be seen, in some ways, to economise the investment of belief and expression of interest in particular projects. This is concretised in the further competition for research funds, the capitalisation of abstract research into material products or services (often prototypes, following the analysis of chapter four) and, more prosaically, for reputation. In the final part of the second section we examined how hope produced from affective dispositions is

slippery and presents problems for description. One can point at specific affective happenings and identify instances of what are regarded as hopings – but, in the final analysis, we cannot really be sure of specific affective bases of hope per se.

I want to highlight two concerns regarding the discourse of hope. The first is that there is a danger that a transcendent morality is simply and normatively assumed, without problematising the finite ethical position of the value judgement in question. Equally problematic, and related, is the invocation of a 'joyous' or hopeful disposition of writing about, for or with hope in recent geographical work (see: Anderson, 2006b, 2007; Anderson and Fenton, 2008; Anderson and Holden, 2008; Braun, 2005; Whatmore, 2001). This interest in hope and associated terms is often, but not exclusively, aligned with an impetus to retheorise or enliven a sense of utopia or utopianism necessary for Left politics (Anderson, 2006a; Pinder, 2001). There is an admirable appeal to an immanence of excess as the foundation of hope in some specific empirical cases, for example Anderson (2007) on nano-technology and Brown (2005) on bio-technology. Yet, in the same theoretical manoeuvre, an appeal is made to an 'aim to cultivate "good encounters" and anticipate "something better" (Anderson, 2006a, p. 749) and the derivation of that 'something better' is elided. Value judgements are made and hidden by a rhetoric of hope. As such, hope seems to operate by abstracting away from the specific instance or context of a vision. Hope, in this sense, is based upon a value judgment made on behalf of the subject in question that becomes individualistic, in the sense that the researcher positions herself/himself as a kind of moral arbiter, or remains 'wedded to the teleology of realising, in history, "something better"' (Rolfe, 2007, p. 12), as laid out in a utopian doctrine (for example, Communism).

The future orientation of R&D practices in ubicomp consists of the networks of relations between various participating people, ideas, institutions and material things. As such, a clear 'cause' or arrangement of relations within which the production of aspirational value judgement of 'better' is made is not accessible. In this light, we should not simply affirm such normative appeals to a polar, unquestioned morality or reduce the ethical negotiation at work to a single academic's individual appraisal. Therefore, in the analysis of the role of hope in future orientation broadly in technology development and specifically within ubicomp R&D, we must look to how the apparent optimism of 'looking forward' to the future produces relations that propagate themselves.

My second concern is that in some of the literature reviewed hope is figured as being redemptive or operates in the face of tragedy:

'The worst is always what the hopeful are prepared for. Their trust in life would not be worth much if it had not survived disappointments in the past, whilst the knowledge that the future holds further disappointments demonstrates the continuing need for hope' (Lasch, 1991, p. 81).

This risks recapitulating the argument that hope is a historically situated impulse, which either implies an appeal to a transcendent force (such as God) or a teleology of realising 'something better', as discussed above. For the move from the state of 'tragedy' to 'something better' implies the necessity of one state of affairs for the other to arise and thus a sense of 'progress', which, if left unproblematised, falls subject to established critique of 'progress' (for example: Foucault, 2000b; Latour, 1993). Even if we follow Anderson's (2006b, 2007) argument that such a movement might be emergent from empirical realities that draw upon an 'immanent' hope, the evidence from ubicomp R&D demonstrates the forging of a different ethos of hope – an abundant and almost unwaivering optimism. Tragedy does not figure in the rhetoric of ubicomp's visions, instead circumstances are figured as getting better and better. Consider Weiser's closing statement in 'The Computer for the 21st Century'

'ubiquitous computers will help overcome the problem of information overload. There is more information available at our fingertips in the world during a walk in the woods than in any computer system, yet people find a walk among the trees relaxing and computers frustrating. Machines that fit the human environment instead of forcing humans to enter theirs will make using a computer as refreshing as taking a walk in the woods' (Weiser, 1991, p. 75). What, then, is being talked about in ubicomp research when people refer to hope? This chapter has discussed a number of ways in which hope might be explored in relation to the future oriented practices of ubicomp R&D. Ultimately, I want to argue that in discussions around ubicomp, the invoking of 'hope' is a discursive practice that aligns a particular project with a broader ethos of value without having to be specific about how that value is judged. The 'statements' of hope made in and through visions of specific ubicomp projects thus have a conditioning function of situating the semblance of value, in the guise of 'something better'. The function of 'hope' expressed in relation to ubicomp is the mapping of a project into a broader, non-specific, notion of 'good' but at the same time asserting the particular goals of the project themselves as somehow operating to 'make things better'. 'Hope' in ubicomp facilitates, or is a shorthand for, anticipating a technological 'making the world better' by implicitly appealing to a meta ethical or moral narrative for improvement (i.e. 'God' or 'Progress') without having to specify what the underlying values by which we might judge that 'making better' are, or how they are derived.

Finally, following the discussion of preceding chapters, I want to return to a politics of anticipation, which, I suggest, is played out at several levels in the discourse of hope. There are three concluding points I want to make here. First, as discussed in chapter 3, practices of envisioning futures and accordingly the hopes they elicit are politically productive because they inspire and provoke debate about what should be valued in the near future and the avenues of research that should therefore be supported. The implied systems of value that support claims for the improvement of life, without substantiating how that value is arbitrated or judged, has the capacity to restrict the space of the political (following: Barry, 2001, p. 207).

Second, and following on from my first point, hopes can become economised. Hopes and visions thus become synonymous. As discussed in Section 6.2.2, 'political economies of hope' have been described in relation to high profile medical and biotechnology research (Delvecchio-Good, 2003; Novas, 2005) and I suggest there are similar, if less high stakes, negotiations of value at play in ubicomp R&D. As former Intel Researcher turned entrepreneur Ryan Aipperspach highlights:

'there is an interesting responsibility [in ubicomp R&D] to design and propose things that aren't completely possible' (Ryan Aipperspach, Berkeley)

This apparent imperative might on the one hand be described, following Stengers (2002, p. 248) as a 'passion of creating new possibility' – 'the hope that something new could be produced'. On the other hand we might see this imperative as both the obligation to produce 'visionary' or 'hopeful' articulations of the future and the obligation for those visions to be continued by virtue of the various forms of investment those visions receive, whether it be emotional or monetary. As argued in Chapter 4 differing communities of practice, which anticipate futures in particular ways, make up ubicomp R&D. There are various ways in which groups within that arena ascribe value on that research, whether it is intellectual property rights, the generation of expressions of interest at conferences, or the 'capitalisation' of a project (as Brown, 2005, p. 336 suggests regarding biotechnology R&D). Thus, the political economy of hope is entangled with competing applications of the anticipatory logic of foresight, which can be described as a 'pre-emptive argumentation over whether the projected state of affairs leads to good or bad' (Michael, 2000, p. 30).

Third, we might argue that there is no 'hope' peculiar to ubicomp. For, if most of the judgements of value that underlie the claims for possible and plausible improvement are based in familiar meta-narratives of morality or progress the 'hope' is actually invested in those narratives, however cryptogenic they may be. Yet, hope based in a rationale of foresight plays a particular part of how ubicomp is presented. Historical contextual discourses have been highlighted as one of the ways in which the statements of 'hope' express a form of programmatic discipline (following Foucault, 1991b, p. 80) as 'sets of calculated, reasoned prescriptions in terms of which institutions are meant to be reorganised, spaces rearranged, behaviours regulated'. As I assert in Chapter 4, although hopes and visions, and the practices that underlie them, can be seen to be programmatic, the inherent uncertainty of dealing with the proximate future, upon which ubicomp R&D attempts to operate, leaves intact the potential for what Adam and Groves (2007) call 'future presents'. This is precisely where hope as an 'anticipatory knowledge' (Anderson, 2007) operates. Particular ways of coding the future are thus made possible by hope, which form the basis for anticipatory action in the present. Value is ascribed to what is being hoped for and worked towards without a clear understanding of how that value is generated. In this way hope is situated in a politics of anticipation. By invoking forms of optimism to generate apparently 'better' worlds and attaching them to specific projects of ubicomp development other forms of future are necessarily elided. Assertions are made about making particular types of ubicomp future present without affirming an obligation to deliver what is hoped. In this sense, and as I will discuss in the concluding chapter, hope is a form of future orientation that is akin to a promise empty of obligation. Hope thus offers a means of ascribing potential value, the identification of 'better' futures, without necessarily having to specify how that value will be derived.

