Reframing Space for Ubiquitous Computing:

A Study of a National Park

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For my family:

My parents John and Debbie,

My sister Jacinta,

My grandparents Stan, Irene, Margaret and Lindsay.

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List of Acronyms and Abbreviations

API – Application Programming Interface

Bourke Street – The main administration office of Parks Victoria

CSCW – Computer-Supported Collaborative Work

CVM – Cultural Values Management

FEM – Fire and Emergency Management

FIFO – First-in/First-out

GPS – Global Positioning System

HCI – Human-computer Interaction

NVM – Natural Values Management

PARC – Xerox's Palo Alto Research Centre

PV – Parks Victoria

RFID – Radio Frequency Identification

The 'Prom – Wilson's Promonotory National Park

The Park – Wilson's Promonotory National Park

TVS – Tourist and Visitor Services

Ubicomp – Ubiquitous Computing

WPNP – Wilson's Promontory National Park

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Appendix A – Application to Research Ethics Committee

Abstract

Since the late-1980's, researchers have been working on a "post-desktop" agenda for human-computer interaction known as ubiquitous computing. Visions for ubiquitous computing have been based around notions of embeddedness and invisibility: where mobile, networked and context-aware technologies are incorporated into the environments and objects of our everyday lives, and where the infrastructures required to operate them remain largely invisible. As this vision becomes partially realised, the focus of ubiquitous computing research has begun to shift towards considering the broader social and cultural aspects and implications of these developments. In addition to conceiving of their technologies as embedded and embeddable within built environments and objects, researchers are therefore beginning to recognise that they are equally embedded within social and cultural practices, interactions and productions. Particularly, as technologies find themselves in diverse environmental and social contexts, researchers are being asked to critically assess the role and potential their technologies have in both defining and shaping the spaces of our everyday lives, and the ways in which we understand them.

This research provides one such critical account of ubiquitous computing, approached through the frame (and reframing) of space. Whereas human-computer interaction has long sought to learn from and mimic physical interactions with the world, where spatial metaphors and conventions have been exploited in the design and implementation of interactive systems, critical accounts of the ways in which technologies reside in and help create spaces remain relatively under explored. As such, this research examines the relationship between ubiquitous technologies, the spaces of our everyday lives and the understandings we have of them. It does so through a cross-disciplinary engagement with cultural geography and the ethnographic practices of sociology and anthropology. It reframes the notion of space inherent in ubiquitous technologies away from one that equates it to a Cartesian representation of the world, or a source of metaphors, towards one that positions it as a social and cultural production. Building on this foundation, two multi-sited ethnographic studies with a state government organisation, Parks Victoria, are presented that demonstrate various productions of space in practice.

Based on analysis of these studies, a series of design inspirations are presented that reframe space as emergent and seasonal processes. Drawing on these design inspirations, two design concepts are presented that are envisioned for use within Parks Victoria: Habitat, a location-based platform for tacit knowledge, and Wayfarer, a visualisation and narrative tool for situated understandings. A reflection on these related pieces of research will then serve to highlight new, practical directions for further work in ubiquitous computing that incorporates perspectives from the social sciences, and moves beyond the typical divides between 'work' and 'non-work', 'urban' and 'rural' contexts.

1

Introduction

Since the late 1980s, researchers have been working on a "post-desktop" agenda for human-computer interaction known as ubiquitous computing (Weiser, 1991; Bellotti & Bly, 1996). Visions for ubiquitous computing have been based around notions of embeddedness and invisibility: where mobile, networked and context-aware technologies are incorporated into the environments and objects of our everyday lives, and where the infrastructures required to operate them remain largely invisible (Weiser & Brown, 1995). Whilst throughout the 1980s and 1990s the concerns of ubiquitous computing remained largely theoretical, the turn of the 21st century brought with it the proliferation of cheap mobile devices, sensors and network infrastructure that thrust ubiquitous computing's vision out of corporate research laboratories and into the popular imagination. Global Positioning System (GPS) technologies now appear in any number of guises to help locate and guide users through both familiar and unfamiliar spaces. Radio-frequency Identification (RFID) chips are embedded within smart-cards that facilitate interactions with everyday spaces: through public transport ticketing, security access and object identification. Smart-phones that contain a number of positioning and orientation sensors, high-speed data connections and software ecosystems used to be confined to science fiction but are now part of everyday lives. At the same time, personal physiological sensors are allowing people to quantify their health with the help of web services (Swan, 2012), and the number of 'smart' objects with networking capabilities continues to proliferate, contributing to the burgeoning movement known as the 'internet of things' (Ashton, 2009).

As these technologies become increasingly ubiquitous, driven by infrastructural improvements, engineering breakthroughs and plummeting costs, the focus of ubiquitous computing research has begun to shift away from exploring and exploiting the potential of sensors, systems and users (Dourish & Mainwaring, 2012), towards considering the broader social and cultural aspects and implications of this shift.

Indeed, with the partial, messier (Dourish & Bell, 2011) realisation of the original vision for ubiquitous computing, researchers have been encouraged to move their attention away from formulating near-future scenarios that position their technologies as utopian solutions, towards understanding and accounting for the ways these technologies are adopted and adapted, used and misused in everyday practice. In addition to conceiving of their technologies as embedded and embeddable within built environments and objects (Swan, 2012; Dourish, 2004), researchers are therefore beginning to recognise that they are equally embedded within social and cultural practices, interactions and productions (Coyne, 2010; Dourish & Bell, 2011; Galloway, 2004; Kitchin & Dodge, 2011). Particularly, as technologies find themselves in increasingly diverse environmental and social contexts, researchers are being asked to critically assess the role and potential their technologies have in both defining and shaping the spaces of our everyday lives, and the ways in which they are understood (Dourish & Bell, 2011; Kitchin & Dodge, 2011).

This research provides one such critical account of ubiquitous computing, approached through the frame (and reframing) of *space*. Whereas Human-Computer Interaction (HCI) has long sought to learn from and mimic physical interactions with the world, where spatial metaphors and conventions have been exploited in the design and implementation of interactive systems (Erickson & Kellogg, 2000), critical accounts of the ways in which technologies reside *in* and help *create* spaces remain relatively under explored (Kitchin & Dodge, 2011). As such, this research examines the relationship between ubiquitous technologies, the spaces of our everyday lives and the understandings we have of them. It does so through a cross-disciplinary engagement with cultural geography and the ethnographic practices of sociology and anthropology. It reframes the notion of *space* inherent in ubiquitous technologies away from one that equates it to a Cartesian representation of the world, or a source of metaphors, to one that positions it as a social and cultural production. It aims to make available and explicit pluralistic and relational notions of space, from cultural geography, so that ubiquitous computing researchers may better consider the ways in which their systems are embedded within, influenced by and influence the various networks, temporalities, movements and embodiments that represent the richness of our environmental understandings.

This research is conducted in the context of a broader research agenda, the 'Affective Atlas' project (Cartwright, et al., 2007), and in partnership with Parks Victoria, a state government organisation in Australia charged with managing a wide array of natural and ecological resources. The research was primarily conducted within Wilson's

Promontory National Park (WPNP), an iconic park in the State of Victoria some 300 kilometres east of Melbourne. However, this research also reaches to cover a number of Parks Victoria administrative offices in regional Victoria, as well as its head office in Melbourne's central business district. Through a multi-sited ethnographic study with the organisation, the ways in which space and environmental understanding are produced within it will be explored. To do this, a range of ethnographic methods are deployed using a 'reflective design' methodology (Sengers et al., 2005), where the author, as a researcher, embedded within a project context, responded to the 'scene and circumstance' (Schön, 1983) of the situation, where methods were deployed in a tactical manner that respond to the project's 'back-talk' (ibid.). Rather than describing a linear process where ethnography has been used in a way that 'gathers requirements' for the design of some system (Dourish, 2006) in a constraining manner, this research employs ethnography in a way that opens up new directions for ubiquitous computing.

Whilst methodological considerations were not the focus of this research, its set of methods and approaches, undertaken through the analytical frame of cultural geography, are intended as a contribution to both designers and ethnographers. They provide an example of how embedded research and reflective design, engaged with theory from the social sciences, can provide a more open dialogue between ubiquitous computing and ethnography, where ethnographic work is not just constrained to the study of users, but used to open up new design directions and opportunities.

This research's main contribution, though, is in offering a reframing of space for ubiquitous computing. It explores the ways in which space is typically conceived of in HCI and ubiquitous computing, where it is considered a static, inert and inconvenient *stage* upon which people act and objects exist. This is contrasted with theories of non-representational and relational space from cultural geography, where space is considered a pluralistic, relational and dynamic *production*. Much of this research is then dedicated to exploring the implications of this reframing, and these are also part of its contribution: it provides a set of methods and methodological approaches and an analytical framework for examining how space is produced in the organisation.

Two case studies with Parks Victoria are then presented, one that details spatial productions that occur in normed everyday park management, contrasted with a study of spatial productions that occur during a severe flood. Inspirations for design are then generated based on findings from this ethnographic work. Finally, using these design inspirations, two conceptual systems are then presented which explore and deploy them in practice.

The research presented here is intended to be of interest to both ubiquitous computing researchers conducting design work, as well as those conducting ethnographic studies. The methodological approach, with its toolbox of methods and analytical framework from cultural geography, provides an example of how ubiquitous computing can engage the social sciences in creative ways. The design inspirations and conceptual systems serve as embodiments of both the ethnographic work, and the reframing of space offered by this research. They serve as both theoretical and practical examples of how ubiquitous computing can both engage with ethnography, but also to deepen its understanding of the existing relationships and interactions between people and places. By making explicit the ways in which technologies can be seen as embedded within spatial productions, not just positioned between people and environmental understandings, this research ultimately provides an example of what it would mean for space and spatiality to be made legible in ways that do not problematise them.

1.1 Research Questions

With the contributions of this research and its intended audience in mind, the remainder of this chapter is dedicated to providing a more detailed overview. Three research questions guided this work. In answering the first research question – *What is the relationship between space, technology and environmental understanding, and where is that relationship headed?* – this research provides an overview of existing approaches to space and spatiality in ubiquitous computing, and offers a theoretical framework from cultural geography, for examining a reframing of this relationship. This theoretical foundation leads to the second research question – *How can we expand this relationship, in a conceptual way, so that this relationship is useful for designers of technology?* – where the multi-sited ethnographic work is presented as a means of expanding this relationship in a way that positions technology within spatial productions, not as imposed solutions. From this, design inspirations are formulated and two conceptual systems are presented which show that this expanded relationship, based on a reframed space, can provide ubiquitous computing with not only practical design solutions, but also new design directions. The final research question – *Given this expanded relationship between space, technology and environmental understanding, what are the implications for Parks Victoria and, more broadly, parks management?* – is intended to ground this research in the concerns of the 'Affective Atlas' project and Parks Victoria's work contexts.

1.2 Chapter Summaries

Chapter 2 details the research context for this thesis, describing the 'Affective Atlas' umbrella project and the nature of the research partnership with Parks Victoria. In outlining these overlapping contexts, it provides the methodological foundation, approach to design and methods for design of this research. It describes the multi-sited ethnographic approach to this research partnership, where the "chains, paths, threads, conjunctions or juxtapositions of locations" (Marcus, 1995. p.105) became the foundation for this work. It explains the methodological bricolage that occurred as a result of being an embedded researcher in this project, and details how the use of technical prototypes as *techniques* (Löwgren & Stolterman, 2004) to the research methods led to insights into the systems described later in the thesis.

Chapter 3 then provides the theoretical foundation for this thesis. It juxtaposes two bodies of literature – from human-computer interaction and cultural geography – in order to investigate different conceptualisations of space. In doing so, it argues that space and spatiality have been problematised by HCI researchers, and that non-representational and relational theories of space from cultural geography offer ubiquitous computing an alternative. It presents a framework for analysis, based on four categories of spatial production derived from a review of the cultural geography literature – networked space, flow space, temporal space and embodied space. It proposes that these categories, and their focus on uncovering the ways space is *produced*, provide HCI and ubiquitous computing with a means of conceiving of space that is embedded within social processes and interactions.

Chapter 4 then uses the methodological and theoretical foundations to present the first empirical and ethnographic work of this research. It introduces Parks Victoria, and then examines the *Spaces of a National Park*, where the management structure, geographical locations of staff, past experiences and contingent movements within and around a park are shown to produce unique understandings of it. This chapter highlights the everyday practice of staff within the organisation, and how these practices, interactions and movements define the park.

Chapter 5 contrasts the everyday practice of park management with an empirically grounded ethnographic study of a major flood that occurred at the case study site in March 2011. It describes the flood, and shows that it caused a space of disruption, where the everyday patterns of practice and movement within the park were thrown out of rhythmic order. It discusses how landscapes of the park became important sites

of comparison for staff as they came to terms with the flood, whilst highlighting that affective connections to the park drove much of the recovery effort. Ultimately, it explains how the flood was an opportunity for renewal for staff within the organisation.

Chapter 6 summarises the ethnographic work of this research, and proposes a reframing of space for ubiquitous computing. It highlights how spatial productions in the park and within Parks Victoria are both *emergent* and *seasonal*, where the cycle of everyday rhythms and disruptions are the precursors to environmental understanding. Based on this reframing, it proposes six inspirations for design that are grounded in the ethnographic work of the previous chapters. It invites designers to consider what it would mean to design technology that acts as *pores*, *thresholds* and *anchors* between relational, emergent spaces. It also invites designers to consider how their technologies support the *rhythms*, *cycles* and *oscillations* inherent in their seasonality.

Chapter 7 uses these design inspirations to design a conceptual system named *HABITAT*, a location-based platform for informal understandings in a national park context. This chapter describes how *HABITAT* is designed to meet three goals derived from the ethnographic work of this research: that of personal habitats, the sociality of infrastructure, and the historicisation of space. It explains how parts of the system were inspired by various technology probes used throughout this research, and explains how the system utilises and explicates the design inspirations of Chapter 6.

Chapter 8 details the design of a second system named Wayfarer, a system aimed at familiarising new Parks Victoria staff with the narrative histories, infrastructure and landscapes of a park. Like the previous chapter, this chapter describes how Wayfarer was inspired by the ethnographic and prototyping work of this thesis, in concert with the design inspirations. It applies these inspirations in an entirely different way to that of the *HABITAT* system, and as such illuminates the flexibility of notions of *emergence* and *seasonality* for system design.

Chapter 9 begins to conclude the research by summarising and explicating the implications for the 'Affective Atlas' project, Parks Victoria, and park management more broadly. It is primarily intended to be used by Parks Victoria as a summary of this research, detailing the main 'take-aways' for the organisation. It argues for a critical perspective on the role of codifiable knowledge in park management, where the distinctions between 'explicit' and 'tacit' knowledge are shown to be problematic. It argues the approach and opportunities for technologies within the organisation are primarily around their ability to make *processes* visible, rather than in attempting to capture and disseminate facts. It concludes with a discussion on attitudes and aptitudes

to technology within Parks Victoria, where some stereotypes are presented and then discounted.

Chapter 10 concludes this research by providing an overview of its major contributions. It explains how this thesis has expanded the relationship between space, technology and environmental understanding for ubiquitous computing through notions of relational space from cultural geography. It argues that the research has provided an example of the key role the social sciences have in future ubiquitous computing research, and it argues that this research's methodologies and philosophical approach provide an example of how ubiquitous computing can overcome and embrace the increasing complexity of the technologies and contexts its researchers face.

With this overview in mind, the following chapter will outline the approach taken to the research, including the project context, the research partnership, and the methodological and epistemological foundations.

2

Approaching the Research Partnership

This research was conducted under the umbrella of a larger research agenda, the 'Affective Atlas' project, in partnership with Parks Victoria, a state government organisation in Australia charged with managing national, state and marine parks. This chapter will introduce Parks Victoria and Wilson's Promontory National Park, provide detail around this research context, and the methodological approaches taken to working within it. Its overall goal is to tell the story of this research through the frame of its project context and the research activities that took place. In doing so, it will detail the methodological approaches to the research; it's planned research activities and the deviations that were taken along the way; the role of embedded research and reflective design in these processes; and the ultimate focus on multi-sited ethnography.

The first section will introduce Parks Victoria, and the primarily case study site of this research: Wilson's Promontory National Park.

The second section will provide an overview of the 'Affective Atlas' project - the umbrella project for this research - and Parks Victoria's motivations and goals for participating. It gives an introduction to the practical problems faced by the organisation, and reflects on this as a foundation from which this research was launched.

Following this, an examination of the role of an 'embedded researcher' within such a project is provided. This is framed as a discussion on the various trajectories taken in this project – particularly how the multi-sited, embedded and ethnographic nature of

the research led to a number of shifts away from the starting point. It details the research methods used throughout the project, and ultimately examines the inherent complexity of conducting research grounded in social science methods. Particularly, it highlights how the methodological approaches used were adapted and deployed in reaction to circumstance.

After this, the role of technology prototyping within the research is explicated, highlighting that the line between examining social processes and technical designs was often blurred. It will discuss the role of 'techniques' in this research, where the technology used to express the research methods provided valuable insight into systems design.

The final section will then reflect on the effectiveness of these research methods within the project, and includes a brief discussion on the validity of these approaches for examining social processes.

2.1 Introducing Parks Victoria and The 'Prom

Before detailing the project context, research design and approach to this project, it is necessary to introduce Parks Victoria, and the main case study site for this research: Wilson's Promontory National Park. This section provides a brief introduction to each.

2.1.1 Parks Victoria

Parks Victoria is a government organisation in the state of Victoria, Australia, charged with managing the state's natural terrestrial and marine resources (Parks Victoria, 2010). It is responsible for close to 130 national parks, state parks, marine national parks and sanctuaries, and well over 2,700 other metropolitan parks, natural features and conservation reserves. In addition to this, the organisation is also responsible for more than 11,000 Aboriginal cultural heritage sites, and 2,500 non-indigenous historic places (Parks Victoria, 2010). These diverse sites total over four million hectares of land, or around 18 percent of the entire state of Victoria, and over 70 percent of the state's coastline (Parks Victoria, 2007). These natural assets are representative of all types of natural habitats, flora and fauna present within the state (Department of Sustainability and Environment, 2009).

Parks Victoria are the industry partners on this research, and their motivations and practical concerns, as it pertains to this research, will be addressed later in this chapter.

2.1.2 Wilson's Promontory National Park

It's not a cozy park up in the hills - it's an iconic park and one that's in the spotlight.

Greg, Ranger. Wilson's Promonotory National Park

Wilson's Promontory National Park (WPNP) is the primary site of research for this project. Located at the southernmost tip of mainland Australia, and colloquially known as "The 'Prom", WPNP holds an important place in the state's park network, and is one of the country's most loved national parks (Parkweb, 2012). It was established in 1898, making it one of the oldest in the country. It is also one of the most visited parks managed by Parks Victoria, with the annual number of visitors days totaling around 398,000 (Tourism Victoria, 2008), providing a significant boost to the economy of the park's surrounding towns and positioning it as a major tourist attraction within its own right (Ibid.). Tourists are able to take part in a number of day and overnight activities within the park, including camping, hiking, bushwalking, fishing and other water sports, and many natural and cultural attractions dot its landscape. Geologically, the park is diverse and dramatic, featuring a number of beaches, swamps, cliff faces, stark granite mountains, rivers and creeks; indeed, the entire park is recognised as possessing "national geological and geomorphological significance" (Parks Victoria, 2002. p. 2). It is roughly 50,460 ha in size (Ibid.) and is an important site for conservation - large numbers of native flora and fauna species are found within the park, some of which are threatened and vulnerable. A map of the park is provided below (Figure 2.1). Figures 2.2 and 2.3 below show photography from two distinct areas of the park.