# Chapter 7

# Promising ubicomp? The politics of anticipation

### Introduction

The futurity of ubiquitous computing is multiple in its practice and expression. However, there are socio-technical and, significantly, political means by which that multiplicity is guided in particular ways. In this thesis I have explored the futurity of ubicomp as a discourse of anticipation, a proactive, material-discursive, future orientation that at once calls the future to be present and holds it at a relative distance. This concluding chapter examines the implications of the principal argument of this thesis, that there is a politics of anticipation inherent to the future orientation of ubiquitous computing. This politics of anticipation can be understood as the particular, sometimes contested, ways in which futurity is coded, and thus forms the basis of anticipatory action. In this chapter I argue that a politics of anticipation must be understood in the context of a delineation between 'politics', as a way of codifying particular forms of contestation which is largely exercised by institutions, and 'the political' as the excessive potential to create something new; a space of disagreement and sometimes antagonism that is constitutive of new forms of life (see: Mouffe, 2005, pp. 8-14; cf. Laclau, 1996). Given such an understanding, the futurity of ubicomp can be understood as betwixt multiple and varied forms of proactive anticipation and the notional obligation towards specific forms of future.

Ubicomp development is, in many ways, 'both an immediate issue and a "hundred-year problem" (Greenfield, 2006, p. 179)<sup>57</sup>. I suggest that Adam Greenfield's sentiment, from a passage in his 2006 book 'Everyware: the dawning age of

<sup>&</sup>lt;sup>57</sup> The passage in question references work by Gene Becker, formerly of HP Labs, who in a blog post talks about ubicomp as 'a one-hundred year problem', see: <u>http://www.fredshouse.net/archive/000159.html</u> (accessed: 09/02/10).

ubiquitous computing', can be read in two ways. Although the two readings may be contradictory, I argue that they are, together, emblematic of the negotiation of futurity as anticipation in and for ubicomp. First, the development of ubicomp is happening now. It is a contemporary concern, and aspects of that development are already finding their way into consumer electronics devices. For example, in the locative applications for Apple's iPhone or the growing reach of wireless networking ('wi-fi') facilities. At the same time, ubicomp development also asks how such systems and devices could and should be used, what we can and should expect from them as consumer-users. Such questions carry implications into the (perceived) long-term future. Second, we are enrolled into the attempts to make particular futures present in the various anticipatory development practices of ubicomp. Yet, at the same time, the futures in which ubicomp gets apparently made manifest are, and have been throughout its twenty year history, held at a proximate distance. The possible worlds of ubicomp always remain, in the words of the promotions for HP's 'CoolTown', 'just down the road' (HP Labs, 2003).

In this concluding chapter, I argue that the futurity of ubicomp rests in tension between multiple forms of proactive orientation to the future and the setting up of an obligation toward *particular* futures. This tension is at the heart of a politics of anticipation, which has been approached from different angles in each of the four preceding chapters, that demarcates the conditions of an emergent system of control inherent to technology development. This tension forms the spine of the argument of this chapter and it has three parts: first, the politics of anticipation detailed in this thesis can be broadly characterised as the ways in which futurity is codified and thus made to form the basis of anticipatory action. Second, an emergent 'system of control' arises to provide the conditions for further anticipation and the perpetuation of futurity in particular modes. In this thesis I have articulated these modes as expectation, foresight and hope, which are enacted through practises such as the production of imaginative representations of the future. Gilles Deleuze's exposition of 'control societies' is useful to understand this conditioning of future orientation. The emergent conditions for anticipation allow for the apparent freedom to look to the future, but within the already codified structure of various ways of addressing that future. Deleuze uses the analogy of 'highways' to explain:

'Control is not discipline. You do not confine people with a highway. But by making highways, you multiply the means of control. I am not saying that this is the only aim of highways, but people can travel infinitely and "freely" without being confined while being perfectly controlled' (Deleuze, 2006b, p. 322).

Third, the negotiation of an apparent freedom to address the future within the bounds of the codified norms of anticipation facilitates what I will discuss as the evacuation of obligation from apparent promises for particular futures. I argue that anticipatory practises of ubicomp R&D appear to imply an undertaking to realise particular forms of technological experience, but that such apparent promises are in fact the culmination of a set of contingent factors. What emerges is the appearance of a commitment to future action without the affirmation of a responsibility to follow through. The apparent promise is therfore evacuated of obligation. The implied promises of particular futures for ubicomp are thus turned into a technical exercise of futurity. My argument is accordingly that just as the multiple methods of anticipating future worlds of ubicomp are emergent so too are the attempts to codify and entrain that anticipation. To understand the function of anticipation in technology development I argue we can understand the difference between 'politics', as a system of codifying acceptable forms of future orientation, and the 'political', as the opening up of alternative and contested forms of futurity.

To conclude this thesis, this chapter folds together the multiple and simultaneous 'diagrammatic' mappings of future orientation found in the previous four chapters to articulate the politics of anticipation of ubicomp, as played out in the corporate research centres of Silicon Valley. Accordingly, the following sections systematically pursue a critical discussion about the politics of the discourse of

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anticipation for ubicomp in three parts. In the first section, the apparent evacuation of obligation from promised futures is discussed in terms of the forms of anticipatory action performed in ubicomp R&D. Second, the relationship between the formation of communities of anticipation within corporate ubicomp R&D and the constitution of relatively obligation-free claims for particular futures is explored. Third, three conceptual strata of politics and political action are examined as a means of analysing the politics of anticipation in relation to ubicomp. Moving on from the discussion of anticipatory politics, in the fourth section of this chapter I explain how this thesis has addressed the research questions laid out in the first chapter. Finally, this chapter concludes by detailing the relevance of this research to broader inter-disciplinary debates and ends with a discussion of openings on to further work.

### 7.1 Evacuating obligation from a promised future

Promises are disingenuous to the openness of the future (Rolfe, 2007, p. 10)

In this first section I explore how the promises for particular futures are evacuated of an obligation to deliver them. I address this problem in two moves. First, I discuss theorisations of the promise and the act of promising and describe how obligation is thereby articulated. Second, and building upon this theorisation, I chart the conditions that allow for promise and obligation to become uncoupled when referring to particular futures in relation to ubicomp. Promises are marked as distinct from the modes of anticipation discussed in this thesis by their notable absence from the ways in which those interviewed for this research described the future orientation of their work. The critical point of the argument in this section is the tension between the explicit avoidance of making promises within corporate ubicomp R&D, to avoid being held accountable for 'failure', and the apparent responsibility for particular forms of future implied by the ways in which futures are represented. Broadly, and first, promises are said to be made and given, to one's self and to others, in public and in private, written, spoken and signalled. The noun and verb perform slightly different opperations, *to* promise is an active operation, whereas *a* promise implies the opening of a contingency by someone to an 'other', which infers a responsibility. Promises in this way are taken as a declaration of assurance; they perform a vouching for a future action. An understanding of responsibility in this way describes a form of obligation enacted in a promise. Yet there is, following Nietzsche (2000b, p. 493, 2003, p. 34), a paradoxical nature to promising: 'human beings can intend a future they only see vaguely' (Vitek, 1993, p. 1). Even without asserting an intentionality, promising remains in tension with a subjective 'active forgetfulness' (Nietzsche, 2000b, p. 494, 2003, p. 35). According to Nietzsche (2000b, p. 494, 2003, p. 35), the (responsible) guarantee provided by a promise has become a necessary grounding to allow life's continuation.

Beyond Nietzsche's (2000b, 2003) exploration of a promissory 'will', to vouch for the future, promise has been explored as a practice of commitment, which 'we use to commit ourselves to a future act' (Vitek, 1993, p. 191). William Vitek, in a thorough exegesis on 'Promising' (Vitek, 1993), theorises promising as a deep-seated convention of behaviour; arguing that it is 'the practice on which we rely to have our future actions coincide with another's' (Vitek, 1993, p. 191). The practice of promising may be reduced to thinking both the discrete act of the promise and the action and disposition of promising as the question of 'how one's words or actions can create an obligation, something like an imperative beyond a responsibility, 'evaluation and judgement are important to the vitality and longevity of the practice of promising' (Vitek, 1993, p. 209). Accordingly, understanding promising as a practice of giving, receiving and evaluating obligation implies a common code by which evaluation might occur. This understanding of a promissory responsibility finds a particular ground in the history of law. As Nietzsche (2003, p. 41) suggests, it is in the realm of 'contract law that we find the cradle of the whole moral world of the ideas of "guilt", "conscience", "duty". Laws have pervaded a sense of responsibility that spans other arenas and activities of judgement, such as politics and religion. Contract law is perhaps the clearest example of the articulation of a responsibility, or further an obligation, in figuring the process of offer and acceptance. A debt, for example, at its simplest may be understood as 'the fulfilment of promises where an exchange has already occurred' (O'Malley, 2000, p. 472). However, in the context of a judiciary whereby there is an official arbitration of moral value, a debt, 'as offer and acceptance was a bilateral consensus', is the enactment of a promise between two parties and it is the promise as such that must be deliberated upon, therefore, in the development of 19<sup>th</sup> Century contract law, 'the content of a promise ceased to be of concern to the court' (O'Malley, 2000, p. 472).