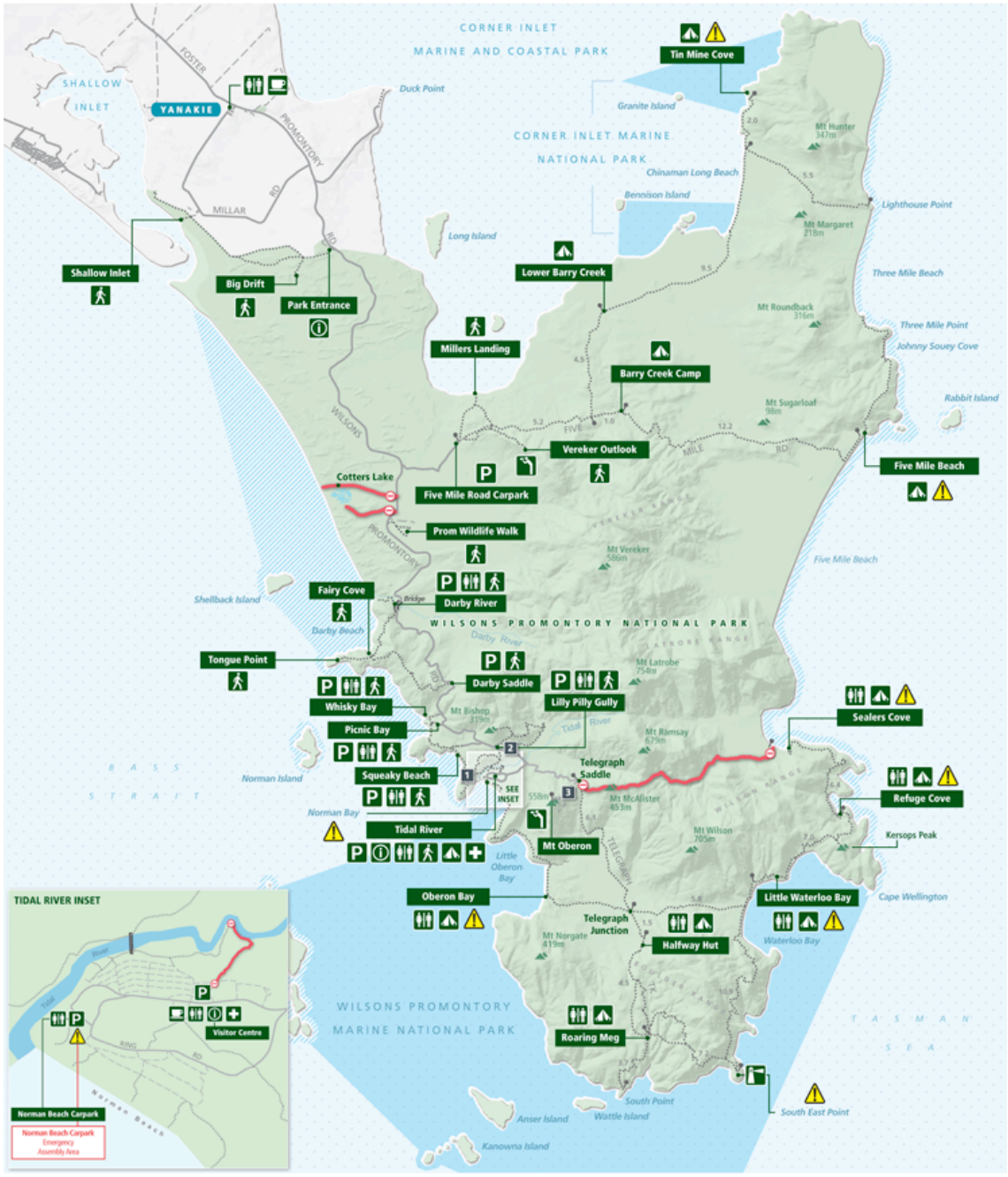


Figure 2.1 – Map of Wilson's Promontory National Park.
Source: http://parkweb.vic.gov.au/__data/assets/pdf_file/0003/510384/Map-Wilsons-Promontory-NP-Overview.pdf

Figure 2.2 – A picture of Tidal River, in the heart of WPNP. Source: Chris Marmo

Figure 2.3 – A view of Squeaky Beach from Main Prom Rd. Source: Chris Marmo.

Staff numbers within the park are seasonal, however there are generally between 50 and 70 people working within WPNP at any one time. These staff are spread across a number of operational roles, including field service officers and rangers who are responsible for much of the ecological work, in addition to tourism, education and administration staff. Staff that work in the park recognise its significance - they recognise that its dual importance as a tourist destination and ecologically significant location keeps their work in the spotlight. There is a general sentiment amongst staff interviewed that WPNP was not a "regular park" in this regard, and they take particular pride in being based there. Indeed, it is one of the most iconic parks in the country.

2.2 The 'Affective Atlas' Project

With Parks Victoria and the case-study site now introduced, this section will turn to addressing the project context within which this research took place. This research was conducted under the umbrella of a larger research collaboration between Parks Victoria and RMIT University: the 'Affective Atlas' project. In order to give some context to this thesis, it is necessary to give a brief overview of this parent project. In particular, it is essential to highlight the ways in which the early activities of the larger project group – undertaken outside the scope of this thesis – influenced and shaped the starting point of this research.

The 'Affective Atlas' project (Cartwright, et al., 2007) was designed as a cross-disciplinary investigation into the role of cartography and "web 2.0" technologies in park management (ibid.). It aimed to explore the implications of participatory web technologies on the design and formation of an 'affective atlas'. 'Atlas' was used here in the broadest sense of the word, where geographically relevant information was to be mapped or visualised. The 'affective' moniker spoke to the types of information to be communicated through such an atlas; rather than simply representing contour lines or place names, it aimed to show a different perspective about the locations in the 'Atlas'. This was interpreted differently by different members of the project team (ibid.); however 'affective' was generally assumed to be indicative of the ways people appropriate meaning from the traditionally functional and empirical nature of a map. That is, it supposed that the way people used a map deposited affect onto it – that despite a map being primarily representational, it became a record of activity and other "emotion trails" (ibid., p. 229) through its use.

The broader theoretical goals of the project then spanned a number of areas: from exploring new ways of representing data about place where that data was obtained in a participatory, user-generated manner, through to understanding how more subjective, affective meaning could be 'captured' and represented.

Parks Victoria were the industry partner on the 'Affective Atlas' project, and their own practical concerns were also a major influence on this research. If the theoretical concerns of the project were with representing a certain kind of information, Parks Victoria's concerns were a step back from this: they presented a problem that could broadly be labelled as 'information management', where they wanted to better understand the large quantities and varieties of information they held about the places they managed. For them, any tool that allowed them to better understand this - such as the visualisations or mapping inherent in an 'atlas' - was a means of achieving greater clarity on what information they possess and how it might be used. They wanted to explore ways of more efficiently and effectively using records that were considered 'location-based' (that is, attributable back to a specific location or region, in a computational sense via coordinates or through place names), and that were, at the time, not accessible in any meaningful way.

So, the shape of this research project began to emerge from the combination of these two concerns. The project team wanted to explore ways of communicating 'affective' information about places, and Parks Victoria wanted better use of information they already had.

As a concrete starting point for the 'Affective Atlas' team, Parks Victoria presented two scenarios. First, they wanted to be able to more easily interrogate data that was deemed relevant to certain locations. This was identified as a key problem within the organisation, where staff expressed dismay at current document management systems – they simply did not know what existed, where it was, or what and where it was about. Second, they were interested in exploring the design of a tool that made their internal decision-making processes more transparent to external stakeholders. At the time, the state was recovering from severe bushfires that caused the death of nearly 200 people and the social and political scrutiny around planned burns as a method of preventing dangerous fires was high. As such, Parks Victoria staff were under pressure to (a) make accurate and timely decisions about preventative burning that would respect both community safety and good ecological management - two concerns that were often at odds with each other - and (b) to make that process transparent to the wider public.

2.2.1 BurnMap

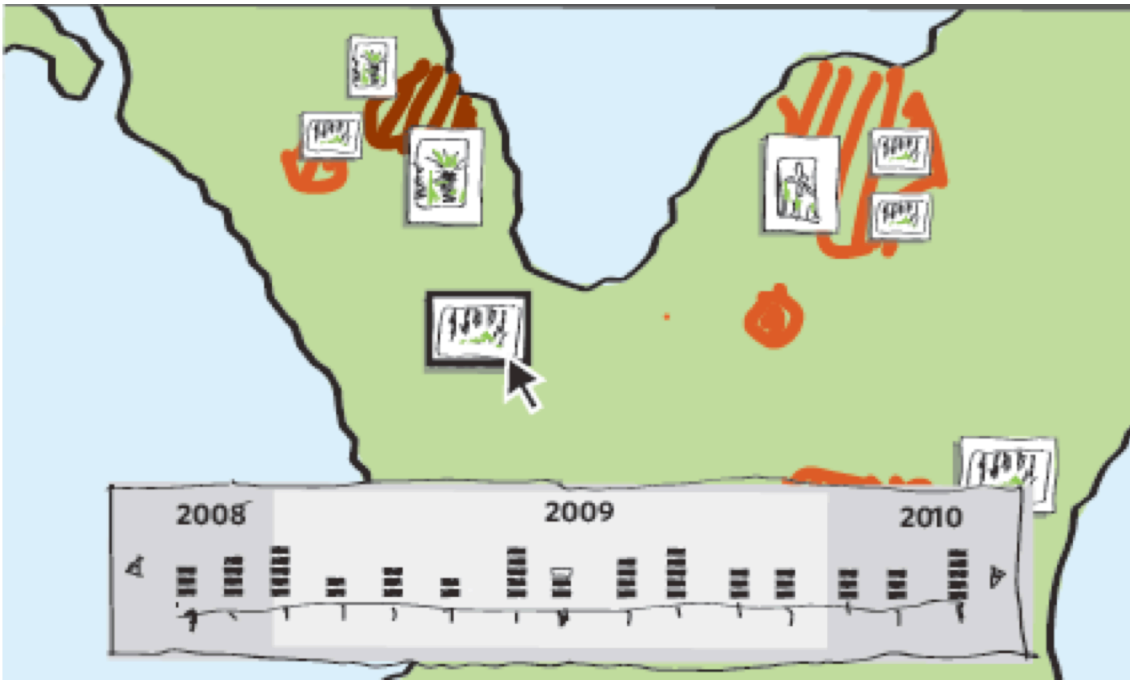


Figure 2.4 – The BurnMap project comprised a set of conceptual designs exploring the combination of geo-visualisation and data retrieval for 'location-based' information. Image courtesy of Miek Dunbar.

These scenarios set the scene for the first research activity within the broader 'Affective Atlas' project. Prior to my personal research commencing, the project team was involved in the creation of a conceptual design for a system named 'BurnMap' (Figure 2.4). BurnMap was the first 'outcome' of the research partnership, and was seen as the culmination of both the team's research interests and Parks Victoria's practical concerns. Significantly though, it also set the expectation within the research partnership of providing design and technical solutions to Parks Victoria's practical concerns, and it was this expectation to design a 'system' that filtered through to my own project.

BurnMap was a conceptual design that was, for Parks Victoria, part location-based information retrieval system and part fire simulator, and was designed as a solution to the organisation's problems around data management, manipulation and interrogation. Its design was approached through the frame of an 'affective atlas', where its goal was to provide access to data relevant to a location through a geographical interface, whilst also allowing staff to use it for 'affective' purposes. 'Data'

in this context was limited to research reports, historical burn logs, and real-time readings of weather conditions and 'fuel' levels – the density and moisture content of vegetation. The 'affective' aspect of the BurnMap was seen as incidental to the design of its interface, but core to its strategic purpose. 'Affect' would be created through its use as a storytelling tool, where staff could use it to construct visual supplements to the explanation of their decisions to external stakeholders. The BurnMap, therefore, was two things: an interactive interface that presented geographically relevant information in a manner that was usable by Parks Victoria, and a tool that could fit within these broader contexts as a storytelling platform. It was both a decision-making tool, and - through its interactive visualisations - a way of communicating those decisions.

Figure 2.5 – An example use case for the BurnMap. Image courtesy of Miek Dunbar

There was also a third element to the BurnMap: it became a starting point for my own research. Being my first exposure to the problem space of the project, and being an observer at early meetings and planning sessions between team members and Parks Victoria, the BurnMap had a significant influence on the early direction of my research. Particularly, it influenced my own perception of what would be achieved over the coming years: by clearly being a designed and (implied) technical solution to the problems and scenarios presented by Parks Victoria, it led me to believe that I too would have to provide 'solutions' to the problematised nature of information that was 'geo-placed', or about locations. It is the role of the BurnMap in influencing the early

part of my research, and the divergences away from this starting point, that the next section will address.

2.3 Embedded Research and Reflective Design

The BurnMap project was a clear culmination of the 'Affective Atlas' team's focus on communicating information about locations, and Parks Victoria's desire to better understand and utilise the data it possessed. With the BurnMap, the project began down the path of considering technical and design solutions to Parks Victoria's practical concerns, and this focus was a major influence on the starting point of my own research. The purpose of this section is to highlight the trajectories that my individual research took away from this starting point, and it will argue that these divergences were the result of being an *embedded researcher* (Lewis & Russell, 2011) in the project.

Embedded research has been proposed as a means of applying the traditional ethnographic principles of immersion and fieldwork to contemporary settings (Brewer, 2000), where those settings require reflexive responses to collaborative researchers, adapting to the requirements of ethics, and accommodating audiences "eager for new forms of ethnographic output" (Lewis & Russell, 2011. p. 400). It recognises that the researcher is "some kind of team member" (Reiter-Theil, 2004. p. 23), where researchers typically cannot engage in the practice they are investigating. This is an appropriate description for my role in the 'Affective Atlas' project, where I, as a researcher, obviously would not be qualified to actually take part in park management and its related practices. Similarly, the notions of reflexivity and accommodating different audiences were applicable as the project was already under way by the time I commenced my research, and Parks Victoria would have been looking for research outcomes that could be applied to their work practice rather than 'traditional' ethnographic outputs, such as thick description (Denzin, 1989).

The notion of embedded research also links to what Sengers et al. (2005) describe as reflective design. If one reading of embedded research means to recognise the researcher's role as "some kind of team member" (Reiter-Theil, 2004. p.23) embedded within a project, then this encourages a form of self-awareness and self-monitoring in respect to that researcher's role in that project (Lewis & Russell, 2011). Within anthropology, this kind of practice has been described as reflective practice (Mann et al., 2009). Within design, this notion of reflectivity has been posited as a central part of design practice (Sengers et al., 2005). Where designers are also often embedded within

projects, reflective practice encourages designers to be open to the 'back-talk' (Schön, 1983) that is produced by a project - meaning to be in "conversation with the situation" (Sengers et al., 2005. p. 52) in such a way that allows designers to change the way they frame a problem in response to the influences of the project. Just as "reflexive response" has been posited as a desirable trait for embedded researchers (Lewis & Russell, 2011.), reflective practice is held in the same esteem by Sengers et al. (2005). Indeed, both embedded research and reflective design advocate the necessity of being reflexive and reactionary to the circumstances of the research, where the "scene and circumstance" should dictate the course of action. In this, the researcher/designer is encouraged to approach the problem space with the "methods and tools of their training" (Sengers et al., 2005. p. 52) yet still remain open to its influences - its 'back-talk' (Schön, 1983).

With the foundations of embedded research and reflective design now established, the next section will highlight two main points. First, it will show that the research methods proposed at the beginning of this research were influenced by the systems design focus that had filtered down from the 'Affective Atlas' project and its BurnMap. Second, it will show that, as the research progressed, these methods were ultimately drawn upon in ways that were not originally planned; the result of being a researcher embedded within a project and responding to its 'back-talk' (Schön, 1983).

2.3.1 A Systems Design Focus

With the 'Affective Atlas' project and its BurnMap as a starting point, this research began with a particular focus on systems design. BurnMap had set the project down the path of designing technical solutions to the practical concerns of Parks Victoria, and by offering a designed and (implicitly) technical solution to their practical concerns it established an expectation within the project that further 'solutions' would be explored and provided. As such, early research proposals and research design for this study reflected this focus on systems design.

After an initial period of reviewing the relevant literature and engaging in informal conversations with project team members, the scope of this research study was further developed in an application to the university's ethics committee. This ethics application indicated how the research was perceived at that early stage of my candidacy. The text below is taken from this application:

> This research will explore the potential for a **location based system** to assist with the retention and dissemination of information relevant to a decision making process. Whilst specifically about fire management in a national park, it will provide broader insights into how knowledge about a location can be effectively retained and communicated.
>
> Appendix A, p. 4 - emphasis added.

This text highlights the significance that was placed on providing a technical solution to Parks Victoria's desire to better handle the data they possessed. A 'location based system' was the focus of the research at that time, and the methods described in the proposal were aimed at informing the design of this system. It also highlights my own personal view on what these 'problems' were - by choosing the retention and communication of 'knowledge about a location' as the focus of such a system, the scope implies that there was a problem with current ways of 'knowing' locations, and that problem was ready for a technical solution. BurnMap's influence and my personal interest in design for mobile computing merged at this stage in the process.

So, in order to approach the design of this 'system', a number of clearly delineated, empirical methods were proposed. These methods are presented in Table 1 below.

Research Activity	Stated Goal
1. Focus Group to generate 'personas'	• To be conducted with parks staff, and to generate a set of archetypal rangers, or 'personas'.
2. Diary Study	• To understand what knowledge rangers possessed about the locations they managed. • Again, a clear focus on 'requirements gathering' for the design of a location based system.
3. Semi-structured interviews .	• To be completed after the diary study, to further explore the role of location, using diary entries as prompts.
4. Focus Group to 'evaluate designs'	• Intended as the last activity in a 'waterfalled' development cycle, this workshop was suggested to allow testing and feedback on a finished 'system'.

Table 2.1 – A list of the research activities used within this research, along with the original goal of that activity

These methods were largely borrowed from user-centred design (Abras et al., 2004), were primarily ethnomethodological (Button, 2000) in nature, and were tailored towards gaining an understanding of the work context (Schmidt & Bannon, 1992) of Parks Victoria staff. They were grounded in the tradition of early HCI and CSCW research (Dourish & Bellotti, 1992; Bellotti & Bly, 1996; Kristofferson & Ljungberd, 1999), where research techniques were borrowed from the social sciences and used to generate representative models of a situation that could then be used as a foundation for design (Dourish, 2006). They also reflected my own background as a user experience designer and the progression of design projects I was typically involved in, where linearly planned activities fed into each other in a waterfall-like cascade to an

acceptable design. Semi-structured interviews were chosen to obtain a clearer picture of current issues relating to the dissemination of information to stakeholders and focus groups would be run to develop personas (Cooper, 1999) representing a set of archetypal users which could be 'designed for'. The aim of these was, upon reflection, to 'gather requirements' (Dourish, 2006) for the design and development of the 'system'.