The philosopher Georgio Agamben outlines the etymological basis for a legalistic understanding of promissory responsibility:

"The Latin verb *spondee*, which is the origin of our term "responsibility", means "to become the guarantor of something for someone (or for oneself) with respect to someone." Thus, in a promise of marriage, the father would utter the formula *spondeo* to express his commitment to giving his daughter as wife to a suitor (after which she was called a *sponsa*) or to guarantee compensation if this did not take place' (Agamben, 1999, pp. 21-22 original emphasis).

This formal contractualisation in speech sites the subject of the contract in a body, which will substantiate that promise and compensate for speculated loss should the promise be broken. The tension in applying such an analysis to the promise of a particular technology is, then, the diffusion of the locus of responsibility – where is the responsible 'body'? How do we reconcile a lawful subject responsible for the claims made for 'life-changing' and 'world-changing' technologies? The apparent promise of such technologies is grandiose and it alludes to an unspecified future in which the technologies may be realised. Given that such a future remains proximate but continually deferred, what do we consider to be 'the contract'? The problematic of conceptualising such acts of promising as obligations is the appeal to a common understanding of obligation as such, which seems to suggest a general rule of judgement. As many and various explorations of a lack of universality in judgement attest, from Nietzsche (2000a, 2000b, 2003) to Deleuze (1988b; 2004b) and beyond<sup>58</sup>: 'Promise as a practice resists the urge to make universal pronouncements' (Vitek, 1993, p. 233). We might thus argue that the forms of promising conducted in technology development, in common with the modes of anticipation explored in this thesis, retain an openness to the future(s). As Rolfe (2007, p. 8) suggests: 'there is something that happens in the making of a promise, something that cannot be foreseen, predicted, and yet a guarantee is still made'.

Promises for the philosopher Jacques Derrida (1982, 1995) are an inherent aspect of speaking. To speak is to promise to communicate: 'Each time I open my mouth, each time I speak or write, I promise' (1998, p. 67). Thus through an inherent language of promise, within and alongside other languages, one is responsible to and for the other before one even chooses that responsibility (Derrida, 1995, p. 394). Yet, a tension exists between the presupposition of the constancy of responsibility, because 'the promise presupposes the constancy of the self who stands by and authorises his word' (Burns, 2001, p. 45), and the potential failure of language to transmit 'truth': 'one cannot in principle demonstrate one's own word is truthful and that a promise has been given' (Burns, 2001, p. 45). For Derrida a promise, as such, is unrepresentable precisely because we cannot ever be truly sure of intentionality: 'We can never know with certainty what are own intentions are, let alone those of another' (Burns, 2001, p. 45).

<sup>&</sup>lt;sup>58</sup> On the notion of judgement in this light one might alternatively look to the critical analysis of Derrida (1998; 1999) on testimony, Levinas (2002; cf. Hand, 2002) on an ultimate responsibility to the Other, and Ricoeur (1976, 1992) on the availability of one to an other.

Responsibility to the other through promise (as understood through Derrida's writing) cannot, and does not, affirm a peculiar historical progress. The time-space of a promise, understood in this way, is of *l'avenir*, it is to-come<sup>59</sup>. This openness renders promise uncertain: whether or not the promised events will transpire, and when, is called into question.

How might we accordingly characterise the promise, or promises, of ubicomp? I suggest that there are two attributes of the expression of futurity associated with the development of ubicomp that may be understood as promising. First, the articulation of a future involving ubicomp, as made by corporate research centres, is often affirmative. Phrases such as 'you will...' or 'the technology will...' do, or facilitate, action are used. For example, in Microsoft's 'Being Human: Human-Computer Interaction in the year 2020' report the importance of screens is set in an imperative:

'what we read with and when we read will change considerably when paper is re-imageable, and when screens can be folded, rolled up and even stretched' (Harper and Selin, 2007, p. 18).

Second, a particular future is framed and specific attributes assigned to that future, which mark out a particular course of action to achieve that future (rather than another). When Microsoft illustrate their 'Future Vision of Productivity', in the form of a video, very specific types of technological encounter are depicted (as discussed in chapter 5). Similarly, in Nokia's 'Mixed Reality'<sup>60</sup> video actors are depicted using imagined technologies in particular ways, which are, of course, significantly different from those portrayed by Microsoft. We can thus see how there is an apparent commitment, by

<sup>&</sup>lt;sup>59</sup> For Caputo (with Derrida1999) *l'avenir* is affirmative of something completely other (*tout autre*) and, in some ways echoing Deleuze's (following Bergson 1988a) notion of a spatio-temporal immanence, *l'avenir* 'is neither real nor ideal, neither present nor future-present, neither existent nor idealizable, which is how and why it incites our "desire", driving and impassioning deconstruction' (Derrida and Caputo, 1999, p. 128).

<sup>&</sup>lt;sup>60</sup> The 'Nokia Mixed Reality' video was launched at Nokia's branded conference: 'Nokia World' in February 2009 and was subsequently made publicly available on YouTube. The video is available from: http://www.youtube.com/watch?v=CGwvZWyLiBU (retrieved: 03/02/10).

various different corporate groups, to a particular form of future action and the envisaged realisation of one type of future as opposed to another.

To develop my argument within a theorisation of promise, and moving on to my second point, we can see that the conditions exist for the dissociation of obligation to a particular future. While there are normative conventions by which obligation may be judged, there remain inherent doubts. Derrida (1995; see also: Burns, 2001) explores the doubts that are cast over the intentionality of the subject who vouches for the future. As Vitek (1993) notes, vouching for a future that we 'only see vaguely' (ibid. p. 1) lies in tension with an obligation to definitely deliver. Indeed, when it is not a single person making a promise but a corporation or other complex entity doing so, uncertainty must surely ensue. Not only does the reciprocal party, or 'promisee', have a less clear idea about who is making the promise but also any clarity of individual intention is lost. This is additionally confused when there is no single 'promisee' but instead an open promise is made to any, or perhaps all, potential consumer-users. Responsibility for a particular form of action in the future, and the means by which intentionality can be expressed, is dispersed in the very act of making representations of such promises.

Furthermore, a particular set of circumstances can be mapped within the future orientation of technology development, and ubicomp R&D in particular, whereby an undertaking for a future is invoked but obligation is lacking. What appears to be a promise to deliver particular forms of technological experience is, I argue, the culmination of a set of contingent factors that, together, give the appearance of a commitment to future action without affirming a responsibility to follow through. I want to quickly explore three of those significant factors before discussing their implications.

First, as I explored in chapter 3 in relation to 'expectation', a 'temporal horizon' is frequently set in R&D (often seven to ten years), which in a sense historicises that temporal domain by projecting a narrative into it. This is particularly tied to the

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corporate setting of ubicomp R&D, as studied in this thesis and discussed in section 2.3 of chapter 2. By virtue of a discrete projection of action forward expectations can be engendered and consumer-users may feel that a promise of certain action has been made.

Second, as I explored in chapter 6 in relation to 'hope', expressions of optimism are made that ascribe potential value, which identify apparently 'better' futures, without specifying how that value may be derived. It is easy to see how the optimistic appeal to 'better' worlds, and the identification of potential value in anticipated future technologies, carries the implication of the promise of a better future.

Third, as I explored in chapter 5 in relation to imaginative representations of futures, the specificity of representations of anticipated technological experience apparently lend material value to futures. Images stylise the content of the vision of a future in familiar visual vocabularies and give detail to imagined socio-technical activity to lend it material authenticity. While no explicit commitment is made to realise these products of fabulation, it is easy to see how the detailed and well-produced representations of future technologies associated with ubicomp R&D can be interpreted as promises to produce such technologies. Not least because they are associated with the kinds of corporate imagery and aesthetic of advertising that the large companies who fund R&D use to validate their 'visions'. So, taken together, these attributes of anticipatory action in ubicomp R&D, and others discussed in the preceding chapters, illustrate how such anticipation can be seen to carry the implication of promises for particular futures without the specificity of a particular undertaking of obligation.