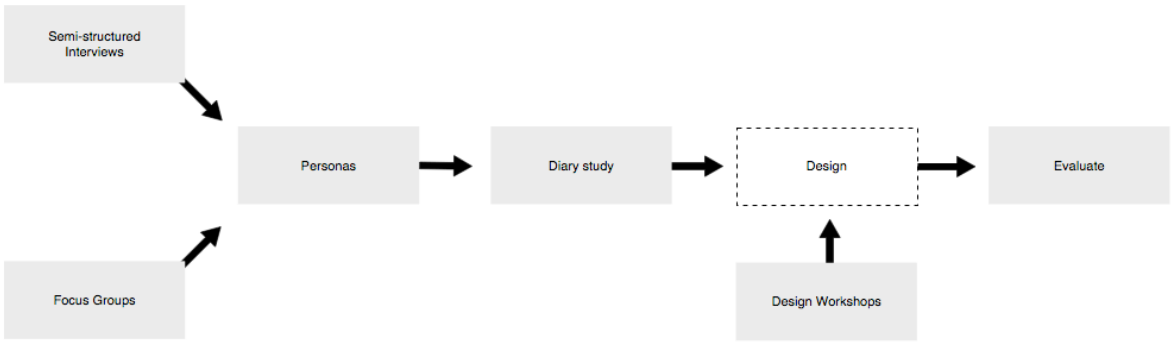


Figure 2.6 – The original research proposal showed a linear progression of research methods.

Whilst these methods were designed to be stepwise and linear in nature (Figure 2.6), in retrospect the way the research developed was far more complex than this. Rather than being deployed in the linear fashion as proposed, the methods described in Table 1 essentially formed a 'toolbox' that was used at various times through the project. In this regard, despite being carefully planned in advance, the ways in which they were used was dictated by the 'scene and circumstance' of the project, in response to its 'back-talk' (Schön, 1983).

2.3.2 The Social Shift

The focus of the research began to change as soon as I became a regular attendee at project meetings, and involved in subsequent conversations and discussions with Parks Victoria staff and team members. One of the first meetings I attended with Parks Victoria took place at the case study site of Wilson's Promontory National Park (WPNP). In this meeting one of the main collaborators on the project, Parks Victoria employee Jim Whelan, gave a presentation to the 'Affective Atlas' team on what he saw as the next step in the research partnership, beyond the BurnMap. If the BurnMap project was about visualising largely objective and measurable information to help

make and communicate decisions, Whelan's presentation focused on a different kind of 'information management'. He talked about the problems with dissemination and the capturing of staff experiences, what would later be recognised as 'tacit' knowledge (Polanyi, 1974). This was a problem that was categorically different to the one addressed by BurnMap. Rather than discussing the difficulty in dealing with data and information that was about places - and perhaps inspired by the 'affective' moniker of the project - Jim had drawn attention to staff's individual, subjective understanding of places, events and people - their tacit knowledge - and by doing so had flagged their value to both the organisation and the project team.

Whilst the design of a 'system' was still very much at the centre of the research, Jim's presentation highlighted that there was some value in examining the sociality of the park, that is, how the connections between people and place constituted a type of knowledge that was missing from the earlier focus of the 'Affective Atlas' project. This was the trigger for the first major divergence away from the BurnMap for my own research, and ultimately led to the use of cultural geography literature to understand these connections. The informal meeting at WPNP influenced the trajectory of the research away from simply representing information, towards an understanding of how people understand places, and later, how understandings are constructed there. So, in spite of a number of clearly delineated, carefully planned research methods, one of the most significant changes in direction early in my research was the direct result of this informal activity, the result of being a researcher embedded within the project (Lewis & Russell, 2011).

Given this increased focus on the practice of staff managing and working within the park, the first research activity was altered to investigate the ways in which staff shared and gained knowledge about the park through communicating with each other. Whilst a workshop to generate a set of 'archetypal personas' was originally planned, semi-structured interviews were used first as they would allow open ended questions about the social processes involved in knowledge and experience; these were topics raised in Whelan's presentation. Rather than focusing on generalising the roles of people, it became more important to investigate the everyday practice (de Certeau, 1984) of staff. The focus of these interviews then was on uncovering the 'sociology of associations' (Latour, 2005) between people, places and objects from which this tacit understanding might arise.

Multiple sites

A 'sociology of associations' is best known as actor-network theory, and treats the circulation, movement and connections between people, objects and ideas as the unit of analysis (Latour, 2005; Law, 2004). In order to investigate these associations, sociologists encourage a multi-sited ethnographic approach, where research is conducted around "chains, paths, threads, conjunctions, or juxtapositions of locations" (Marcus, 1995. P. 105). Rather than a persistent engagement with one particular site of research, Marcus & Fischer (1986) point out that a shift from static views of the 'social' to this more dynamic, relational perspective throws the appropriateness of focusing on isolated situations into question.

So now, rather than investigating static locations in the park with the aim of uncovering what information was metaphorically 'there', my focus shifted to understanding the movement of knowledge within the actor-networks of people and places. As such, it was necessary to broaden the scope of the study to investigate the social processes *around* the park as much as what happened in the park itself.

The early results from the formal interviews led to a change in approach. After interviewing a number of staff in WPNP, the importance of the multi-sited approach to the research became clear. The ways in which rangers gained experience in their work was not just contained to the park itself, but relied on many people across the whole organisation including those who were not necessarily in the same geographical region. As such, the scope of the interviews was broadened to include Parks Victoria employees in the city administration office where a number of scientists inform decisions in the park itself.

Over the next few months the less formal visits to the study site and the city offices typically revolved around delivering a presentation on the research progress, updating the organisation on early findings, or a review of relevant literature. These visits often led to multi-day stays on-site at the park, or full days spent in the city office. Figure 2.7 below shows the 'Affective Atlas' team on one such trip. Informal interviews and conversations were conducted during these site visits, and Parks Victoria staff were "shadowed" (Lewis & Russell, 2011) in order to provide a sense of their everyday activities. Key project collaborators gave many tours through the park, as well as its associated information management systems and processes.

Figure 2.7 – Parks Victoria staff giving the 'Affective Atlas' team a tour of the park.

Amongst each of these activities, it became apparent that the time between the planned, 'formal' research activities – where I visited WPNP and spent time with staff in the city office as a part of the broader project activities – was providing much of the insight that influenced how the more formal activities would be structured, altered, and used. Conversations with staff influenced the questions planned for the semi-structured interviews, and observational data often led to the type of "reflection-in-action" that Schön (1983) suggests is in the nature of embedded design, and what Sengers et al. (2005) have suggested is a core part of the practice of designer researchers.

2.3.3 Responding to a Natural Disaster

During the period when focused formal interviews were held parallel to informal visits to sites, plans were made to execute the next stage of the research proposal which was a mobile diary study. Mobile diary studies - sometimes known as mobile probes (Hulkko,

et al., 2004) - are a tool that allow dynamic self-documenting of people's actions in a mobile context, and use mobile phones as the creation tool for these rich accounts (Ibid.). The use of this tool was originally planned to allow rangers to record their 'knowledge' about places as they moved about the park, but given the early findings from the interviews, it became a tool to further investigate the social interactions and processes that occur within the park itself.

Here, the most significant example of responding to circumstance occurred. In March, 2011 WPNP was damaged by a severe storm that flooded the park with 370 millimetres of rain in a 24-hour period (The Age, 2011). This was a 'once in three hundred year' event, and placed significant strain on the operations of the park. It occurred at the time decisions were being made about the use of the mobile diary study and became a significant example of responding to circumstances that subsequently dictated the course of action to be taken.

Whilst initially intended to be an examination of the day-to-day practices of those working in the park, the focus of the diary study quickly shifted - out of necessity - to a focus on the practice of staff during the flood recovery. The diary study still asked people to record their daily activities; however, given the shift in focus within the park they were of a different quality than would have been recorded at another time. A large number were emotional recollections of changes resulting from damage that had occurred within the park; many were around recent inconveniences; and relatively few were of a more "day-to-day" flavour. Over the course of six weeks, six staff participated in the study, and contributed more than 90 geo-tagged and time-stamped mixed-media entries. It was upon reflecting on these diary entries, and through conversations during site visits over this time, that an examination of the social and cultural aspects of the park was deemed relevant to the 'affective' aspect of the project. This continued the trajectory away from the design of a system and towards human and cultural considerations, particularly those that examined the connections people form to place.

The flood led to a radical shift in the approach taken to this research, and methods had to be adapted and used in ways that were increasingly less about 'system design', and more about these social and cultural processes.

Further to this, it became clear that the difference in practice between a 'typical' period in the park and an 'emergency' event would play an important role in this thesis. In response to the diary study, a new round of semi-structured interviews was planned around the notion of change: questions covered how people were effected by the flood and how this played into the concerns of the project and the organisation. These

interviews occurred mostly in and around the park, in regional management centres as well as in administration offices. Around 20 interviews were conducted with a wide range of staff, with differing roles and across varying management levels.

2.3.4 Following the Thing

The pool of data comprised a number of interviews looking at the daily practice of park management from the perspective of those in the 'city' and those in the 'park'. The diary study, whilst originally planned as an extension of this data set, became a demonstration of an entirely different view on a park: what happens during an emergency event. The approximately 90 entries recorded by the six participants provided a rich account of an emergency event within the park, and detailed the changes in practice that occurred at such times. Further semi-structured interviews were then conducted to investigate the effect and affect of the flood, building on the findings of the diary study.

These two distinct bodies of data were interesting in their own right, as they revealed the daily realities of the flood recovery along with the broader interactions and communications that occurred around it. However, in an attempt to connect the earlier interviews about daily practice with this new data around the flood, I decided to investigate the 'social life' (Seely-Brown & Diguid, 2000) of the diary entries across different areas of the organisation, and outside the general flood recovery. To achieve this, an emulation of the 'follow the thing' methodology proposed by Marcus (1995) was used, where diary entries were selected as 'social objects' (Seely-Brown & Diguid, 2000). Marcus describes this method as useful in tracing the movement of an object across a variety of contexts (1995); within this project, physical locations and staff roles were treated as the 'contexts' of interest. By presenting a diary entry as a discrete object that moves between these contexts, the aim of this activity was to socialise the entries in a way that revealed more about the ways information from different locations - different contexts - might be perceived. Whilst Marcus typically conceives these 'objects' as commodities moving through capitalist markets, they were treated here as a way of investigating the 'sociology of associations' (Latour, 2005; Law, 2004) that formed in and around the park. By taking these highly contextualised entries - taken in the park at the time of the flood recovery - across *different* contexts, I hoped to gain an understanding of how the flood event would be interpreted by the organisation as a whole, in the daily practices of those not directly involved in the park or the flood itself.

Five entries were selected, anonymised and presented to staff both in the park and in the city administration office. An example of one of the five entries is presented in Figure 2.8 below. Participants were asked to comment on what they found interesting or intriguing about the entry, along with how and why they would use it in their typical role. They were also asked who they thought would be interested in that piece of information. Upon exploring the reasons for their thoughts, every effort was made to follow up that person and ask them those same questions. In this regard, I was able to 'follow the thing' through a network of people and places.

Figure 2.8 – Notes were presented back to interviewees in both the park and the city office.

2.3.5 Reflections on Embedded Research

The early focus on systems design, coupled with my own background in ethnomethodology-based design, led to a proposed set of research methods broadly aimed at 'gathering requirements' (Dourish, 2006a) for the design of such a system (Table 1). They were proposed as a set of linear activities that would progress neatly towards an acceptable design. Löwgren and Stolterman (2004) use the term "glass box" (pg. 64) to describe research that is planned in a systematic and sequential way, and

where each step in the process is easily describable and disseminated and is transparent to the project team. However, in retrospect, the way these methods were eventually used was much more complex than this. Figure 2.9 below shows that they were deployed in a way that responded to the circumstances of the project, and were intertwined with the informal conversations, meetings and encounters that were a part of being an embedded researcher in the project. These less formal activities guided the outcomes of this project just as much as the formal activities.

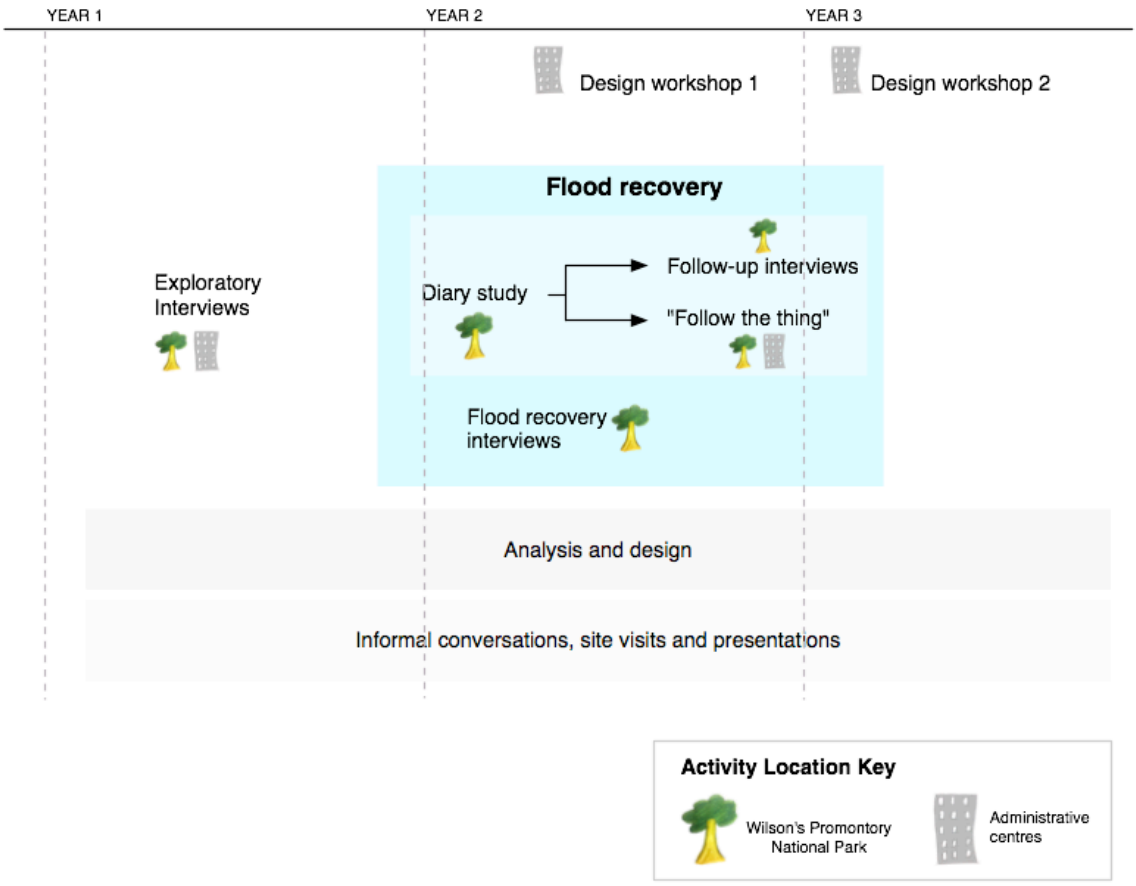


Figure 2.9 – A summary of research activities

In this respect, the proposed methods formed a 'toolbox' to draw from, and they were selected and adapted in a reflective manner in response to the 'talk-back' of the project. Rather than a linear progression, the methods used were more complex and were akin to a "self organising system" (Löwgren & Stolterman, 2004), where myself as the researcher reacted to the circumstances of the project, whether they were unexpected findings from a round of interviews, or a natural disaster.

2.4 Research as Prototyping

Throughout the majority of the project, there was a lingering expectation, filtering down from the Affective Atlas project, to build a 'system'. The previous section discussed how the research moved away from a technology focus, but technology in fact did feature in the study. Indeed, the shift in focus away from designing a 'system' still required the use of forms of technology or prototyping in the project: at various points in the research, prototypes were used to gain preliminary feedback on designs. Similarly, a number of design workshops were held specifically to conceptualise designs beyond the BurnMap. Interfaces were designed and presented to staff and the project team either to a) gain specific feedback on the use and utility of a design, or b) as "technology probes" (Gaver, et al., 2004) to provoke discussion about broader social and cultural issues surrounding the use of technology within the organisation.

Interestingly though, the ways in which the research methods themselves were presented often acted in the same capacity: whilst the methods are common ones used in design research, the way they were *expressed* and *executed* (Löwgren & Stolterman, 2004) held important insights for the design of a 'system'. That is, the tools used to carry out the methods, and how they were presented to participants, often yielded insight into the design of any potential system. In this regard, the lines between examining social processes and technology were often blurred.

2.4.1 Methods and techniques

In their book "Thoughtful Interaction Design" (2004), Löwgren and Stolterman make a distinction between 'methods' and 'techniques' as a means of describing how design (and specifically design research) is conducted. For them, a 'method' describes a "recipe for action" (pg. 63) - a particular way of working that translates a specific purpose or value into something actionable. A 'technique', on the other hand, describes the way in which a method is expressed or executed. They make reference to the visual arts, where they highlight that pencil and charcoal would be categorised as techniques. In this regard, a method can have multiple steps, and each step can be carried out using a different technique. The previous section discussed a number of methods: semi-structured interviews, diary studies and workshops were all methods proposed to obtain a certain insight. What that section did not discuss was the *techniques* used: the

way those methods were carried out and expressed. The next section will show how the techniques of this research positioned the research methods as system prototypes.

The Diary Study 'System'

The mobile diary study was conducted on multiple Apple iPhone 3GS handsets which were loaded with data credit and given to Parks Victoria staff. On these phones, a free note-taking application, 'Evernote' (Evernote, 2012), was installed and this software was used as the diary study tool itself. 'Evernote' allowed rangers to create mixed media 'notes' that were used as entries in the diary. Through the iPhone's GPS unit, each note was automatically geo-tagged and time-stamped. Provided rangers were within range of a data signal, each entry was automatically synchronised in real-time to a central server, where progress could be monitored at regular intervals.

As has already been discussed, the diary study itself - the method - was aimed at uncovering the daily practice of rangers, their interactions with people and places, and their reactions and responses to the flood. However, the technique - a phone loaded with a number of sensors, and software that had the ability to both record data and 'sync' in real-time - led to valid and interesting data in its own right.

Rangers often commented on the utility of the system within their work, and the technique of the study was used as a starting point for discussions around broader technology concerns and aspirations within the organisation. By choosing a technique that was based in technology, the diary study system was treated as a prototype with value beyond the qualitative data it produced.

Meta-data: Visualisations and Interfaces

One of the major benefits of using 'Evernote' as the technique for the diary study was that it automatically added meta-data to ranger notes. Each entry by a participant was time-stamped and geo-tagged, and this data was stored along with the raw contents of the entry itself. Further to this, the 'Evernote' services provided an Application Programming Interface (API) that allowed programmatic access to the diary study entries. As a means of analysing the entries, beyond the qualitative coding and interpretation that took place, a number of visualisations were created, via custom code, based on this meta-data. Entries were plotted on maps, and I experimented with timeline-based interfaces for navigation through them. Examples of two such visualisations are shown below (Figure 2.10).

Figure 2.10 – Visualisations showing the location of diary study entries.

These visualisations provided an extra level of analysis for the data entered via the phones, and the artefacts themselves - the visualisations - were used in informal conversations and presentations as talking points. On more than one occasion, they were commented on as a benefit of the diary study as a system, where the technique of the research revealed how there might be value in the meta-data derived from the entries. In essence, the visualisations were seen as low fidelity prototypes (Rudd, et al., 1996), where they were "created to communicate, educate and inform but not to train, test or serve as a basis from which to code" (p. 78). Further to this, the API associated with the diary study also provided a level of analytical flexibility - the ability to create ad-hoc visualisations - that would have not been possible had another tool been used to conduct the study.

This 'lo-fi' systems design as a technique continued through to the 'follow the thing' study. Meta-data was also used in this study to supplement the content of the entry itself. When presenting the diary entry - the 'thing' to be followed - each entry was displayed in a consistent manner across a series of slides that were shown to participants. On these slides, photographs were presented along with transcribed audio from the entry. This information was supplemented with a proxy 'author' name, as well as a timestamp and a map showing where the entry had been recorded. Actual audio from the entry was not played in order to protect the identity of diary study participants.

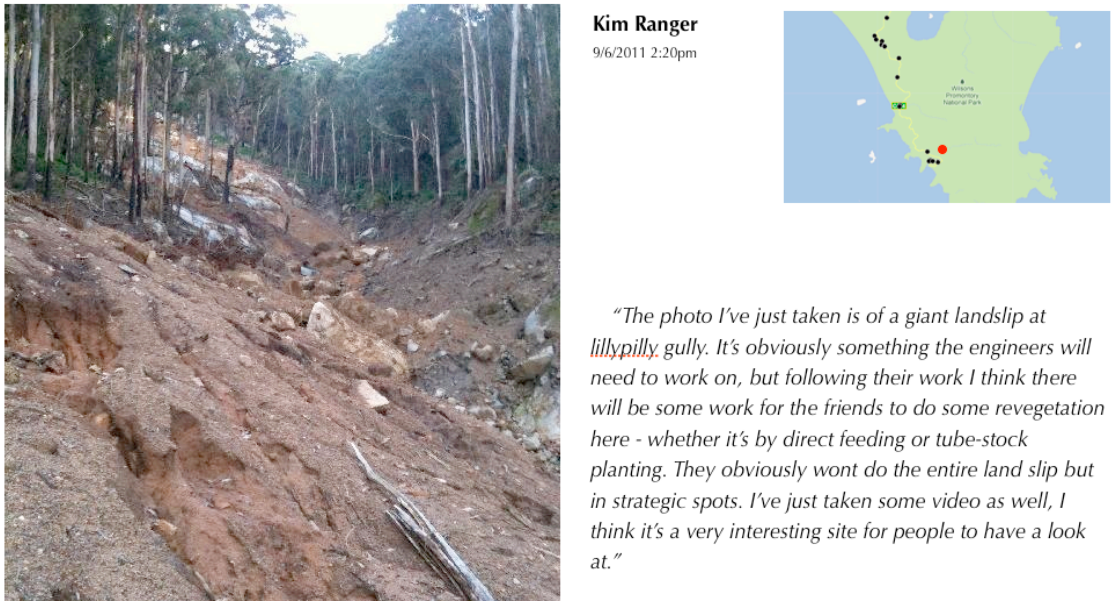


Figure 2.11 – Entries from the diary study were presented as a lo-fi prototype

The design of this display (Figure 2.11) was deliberately kept simple so meta-data could be included in the presentation of the diary entry. Similarly, it was a deliberate choice to maintain consistency in the presentation across each of the diary study entries. Consistency in presentation is one of the oldest adages of user interface design (Nielsen, 1989), and by presenting different entries (and their meta-data) consistently, as a user interface might, the potential of a system that comprised this same data was suggested. By suggesting, covertly, an interface that would display such information it subsequently prompted comments not only around the merits or potential 'journey' of the information displayed - the goal of the method - but also the potential for an 'information system' that comprised field reports within the organisation - a reflection of the technique.

The method of 'follow the thing' turned entries from the diary study into a social object (Seely-Brown & Diguid, 2000) that could be followed through the organisation, and primarily aimed to explore the ways in which staff were connected (or not). Its technique of presenting the entries in a lo-fi interface with their meta-data revealed more about the utility of the diary study and its information as a potential system.

Indeed, whilst the primary aim of each of the methods used in this research shifted more towards cultural and social understandings within the organisation, their techniques, based in mobile technology and lo-fi interface design, provided insight into attitudes towards technology and the potential utility of any new system.

Technology Probes

Whilst technology did feature in the techniques of the methods of this research, none of those methods mentioned above were explicitly focused on technology. However, there were times where technology probes (typically prototyped software or interfaces) were explicitly invited to be commented on. Similarly, two technology-focused design workshops were also conducted. A brief overview of these will be provided below, highlighting again that, despite being decidedly 'technical', the scope of their findings was much broader. Again, the division between examining social processes and technology itself was often blurred.

Figure 2.12 – Locanote - a location-based note-taking application

Locanote (Figure 2.12) was an iPhone application that was initially developed as the data collection tool for the diary study. A prototype was developed early enough to be included in the first round of semi-structured interviews, and the opportunity was taken to introduce it to participants in order to test its utility for that purpose. To test this, participants were handed an Apple iPhone with the application running and were asked to describe what they thought it was and what it would be used for. Whilst the application was eventually replaced by 'Evernote' (due to data syncing issues), *Locanote* as a technology probe led to a number of discussions around broader attitudes to technology use within the organisation. Comments were made about the likely use of such an application by different people in the organisation, and these often led to participants expressing frustration at the technology available to them, or sometimes even scepticism around the use of technology at all.

Figure 2.13 –'Timeline' prototype

Timeline (Figure 2.13) is based on an open source project from Verite.co (Verite, 2012) that allows its user to construct time-based narratives using mixed media. This project was initially used as another 'visualisation' for the diary study notes; however, a demonstration was given to key project collaborators towards the end of the research, and this sparked interest in it as a tool for representing historical information. Working with a key collaborator on the project, a number of timelines were generated collaboratively (but remotely) using the tool. Like *Locanote*, *Timeline* as a technology probe led to insight into attitudes towards technology within the organisation. Some expressed excitement at the possibility of capturing and telling time-based stories through *Timeline*, whereas others questioned whether it - or something like it - would be embraced if it were widely available within Parks Victoria. Beyond this, *Timeline* was a successful tool in eliciting comments on the role of historical data in park management, and this is what was ultimately of most use to this research project.

Workshops

Two design workshops were conducted toward the middle and end of the research project. These were the only activities within the project that explicitly asked participants to focus on technology solutions.

The first was with project team members and was based on three themes: social, temporal, and location. They were asked to choose two themes and consider the

potential uses of technology between the gaps of those two. These uses were presented to the groups who were then asked to sketch design solutions to problems that resonated with them.

The second workshop was conducted with a key collaborator within Parks Victoria, and revolved around the timelines that were produced through the *Timeline* interface. Previous timelines were presented and the participant was asked to consider how the timeline interface could better suit the variety of content produced. This produced a number of sketches that essentially formed a framework for representing stories over time and at a place.

These workshops continued to highlight the overlap between investigating social processes and evaluating technology. The focus on technology in each of the workshops still yielded more data around broader attitudes and practices within the organisation, particularly around the role of historical data and story-telling at locations.

2.5 Interpretative Validity

A key theme for this chapter has been the concept of the complexity of embedded research and the kind of methodological bricolage that occurs as a result. This improvisational and reflective approach to research has been shown to be effective, and even necessary, in the study of social and cultural issues (Law, 2004), where the focus has shifted in the past decade away from homogenous and discrete notions of *society* towards heterogeneous and complex forms of *sociality* (Albertson & Diken, 2001). In essence, this arguably recent embrace of complexity in research methods recognises and reflects a similar embrace of the "diverse and non-linear changes in relationships … and of the sheer increase in hyper-complexity of products, technologies and socialities" (Urry, 2006. p.111). It has been the goal of this chapter to highlight the parallels between this complexity in social research and the trajectory of my own research. The ability to improvise on methods, to reflect on their purpose and technique, and to assemble their findings into a harmonious whole is arguably important for a period where "certainty has left the room" (Ibid.). As Lincoln (2001) states, he prefers researchers who can "improvise within the situation and allow the circumstance of the project or the absence or presence of co-researchers to dictate the method" (p. 694).

In addition to positioning the research design within this recent trend towards disorder and complexity, the point of highlighting how progress was made in an apparent

improvisational way, is to show that findings presented in this thesis are drawn from a large pool of data that is intertwined and related in complex ways. So, rather than being presented as clearly separate "studies", where results from each research activity are reported in a way that treats them in isolation from the broader 'data pool', this thesis drew upon the entire body of research in order to derive its findings. Each activity moulded the outcomes of the project in a distinct way, and to understand how the findings were uncovered it is important to consider that they were mostly the result of 'living' the methods, of being an embedded researcher within the project.

However, in order to address the overall validity of this research, it is worth highlighting some of the common risks with the methods described, and how those risks were overcome. According to Creswell & Clark (2007), qualitative research methods are most at risk in two main areas: data collection and data analysis. This section will now address each of these key areas in turn.

2.5.1 Data collection

Throughout this project, the most significant risk around data collection has been the potential for bias through participant selection, or selection bias. Given the research partnership with Parks Victoria, and the subsequent ease of access to particular staff from specific departments, it remained important to seek a diverse mix of participants that covered different perspectives within the organisation. As such, every attempt was made to look beyond staff members who were directly involved in the project, including people from each geographical location relevant to the research - the administrative centres of the Melbourne office, the park itself, as well as surrounding regional management centres. Similar efforts were made to interview people from differing departments and managerial levels. This was done in order to avoid any bias inherent within the vertical structure of the organisation.

Another concern in the data collection phase was the potential for observational bias. This bias refers to the researcher's (or observer's) potential for conflating findings based on their own set of pre-determined viewpoints on the data. Given the embedded and non-linear nature of this research, where many informal conversations about the research occurred and where analysis occurred at all stages of the project, the potential for this bias was high. To overcome this bias, a number of unobtrusive data collection procedures were used. Interviews only used open-ended questions that did not guide responses to a pre-determined, desired outcome. The diary study relied upon self-

reporting, and only minimal guidance was provided in suggesting broad categories of entries to act as 'inspiration'. Similarly, technology probes and the 'social objects' of the 'follow the thing' study were used in a way that invited response, rather than induced.

2.5.2 Data analysis

Further risks to the validity of the findings of this research are inherent in the way the data was analysed (Creswell & Clark, 2007). Most relevant to this project is the risk inherent in data transformation approaches. These are methods that are used to move from raw data to reportable 'findings' via a number of steps, and it is assumed that there is risk of conflating findings between various steps of transformation. To mitigate this risk, this research used simple, accepted coding techniques on interview and self-report transcripts, and these codes were iteratively grouped in order to derive themed categories. These categories were then used to form a number of mental models that were supported by key quotes and media.

As an additional check on the integrity of findings in this research, they were regularly presented back to both the 'Affective Atlas' group and staff at Parks Victoria. Creswell and Clark (ibid.) identify this 'member checking' as an important and frequently used approach in order to maintain validity of findings, in which "the investigator takes summaries of findings back to key participants in the study" (p. 134). Within this project, this was often in the form of a short presentation back to project team members and Parks Victoria stakeholders, but also included more formal summaries, such as two-page overviews that were disseminated within the organisation.

Despite this research being the result of methodological improvisation, this section demonstrates that this did not hinder the reliability or validity of the work that was conducted.

A Note on Participant Quotations

Given the impersonal nature of this research, and the close collaboration with Parks Victoria, quotations from participants used in later chapters of this thesis use participant's real first-name, job description and work location. This is to provide additional context to those reading this thesis from Parks Victoria, and are used with permission from participants. Every effort was made to present participants with the quotations used in this thesis, and they were given the opportunity to amend,

anonymize or withdraw the quotation from use in this thesis. In cases where permission for real name usage was not given, or there were concerns about the content or nature of the quotation used, they are reported anonymously. In these cases, the work location is still included as context to the quotation.

2.6 Chapter Summary

The goal of this chapter has been to detail the research design of this thesis, and the ways in which it proceeded. It provided a discussion of the different trajectories taken within the project, delivered through the frame of the methods and techniques used throughout. It showed how the concerns of the umbrella 'Affective Atlas' project filtered through to the research study and how it influenced its starting point. It then demonstrated how this initial focus on producing a 'system' that addressed Parks Victoria's practical concerns evolved into a project that was as equally concerned with social and cultural issues as it was with the use of technology in such situations.

This divergence was the result of being an embedded researcher within the project, where the project 'back-talk' influenced its direction, and where methods were chosen in a reflective, improvisational manner in reaction to circumstance, a methodology that is increasingly encouraged in HCI research (Dourish & Bell, 2011).

Finally, this chapter has shown how technology was eventually used in the research study, highlighting that the original division between 'system' and 'situation' was perhaps unwarranted as the lines between evaluating the 'technical' and the 'social' are inevitably blurred.

With the project background and its methods providing the overarching trajectory of this research study, the next chapter will introduce the theoretical foundation on which the thesis and its contributions are positioned. It will juxtapose two bodies of literature that reflect the key concerns discussed in this chapter: human computer interaction (HCI) and cultural geography.

3

The Relationship between Space, Technology and Environmental Understanding

With the project context of this research now established, this chapter will turn to exploring the theoretical gap within which this research resides. Given the multi-disciplinary nature of this thesis, it is necessary to explore the relationship, gaps and interactions between two different bodies of literature: ubiquitous computing and cultural geography. To begin answering the first research question of this thesis – *What is the relationship between space, technology and environmental understanding, and where is that relationship headed?* – this chapter will start with an exploration of the origins of space and spatial concerns in ubiquitous computing. To do this, it will begin by looking at how space has been conceptualised more broadly in Human-Computer Interaction (HCI) and its workplace oriented sub-discipline Computer Supported Collaborative Work (CSCW). Through this examination, this chapter highlights how technology has been purported to influence our understanding of our surroundings, and ultimately shows that space has been positioned as an impoverished, abstract and static container that poses problems for technologists to solve.

This problematic conceptualisation of space will be followed by an overview of literature from cultural geography that views space in an entirely different way. Rather than being positioned as a singular, abstract container that is inherently meaningless

and within which social processes and interactions occur, this literature considers space as something that is the *product* of these interactions: a relational entity that is pluralistic and dynamic, and inherently meaningful. It offers a thematic analysis of this literature as a framework for analysis that is used throughout this research, and proposes this foundation as a starting point in considering where the relationship between space, technology and environmental understanding may be heading.

The definition of space used in this chapter will vary. In the first section, it is used to refer to the way the world and any number of locations and environments are seen as an absolute, abstract container within which objects reside and social processes play out (Thrift, 2003; Kitchin & Dodge, 2011). The second section will introduce a different conceptualisation of space, one that is relational, where it is seen to emerge from any number of interactions and processes (Urry, 2000; Massey, 1995; Kitchin & Dodge, 2011). Further, if *space* is the object of analysis in this chapter, then *spatiality* refers to the perceived influence of space on those same interactions and processes: essentially, the ways in which space has been problematised.

Ultimately, this chapter aims to assess current conceptualisations of space in HCI and ubiquitous computing, and detail a conceptual framework for investigating where that understanding may be heading. It argues that space is currently positioned by HCI as impoverished and static, and spatiality as a source of problems that only technology is positioned to overcome. By considering space as a pluralistic, dynamic and relational entity, it argues that ubiquitous computing can begin to move beyond this problematised notion of space. Before introducing the concept of relational space, the chapter will first discuss how spatiality has been perceived of in HCI to date, and how technology has been purported to provide an understanding of the lived environment.

3.1 Space and Ubiquitous Computing

Space and spatiality, whilst not always explicitly stated, have had a major influence on HCI research in recent decades, whether that be in reference to digital environments as "mirror worlds" (Gelernter, 1991), "collaboration spaces" (Greenhalgh & Benford, 1995), or as evident in the number of other spatial metaphors in use, such as "desktop", "discussion forum", "data warehouse" or "co-presence" (Harrison & Dourish, 1996) and "co-location: (Zhao, 2008).

The purpose of this section is to show the ways spatiality has entered the realm of HCI and CSCW research. It does so by highlighting, thematically, the ways in which spatiality has been problematised by these disciplines. Three categorisations of solution to these problems are discussed: systems that *transduce* space both physically and temporally, those that *augment* space with information it is deemed to lack, and those that supposedly *reveal* otherwise invisible aspects of space. It is argued that the implicit belief amongst each of these solutions is that space is an absolute, inert container that either unfairly constrains human movement, lacks meaning, or is only meaningful with the help of technology.

3.1.1 Space Transduced

The first mention of space or spatiality within HCI emerged from Computer Supported Collaborative Work (CSCW), a sub-discipline of HCI which focuses on the role of technology in facilitating interactions within work environments (Harrison & Dourish, 1996). Spatial concerns generally entered this research area in the form of a problem - where physical and temporal limitations of dislocated people and data were attempted to be overcome through the application of technologies specifically designed to *transduce* space. Transduction is used here to describe the act of overcoming both physical (Belloti & Bly, 1996) and temporal (Luff, Heath & Greatbatch, 1992) distances.

This early research was borne out of the realisation that computing might allow people to work in different places across different times, whether that be across different rooms in the same office, or across geographically-split locations. The initial work in this area was conducted at Xerox's Palo Alto Research Centre (PARC) in the mid 1980s, when researchers there began to consider the implications of interpersonal computing, the logical successor of the personal computing movement of the earlier part of the decade (Bly, Harrison & Irwin, 1993). This led to the development of a range of systems called "media spaces" (ibid.), electronic environments which created visual and acoustic links between geographically-split locations. The intent of these media spaces was to combine the sensory feeds in ways that supported real-time collaboration and awareness across separated worksites.

These systems attempted to address the problem of spatial *disconnection*, where they sought to overcome the physical dislocation of collaborators by bridging two physical spaces: by *transducing* them. At the same time, they allowed people to access archival recordings of these initially real-time interactions. By doing this, they not only

addressed a spatial *disconnection* – one where individuals were not in the same location – but also a temporal *disconnection* – where people were not able to collaborate in real-time. In other words, they *transduced* time. Other systems such as ClearBoard (Ishii, Kobayashi & Gruden, 1993) – which created a shared workspace for collaborative drawing – and RAVE (Gaver, et al., 1992) – a video portal to support awareness of work practices across multiple sites – similarly *transduced* space and time by combining media spaces with existing physical workspaces. These systems all aimed to address the problem of *disconnection* via electronic environments, within which the geographical location and real-time presence of collaborators was no longer essential to performing tasks.

In these early systems, spatiality, in the form of spatial and temporal distance, was seen as problematic as it inconveniently separated both people and data across these distances. This was derived from the inherent notion that space - in this context, the physical world - was an absolute Cartesian plane that unfairly separated people from each other. In this sense, spatiality was seen as a way of framing a problem to be overcome through the application of early ubiquitous computing techniques.