Generalised assumptions about how the future is addressed and called into the present can become standardised as *the* vision for technological development, rather than one of many. The ways in which promises of technological futures can be assumed illustrate how emergent forms of future orientation carry with them the potential for generalisation. As Berkhout (2006) suggests in relation to expectations, particular forms

of future orientation that are codified, communicated and shared as 'visions' 'seek in some sense to create a *normative space* in which they can exist' (Berkhout, 2006, p. 309 original emphasis). I argue this rationale is similarly at play in the implication of promises, indeed it is necessary for their function because 'novelty can only seem plausible if it has a chance of being widely accepted as good' (ibid.). This can be, and is, exploited in the marketing of consumer electronics. Companies draw upon the implication of a promised 'better' technological future and intimate that the technology being marketed now is a step in that direction. In this way, devices like Apple's 'iPhone' or Google's 'Nexus One' are considered 'futuristic' and, in this sense, there is the appearance of associated promises for particular forms of future. Consumers are thus asked to literally 'buy in' to particular forms of future. Where there is no saleable device or system, as in the case of corporate ubicomp R&D, the implication of an undertaking of obligation or responsibility to create particular forms of future is emergent from various combinations of anticipatory practices.

Anticipatory action in technology development does not, of course, set out to condition the forms of futurity associated with the use of technology. However, as I have demonstrated in this section, the combination of different forms of anticipatory practice can cumulatively lead to particular conditions of future orientation. For example, the semblance of promising particular types of future and the association of an obligation or responsibility, even when no such undertaking has been actually made, is a rationale that lends credence to simplifying 'meta' narratives, such as technological determinism. Coinciding forms of future action can be read together as intentional and interpreted as particular undertakings when, in actuality, they may be merely contemporaneous. I argue the appearance of promising is emergent from assemblages of anticipatory practices that thereby situate normative conditions of future orientation. Such groupings of conditions can elide or constrain the various activities and arrangements of future orientation peculiar to specific circumstances.

The corporate setting of the majority of the empirical ground analysed in this thesis shapes, in part, much of the accumulation of particular conditions of future orientation that leads to the abstraction of obligation from apparent promises for particular futures. The conclusions drawn in the remaining sections of this thesis are predicated on the understanding that the particularities of the 'field' under scrutiny influence the kinds of conclusions that can be drawn. It is therefore necessary to reflect, albeit briefly, upon how the context of research and the means of analysis shapes the conclusions detailed in this chapter. I want to make two observations in this regard. First, the research participants, and corporate research centres in which many of them were working, addressed in this thesis are not fixed entities. Indeed, since the fieldwork for this research took place, HP Labs have made redundant a whole team of researchers involved in ubicomp R&D. This thesis treads the line of capturing an empirical snapshot while offering theoretically informed conclusions about the longer-term conceptual issues which thereby arise, specifically around a politics of anticipation. Second, and finally, all of the peculiarities of the corporate R&D 'site' of research for this thesis participate in the making of 'the realities' being studied (following Law, 2004). However, this thesis is not concerned with laying out the specificities of day-to-day activities of anticipation as researchers practise them, and subsequently how these Instead this work offers an analytical framework for become 'institutionalised'. understanding the rationales and types of practices by and through which the anticipation of a near future of ubiquitous computing is produced<sup>61</sup>.

Throughout this thesis I have argued that it is important to attend to the particular ways in which futures are discussed and practised to better understand how the future remains near, or 'proximate', for ubicomp R&D as practised in corporate settings in Silicon Valley. The formation of communities of practice around particular

<sup>&</sup>lt;sup>61</sup> In addressing the points raised in this section, this research is conducted following the diagrammatic approach outlined in section 2.1 of chapter 2.

forms of anticipatory action are significant to understanding the underlying practices and rationales that constitute the perpetually proximate future of ubicomp, and it is to those communities of practice that I turn now.

# 7.2 Catalysts for communities of anticipation in ubicomp

Anticipation is performative. It is arrayed in discourse and practice through particular forms of action and emerges in relation between the constituents of the event of that anticipatory action. It is the affectual formation of those relations that constitute communities of anticipation. The implication of promises for particular futures is also emergent from relations between anticipatory practises. There may be no fixed or explicit 'promisee' (to whom an undertaking of obligation is made) but a community or group that forms in the inter-relation of practices connect through shared values expressed in a common mode of futurity. In chapter 4, I argue that particular interrelated communities of practice that form in different contexts of funding, institution and research tradition galvanise around particular types of anticipatory practices. In this section I want to reprise this argument and discuss the common constituent features of anticipatory action that perform as catalysts or impetuses of communities of anticipation. I suggest that there are four key attributes of the practices of enacting, imagining and specifying futures that keep the proximate future of ubicomp as such, proximate and unattainable. I suggest these four attributes are: using the future as a tool, performative representation of the future, a network of visions of the future, and aspirations to 'change the world'. In this section I will discuss each of these 'catalysts' in turn. I argue that these common attributes of the formation of communities of anticipation demonstrate the 'operative logical' function (Massumi, 2007a, p. §17) of anticipation that enables the evacuation of obligation from apparent promises.

#### 7.2.1 Using the future as a tool

First, then, practices of anticipation utilise a prospective near future as a tool. As such, the objective idea of a future becomes a thing to be manipulated. In a sense, this apparent use of the future, almost rendered empty of content like a blank canvas ready for ideas to be projected upon, renders it a 'present future', in Adam and Groves (2007) terminology. As [anonymous] stated in an interview:

'The future is an absolutely essential tool that has to be deployed' ([anonymised], formerly of Intel Research).

However, this proximate future is not a blank slate, in fact the practises of anticipation rely on a host of tacit knowledges that are firmly situated in the present. As Nigel Thrift (2006) suggests, forethought stems from processes in the present, thus the status of the future addressed by practices of anticipation is, I argue, simultaneously 'present future' and 'future present', which Adam (2006) describes as 'present possibilities for the future'. Rather than being revelatory, as is the claim for some applications of 'foresight', representations of the future produced and discussed in ubicomp instantiate and make present a particular imagined socio-technical scenario. The 'future as a tool' is performatively represented in the present and situated by the practices by which such representations are formulated. Indeed, this form of anticipatory action reflects back upon the processes and groups that spawn representations of the future, as [anonymous] goes on to say:

'the visions that we have are useful diagnostic devices [for] our own values' ([anonymised], formerly of Intel Research Berkeley).

We may not be able to 'diagnose' particular invocations of future oriented value in the event of their formation within a community of practice, but the 'visions' that are produced by particular groups offer an insight into how anticipation has been practised by a specific community of practitioners.

#### 7.2.2 Performative anticipation

Second, as already suggested, the future is performatively represented through anticipatory action. Representations of particular types of future (as explored in chapters 4 and 5) can constitute and condition anticipatory practices and representation is key to the ways in which anticipatory action is exercised to encourage particular ways of thinking futures. As Brian Massumi (2005) suggests (in the context of pre-emption but it is equally applicable here): certain feelings are anticipated and 'the anticipation precipitates their arrival' (Massumi, 2005, p. 40). I argue that the constitutive agency of the production and proliferation of representations of the future in and through R&D is key to the institution, development and storytelling of ubicomp. Imaginative practices of representation can become a powerful visual shorthand, but they can also become too static and outlive their usefulness. Likewise, the viewing of such images is a performance of representation, the distributed codification of a particular imagined future. Imaginative representations of the future remain, for some, abstract tools, an immaterial future never to be made present. For others, 'visions of the future' are constitutive - they are not a means of operating on the future but, because anticipation is enacted in the present, 'the representation of the future, conceptualised as a performative materialised artefact shapes the 'present' in which it performs' (Michael, 2000, p. 34 original emphasis). The 'performative materialised artefact' of Weiser's (1991) depiction of Sal's world, for example, helped shape the research environment in which it was performed both at Xerox PARC and more broadly in aiding the initiation of a Ubicomp research community.

#### 7.2.3 Networked anticipation

Third, there is not one single 'vision of the future' but an interconnected network of different forms of anticipation. As discussed in chapter 4, in the broadest sense there are sub-disciplinary genres, for 'ubicomp' is not the only label for research that has been influenced by (and references) Weiser's work. In addition to the conference and various journals that utilise the 'ubiquitous computing' terminology there are the journal and conference 'pervasive computing' (convened and published by the Institute of Electrical and Electronics Engineers) (Satyanarayanan, 2002); the relatively recent 'urban computing' (Kindberg et al., 2007; Paulos et al., 2004); and the predominantly European 'ambient intelligence' (Information Society Technologies Advisory Group, 2003). Different terminologies push forward different agendas. Some specifically evoke Weiser's vision, others express their own forms of anticipation. As I demonstrated in chapter 4, researchers will present research across forums and will thus have to slightly reformulate the means of representation to meet the forms of anticipation associated with each agenda. For example, the same project might be presented as intimately tied to the exploration of facilitating user mobility, and also presented elsewhere as an investigation of devices demonstrating 'context awareness'. One might suggest that it is fairly obvious that the products of practices of anticipation do not emerge fully formed:

'When you go to a conference talk, of course, you'll hear everybody talk about their coherent vision – it will appear as though there was this great linear narrative from the beginning but that's not the way it actually works' (Scott Carter, Fuji-Xerox Palo Alto Lab).