This problematisation of space and spatiality continued through the progression of this early research into CSCW. As the notion of media spaces matured and moved away from the simple consumption of video and audio feeds in physical workplaces, spatiality entered CSCW in a second way: that is, as a mode of interaction to study, where researchers (see Gaver et al., 1992) examined the ways people spatially interact with and organise their social and physical worlds. Whereas the work around media spaces explored the possibility for computing to create collaborative environments which transduced spatial and temporal *disconnections*, others such as Gaver et al. (1992) studied work environments in terms of their spatial properties and affordances – examining the ways in which individuals organise their desks, through to the design of built office environments – in order to better understand and exploit spatial processing abilities in the design of these digital collaborative environments. They argued that in order for digital spaces to be effective, they would need to allow for the same kinds of spatial affordances that are available in everyday lives. Early examples of the application of spatiality as interaction include the virtual world platforms DIVE (Carlsson & Hagsand, 1993) and MASSIVE (Greenhalgh & Benford, 1995), both of which built upon the notions of presence, attention and action from real-world contexts to better allow for spatial modes of interaction (Harrison & Dourish, 1996).

These virtual worlds - like the media spaces of Xerox PARC and others (Mynatt, et al., 1997; Bly, Harrison & Irwin, 1993) - still aimed to address the problems of *disconnection*. However, they did so not through the combination of media with existing physical work environments, but through the creation of wholly digital spaces that attempted to emulate natural, spatially grounded modes of interacting with each other and the world. In this sense, they looked to learn from people's ability to process the world spatially, and to design these same affordances into new, virtual worlds.

The growth of interest in those concerned with virtual worlds led to the exploration of virtual reality – immersive digital worlds in which users navigated with their bodies – and eventually to complex virtual worlds such as Second Life (Second Life, 2012) and the gaming environment of World of Warcraft (World of Warcraft, 2012). However, the life of these as a means of collaboration - particularly virtual reality - was relatively short-lived. Researchers criticised them as being too impoverished for certain tasks, and accused these digital worlds of unnecessarily separating users from the tools of their physical environment (Billinghurst & Kato, 1999). Researchers of virtual worlds began to be more interested in them from sociological perspectives: that is, for the social processes and interactions that happen within them (for example, for a study of economics within online virtual environments: Harrop & Gibbs, 2010; and how male body image is influenced by avatars: Cacioli, 2012), rather than for their ability to overcome any form of spatial or temporal disconnection.

At the same time, issues of mobility were beginning to enter HCI; again, this was initially in the workplace (Belloti & Bly, 1996), but later in other contexts such as mobile computing (Brewer & Dourish, 2008; Dourish, Anderson & Nafus, 2007) and rural indigenous knowledge (Bidwell & Browning, 2009). The focus on this research became not just about the overcoming of *disconnections* in space or time, but also the explicit support of movements within space. This led researchers to consider a different problem: as people moved out of the office and began to work across multiple locations - and indeed *between* locations - they were not just dislocated from people, but equally from the resources and information housed in their physical and digital workspaces.

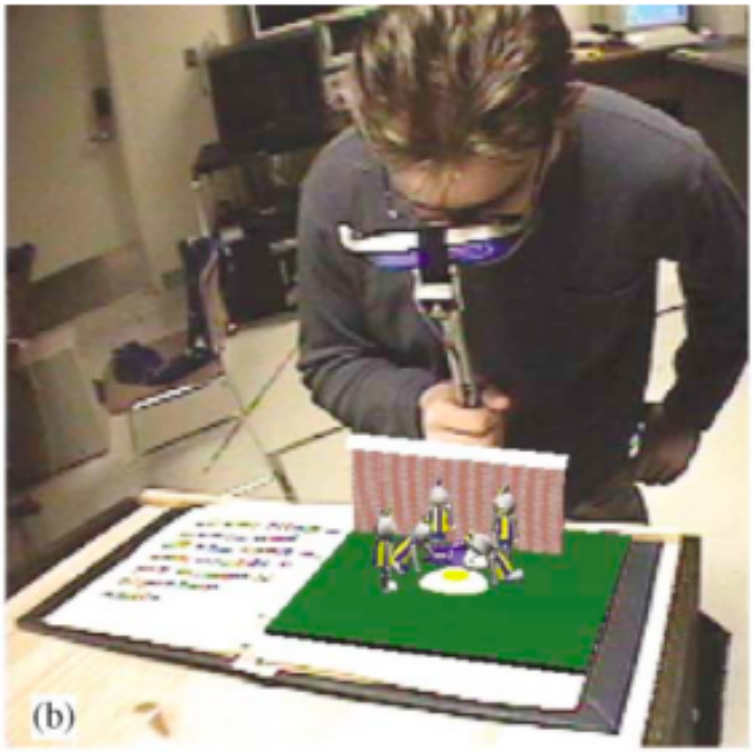


Figure 3.1 – MagicBook: Moving between Reality and Virtual Reality. (Billinghurst, Kato & Poupyrev, 2001. p. 747)

With a desire to move away from virtual worlds as an environment for collaboration and a burgeoning interest in the unique challenges of mobility (Brewer & Dourish, 2008), a new type of spatial problem emerged, one where physical and digital spaces were separated, and researchers began to consider ways of bringing aspects of these digital worlds into mobile work. That is, they began to look into ways of *transducing* physical and digital spaces. MagicBook (Billinghurst, Kato & Poupyrev, 2001; Figure 3.1) was one of the first systems that tried to break down the barrier between digital spaces and the physical world. It used head-mounted displays to project three-dimensional computer objects onto the user's view of the real world, allowing them to interact with these digital objects in a way that was analogous to that of real-world physical objects. Broadly termed "mixed reality" (Billinghurst & Kato, 1999), this mode of interaction allowed people to continue to interact with their physical world whilst also gaining access to digital data.

3.1.2 Space Augmented

This movement into the world, through concerns of mobility, leads to the next problem proffered by spatiality. If the first problem was that of imposing physical and temporal limits on people and data, then the second problem that spatiality enticed researchers to solve was that of being devoid of intrinsic meaning: of lacking the ability to inform people about their surroundings in any meaningful way. This section will discuss the ways in which this view of space as an inert container has led to types of augmentation, where meaning is laid on top of space through technology.

Whereas much of the initial work around technology in collaboration was about overcoming the spatial and temporal *disconnections* between people and data through *transduction*, systems such as CampusAware (Burrell, et al., 2002) and WebPark (Mountain & Raper, 2000) began to address spatial problems in a way more aptly described as *augmentation*, where locations were seen to provide context to information, yet lacked any intrinsic meaning themselves.

CampusAware (Burrell, et al., 2002) was a campus tour guide system designed for new students. It aimed to bring social awareness to locations within a university campus via a process the authors describe as "annotating space" (ibid. p. 2). As users moved through the campus, they were able to author and attach text notes to a given location, and also read notes left by other students. However, given the locative nature of the annotations made by users - current students "annotated space" with notes containing a coordinate via GPS – spatiality can be seen as problematised in a different way. Rather than being disconnected from people, or data, students were seen as disconnected from social information. Here, spatiality is seen as problematic in that it provokes a type of social disconnection: the environments through which students moved were devoid of any meaningful past experiences from other students, and this lack of meaning was seen as undesirable. By *augmenting* a space with this missing social information, CampusAware hoped to connect students to meaningful experiences. There was no credence paid to the aspects of the campus environment that do hold meaning: worn paths across grass or graffiti on walls were not considered valid indications of a past experience. This view essentially states that only technology can provide a space with the social context it lacks.

This notion of 'context' is common in work that treats space in this manner (Abowd & Mynatt, 2000). At best, the value of space in these systems has been in providing a

computational black spot, in the form of a GPS coordinate, upon which to augment socially meaningful information; it is only considered useful in providing an index to this information, and is treated as the 'dumb' context to a data store. Whilst CampusAware's focus was on a university campus, this view of space has also been used in broader settings, such as in museums to facilitate a shared experience of an exhibition (Brown, et al., 2003), and in the form of city guides for tourists (Abowd, et al., 1997; Cheverst et al., 2000). Indeed, tourism has proven to be an important area of focus for HCI researchers considering spatiality. Feelings of displacement are quintessential to the experience of travel, and researchers have looked at ways of solving the problems of local knowledge and navigation. Like new students on a campus, tourists are *disconnected* from these locations and the local knowledge that goes with them, and researchers have turned to technology to assist.

Cyberguide (Abowd, et al., 1997) was one of the first systems targeted at tourists in a city. It aimed to re-place tourists by providing them with location-aware content and navigation aids which would guide them through a city via a map, pointing out landmarks and common tourist sites as they passed by. The GUIDE system (Cheverst et al., 2000) grappled with similar issues, whilst also discussing the real-world implementation issues of such systems including data access. Both systems, amongst others, aim to re-place users by augmenting an unfamiliar space with local knowledge and navigational waypoints. Space (in this case, a city) is again problematised as being devoid of meaning in these systems, and there is also no credence paid to the desire of those tourists who want to wander and explore a city, or enjoy being disoriented. Those researchers that do pay attention to this still insist that tourists may need help in their wandering practice, and open this up to solutions in ways similar to that of navigation (Brown & Chalmers, 2003).

Importantly for the current project, if the population-dense space of an urban environment has been seen as lacking meaningful information in HCI, then it should come as no surprise that natural and rural environments have similarly been targeted by technical solutions to problems of meaning and navigation. WebPark (Edwardes et al., 2003) was envisioned as a location-based service platform to assist tourists in protected and recreational areas, like a state or national park. It frames itself as a tool for knowledge discovery, allowing users to perform a number of tasks aimed at providing information to them in situ. One application using the WebPark framework created a guide that contained information on flora and fauna, and allowed users to query this information via a portable digital assistant. Unlike other systems discussed in this section, it made the notion of spatial context explicitly available to users by

asking them to choose whether their question is about something "visible from here", "around me" or "in all of the park" (ibid., pp. 1017-1018; Mountain, 2007). In this way, it aims to provide greater control of the scale of information to be augmented. However, by doing so it forces the computational view of location-as-context onto users whilst making assumptions about precisely what scales and information tourists might find useful. Once again, space is assumed to be the context onto which information can be augmented, and there is an apparent tension between the desire of the researchers to solve the problem of displacement, and the tourists' desire to simply enjoy their recreational activities. Indeed, this tension was explicitly commented upon by the researchers of the GUIDE system when during field tests they felt as if they were "impinging on the leisure time of tourists" (Cheverst et al., 2000. p. 22). WebPark, in a similar way, imprints a techno-centric view of a natural environment onto users, one where users must think in spatial scales. At the same time, WebPark assumes that 'knowing' is the correct and desirable state of being for users, and again pays little credence to experiential aspects of being in the park, expressed through acts of wandering or exploration.

3.1.3 Space Revealed

In addition to viewing space as an abstract container to be augmented with meaning, WebPark's researchers problematised spatiality in another way. Whereas the flora and fauna application aims to solve the problem of displacement, other functions within the platform are better described as solving the problem of *visibility* – primarily, the lack thereof. In addition to a query tool for plant and animal data, WebPark provides a number of map-based visualisations to users that aim to make visible aspects of the park that were claimed to be otherwise invisible. One of these maps allows users to view the popularity of certain trails by visualising the frequency and density of visitors along these trails. Here, the popularity of a trail - claimed to be otherwise invisible - was seen as analogous to the frequency and number of visitors it received. By capturing data claimed to be absent within the trails themselves, these visualisations purported to reveal an aspect of the park that would otherwise not be accessible to users: the precise numbers of people using that path. Again, space and spatiality are problematised in a way that pays little credence to aspects of the trails themselves, such as the level of wear on paths, broken twigs, or footprints. It also portrays an entirely techno-centric view to the notion of capturing meaning within space, where the authors claim the only meaningful trace of social activity within the park is left through the use of the system

itself, and that the space of the park and its trails would be devoid of this meaning without the system. This techno-centric view of capturing and revealing information about a space is reflected in another aspect of the WebPark system, where a measurement of accessibility is offered. This is calculated from the velocity of users - the speed at which they move through certain trails in the park - where this speed is claimed to provide an indication of how easily accessible these areas are. Again, in this techno-centric view, the authors purport the system leaves and reveals *social traces* in a physical space that would not otherwise be there.

Indeed, this notion of *social traces* (Anderson, 2009) is an example of where researchers have looked to learn from physical spaces (Erickson, et al., 1999; Erickson & Kellogg, 2002), and can perhaps be seen as the start of a view that treats space as informative, rather than devoid of meaning. The notion of technology revealing otherwise invisible social data was first addressed by Erickson et al. (1999), when they developed a system called Babble based on the concept of 'social translucence'. It aimed to support digital communications through the use of minimal visualisations – graphical representations that act as a social proxy that facilitate the kinds of social perceptual awareness that are typically missing from digital communications. The authors offer a swinging door as a metaphor and inspiration for design: in their office, a swinging door was causing problems when people would be accidentally hit by someone coming through in the opposite direction. A door with a glass window in it communicates who might be on the other side, preventing the undesirable result of being hit. The window supports our natural proclivity for perceptual awareness; it highlights movement behind the door, reveals faces and invokes a sense of social responsibility to the user of the door. The window in the door is a design that is socially translucent.

Building on the work of Ackerman & Star (1995), they looked to incorporate this design inspiration into digital systems. By capturing social acts, socially translucent systems aim to reveal them to users. Figure 3.2 is an example of a social proxy from this work (Erickson et al., 1999), and shows two people (dots 1 and 2) actively involved in a conversation, an inactive person (dot 3) and a person involved in another conversation (dot 4). The other three instances of the social proxy show (from left to right) a 'hot' conversation, a dormant conversation, and a mixture of conversation, idleness and other conversations (ibid. p. 74).

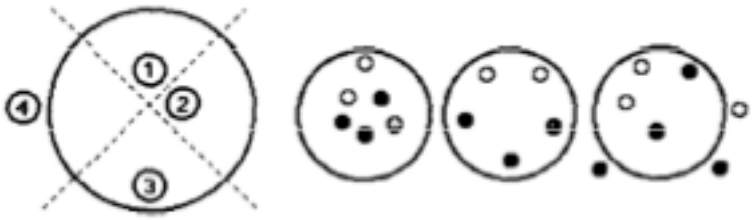


Figure 3.2 – Babble's social proxy, where social interactions taking place on a mailing list system are visualised (Erickson, et al., 1999. p. 74).

By making this type of social behaviour visible, by *revealing* it, the authors claim their social proxy led to a number of outcomes that would otherwise have been missed. Users engaged in opportunistic interactions by being able to see who was or was not active in a discussion at any one time. It also led to a greater degree of group awareness - an understanding of what was 'happening' within the space of the software (and subsequently, the office), and allowed for a degree of informality and sociability. In this sense, the authors claim that Babble created a social 'place' through which sociality could be played out, and their visualisations revealed aspects of the social interactions that are otherwise invisible within a digital system.

It can therefore be seen that systems that aim to *reveal* an aspect of space - like those that aim to *augment* it - have been primarily designed to capture, summarise and present social interactions and behaviours that occur within a space. This again highlights the dichotomy that researchers and designers (Harrison & Dourish, 1996; 2006) within HCI have turned to when dealing with issues of space: that is, a separation of physical spaces and social processes, where notions of 'space' have been treated as separate to the socially constructed 'place' (Harrison & Dourish, 1996; 2006). However, through an examination of the systems presented so far, it is clear that it is precisely from the examination of social interactions within digital systems that a different approach to spatiality has begun to emerge, one which considers how technology and design can play a role in carefully selecting and amplifying the ways in which spaces are *already* informative. The problem this section highlights though is that, whilst these systems do treat space as being already informative, they do so in a way that treats it as not being informative in the right way, or simply not informative enough.

Taking design cues, such as a focus on aesthetics, from urban planners and architects (Holmquist & Skog, 2003; Skog, et al., 2003), along with theories such as social translucence (Erickson, et al. 1999), contemporary systems aimed at performing social translucence have generally been in the form of ambient displays in public spaces

(Skog, 2004). These have looked at revealing aspects of space in a number of ways: by bringing in information from distant places (like transport arrivals), aggregating social meaning over time (like a history of noise levels in a café), or presenting abstract phenomena in ways that may subtly influence behaviours (Robles, Nass, & Kahn. 2009). Resulting from Weiser and Brown's notion of "calm" technology (1996), designers of these systems have typically paid more attention to the aesthetic experience of such displays, attempting to avoid 'information overload' by carefully selecting the type of information and the mode of presentation. This attention to aesthetic experience and perceptual processing stresses the embeddedness of the technology within a given setting where such systems are seen not just as screens, but as part of the space itself, and to be used by people in the same way as physical spaces (Skog, 2004).

Indeed, the notion of revealing otherwise invisible, intangible aspects of an environment has taken two separate paths in ubiquitous computing. The first has been focused on capturing and revealing social processes within a space (Erickson, et al., 1999), and the second has been about revealing the details of infrastructure within a space (Immaterials, 2010).

Figure 3.3 – Immaterials: Light painting WiFi project (Immaterials, 2010).

Immaterials (2010) is one such project which aims to visualise the traditionally invisible digital infrastructure that is now an intrinsic part of everyday life. Researchers built a light rod consisting of LEDs which, when moved around an urban landscape, reacted to the strength of the surrounding wifi networks (Figure 3.3). By doing so, it

visualised a new type of information that was already contained in space - that of digital infrastructure - in a way that makes these available to users of that space. Immaterials, whilst primarily a visual art project, aims not to smooth over the gaps between digital and physical (as "calm" technologies might desire), but to deliberately and purposefully address these gaps by making them available for interaction.

The notion of making aspects of otherwise invisible digital infrastructure has been broadly termed 'seamful' design (Chalmers & Galani, 2004; MacColl, et al. 2002). In this case, a 'seam' is the gap between a physical and a digital environment, and usually indicates aspects of digital infrastructure that influence - or restrict - use of technology. Whereas systems such as public displays aim to be seamlessly integrated with the physical space, seamful design takes an opposite approach. It proposes that instead of trying to smooth over issues related to infrastructure, designers should aim to reveal infrastructural problems in order for them to become interaction features in their own right. Examples of this are already pervasive in technology design - the signal strength bar on a mobile phone and the wifi strength indicator on desktop computers are both very common examples. Here, technology is revealing a different aspect of space, one that is based in digital infrastructure rather than social interactions and processes.

MobiTip (Rudström, Höök & Svensson, 2004) is a system that combines the revelation of social and infrastructure aspects of the built environment. By revealing aspects of the surrounding bluetooth network, MobiTip aims to make the technical context available to users themselves, while at the same time it highlights the social context within which the application and the user reside, allowing the peer-to-peer exchange of opinions. In this sense, it deals with both types of invisibility discussed in this section: social and infrastructural invisibility.

3.1.4 Space as Problematic

In this overview, it can be seen how the application of early ubiquitous computing has been purported to influence an understanding of the world. Spatiality, in general, has been seen as problematic to designers of ubiquitous computing technologies. First, it has been seen as the cause of *disconnections* between people and information. Early research into inter-personal computing (Gaver, et al., 1992) and collaboration (Ishii, Kobayashi & Gruden, 1993) problematised these *disconnections*, and explored ways of overcoming them. Solutions to this problem can be categorised as *transducing* space; that is, of bridging the spatial and temporal gaps between collaborators, and their data

(Belloti & Bly, 1996; Luff, Heath & Greatbatch, 1992). The first section in this overview highlighted the ways that space, and spatiality, have been seen as things to fold together as a matter of convenience.