The 'circulating reference' (Latour, 1999, pp. 76-79), founded in the simplicity of the 'performative materialised artefacts' of anticipation, facilitates the adoption and development of particular modes of anticipation. What 'sticks', the anticipatory action that is successful, can take on something of a 'programmatic' guise, becoming a form of 'meta' narrative, or can also become perceived as a promise. Not only do anticipatory practices facilitate the propagation of a certain sense of futurity but also its regulation. Whilst the network of for ubicomp demonstrates diversity, there is also something of a self-regulation, not least through the invocation of Weiser's work.

#### 7.2.4 Affective altruism

Fourth, as discussed at length in chapter 6, there are obvious forms of altruistic ambition at play in practices of anticipation associated with ubicomp R&D. Many of those involved in the diverse and wide-ranging ubicomp projects in both academic and industrial research centres express or imply an ambition to 'change the world for the better'. The connotation of 'world changing' active in the anticipatory discourse of ubicomp, I argue, follows a particular type of rationale distinct from a doctrinal commitment or transcendental push. For example, Eric Paulos with others (2007; 2008b) has pushed forward an agenda for the development of existing technologies as platforms for 'sensing' environmental data to empower local communities. Further examples of this type of research can also be found in a recent *Environment and Planning B* themed issue on 'Space, sociality and pervasive computing' (see: Dave, 2007). Following Stengers (in interview with Mary Zournazi 2002), one might suggest there is an irrational edge to the logic of foresight practised to change the world, it is a 'passion of creating new possiblity' (ibid. p. 248). This is somewhat different from Ben Anderson's (2006b) inference that hope largely stems from the tragic, instead it is tied to an intellectual curiosity. It is a form of 'hope' exercised not in the assuming of power over the future, but as the exercise of creative potential: 'the hope that something new could be produced' (Stengers and Zournazi, 2002, p. 248). As I assert in Chapter 4, although 'hopes' and 'visions', and the practices that underlie them, can be seen to be programmatic, the inherent uncertainty of dealing with the proximate future, upon which ubicomp R&D attempts to operate, leaves intact the potential for what Adam and Groves (2007) call 'future presents'. This is precisely where hope as an 'anticipatory knowledge' (Anderson, 2007) operates. Hope offers a means of ascribing potential value and the identification of 'better' futures, without necessarily having to specify how that value will be derived.

The four attributes of anticipatory action that precipitate the formation of groups, or 'communities', collectively demonstrate the 'operative logical' function (Massumi, 2007a, p. §17) of anticipation that I argue enables the appearance of an ongoing commitment to realise particular futures without a specific accountability to 'Operative logics', following Massumi (2007a) are forms of rationale that deliver. include in their structure of reasoning the means to self-perpetuate. Modes of anticipation, as I argue in chapter 4, are sustained by operative logics. I argue that the attributes of anticipatory action in the practices of ubicomp R&D discussed in this section demonstrate a rationale inherent to those practices of R&D that maintains anticipation as such. This is the conceptual apparatus that both constructs and perpetuates the 'proximate future' (Bell and Dourish, 2007b) of ubicomp and facilitate the disregard of any obligation tied to perceived promises for such near futures. The multiple and self-perpetuating ways of anticipating a future world and the ways in which they condition understandings of futurity thus constitute a politics of anticipation, to which I turn now.

## 7.3 Ubicomp and a politics of anticipation

'Politics is the art of [conditioning] the possible' — Otto von Bismarck (adapted)<sup>62</sup>

Arguments in the vein of an unproblematic means of addressing futurity can be constructed about the various attributes of futures of ubicomp, whether tabs, pads and boards should be faithfully realised, or an alternate vision such as HP's 'CoolTown' or Microsoft's 'future visions' should be rendered material as the 'authentic' future of ubicomp. However, regardless of what is chosen or negotiated as the authentic future, particular modes of futurity are perpetuated. Technologies are realised, consumed and

<sup>&</sup>lt;sup>62</sup> The unaltered quote: 'politics is the art of the possible' is attributed to Otto von Bismarck, reportedly said in conversation with Meyer von Waldeck, by Heinz Amelung (1918) in an edited volume of Bismarck's collected sayings, as recorded in the 'Yale Book of Quotations' (Shapiro, 2006, p. 86).

sold, that may be categorised as ubicomp, which is not the concern here. It is precisely the modes of futurity themselves that this thesis puts in question – this is the politics of anticipation, the contestation and negotiation of how futurity is discussed, practised and ignored with regard to ubicomp.

Throughout this thesis I have charted aspects of a politics of anticipation with regard to the modes of anticipation discussed in each chapter. In this section I assemble a fuller articulation of the politics of anticipation I have explored in the practices of ubicomp R&D. This proceeds in two parts. First, I summarise five key aspects of the politics of anticipation discussed in the preceding chapters, tying together the conceptual threads. Second, I map out what I theorise as three strata of the politics of anticipation I argue is inherent to ubicomp. This section culminates with my argument for how such a politics may be addressed, which will be elaborated upon in the next, concluding, section concerning the relevance of this research to broader debates.

First, I have already suggested that the politics of anticipation detailed in this thesis can be broadly characterised as particular ways in which futurity is codified and thus form the basis of anticipatory action. Following Andrew Barry's (2001) work on the governance of technological societies, politics 'refers to the conventional forms in which the term is used' and is 'a way of codifying particular forms of contestation' (Barry, 2001, p. 194). However, given this definition, the boundaries of such a politics are the objects of its enactment. Thus, to index the emergent and febrile timespaces of contestation and the varying durations of anticipatory action we can employ the notion of the 'political' (Following: Agamben, 1993). The political offers the articulation of a 'space of dissensus and contestation which is not reducible to politics' (Barry, 2001, p. 207). We therefore have a means of articulating differences between the conditioning action of 'control' (pace Deleuze, 2006b) as politics and the excessive potential of the political to create something radically new. Respectively, this is the difference between normative politics, in the guise of emergent 'systems of control' that arise to provide the

conditions for further anticipation and the perpetuation of futurity in particular modes, and the disruptive 'political', which emerges in the charting of alternative forms of anticipation.

In this light, and second, the practices of anticipation are politically productive because they inspire and provoke debate about the direction of research and possible uses of what might otherwise be considered 'value neutral' technologies. In this sense it might be suggested that technological R&D has an innate political value. Interestingly, similar concerns have spawned an associated literature for 'value-sensitive design' (Friedman, 1997). Who adopts responsibilities for arbitrating and deciding such directions, and how, constructs specific communities of practice, such as 'ubiquitous' perhaps vs. 'pervasive' or 'ambient' (although often these delineations are overly simplistic), which, Barry (2001, p. 207) notes, has the capacity to restrict the space of the political. However, whilst 'visions' such as Weiser's 'Computer for the 21st Century' have a regulatory effect on the ways in which practices of anticipation play out, the discourse of anticipation allows for more subtlety. The statements through which we can describe, and attempt to make present, particular types of future contain variety that allows for the potential of difference in the repetition of 'operatively' perpetuated anticipation.

Third, a politics of anticipation plays out between different groups, which I have identified in this thesis as 'communities of anticipation'. These communities can seek to assert conditions, or exercise power over the articulation of the future for ubicomp. However, they are also enrolled into forms and conditions of anticipation that emerge in the enactment of practise. We are not speaking here of politics associated with conventional institutions of government. Instead, following political philosophers such as Alain Badiou (2005), Ernesto Laclau (1996) and Chantal Mouffe (2005), we can understand politics as not grounded in the traditional entities often presumed to exercise power. It is a form of politics allied to Deleuze and Guattari's (1994) evocation of a 'minoritarian' politics in which 'publics' can produce 'not as their aim but in the very process of their emergence, the power to object and to intervene in matters which they discover concern them' (Stengers, 2005, p. 161). As I argue in chapter 4, in the case of a politics of 'making futures present', we can find a basis for anticipatory politics in the emergence of community. Whilst there is certainly validity in contemporary critiques of political discourse that it can be become 'narrowly empirical in its focus on formal political institutions' (Barry, 2001, p. 199), it is important to ask and perhaps rethink what are the 'institutions' of anticipatory action. The communities of anticipation that form around particular practices become institutions of another kind. They 'institute' meaning in the process of 'making futures present' and only last as long as those processes last. The driving momentum of this process is the collection of anticipatory practices described in this thesis, which are the means by which people are persuaded towards particular futures. This 'persuasion' is the unifying 'point in which the 'reasons' for a belief and the 'causes' of the belief constitute an inseparable whole' (Laclau, 1996, p. 116). The politics of anticipation is the playing out of 'persuasive' anticipatory action, enacted in anticipatory practices; rationalised through anticipatory logics; and enrolled in communities of anticipation.