As people became more mobile, space was conceived not just in terms of their geographical locations and resources, but as a container through which to move. This spatiality-as-container view (Harrison & Dourish, 1996) perceived space as a singular, abstract stage upon which social processes played out (ibid.). As such, space was viewed as devoid of any social meaning itself, and technology was applied in ways that purported to bring that meaning to it. That is, it was used to *augment* space with the information (Burrell, et al., 2002; Mountain & Raper, 2000) and social context (Abowd & Mynatt, 2000) it was deemed to lack. In this conceptualisation of space it was considered inherently meaningless and the source of various forms of *displacement* where technology was once again positioned as the solution.

Finally, researchers examined ways of *revealing* the kinds of social processes that occurred in a space through acting with technology (Chalmers & Galani, 2004; MacColl, et al. 2002). Technical solutions were seen as ways of capturing and revealing social traces that were otherwise considered absent or invisible (Edwardes et al., 2003). Similarly, as technological infrastructures became more pervasive, aspects of space were made available in ways that could influence behaviour, or guide decision-making within space (Immaterials, 2010; Rudström, Höök & Svensson, 2004). In these systems, technology was claimed to *reveal* information that was intrinsically in space, but unavailable to our embodied selves. Space is considered meaningful here, but not meaningful enough, and not in the right ways.

The common thread amongst each of these approaches is the notion of space as an abstract container. In beginning to answer the first research question of this thesis: *What is the relationship between space, technology and environmental understanding, and where is that relationship headed?* this section has shown that technology has been purported as the 'missing link' in the interactions between people and their environments that can at once help overcome their inconveniences and make them more meaningful. This distinction between 'space' as a container and 'place' as the site of social activity has pervaded ubiquitous computing research for some time (Brewer & Dourish, 2008), and despite its commonality has been shown to be problematic (Harrison & Dourish, 2006). Nevertheless, this overly techno-centric conceptualisation of space pervades the design of systems that purport to assist in understanding the environment, the *spaces* in which we live.

In beginning to answer the second part of this question: *where is that relationship headed?* this chapter will now turn to literature from cultural geography that treats space in an entirely different way. Space, as a concept from cultural geography, is as much a social construction as any notion of place. This next section will detail a view of space that does not treat it as a singular abstract unit within which actions occur and objects exist, but rather something that is the *product* of those actions. The rest of this chapter will be dedicated to exploring this notion of space as a relational product, and aims to provide a theoretical foundation for re-examining the role of technology in the relationship between space and environmental understanding.

3.2 Space Constructed

Spatial concerns have evolved considerably over recent decades and have been taken up in a variety of disciplines, including, as this chapter has pointed out, HCI, CSCW and ubiquitous computing. As an introduction to alternate ways of environmental knowing, this section will introduce one of the key tenets of cultural and human geography: Space.

Space is the fundamental 'stuff' of cultural geography (Thrift, 2003), a discipline concerned with the human and social aspects of geography, particularly on our relationship to and understanding of the world. However, despite such a fundamental position within the discipline, the precise definition of space has been the instigator of much debate (Thrift, 2003; Kitchin & Dodge, 2011), so much so that it is probably more accurate to talk about types of space (Crang & Thrift, 2000), than to attempt to define it as a singular whole. Whilst it was fashionable some time ago to think of space as an abstract reality (Curry, 1995), and place as the realm of social performance (Harrison & Dourish, 1996), space is now considered, in cultural geography, as much of a social construct as place (Anderson & Harrison, 2010; Crang & Thrift, 2000).

The role of this section is to give an overview of these contemporary, relational theories of space, with the aim of providing a theoretical foundation for the analysis of case studies that appear in later chapters. Given some of the most experienced researchers in the field have stated the difficulty of accurately summarising these views (Thrift, 2003; Crang & Thrift, 2000), the aim of this section is not to provide a comprehensive account of space as it has evolved to be used in cultural geography. Rather, its aim is to examine key perspectives as they relate to the current research project. With this in mind, a thematic analysis of the literature from human and cultural geography on the

topic will be provided. These themes are centred around the 'relational' theories of space that emerged out of the Marxist movements of the early 20th century, which led to the development of structuration theory (Giddens, 1984; 1990) and beyond.

The themes of analysis are:

- Networked Space
- Flow Space
- Temporal Space
- Embodied Place/Space.

To provide some context to the discussion of these relational themes, it is worth briefly documenting the trajectory that theories have taken away from absolutist, reductionist definitions that were pervasive in both the physical and social sciences in the middle of the 20th century, and that are still reflected in much HCI and CSCW research.

3.2.1 From "What is Space?" to "How does Space Become?"

To help contextualise some of the discussion that follows, this section will outline how spatial thinking has evolved in the social sciences in recent decades, away from the process of defining what space *is*, to that of exploring how space *becomes*. That is, away from the notion of space as an absolute container within which actions occur and objects exist, to one that considers it to be the product of many varied and complex interactions (Thrift, 2003).

Whilst now considered a central topic of enquiry in the disciplines of human and cultural geography, in the early part of the 20th century not much attention was given to the notion of space (Hartsthorne, 1959). In both the physical and social sciences (as in HCI to date), space was referred to – almost entirely implicitly (Kitchin & Dodge, 2011) – as an abstract, absolute container. That is, as scientists and sociologists of different persuasions went about the work of their own particular disciplines, they did so with only the implied assumption that their objects and processes of enquiry resided in an absolute container. Subsequently, they mainly focused on producing rules for locational arrangement, geographical pattern discovery, and geological processes (Kitchin & Dodge, 2011).

As the century progressed, space began to be explicitly stated as an ontologically absolute out of attempts from "geographic scholarship … to reinvent itself as a 'spatial science'" (Kitchin & Dodge, 2011, pp. 67) that aimed to create generic rules of the world in relation to the arrangement of locations and geographical processes. With this, space was to be understood as a geometric system of organisation and measurement akin to a uniform grid over the world, within which "objects are located and events occur" (Curry, 1995, p. 5). That is, space was primarily defined in terms of Euclidean geometry, consisting of x, y and z axes, across time, within which objects and events could be determined objectively and measured empirically.

Whilst many fundamental advances of the modern world are due to this account of space - one only has to consider the broad range of technologies based on an ability to accurately locate a user within this space - theorists such as de Certeau (1984) and Foucault (1966) from the 1970s onwards began to criticise the spatial sciences for the lack of attention they paid to social and political processes (Crang & Thrift, 2000). They argued that by attempting to reduce, generalise and operationalise our conception of the world, spatial scientists were effectively relieving it of any of the social nuance and political influence that - according to these modern theorists - constituted much of our daily, mundane experience. These theorists argued that it was in fact this mundanity that caused the spatial scientists to look towards other methods of measuring and quantifying the world: that the experiences of everyday life were so ingrained in daily practices that they seldom invited reflection: they just were (Crang & Thrift, 2000).

Effectively, they claimed that the notion of space as an absolute container was so far removed from the practices of everyday life (de Certeau, 1984) as to be meaningless, and that this tendency towards reduction, abstraction and quantification was essentially positivist in nature. Indeed, whilst positivism is not mentioned explicitly in the early work of spatial scientists such as Schaefer (1953), Burton (1963), or Harvey (1969, cited in Kitchin & Dodge, 2011), it has been demonstrated that some of its central arguments were based in this philosophical tradition (Kitchin, 2009). So, as a direct response to these positivistic tendencies of the spatial sciences, relational ontologies of space began to emerge. At their core, relational theories of space are attempts to bring the social, cultural, political and embodied experiences of place back into considerations of what constitutes space. They are about the movement away from space as a pre-existing container within which different phenomena occur, towards one in which space is a product of many and varied interactions (Crang & Thrift, 2000). Relational theorists believe that by examining different types of interactions and relationships, one is examining wholly different types of space, and these spaces are in

a constant state of remaking. Space, therefore, is the result of deliberate attempts to build and maintain collectives by bringing different things into alignment (Thrift, 2003). Hence, the appropriate question that concerns human and cultural geographers is not "*What is space?*" but "*How does space become?*" (Kitchen & Dodge, 2011).

3.2.2 Relational Space: An Introduction

The previous section showed how the positivist stances on spatial understanding were argued to be devoid of any social meaning or political intent, and ignored the embodied, lived experience of being-in-the-world (de Certeau, 1984), and that these reductionist models, through their attempts at objectifying knowledge, actually overlooked much of how the world is understood. This evolution in approach provides context to the current section, which will discuss - by drawing on literature from human and cultural geography - some of the broad themes that have emerged from these relational understandings of space.

Theories on relational space can be broken down into three types: Marxist, Humanist and Post-structuration (Thrift, 2003). Marxist theories have been based on a modern interpretation and incorporation of perspectives of 19th and 20th century philosophers whose work is both explicitly spatial (de Certeau, 1984; Lefebvre, 1974), or has been freshly interpreted with a spatial lens (Foucault, 1966). This group of theories discusses the dichotomy of a state-imposed structured space, or "conceived space" (Lefebvre, 1974) versus the intents of individuals, who tactically manoeuvre within these imposed structures (de Certeau, 1984). They believed that the actions of an individual were constrained and predicted by the broader social structures within which the individual resides, the central tenet being that the nature of these structures is defined by governments and other large institutions of professionals, and as such are laden with issues of power and knowledge control. Examples of this include de Certeau's 'strategies' (1984), and Lefebvre's 'conceived space' (1974).

Humanist theories, extending largely from the work of Tuan (1974; 1977), are grounded in the opposite belief - that humans have an agency that is detached from any broader social context or imposed structures (Crang & Thrift, 2000). Like Marxists, they view space as the production of an interplay between larger social structures and individuals' actions, but instead privilege the individual will and desires above all else (Tuan, 1977; 1974).

This duality - of social structure and individual desire - persisted in the social sciences for some time, and was eventually resolved by Giddens (1984; 1990) through his 'structuration' theory. Structuration theory aimed to bring the competing dichotomies of the state and individuals together by proposing a reflexive loop. That is, rather than one of either structure or agency dominating or subverting the other, Giddens argued that each is a product of the influences of the other. Whilst humans do have agency, it is influenced by the social contexts within which they act; similarly, the social structures people find themselves in are influenced by the actions of individuals.

With this duality resolved, human and cultural geographers were free to explore the spatial application of further models of social production, ones that moved even further away from the distinction between structure and agency towards theories that completely abandoned such distinctions (Thrift, 2008; Latour, 2005), and to ones that focused on flows of information and mobility rather than static structures within which actants acted (Urry, 2007). It is this group of theories that form the post-structuration movement in cultural geography.

Whilst the above can be read as a genealogy of spatial thinking in the social sciences, the themes presented next draw on elements of thinking from each of the categories above. In each of the examinations - *networked* space, *flow* space, *temporal* space and *embodied* space - further detail on their foundations will be provided, with the aim of illuminating how they constitute a different form of space that has been pervasive in most HCI and CSCW research to date.

3.3 Spaces of Knowing

Given the notion of relational space introduced in the previous section, it is apparent that it is possible to conceive of space not as a singular, abstract unit within which to measure things, but as a product of any number of complex and evolving social processes. The most appropriate question regarding space then is not "*What is Space?*", but "*How does space become?*" This view of space is a departure from how it has been previously conceived of within HCI and CSCW research. Whilst the previous approach has led to a great number of technical advancements and benefits (for example, in-car GPS navigation), this section will now highlight some of the ways of conceiving of space that view it as more than a pre-existing stage within which actions occur and objects exist, or as something to overcome through technology. This section aims to provide an overview of some useful ways of conceiving of space that *becomes*; that is, theories of

space that place it as the relational product of any number of cultural, political and social practices. Each of the following descriptions of types of space not only describe a particular way of "bringing things into alignment" (Thrift, 2003), but as particular ways of understanding that are tied up in our interactions with each other and our environment.

The categories addressed here are the result of a thematic analysis of the literature around human geography. It is not the intention of this section to claim that these categories are the current, leading understandings of the ways in which space arises. Rather, it is meant simply to present some alternative ways of conceiving of space that have not been represented in much of the HCI and ubiquitous computing research agendas. Similarly, rather than offering these categories as 'solutions' to the problematisation of space within these fields, they are meant simply as an overview of conceptions of space from cultural geography that are useful in later chapters of this thesis. In this regard, the four categories of spatial production provide a framework for analysis that is drawn upon in coming chapters.

3.3.1 Networked space

Perhaps the most common theme within human geography is the notion of networked space (Thrift, 2003). As opposed to space as an absolute container within which events occur and objects reside, in relational theories the term 'networked space' is used to describe the process from which space emerges from any number of complex relationships. In the context of this thesis, the word 'network' is used more broadly than to describe simply a social network (Larson, Urry & Axhausen, 2006), or a technology network derived from software and infrastructure (Kitchin & Dodge, 2011). Like Riles' (2001) use of the term, 'network' is used here to describe more abstract phenomena comprised of sets of institutions, knowledge practices and artefacts that effect their own realities in what Giddens would call a reflexive loop (1984). Networked space describes then the result of a process of bringing things into alignment (Thrift, 2003) by certain actors, and can take on different forms depending on the actors involved. The examination of different actors is therefore an examination of different spaces. Similarly, it is used here to highlight the 'act of becoming' that is inherent in relational notions of space; through a continual cycle of making and remaking, networked spaces are best viewed as processes rather than as objects.

It is the contention of relational geographers that knowledge is tied up in this cycle of creation and remaking, including such broad examples as the tacit sharing of expertise across a tribal network (Williams, et al., 2003) through to the role of the 'landscape' in persisting cultural and moral stories (Basso, 1988; 1996). So, if instead of viewing space as bounded and abstract, focus is instead given to the different ways space is produced out of diverse, competing networks, this provides an alternative to the conceptions of space that researchers (Harrison & Dourish, 1996; 2006) in HCI and CSCW have taken.

An examination of different conceptualisations of space, tied up in networks, can begin by examining cultural differences in these conceptualisations. Whilst it is common in western thought to view space as an area contained within topographical boundaries, there are examples from other cultures where the conceptions of space are more intricately tied up in networks of social and cultural practices. Munn (1996) discusses ways in which space is produced by Aboriginal and Torres Strait Islanders. The spaces Australian Aboriginals inhabit are defined and dictated by an intricate interplay between taboo tribal and familial relationships in a constant state of mobility, ephemeral events at a place, and ancestral mythologies that are closely tied to a location. Rather than being defined by a set of topological markers, Australian Aboriginal notions of space can be seen as zones of exclusion, where individuals view environments in terms of places they cannot be, and where the factors defining these exclusions come out of a network of relationships. These permissible areas radiate out from visible sacred places that act as centres, and the boundaries from these centres are tied up in both the temporality of taboo events (ibid), or the presence and movements of people of a particular gender or lineage group (Bell, 1983). So whilst these sacred places are fixed, the boundaries radiating from them are not. As such, Aboriginal space can be seen as "a symbolic nexus of relationships produced out of interactions between bodily actors and terrestrial spaces" (Munn, 1996. pp. 449). Space is not considered a fixed entity for Aboriginal people; it emerges from interactions between spiritual, cultural and spatial aspects of the landscape, and as such is in a constant state of making and remaking. It is the product of a culturally and spiritually grounded network of places, people and events. This interaction between people, events and places is one way that an understanding of the landscape - a sense of space - emerges from a network of interactions. Here, locations play a key role, albeit in relation to social relationships and ancestral stories.

Stories that are closely tied to a landscape are also important for another indigenous people, the Native American Western Apache. In a more explicit examination of the role of locations in the formation of understanding, Basso (1988; 1996) describes the

role of location in the cultural practices of the Apache, particularly focusing on their strong connection to the stories told about them. For these people, stories are the primary source of historical, moral and practical lessons. Everyone learns a set of stories that have cultural implications, and it is a sign of wisdom when a person is able to draw upon lessons from these stories to understand current circumstances (Basso, 1996). In addition to being cultural messengers, stories are closely tied to places; in fact, a story without a place is considered nonsensical (Brewer & Dourish, 2008). The places where particular stories happened are always included within the story, and they are generally locations that are known to both listeners and storytellers (Basso, 1996). By being neither mythical nor distant places, listeners are able to imagine themselves in those places as the story unfolds. This visualisation entrenches the importance of the place within the cultural landscape of the Apache people, to the point where place names become proxies for the stories themselves. Wisdom is inherent within stories, and stories are always located at a place. As the title of Basso's book conveys, for the Apache "Wisdom Sits in Places" (ibid.). Place names are proxies for cultural lessons, and the morality of these stories dictates whether or not Native Americans can visit these places. Similar to Australian Aboriginals, the space of their societies is produced out of a relationship between the landscape, stories grounded in places, and the people that tell them. It is the network of historical events, experiences, and morality that produces stories that become a moral compass.

Outside of indigenous populations there are other examples of conceptions of space that are produced from networks. In describing what she coined "power geometries", Massey (1993) discusses how spatial arrangements (for example, the proximity of homes to amenities and sources of noise and pollution) and patterns of movement and access (for example, in the competition for resources between public and private transportation) reflect certain power and control structures. She examines how the same (primarily urban) locations can be viewed differently by different people depending on the types of access they have to particular resources. Here, space is produced out of complex interactions between these control structures, degrees of social differentiation and modes of transport and communication that reflect them. For example, the experience of a city for affluent youth with disposable income, a disposition towards new gadgets and cultural events makes the city a site of consumption. Others within the city – the homeless, or those with less money available to participate in these acts of consumption - may have entirely different ways of inhabiting and navigating the same locations. The same urban environment produces

different kinds of space - ones as diverse as consumption and survival - and these arise out of a complex network of power and control structures.

Whilst the definition of a network used so far has been careful not to mention technology, the last example begins to hint at how technology, in its broadest sense, may be included in the production of space. While it is true that software is used to sort geographies (Graham, 2005; Brunn, Cutter & Harrington, 2004), technology, including technical objects and their associated infrastructures, can be viewed as part of a network of production in much the same way as stories, taboo social relationships or power structures can be. Technology has as much of an influence on space as social contexts and forces as any individual agency. In the previous example, access to certain modes of transport and communication technologies can be seen as ways of transducing space and time for some people, whilst constraining it for others. Here, technology can be seen as contributing to the production of space with both negative and positive consequences.

Kitchin and Dodge (2011) explore this further with their notion of Code/Space, an examination of the spatial implications of software that is embedded in everyday objects, infrastructures and processes. A Code/Space is a certain type of networked space that has software entangled within it, such that it is almost impossible to conceive of the space without considering the software that comprises it. Offered as an example is an airport where, according to Kitchin and Dodge, the entirety of the practices and experiences that comprise air travel are defined by a vast number of "coded assemblages" (p. 137). Everything from the initial transaction of purchasing a ticket, through to the processing through airport and border security and the eventual exit at the arrival destination, is dictated and indeed dependent upon technology. According to Kitchin and Dodge, without technology, the networked space of an airport would collapse, or at the very least would be an entirely different kind of space.