Fourth, if we read a politics of anticipation in terms of the exercise of power then we might think about the artefacts of imaginative representation, such as 'vision videos' (discussed in chapter 5), as vehicles for asserting authority and thus laying claim to the future. A normative 'technologically determinist' reading of vision videos might see their content as goals towards which companies are specifically working, largely driven by economic imperative (Galbraith, 1974). Anticipation can become institutionalised and thus be seen as regulatory (Foucault, 2007, pp. 29-54), insofar as anticipatory action can be figured as programmes—which are 'sets of calculated, reasoned prescriptions in terms of which institutions are meant to be reorganised, spaces rearranged, behaviours regulated' (Foucault, 1991b, p. 80; see also: Rabinow, 2003, pp. 39-40). The rationale here would be the calculation of *the* future as 'present future'. Alternatively, if we understand anticipation as the performative representation of a 'future present', then power is less clear-cut. The 'mechanisms of power' (Foucault, 2007, pp. 1-2) emerge from, and are an intrinsic part of, the relations in which the performative artefacts of anticipation are situated. The power of the 'vision of the future', or rather its artefact, is the effects it has on what I have discussed as the 'technological unconscious' (following Clough, 2000; Thrift, 2004c), and these effects are emergent. The anticipatory action enabled by artefacts of anticipation is akin to an affordance (pace Dourish, 2004b, p. 118). Rather than a property of the environment, an anticipatory affordance is a property of the body that affords action should that body become appropriately equipped. Anticipation therefore remains as such, it can be propagated, and perpetuate itself (Massumi, 2007b).

Fifth, the politics of anticipation can be articulated as the negotiation of 'desire'. In this sense I suggest desire can be figured in two ways: as the presence of an absence in the present that infers the future (akin to a Hegelian sense of desire, see: Kojève, 1980); or the 'pre-personal' push of a world that is becoming; the impulse that carries us 'forward' (Thrift, 2000, pp. 216-217; pace Deleuze, 2004). According to the former desire comes forth from an implicit state, such that 'everything has, in a sense, been here all along' (Butler, 1987, p. 24). Desire according to the latter is the 'sub- and super-personal' production of reality even though 'social representation and belief deprive us of much of that reality ex post facto' (Holland, 2005a, p. 54). Future orientation, not as a determinate state but as an openness to potential, is a strong underpinning of the means by which the world is performed. Desire flexes in constant tension with the necessary rational push for description and representation. The performative aspects of anticipation are entwined with the technological unconscious and it is here that a politics of anticipation as the negotiation of desire operates. For it is the technological unconscious, that pre-personal substrate of unconsidered anticipations

(Thrift, 2004c, p. 177), which affords 'new senses of sense [to] become possible built on the new frames of anticipation and forms of memory that can show up and be touched in and by events now' (ibid. p. 188). Perhaps the most important effects they have are therefore interpretations of the present. There may be no conscious working towards particular goals nor a conscious expectation but as iterations of technologies ebb and flow, apparent 'advances' are not a surprise, they are already bodily familiar. As McCullough (2004, p. 261) suggests: 'the success of design is arrived at socially', or in this case between the viewer and the communicative space of the video. The space of the technological unconscious, and the forms of unconsidered anticipation therein, is 'within a signifying chain as the instability of all iterability' (Butler, 1991, p. 28), which, for Butler (ibid.), is the iterability of difference in the performance of identity. As such 'the unconscious, is not 'in' the body, but in the very signifying process through which the body comes to appear' (ibid.). Not only tool-use but our imagination of technology is therefore inherent to the technological unconscious, always and already filtered through 'cultural markers inscribed in visceral process[es]' (Connolly, 2002, p. 34). Thus, in the imaginative representation of futures of ubicomp: 'Cultural questions... are prior to, not consequent to, design practice' (Dourish and Bell, 2008, p. 12).

The five aspects of a politics of anticipation for ubicomp I have summarised here can be situated in a broader understanding of the difference between politics and the political. Futurity and the proactive future orientation I have characterised as anticipation are realised in relation. It is in the assemblage of practices at particular moments in the development of ubicomp that anticipation is instantiated as evental. These events are singular moments of collective knowledge and practice that instantiate networks of activity, ideas, feelings, people, techniques and more, which add up to particular forms of anticipation. The formation and identification of such relations as discussed in the five points above, and the subsequent formation of anticipatory action, is political. So, in concert with this discourse of anticipation in ubicomp, I suggest there are three tranches of interlocking and performative activity of politics/political actions, which may be sketched as: 'simplifying programmes', 'codings & conditions' and 'excessive reckonings'. To conclude this section, I will discuss each of these three aspects of the politics of anticipation of ubicomp.

#### 7.3.1 Simplifying programmes

First, meta-narratives of progress that impose a teleology, such as technological determinism, are *simplifying programmes* that are projected on to assemblages of practices to over-code activity with an accepted doctrine. Such programmes of thought have little to do with the peculiarities of the activities of ubicomp R&D and a lot more to do with generalising activities of governance. This is evident in the ways formal institutions of government address all technology R&D with a discourse of 'innovation'. Simplifying programmes of future orientation attempt to assert particular, 'authorised', ways of discussing the future of ubicomp. The 'system of knowledge-power' produces objectives that are the things (to be) controlled by being wanted for the desired future (Foucault, 2007, p. 42). Exercises in programming attempt to address the complexity inherent to notions of an unscripted future by masking that complexity, in favour of goals and targets that can be measured. Programmes, following Foucault (1991b, 2007), result in an apparatus of control, which necessarily focus on that which may be controlled, and attempt to mask what lays outside of that control. Whilst programmes and their resulting governmental apparatus can assert a conventional mode of anticipation they remain one of 'a set of diverse realities articulated onto each other' (Foucault, 1991b, p. 81), all producing a different sense of futurity:

"The difference between envisioned aims of a program and its actual effects does not refer to the purity of the program and the impurity of reality, but to different realities and heterogeneous strategies' (Lemke, 2002, p. 56).

#### 7.3.2 Codings and conditions

Second, conventional activities of negotiating the meaning and means of addressing desired or feared attributes of the future operate as codings and conditions of particular forms futurity. In broad terms, codings of futurity are the accepted forms of terminology and techniques used to make particular futures present. I have identified these as modes of anticipation-specifically: expectation, foresight, and hope-and explored their rationale (in some cases specific logics, such as: fabulation and invention) and associated practises, such as: enacting, imagining and specifying futures. An integral part of codings of futurity is the implicit conditions such coding lays down. While such conditions of anticipation may not be as programmatic as imposing narratives of progress, these conditions assert bounds to a discourse. The conditions identify the group of statements and practices that determine the range of ways in which it is possible to address futures of ubicomp. Conditions or conventions afford 'a certain regularity in the relations between statements that provides an unproblematic way of talking about a topic' (Allen, 2003, p. 25). This is not the assertion of disciplinary authority, the politics played out in the codings and conditions of anticipation is the negotiation of the control over what is possible to say about the future(s) of ubicomp, particular amongst those that develop it.

#### 7.3.3 Excessive reckonings

Finally, and third, there is not always a clear identity, political interest or programme at stake in the practices through which ubicomp is anticipated. There are *excessive reckonings* of futures that may not succeed, may be fiercely contested and constitute small constituencies, this is the space of 'the political' (following: Barry, 2001; cf. Agamben, 1993). The 'excessive' nature of 'political' anticipation is located in events of future orientation, the moments in which communities of anticipation assemble: 'singularities form a community without affirming an identity... humans co-belong without any representable conditions of belonging' (Agamben, 1993, p. 84). What is distinctive about such formations is their emergent characteristics, as Deleuze suggests:

'what counts in such processes is the extent to which, as they take shape, they elude both established forms of knowledge and the dominant forms of power. Even if they in turn engender new forms of power or become assimilated into new forms of knowledge. For a while, though, they have a real rebellious spontaneity' (Deleuze, 1995, p. 176).

These are the characteristics of the political as an event, in the case of technology R&D it is the proposition or prototyping of, what some call, 'disruptive technologies', which are devices and systems that change how we think about technology. These political formations are not common, because the practice of politics is the convention:

'events... can't be explained by the situations that give rise to them, or into which they lead. They appear for a moment, and it's that moment that matters, it's the chance we must seize' (Deleuze, 1995, p. 176).

However, significantly different ways of thinking futurity do happen. Mark Weiser's work, which led to all of the R&D explored in this thesis, was arguably a political event of anticipation. A group of researchers, initially across a few research institutions, converged on a set of compelling ideas that sparked debate, in Deleuze's terms: the chance was seized. These ideas were indeed assimilated into new forms of knowledge and produced codings and conventions of addressing particular forms of future, but they stemmed from an event. The repercussions of that event are still evident in the forms of research conducted now.

In this section, and throughout this thesis, I have argued that particular ways of addressing the future in ubicomp R&D signal a politics of anticipation that situates and conditions what it is possible to say about futures of ubiquitous computing. Complex forms of technology development and the associated and diffuse modes of anticipation that are practised as part of them necessarily have groups and particular methods attached. As groups align, methods become normalised and a discourse of futurity is instantiated, the attributes of future orientation can form the bounds of emergent systems of control. The immaterial discourses of anticipation are lent materiality in the living present by virtue of the forms of anticipatory action through which they are elicited. I have illustrated how the affective dispositions of anticipation, which emerge within the relations of discourse and practice in the formation of communities of anticipation, are the material evocation of these forms of futurity. In the context of ubiquitous computing I have argued that a proactive form of addressing the future can be identified as a discourse of anticipation, which in turn carries political implications. In light of the observations of this research I suggest it is necessary to make the politics of anticipation, and other mechanisms of addressing the future, explicit in technology development. We should thus attend to socio-technical futurity as inherently situated in the living present, with all of its associated concerns, and allow for the indeterminacy of the future.

#### 7.4 Research questions

Following on from my specific concluding arguments on the politics of anticipation and ubicomp, I am able to offer some responses to the specific research questions I posed in section 1.4 of chapter 1.

1. How are the rationales of anticipation inherent to ubiquitous computing produced, normalised and contested?

Although, as I suggested in chapter 1, there are 'many ubiquitous computings' (Greenfield, 2006, p. 11) and the observations of this research are specific to the practices and practitioners I have studied, I can point to two inter-related ways in which anticipation is produced in ubiquitous computing development. First, there are practices of anticipation that function as human cognitive and material engagements with the world that attempt to give content to futures. Anticipatory practices are a means of establishing the presence of what has not happened and may never happen, an

'indeterminate potentiality' (Massumi, 2007a, p. §13). In chapter 4, I discuss three specific types of anticipatory practice as 'enacting', 'imagining' and 'specifying' futures. Futures are apparently made present through practises that stage the possible through some form of acting, gaming or pretending. Imagination is used in practise not to necessarily predetermine the future but to open out and explore spaces of possibility. Established practices of development can thus be reconfigured through these imaginaries. Specific scenarios are formulated to array a multiplicity of options and variables that are described and quantified to make the potential of a future present. Second, interior to practices of anticipation are logics that regulate how those practices are enacted. In chapter 4 I explored logics of fabulation and invention as specific forms of foresight and in chapter 6 I suggested that the overt optimism for 'better' futures exhibited in ubicomp development practices follows a logic of hope. A key tenet of the modes of 'foresight' and 'hope' practised in ubicomp is, I argue, an 'operative logic' (Massumi, 2007a) of forecasting and optimism. Anticipation, as practised in ubicomp R&D, is an iterative process. Anticipatory action has a duration, as discussed above, but it is motivated by an 'operative logic' because their ethos inherently perpetuates further anticipation. I suggest that particular forms of anticipation in research remain anticipation. I argue that by looking at the rationale, or anticipatory 'logics', that are used in their instantiation, through particular practices, we can examine particular ways in which we produce futurity. Furthermore, I argue, in this chapter, that such logics can be codified, normalised and sometimes contested in a politics of anticipation.

2. How are the anticipated futures of ubicomp located in relation to the present?

The locus of ubiquitous computing in a near future was present from the outset, as Genevieve Bell and Paul Dourish (2007b) assert, in the shape of Mark Weiser's 'foundational' article, entitled 'The Computer for the 21<sup>st</sup> Century'. Weiser's (1991) description of computing devices for (and in) a proximate future was spurred on by interdisciplinary community of practice at the Palo Alto Research Centre (PARC). Weiser's (1991, 1998; 1999) vision, and subsequent experiments, positioned ubicomp technologies not in fanciful or outlandish scenarios but rather in apparently 'everyday' office or home life (Galloway, 2004, pp. 385-388). Those involved in this early ubicomp research set great store by both 'envisioning' futures by depiction through storytelling (cf. Gold, 2007, pp. 36-41) and by constructing simulations of future computing environments (cf. Want et al., 1995; Weiser et al., 1999). This latter, 'time machine' (Bell and Dourish, 2007b, p. 134), approach required significant investment and resources and certainly captured the imagination of scientists and engineers who took the research forward and set a precedent for the forms of anticipatory practice discussed earlier.

The centrality of a 'proximate future... just around the corner or over the horizon' (Bell and Dourish, 2007b, p. 134) in Weiser's (1991) foundational vision of ubiquitous computing, and the manner in which it continues to live in the writings of contemporary researchers, continually places its achievements out of reach, while simultaneously eliding current technological practices. The distance of an anticipated future from the present connotes a relative activity of that future – both in one's ability to affect its production and the ways in which that representation of a future can perform. This is a key area in which the politics of anticipation operates. However, in the case of ubicomp, not only *was* the future of Weiser's vision proximate, it also remains so, as the referent object of the discourse of anticipation. The anticipated 'futures' of all subsequent renditions of ubiquitous computing remain anticipatory because they are emergent from practises that take place in the present. As a spatial imaginary, the locus of the proximate future remains distantiated. Ubiquitous computing futures are aspirational; they are not taken as benchmarks or goals against which to measure 'progress'. Instead, futures in ubicomp R&D are figured as a means to ascribe potential
value to particular ventures, without necessarily specifying how that value will be derived. These proximate futures are kept separate from the ways in which what is produced is addressed, measured and made manifest. What is produced, as prototypes, proofs of concept and imaginative representations, is measured and addressed as a present concern in terms of the potential value, it is in a sense secondary to practise of anticipation itself. This highlights the value of theorising a politics of anticipation; it provides a means of articulating how these forms of anticipation are perpetuated, normalised and contested.

### 7.5 Broader debates and openings onto future work

Reflecting on the research project represented in this thesis I can highlight several areas that this work informs both within broader debates in the increasingly interdisciplinary discourses of futurity and technology. I suggest that this work can offer an interface between these debates, not least with human geography. In particular, I argue that this thesis provides a means of articulating how proactive forms of futurity are thought, practised and contested through the conceptual resources of theorising a discourse and politics of anticipation. In this final section I offer suggestions of how this contribution to broader debates might be articulated and I signal openings onto future research.

Theoretically, this thesis has developed a framework for articulating proactive forms of future orientation situated in the living present. This was built from a postphenomenological sensibility, following Hoy (2009) and Ihde (1993, 2009) but read through recent debates in non-representational geographies (for example: Anderson, 2006a; Ash, 2009; Dewsbury, 2007; Thrift, 2004c), and supplemented by an eclectic, but broadly Foucauldian, or 'genealogical', reading of interdisciplinary debates around futurity and technological experience (particularly: Adam and Groves, 2007; Barry, 2001; Brown et al., 2000a; Massumi, 2002b, 2005, 2007a). The analytical framework produced in this thesis has focussed on the attributes of a performative discourse of anticipation that is eventalised in singular moments of anticipation, configured in assemblages of knowledge, people, places, practices, and things. Thinking about proactive futurity as trans-subjective and constituted in a living present allows us to attend to specific nuanced moments of anticipation. By addressing the ways in which anticipation, as a discourse, functions in both knowledge and practice, and by emphasising how this can play out at the level of the body, in forms of affect, this stance illustrates how futurity is not an abstract transcendent force or outside the moments in which it plays out. This is important to articulating how anticipation is multiple and inherently carries a politics that critically problematises 'meta' narratives of progress, such as what the geographer Nick Bingham has called the 'depressingly ubiquitous discursive scaffold of technological determinism' (Bingham, 2005, p. 202). Just as STS scholar Sally Wyatt (2008) argues, then, the technological determinism at play in the anticipatory discourse of technology development should not be merely discounted but attended to as one of the many aspects of its assemblage.