Whereas Kitchen and Dodge's example points to the role of technology in producing space as part of a network comprising other entities, others such as Thrift and French (2002) further claim that software and technology automatically produce space in their own right, discussing a type of "machine space" (pp. 320) within which software processes reside. In this sense, this view claims that technologies do more than simply transduce time or space - they form different types of topologies that automatically contribute to our conceptions of cities and regions (Terranova, 2004). Indeed, Mackenzie (2002) even argues that technologies themselves, in their broadest sense, should be viewed as the product of complex networked processes in much the same

way as the type of space discussed in this section. Describing this process as transduction - a use of the term different to that used earlier in this chapter - Mackenzie argues that technical objects are "composed of bodies, institutions, conventions, representations, methods and practices …" and that "… technical objects evolve [via transduction] over time by articulating diverse realities with each other" (ibid. p. 18). In this, Mackenzie describes a type of space – "technicity" (ibid. p.18) - that emerges from these networked assemblages.

3.3.2 Flow space

The notion of networked space discussed previously is closely tied to relational theories of space that have emerged from human and cultural geography. Much of these theories examined space as an outcome of processes around certain geographical areas or regions, treating them as self-contained structures that could be examined independently of other areas (Crang & Thrift, 2000). This "blocked space" (Thrift, 2003) was useful as it attempted to capture and hold still an aspect of the world in order to examine its characteristics. However, it has become common for theorists to remove the barriers and borders around geographical areas, and to study them not in terms of their boundaries, but in terms of the movement of people, information and objects in and between them. This chapter has already discussed how spaces can be formed out of networks that help define the boundaries of space, rather than act within them (Munn, 1996). However, as Thrift points out (2003), networks are still an attempt to draw boundaries around certain types of flows, whilst allowing the possibility of new networks to emerge. In response to this, an alternative way of conceiving space has emerged, one where the world is seen as comprising of these flows, and where movement itself is treated as the unit of analysis, not the boundaries, origins or endpoints of bounded space (Urry, 2000; Cresswell, 2006). In other words, this focus on the mobility of people, information and goods is not just about examining the effects of movement on places; it is about treating those movements as producing spaces in their own right. This section categorises these types of spaces as *flow spaces*, where the focus is on the flows themselves, rather than on origins or destinations.

Whilst information and goods are considered by these theoretical accounts, the movement of people is perhaps the most common area of study for researchers working with mobility. For reasons as diverse as asylum seeking (Neumayer, 2006; Marfleet, 2006), business travel (Davidson & Cope, 2003) or youth journeys of discovery to

'back-packer enclaves' (Williams, 2006), physical mobility has become a way of life for both rich and poor. In work that explored different forms of global movement of people, Urry (2000) examined how spaces are mediated, produced and consumed by a continuous flow of people, and describes the complex assemblages required to support and, in some cases, restrict these movements. In the case of tourism, places 'move' closer to various global centres, while others 'move' further away from the global stage as flows of tourists move towards one place over another. In attracting these flows, places are in a constant state of performance and in order to be recognised they must be, in part, places of distinct spectacle. Through their particular flows, tourists create a space within which the position of various destinations is in constant negotiation - by moving to or visiting a place, people are communicating that that place is "the place to be" (pp. 265), a place that should not be missed. The performance of moving establishes and positions destinations in a particular kind of global order that lives in the space of tourism.

At the opposite end of this spectrum of human movement is the global travel of asylum seekers and refugees, who seek to escape from places of famine, persecution and poverty (Marfleet, 2006). The flow of these travellers - and thus, the kind of space that is produced from their movements - is vastly different to those of tourists. Whereas places compete for the flows of tourism through performance, access to foreign spaces is profoundly restricted and unequal for refugees (Neumayer, 2006). Through complex visa and passport restrictions, nation-states aim to attract visitors from certain countries whilst deterring others. For these latter people, their mobility orders the world in a way in which migration is full of risk, is complex and expensive, and is to places that are likely to offer a contingent 'hospitality' (Marfleet, 2006). Their flows represent spaces of exclusion and of danger.

On a less global level, the flow of individuals within their regular environments is also seen as producing a certain kind of space. For de Certeau (1984), patterns of connection and understanding are formed out of tactical movements people make through spatial environments. Particular places and paths provide a spatial grid that defines memories and imagination beyond more strategic social systems. Through movement, people poach what they need from these systems, and it is through this act of 'making do' that the real world emerges (Hubbard, Kitchin & Valentine, 2004). Exploring this concept of order and movement, Lynch (1960) famously used a map-drawing technique to solicit an egological representation of the city in which participants lived. The maps featured urban landmarks along paths most commonly travelled, and it was around these landmarks that the city was organised for its inhabitants. Each map therefore

represented the city as it was lived and experienced by participants, rather than as it was actually ordered. Here, everyday movement and flow was seen to impose a kind of social geography onto the city (Brewer & Dourish, 2009).

In addition to the egological maps of Lynch (1960), another representation of space that is arguably based on movement is that of Mercator's projection (Wood, 1992). By representing the world as a series of straight lines with navigational utility, Mercator famously misrepresented the relative size of certain geographical regions at the northern and southern extremities of the Earth. By representing the globe on a flat plane, his map does not accurately represent the world as it is, but instead provides a useful way of conceiving the world in order to navigate it. Given this, it may be said that Mercator's map does not represent space, but rather potential movement (Brewer & Dourish, 2009).

Taking a different approach to the notion of a flow space, Nardi and O'Day (1999) describe the type of space that is produced from flows of information. In what might otherwise be called a community of practice, they explore the notion of 'information ecologies', which are made up of relationships and human activity occurring in a certain 'habitat' that supports the movement of information. They use the example of libraries, Internet message boards, and a high school art class to describe the ways in which the meaning of technology within these groups was negotiated. Through imparting shared values and practices (and supporting their flow), each of their case studies formed a particular kind of space within which technology could reside.

Flow space can be seen then as analogous to space that is produced by movements and rather than putting boundaries around flows, it is better to think of them as spaces that are differentiated from each other as a result of these movements (Urry, 2000). These spaces can be ephemeral or longer lasting, global or local in scale, and involve people, information and goods.

3.3.3 Temporal Space

So far it can be seen that sense is made of the spaces where interaction occurs, not simply in terms of their local geometries or built features, but their positions in larger frames – be they 'power geometries' as in the case invoked by Massey (1993), or the frame of mobility as set out by Urry (2000, 2005). With these, it is clear that space is a product of a number of different kinds of networked interactions and mobilities, where

the focus is placed on the spaces in between subjects, and where the "product is the process" (Baines, 2002. p. 112). If space is viewed as emerging out of these networks of people, practices and the built environment, and similarly out of the flows of people, goods and information, then it does so as a process, as an act of becoming. This act is important to consider as it implies a movement of things from one state to another, an evolution enacted by the 'interconnectedness' of various forces (Massey, 2005). This process of emergence is an irreversible one, and time is the vehicle that guides it (Massey, 1999). It is with this that the relationship between space and temporality can be seen, which will be explored in this section.

The relationship between space and temporality has not always been obvious. Early theorists treated time and space as conceptually separate (most notably Descartes and Newton, see Nerlich, 1976), and whilst philosophers such as Foucault (1966) and Lefebvre (1974) both argued that history is essentially spatial rather than temporal, they still treated time and space as divided entities to be brought together through conceptual frameworks. This divide has been shown to be problematic by a number of contemporary theorists such as Askew (2002), Gregory and Urry, (1985) and Urry (2000), primarily through ways that have already been discussed; that is, through the ways in which space is considered abstract and objective. More recent conceptualisations of space instead propose that it is actually more accurate to consider space as a space-time entity; that is, indivisibly both spatial and temporal in nature (Urry, 1985). With this, spaces can be pictured as "fields of emergent potentiality" (Crang, 2001. p. 205) within which time and temporality are integral, driving aspects. By examining the construct of 'space-time' then, space should not be considered static, defined by its absence of temporality, or defined as a 'slice through time' in which time changes but space stays the same (Massey, 1999). Rather, time and temporality can be viewed as an integral part of what space is, and a guiding force in the act of becoming.

In addition to describing temporality as the vehicle through which space becomes, Massey (1995) discusses the ways in which space (that is, space-time) is influenced by a combination of competing histories. Spaces, she argues, are by definition made out of a hybrid of influences, not least the histories that coalesce to construct their present. She states that "the past is present [in space] in a variety of ways" (ibid. p. 186): materially in the form of a building whose nature changes over time; or in the resonances left by street or suburb names that link to a nostalgic past. For Massey, these links are a two-way process: rather than representing singular histories in a linear progression from past to present, the meanings of these material, resonant histories are contested and negotiated by a multiplicity of voices. The old building that was once a cinema but is

now a mosque draws different meaning for different groups of people, and historical signs such as street names can be used to evoke different effects when embedded within different histories. As she writes regarding her local high street, “It is (or ought to be) impossible even to begin thinking about Kilburn High Road without bringing into play half the world and a considerable amount of British imperialist history,” (Massey, 1993. p. 65).

Nora (1993, cited in Fenster, 2010) similarly discusses the temporal nature of space by treating what Massey calls history as a form of cultural memory. To do this, Nora makes a distinction between *spaces* of memory and *sites* of memory; whereas a space of memory might be a space which returns us, metaphorically, to another time, sites of memory are constructions made precisely because we cannot live within particular spaces of memory. Memorials, archives, memorial days and ceremonies are the means by which memories are turned into sites; when spontaneous memory does not exist any more, the need to symbolise these memories arises. So whereas Massey could be seen to be discussing spaces of memory, Nora argues that cultural memory and identity (as defined by Halbwachs, 1989) is constructed within sites of memory. By spatialising memories in these ways, they are made a part of history (Padan, 2004).

This spatialisation of memory was further explored in the context of cultural identity in the South Korean capital, Seoul (Podoler, 2010). Through lenses of foundation, separation, occupation and recovery, Podoler examines how the national identity of Koreans changed in line with the spatiality of the city; that is, with the construction, renovation and deconstruction of monuments which acted as sites of memory. In post-war South Korea, the national government looked to promote and cultivate myths about national historical figures whom they held up as examples of the new national character. Podoler explored the way the myths of these individuals were adopted via spatialisation; that is, primarily through the building of statues and places of worship within the city. The construction of these sites contributed to the mythology surrounding these figures, and it was around these mythologies that the cultural identity of this new southern state was developed. As sites evolved beyond simple monuments and sacred buildings, and took the form of more accessible and interactive museums and parks, the collective cultural identities attached to them began to be adopted on an individual level. In this sense, the urban landscape of Seoul was produced, regulated, and ultimately consumed in order to form a sense of cultural and individual identity; the city acted as a spatial correlate of cultural memory, a type of spatial memory.

Importantly for this research project, urban landscapes are not the only examples of spatial memory. Ingold (1993) describes the ways in which landscapes are an enduring record of - and testimony to - the lives and works of past generations who have dwelled in them, and in doing so, have left there something of themselves. Over time, actors within a space leave traces, and these traces are said to influence the process of becoming. Van Loon refers to these traces as 'resonances' (2002), where the actions that have occurred within a landscape resonate across space-time. Importantly, rather than viewing a resonance as representing something other than the action itself, it can be viewed as a temporally variable intensity of the same thing. Like the relationship of an echo to the originating sound, the resonance of an action within a place is not a separate thing in its own right, but simply the same thing at a different intensity. In this sense, space can be the source of memories through the ways in which it provides a home for these intensities.

In addition to the ways space is historicised (Massey, 1999; 1995) and used to create sites of memory (Nora, 1993), the rhythmic nature of relationships to space have also been used to further explore and demonstrate the interconnectedness of space and time. Referred to as 'oscillations' (Askew, 2002) or 'rhythms' (Crang, 2001), repeating temporal connections to the environment have long been documented as being important in the construction of meanings within space (Crang, Crosby & Graham, 2007; Crang, 2001; Urry, 2000).

For Crang (2001), time-spaces are produced out of the relationship between a multitude of routines, each of which possess different timings, tempos, and durations. Whilst closely tied to the notion of flow space discussed in the previous section, rhythms and oscillations describe particular patterns of movement that possess temporal characteristics (Urry, 2000). This was explored by Askew (2002), where his study of migrant workers in Bangkok describes the oscillating nature of the city. Workers from rural areas, across a number of 'informal' industries such as domestic help, construction, sex work and food vending will periodically return to their villages to visit family or help with particular farming duties, or simply to take a break once they had earned enough money to afford it. In this, Askew describes a city within which the rhythmic, cyclical relationship between people, their hometowns and the city both define and influence it. With this, it can be seen how spaces may oscillate over time, and that this oscillation is due to rhythms that are closely tied to temporality. It can be said, therefore, that space becomes and oscillates with the rhythms of everyday life (Crang, 2001).

3.3.4 Embodied Space (Place)

What has been discussed so far is how space emerges from a combination of networked interactions (Thrift, 2003) and flows (Urry, 2007) that coalesce to produce meaning, and how temporality is an integral part of that process of emergence, contributing to the production of space not only as a vehicle for the act of becoming (Massey, 1999), but also through the histories that leave their resonances (van Loon, 2002) and the cultural identities and memories that form as a result (Podoler, 2010). A number of examples have been discussed, ranging from the ways the meaning of particular places is dictated by social relationships (Munn, 1996), through to how movement and mobility itself can be seen as producing space for global tourists and refugees (Urry, 2007). Whilst each of these examples has discussed a particular scale of space, focusing on the networks and movements of large groups of people, objects and information, and the histories that reach back across time to influence a place, each has at their core a different kind of space – the everyday lived experience of individuals (de Certeau, 1984). This final discussion on relational space will therefore focus on the space that arises through an individual perspective of space, the result of being-in-the-world (Galloway, 2004; Dreyfus, 1991), a theoretical foundation based in the phenomenology of Heidegger and others (Dourish, 2001). That is, the discussion is about embodied space, what Thrift calls 'place' (Thrift, 2003. p. 102).

Whilst the term 'place' is a contentious one in human and cultural geography, Thrift highlights that the one agreed-upon aspect of place is that it is involved with embodiment (2003). So whereas *place* was once considered to be the realm of social activity taking place on the stage of static *space* (Harrison & Dourish, 1996), notions of embodiment have re-focused *place* to the ways in which an environment is experienced through a combination of embodied movements, senses and emotions - the direct result of our physical and social presence in-the-world (Thrift, 2003; Dreyfus, 1991). Embodiment is used here to explain how a sense of place arises from the ways in which humans inhabit and perceive the world, where these phenomena are 'situated' (Suchman, 1987) in real space and real time (Dourish, 2001).

Within HCI and CSCW research, the theory of embodiment has helped researchers avoid dichotomising the mind, body and environment (Dourish, 2001; Galloway, 2004). Within cultural geography, it has had similar effects (Tuan, 1974; 1977). Whereas what might be considered a 'place' is generally thought to be something 'out there', external to both our bodies and minds, embodiment focuses back on what is

actually experienced in an environment, and how these experiences are selected, shaped and coloured by what can be sensed, felt, and known (Greenbie, 1981). Returning to the notion of relational space, embodied space, or 'place' (Thrift, 2003), can be said then to be produced out of an individual presence, posture, bodily and emotional perceptions of a physical environment (Dourish, 2001).

To highlight this, Thrift (2003) uses the example of a country walk, where a sense of place is dependent not just on the visual surveying of an area, but also the "push and pull of walking up hill and down dale, the sounds of birds and the wind in the trees, the touch of wall and branch, [and] the smell of trampled grass" (2003, p. 103). In this example, Thrift is calling attention to the whole range of embodied perceptions individuals have to an environment, each of which combine together to produce a sense of place; the felt incline of the hill through the efforts in climbing it, and the combined tactile influence of the wind, branches and walls, along with "push and pull" of movement, and vision produce an immersive, embodied experience of an environment. His example talks to the 'lived experience' of being in the country, where a sense of *place* is the product of this experience.

It can already be seen that it would be an error to assume that embodiment in this sense is just movement within an environment. Whereas de Certeau (1984) based his notions of everyday life (or lived experience) in the act of moving tactically within a space, Thrift is drawing upon the whole gamut of human perceptual ability to illustrate how a sense of place is produced. Similarly, it would be a mistake to assume that place arises simply from a physical presence in an environment, and the perceptions that result (see Lefebvre's perceived space, Stanek, 2011). Whilst people's initial experience and interactions with an environment are "multi-sensory and corporeally replete" (Bidwell & Browning, 2006. p. 229), it is from the intertwining of this with emotional, aesthetic, cultural and material dimensions of that experience that place is produced (Tuan, 1977).

Humanistic geography is a key theoretical underpinning here, with the work of Tuan (1977, 1974) forming a basis from which much work has evolved. Tuan defines human geography as the study of human-environment relationships, and was concerned both with the physical and emotional, experiential nature of our relationship to environments (Hubbard & Kitchin, 2004). He coined the term 'topophilia' (1974) as a means of describing the affective bond between people and place. He argues that these bonds may vary in intensity and cultural expression, and can be based on aesthetic appreciation, memory, pride of ownership or dependence on a place for one's livelihood

or security. It is not only a response to place, but actively produces it (Gregory, et al., 2009). Whilst his definition of space is something close to what has been termed 'flow space' in this chapter, he defines place as an aspect of space that is constructed through experience and symbolic attachment, whether that be through the embodied senses of touch or movement, or through those same senses on pieces of art, which mean to convey the patriotism or values of a nation-state. In this sense, he says that human places can vary in scale: an armchair by a fireplace is a small place, understood through experience. A nation-state is equally a place, understood not through direct experience (due to its scale), but through the symbolism implicit in artworks, in literature, and in conversations.

Therefore, it can be seen that whilst a person's immediate embodied experience (with its intertwined cultural, emotional and aesthetic perspectives) forms a perception of place, it is through a dialogical relationship that meaning about that experience emerges (McCarthy & Wright, 2005). The process described by Tuan then is examining the creation of an ontologically separate conception of place. Whereas embodiment provides a sensual experience of place, a place's meaning as separate from self emerges as a person reflects upon the immediate embodied experience - either at the fireplace, or through gazing at an artwork - and, either personally or communally, appropriating this meaning (Bidwell & Browning, 2006). Theories of embodiment and a dialogical relationship between space and experience (McCarthy & Wright, 2005) provide a frame through which to understand how meaning can arise from embodied space; that is, how place emerges and is understood.

3.4 Conclusion

This chapter has provided a theoretical foundation to answering the first research question of this thesis: *What is the relationship between space, technology and environmental understanding, and where is that relationship headed?* The first part of this question was explored in Section 3.2, which showed how space has been positioned in HCI to date. That section argued that space is conceived of as a static, abstract container that is the source of problems that technology has been purported to solve. In this relationship then, technology has been positioned as the necessary link between the intrinsically meaningless and problematic space, and our understandings of these same environments. In answering the second part of this question: *where is that relationship headed?* this dichotomy between space and environmental understanding was challenged through the introduction of relational notions of space, and a thematic

exploration of its literature. Within this literature, space is treated as the *product* of various and complex processes and interactions, not simply a stage on which they occur. Rather than viewing space as a singular, abstract plane, it treats it as pluralistic and dynamic, in a constant state of *becoming*. This is in contrast to prevailing approaches in HCI, where relational notions of space further propose that space and environmental understanding are produced from the same processes and interactions and are thus inextricably linked. It is this alternative conceptualisation of the relationship between space and environmental understanding that this thesis will argue can provide a fruitful way forward for ubiquitous computing.