The empirical, and thus analytical, constraints of this work significantly shaped the diagrammatic account presented in this thesis. The context of corporate R&D is one of the co-productive factors of the 'reality' of the anticipatory politics of ubicomp presented in this thesis. It is worth noting that other forms of account are possible, given different means of addressing the field and in the study of alternative sites of ubicomp R&D. An in-depth ethnographic observation of research and development practices would have perhaps given more detail about the specificities of day-to-day practices. Equally, a shift in focus, away from the corporate sites of R&D, towards the 'start-up' companies engaged in the production of technologies that might fit within a ubicomp ecosystem of networks and devices could reveal different and alternative forms of anticipatory practice or logics. Thus, there are openings for broadening and varying the sites of study within the field of ubiquitous computing and related arenas of research.

More broadly, such an understanding of futurity may afford fresh insight into other future oriented activities that have been the recent subject of research. A number of agendas for various ways of addressing futurity have arisen in contemporary research Within this thesis I have identified three particular in the social sciences. interdisciplinary debates to which this thesis can make a contribution, which are: sociological studies of expectation, discourses of foresight and theoretical articulations of hope. In my discussion of a 'sociology of expectations' (Borup et al., 2006) I argue that expectations are somewhat treated as static objects for study, albeit situated in a complicated network of relations, with little investigation of how and why they are formed. I feel the politics of anticipation articulated in this thesis can be usefully applied to offer insights into the negotiation and contestation of such expectations. In relation to discourses of foresight, this thesis offers a useful conceptual method of identifying practises and logics of anticipation around which communities form, which engages the nuances of particular instances of futurity rather than over-arching narratives that mask the specificity of events. Similarly, rhetorics of hope both make and hide value judgements about what can be 'better'. As such, hope seems to operate by abstracting away from the specific instance or context of future orientation. Bv attending to those specific instances and the negotiation of value therein the implicit politics of such forms of futurity can be made explicit for study.

A common factor in the ways these interdisciplinary debates are being translated into human geography is, I argue, the articulation of a sense of trepidation or fear. A significant implication across work addressing a diverse range of subjects, such as: bio-security, nanotechnology, and the threat of terrorism, is that the future must be defended against (see, for example: Adey, 2009; Amoore and de Goede, 2008; Anderson, 2010d; Dillon, 2007; Hinchliffe and Bingham, 2008). Of course, many of these areas of study inherently carry themes of the precaution and prevention of undesirable circumstances and should rightly be explored as such. However, this thesis demonstrates that there is a greater diversity of ways of addressing the future prevalent in broader interdisciplinary debates with which geographers could readily engage.

Although I have focussed on the future orientation within ubiquitous computing as a case study I do not think that the discourse and politics of proactive futurity I have labelled 'anticipation' is reducible or peculiar to that form of technology development. Rather, proactive forms of futurity feature in a whole range of activities and circumstances that can bear further analysis. For example, other forms of science and technology practices project development into varying time horizons and attempt to make present particular forms of future, such as: biotechnologies (like genomics and genetic modification), nanotechnology, space flight, and medical technologies (such as stem cell research). More broadly, there have already been applications of debates such as the 'sociology of expectations' to case studies such as education and 'e-science' (for example: Pieri, 2009). I suggest that the analytical framework of a discourse of anticipation could also be readily applied to diverse contemporary concerns such as the politics of an ageing society in Western Europe, forecasts of a rapidly growing global population, attempts to forecast and mitigate climate change and the development of alternative sources of energy. It is important to note here that such analysis should not be conducted in such broad terms, instead, following the research discussed here, the aim should be to identify particular formations of future orientation, and, specifically, the communities that form around them.

Finally, the practice of futurity need not, and arguably cannot, remain the detached subject of dispassionate study. The conceptual framework generated in this thesis could be further developed in concert with other researchers and industry practitioners to inform the research and development process itself. As I believe this thesis illustrates, those involved in R&D are not blind to the ways in which they invoke

the future, nor are they necessarily naïve to the multiple and contested nature of how such futurity plays out in practice. I suggest it is not only possible but desirable for there to be increased interdisciplinary attention made to socio-technical futurity as inherently situated in the living present, with all of its associated concerns, which looks to allow for the indeterminacy of the future within the practices of research and development themselves.

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### Appendix 2

## Descriptions of influential companies in the Silicon Valley Area

#### Palo Alto Research Centre (PARC)

PARC is a research and development company, set up and formerly run by the Xerox Corporation, that has had an extraordinary impact on the development of computing as we know it today. Researchers at PARC were responsible for the laser printer, the Ethernet standard, upon which many computer networks are based today, and many of the facets of the modern personal computer, including the Graphical User Interface, made famous by Microsoft 'Windows'. PARC was also instrumental in the development of ubiquitous computing because it was the institution that employed Mark Weiser and facilitated his novel research projects that created the impetus for the field of research as it exists today. Ubiquitous computing research is still carried out at PARC, as one of many strands of research and development.

#### Fuji-Xerox Palo Alto Laboratory (FX PAL)

FX PAL is a leading multimedia research laboratory established in 1995 by Fuji Xerox. FXPAL broadly specialise in research into 'distributed collaboration' and 'interactive media', and as a company assert that their researchers invent information technologies intended to address key issues affecting businesses and society. Situated just down the hill from PARC, FX PAL has links with its neighbour, not least through the interchange of staff over the years. Ubiquitous computing features amongst the wide range of research projects conducted in the laboratory. FX PAL is principally responsible for conducted early stages research and development that feeds business development units in the parent company Fuji-Xerox.

#### HP Labs

HP Labs is the research and development arm of the large electronics corporation Hewlett Packard (HP). It is described as the exploratory and advanced research group for HP. The stated goal of the organisation is to tackle complex challenges faced by their customers and society while pushing the frontiers of fundamental science. The vast range of scientific research conducted at HP Labs dwarfs the relatively modest ubiquitous computing related research and development in which they engage. Such research has recently been significantly reduced in the dissolution of the 'Pervasive Media' research group at HP Labs Bristol. HP Labs' most significant contribution to ubiquitous computing research was the widely promoted 'CoolTown' research agenda, which produced high profile visions of the future depicted in text and images that were widely reported in the international media.

#### Intel Research Berkeley

Intel Research Berkeley is one of three laboratories in the Intel Labs Network, which Intel describes as an innovative approach to collaboration between industry and universities. The Berkeley lab shares principal researchers with University of California Berkeley and promotes experimental research and development that has been well received by the international media. Significant amongst the research conducted at Intel Research Berkeley was the 'Urban Atmospheres' research programme, led by Eric Paulos, which focussed on the use of existing mobile technologies, such as phone handsets, as platforms for ubiquitous computing applications related to contemporary environmental concerns.

#### Nokia Research Centre

The Nokia Research Centre is the research and development arm of the Nokia Corporation, comprising a network of twelve individual Research Centres located around the world. The stated aim of the Research Centre is exploring new frontiers for mobility, solving scientific challenges to transform the converging Internet and communications industries. The Research Centres work closely with universities of international standing in research that compliment the research goals of Nokia, in the case of the Palo Alto Research Centre this is Stanford University. While there is a broad range of research and development conducted at Nokia Research, the Palo Alto Research Centre conducts prominent research related to ubiquitous computing themes, speerheaded by the multi-disciplinary 'IDEA' team of designers, computer scientists, ethnographers, philosophers and engineers. The 'IDEA' team is led by Senior Researcher Mirjana Spasojevic, a former HP Labs researcher, who was significantly involved in the 'CoolTown' agenda. Significant amongst the contributions made to the field of ubiquitous computing by the Nokia Research Centre are the object recognitions systems designed for mobile phones equipped with cameras. These systems afford forms of contextual awareness a key theme in ubiquitous computing research and development.

#### Yahoo Research

Yahoo Research is global research section of the Yahoo corporation, concerned primarily with conducted research into communications and internet technologies. Amongst the stated goals of Yahoo Research is to invent the future of the internet. Yahoo Research is sited in seven labs situated around the world, amongst these is the Santa Clara Lab, in the heart of Silicon Valley. While Yahoo Research conducts a broad range of research and development from novel forms of advertising to machine learning, there are ubiquitous computing related research activities taking place at the Santa Clara laboratory. Significant amongst those involved in such research are Elizabeth Churchill and Marc Davis, working on novel forms of mobile technological experience. An example of such research is the 'Social Pulse' system that aggregates a user's social networks and communications tools into a socially connected address book on their mobile phone.