The thematic categories of *networked space*, *flow space*, *temporal space* and *embodied space* lay the theoretical framework for the analysis that follows in Chapters 4 and 5. Having provided this foundation, these chapters will aim to answer the first research question more fully. With the understanding that there is a way forward for ubiquitous computing in taking a different approach to the relationship between space, technology and environmental understanding, the following chapters will provide an exploration of the dynamic and pluralistic spaces of a National Park. They explore how space (and subsequently, environmental understanding) emerges and is produced for a geographically-dispersed organisation charged with managing these natural environments.

4

The Spaces of a National Park

As a means of exploring the pluralistic and relational notions of space presented in Chapter 3, this chapter presents an ethnographic study of the management of a national park within a State government organisation: Parks Victoria. Chapter 2 introduced the organisation and the methods used to investigate the topics addressed in this research. It highlighted that the organisation's practical concerns overlapped with the Affective Atlas project, and how this thesis sits within that relationship. Chapter 3 then juxtaposed literature from ubiquitous computing and cultural geography in order to begin to answer the first and second research questions of this research. To answer the first question – *What is the relationship between technology, space and environmental understanding, and where is this relationship heading?* – it highlighted the ways in which spatiality has been problematised by designers of technology, where space is treated as an inert container that is static, and where technology is positioned as a means of overcoming the disconnection, displacement and invisibility of meaning that result. To answer the second question - *How can the relationship between space and technology be conceptualised in a way that is useful to designers?* - Chapter 3 then provided a thematic analysis of literature from human and cultural geography that treats space as something that emerges out of and is produced by any number of complex processes and relationships. The themes presented - *networked space*, *flow space*, *temporal space* and *embodied space* - provide an alternative view of the relationship between space, understanding and technology.

If – as is posited by cultural and human geographers – every environment can be seen as comprised of multiple spaces, what does this mean for ubiquitous computing on a more pragmatic level? This chapter aims to build on this theoretical understanding by

providing an empirically grounded exploration of what it would mean to consider this pluralistic, relational, and non-problematic notion of space. It does this by exploring the *spaces of a national park*, providing an account of the spaces that combine to enact a national park, on a day-to-day basis, within a government organisation.

The aim of this chapter then is twofold. First, it aims to show that the geographical area known as a 'national park' is comprised of a number of differing and competing processes that are socially and culturally grounded. It will demonstrate that there is not a single 'space' in which technology might reside within the park, but indeed multiple spaces that are produced out of varying and often competing processes and interactions. Second, it will provide a case study that utilises the theoretical framework presented in Chapter 3, which will be used to contrast against work presented in the next chapter. The 'spaces' at the core of this chapter will address both of these aims, connecting the literature from human and cultural geography to the research conducted within the organisation. The spaces to be addressed are: *the spaces of management*, where a description of the various ways the park is managed is given; *a space of alterity*, where the geographical distance between the park and the administrative centre in urban Melbourne was seen as a source of difference; *an historical space*, where an examination of the various ways past experience and knowledge is enacted in the park, and finally, the space of *habitats*, where an examination of the ways the park forms a sense of 'home' for rangers is given.

4.1 Spaces of Management

Parks Victoria is a State government organisation whose primary task is to manage the state's natural marine and terrestrial parks. Chapter 2 gave an overview of the scale of this task, highlighting that the organisation is responsible for the health and maintenance of over 19% of the State's land mass, incorporating most kinds of flora, fauna and landscape found within the State (Parkweb, 2012). Given the diversity of the environments it manages, it should come as no surprise that its management approaches are similarly diverse. 'Managing' in this sense is not just a singular, predictable activity; it means a number of different things to the organisation and its staff. Ecological concerns around preservation of animal and plant species often compete with the need to conduct preventative and ecological burning. Each of these must be considered for their potential impact on tourism and cultural heritage. Each one of these management areas is handled by a distinct department within the organisation, each with their own focus and desired outcomes.

These management areas are the focus of this section, which aims to reveal how each views the park through their own lens, possessing and producing their own unique understandings of it. Their different goals and priorities, borne out of networks of people and places, lead them to interact with the park in different ways. These management areas combine to show that a park is, administratively, a number of *spaces of management* (Figure 4.1).

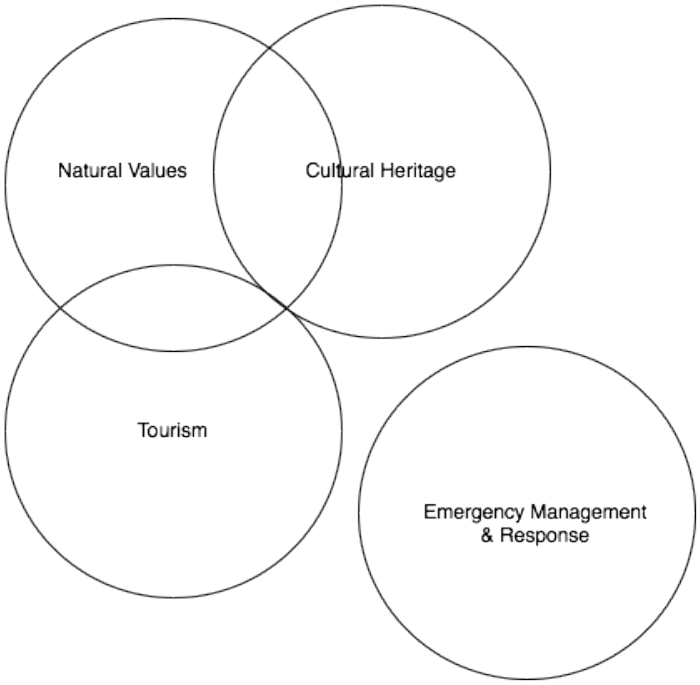


Figure 4.1 – Four main management areas in the organisation overlap and compete with each other. Each view the park as something different, based on their priorities and perspectives.

Whereas the organisation's primary role is to preserve and protect the flora, fauna and natural features of these assets, fire ecology and management is also a key area of responsibility. These ecological concerns are covered by two broad focus areas within the organisation, each represented internally by a group of people with their own structure and goals. They are the Natural Values Management team and the Fire and Emergency Management team.

The Natural Values Management (NVM) team is responsible for monitoring of flora, fauna and water within the organisation's protected areas. Their stated goal is to "sustain healthy parks in a time of climate change" (ibid. p. 9), and they do this through extensive monitoring of pest plants, animal control and other monitoring programs, in addition to conducting collaborative research with universities and government

research institutes (Parks Victoria, 2010). When asked to describe the typical work this group is involved in, NVM team member Mark responded:

> We design experiments that monitor some aspect of the park and help staff in the park implement them. We base these [experiments] off our 'natural values', which might mean eradicating pest animals and weeds, protecting endangered species and stuff like that. These programs can last up to 3 years, and we collect all that [data] together to get a snapshot of how healthy our parks are.
>
> *Mark - NVM Team, Bourke Street.*

The team also involves external research groups in this process, and it acts as a 'port of call' for staff in parks who have scientific enquiries. Within the *space of management* for the NVM team, parks are places that need to be closely observed and controlled; they are places to monitor, to watch for trends, and places to protect. They are also places to *aggregate*, with the group holding an important reporting duty in the organisation's annual "state of the parks" report (Parkweb, 2012).

Separate to the monitoring activities of the NVM team, the Fire and Emergency Management (FEM) team are responsible largely for the mitigation of fire risk through controlled burning and ecological management, but they are also equally responsible for responding to any kind of natural emergency, including both fires and floods. Their goal is to provide "responsive and professional fire and emergency management" (Parks Victoria, 2010. p.9), and they do this by collaborating with other State government departments to conduct planned burns that reduce fuel levels, manage the initial response to an emergency event, and plan and oversee any recovery works that may be required. For them, the park is seen as a place of *potentials*, where emergency events are always a possibility. The majority of their efforts involve attempts to mitigate this risk; however, they must be always prepared and on alert for conditions that may lead to an uncontrolled event. They prepare for this by balancing the need to protect the ecology from the adverse effects of planned burns, whilst also having to respond to community and political perceptions of safety and preparedness.

So, even under the umbrella of 'ecology', the organisation's focus and goals are varied. Teams of scientists are employed to monitor and control populations of animals, eradicate pests and promote the health of native wildlife and flora, whereas others are responsible for planning burns that are both ecologically responsible, and politically and socially acceptable (Fire Commissioner's Report, 2009). In recent years, this has seen tensions increase between the need for responsible ecological management –

where fire is seen as an important part of managing a landscape, but only in the *right places* at the *right time* – and a political imperative to burn a designated number of hectares per year to ensure community safety. Within this, ecological management is indeed a balancing act between environmental concerns and public opinion. For these two management areas the park is at once a place to monitor and protect, but also one to tame, control and *present* to an attentive public.

In parallel to these complex ecological responsibilities, cultural heritage and management is also a significant focus within the organisation (Parks Victoria, 2010).

> My job is to understand how Parks Victoria stores information about its parks, and to figure out how I can input indigenous values and knowledge into that. It goes an extra step beyond natural values management. It's about aboriginal cultural knowledge about these areas.
>
> *Bec, Indigenous Research Officer. Bourke Street.*

The Cultural Values Management (CVM) team are responsible in large part for the organisation's cooperation with various groups of indigenous and traditional land owners, whose land is now partially or wholly contained within the land parcels managed by Parks Victoria. The focus of this team is on incorporating traditional land management practices and cultural values into the management plans of the broader organisation, and in recent years has taken the form of joint and co-management with indigenous communities (Parks Victoria, 2010). These initiatives have led to the establishment of two large, formal areas of collaboration within the State (Parks Victoria, 2012), and the continued identification, documentation and maintenance of over 600 Aboriginal Heritage sites across Victoria.

For the CVM team, parks are places of historical significance, and are typically of great cultural importance to their traditional landowners. Indeed, the separation between what the NVM team calls 'natural values' and traditional cultural and ecological knowledge is not made within the CVM team. 'Cultural' knowledge, and the 'ecological' knowledge tied up in the organisation's natural values, are seen as the same thing.

> It's the world views and belief systems [of Aboriginal people] that allow us to look at the environment differently. It's those cultural lenses that we wear… we see different things looking at the same place. At the moment Parks Vic sees those [natural values and cultural values] separately, whereas Aboriginal people see them as the same thing. We need these places to be healthy because they support our social systems.
>
> *Bec, Indigenous Research Officer. Bourke Street.*

Whilst the incorporation of indigenous practices into the organisation is an ongoing challenge, the co- and joint-management plans are an attempt to involve the indigenous populations, whose land is now classified as a 'park', in the organisation's form of management, and to enable them to continue to practice and pass on their cultural knowledge. At the same time, they are attempts to incorporate those same values within the organisation as a whole. 'Management' here then is about enabling traditional practices to continue, preserving significant sites, and simultaneously looking for opportunities to incorporate lessons from these into Parks Victoria's other management practices.

Each of these management areas discussed so far focus on the parks as natural sanctuaries that need to be protected and nurtured. The NVM and FEM teams are primarily concerned with maintaining a level of health in parks based on a particular world-view, based in measurement and observation. The CVM team, on the other hand, are focused on preserving aboriginal cultural heritage, and fostering partnerships with traditional land owners in the hope of preserving these cultures, but also to incorporate lessons from them into these other ecological management areas.

Overlooking each of these areas is an attentive public and political body - comprising local community groups, holiday makers, nature enthusiasts and various environmental, tourism and recreation ministers - whose opinions and expectations on public safety and year-round access often compete with notions of good ecological and cultural management carried out by these groups. This close attention is not surprising given the significant number of visitors hosted by parks. As such, Tourist and Visitor Services (TVS) is also a significant area of focus for Parks Victoria, and the final *space of management*. According to Tourism Victoria (2008), Victorian national parks attract the highest number of park visitors in Australia, with over 85 million visitors recorded in the 2010-2011 period (Parks Victoria, 2010). The simultaneous economic and well-being benefits position these parks as important for both the rural communities that surround them, and urban visitors who use them as recreational destinations. Visitors also include those arriving for educational purposes, such as school groups, and volunteer and hobbyist groups wishing to contribute to various programs and initiatives. In 2010, volunteers contributed close to 200,000 hours of their time towards such initiatives, figures which, when taken with overall visitor numbers, hint at the significant place parks hold within the community (Parkweb, 2012). The TVS team are responsible for ensuring parks are accessible to the public in ways they expect, and to facilitate the participation of groups such as 'friends of the park' (Parkweb, 2012), school groups and other hobbyists in forms of citizen science

that contribute valuable data to the rest of the organisation. For the TVS team, park management means a focus on *accessibility* and *facilitation*.

These *spaces of management* highlight the delicate balance Parks Victoria is tasked with on a day-to-day basis. Ecological concerns for the preservation and protection of parks must be contrasted with a responsibility for community safety through planned burns, which can often compete with the ideals of good ecological management. At the same time, there is a large responsibility to provide year-round access to the community for recreation, education, research and economic purposes; as such, there is a deep-seated expectation within the community that parks recover quickly from naturally occurring events such as floods and fires. In addition to this, each of these areas of focus must also be managed with respect to cultural heritage sites in the context of joint and co-management agreements with traditional landowners. Already, then, it is not difficult to see that the notion of a 'park' is the result of many varied, competing spaces that combine to produce it. Indeed, each of these management areas can be seen to interact with parks and sanctuaries in different ways, producing different understandings of them. From the organisation's perspective, Wilson's Promontory National Park (WPNP) is produced out of these *spaces of management*.

4.2 A Space of Alterity

The last section examined how various management groups within Parks Victoria produce *spaces of management*: spaces within which the organisation's parks are seen as something to control, tame, monitor and protect. On the one hand that section acted as an introduction to the formal structures of the organisation, showing how the top-down division of responsibilities within Parks Victoria formed networks of people and practices that dictate the way parks are managed. On the other hand, it exposed how the notion of 'management' was not just a singular activity but instead a pluralistic one that takes into account many different and often competing priorities and perspectives. Each *space of management* is defined by these priorities and perspectives, and their differing interactions with the park produce unique understandings of it.

In addition to showing how different understandings are produced out of competing management areas, the *spaces of management* can also be seen as an example of how groups and group identities form within the organisation. By clearly delineating priorities and responsibilities into separate management areas, the organisation has established conditions under which individual group identities are formed and enacted.

These groups are defined by their management priorities: scientists in the NVM team are positioned as experts on the measurement and assessment of the organisation's natural values, yet are lacking in local knowledge, whereas members of other teams might be seen as advocates for park visitors and volunteers, or custodians of traditional cultural knowledge for whom ecological concerns are second to tourism and cultural values.

This section will further explore the ways in which identities are spatially formed and enacted within Parks Victoria. It will do this through the notion of *alterity*, exploring how different areas of the organisation position and define themselves against an 'other'. 'Identity', as it is used here, is often closely tied to notions of alterity, a word from philosophy that describes how the notion of the 'self' is defined through comparisons of difference (Gingrich, 2004). In this, individuals or groups are said to define their concepts of 'self' through explorations of what constitutes 'not-self' (Linke, 2012). *Alterity* then is two things: a means of investigating how an individual or group of people define themselves, and a way of examining the way these same entities differentiate themselves from others. For that group to know themselves, they have to know also what they are *not*.

Therefore, if the *spaces of management* can be seen as the result of the top-down formation of groups within the organisation - one example of *alterity* - then exploring the ways in which further groups form is worthwhile. Similarly, exploring the gaps *between* these groups will illuminate how the staff within the organisation identify themselves as distinct from others. It is these gaps, the distinctions *between* groups, that produce what this thesis will refer to as a *space of alterity*. This space is one that is the result of comparisons of difference (Gingrich, 2004) within the organisation, and examines how staff differentiate their practices, knowledge and experience from each other in a process that defines them. This section will therefore explore how the notion of 'otherness' is both a source of identity within Parks Victoria, but also a source of *opportunity*, where groups eventually recognised each other's unique sets of skills and perspectives.

Beyond the prescribed networks of management focuses within the organisation, the most prominent ways staff created a sense of the 'otherness' was through notions of spatial *proximity* and *distance*. Within this, the geographical location of staff was seen as an identifier to an assumed set of knowledge, perspective and motivations. Just as Lofland (1973) explains how locations, rather than appearance or actions, are often used to define the people that are in them, Parks Victoria can be seen as a highly

territorial organisation within which geographical locations are seen as a clear signifier to a set of stereotypical perspectives and skills. This was most prominent when examining and comparing staff based in the 'city' office, and those in the 'country', that is, the regional centres close to the parks.

> There seems to be such a distance between 'PV' staff who work in Bourke Street in the city, versus those who work in the field. Bourke Street and Box Hill seem to be their own separate entities and are very much detached from the parks.
>
> *Anonymous. WPNP*

Whereas the *spaces of management* can be seen as a top-down formation of group identities through management structures, the quote above, from a member of staff who wished to remain anonymous, highlights a sense of 'otherness' based on something that is inherently more spatial*: distance*. Distance, as it is used in the quote here, is ostensibly about the geographical distance between WPNP and the administrative centres in 'Bourke Street' (in the Melbourne central business district) and the suburb of Box Hill in Melbourne's east, both of which are approximately 300 kilometres away from WPNP. However, the phrases 'separate entities' and 'detached from parks' allude to something more than just a physical distance; it is a distance in the *practice* of people in these locations, or *understandings* about the parks themselves they are assumed to possess (or not). '*Detachment*' hints at some kind of fundamental lack of understanding, and phrasing these locations as '*separate entities*' suggests a division that goes more deeply than simply being geographically separate. When prompted on this, the participant continued:

> Well, there's that difference between people who work in different parks too, but it's more obvious with the desk-based jobs. 'PV' staff who have the privilege of working in a park don't necessarily know what Bourke Street do, and vice versa.
>
> *Anonymous. WPNP*

This quote is illuminating, as it explicitly makes the connection between an assumed difference in practice and physical location. Distance, as a source of *alterity*, is not just about different parks being geographically separated from each other, or about 'Bourke Street' being 300 kilometres away; there is an implication in this person's quotes that there is something learnt from being proximate to a place. Those further away are believed to lack the experience or understanding of those who are physically located in

WPNP, and similarly that those in the 'park' are separated by a lack of understanding of the practices of those in the 'city' - what they '*do*'.

It can be seen therefore that locations are assumed to be an indicator of the kind of practices and knowledge people located there enact, and geographical *distance* is treated as a proxy for 'otherness': the further away staff are from the park, the further away their assumed understanding and knowledge of the park is. This is echoed in the following statement from an anonymous member of staff working from WPNP:

> What do they do in the city? No idea!
> *Anonymous. WPNP*

Whilst the tone of the above quote was off-the-cuff and jovial, it summed up the attitudes of many in the park. Due to the 'city' being quite distant from the park geographically, it was seen as detached from it in a way that more aptly spoke to its knowledge and practices rather than actual physical distance. It also suggests a lack of *visibility* and relevance of practices that is a result of such distances; "*no idea!*" indicates not just a lack of comprehension over what occurs 'outside' the park, in those 'other places', but equally a lack of means or desire to find out.

This was not just a uni-directional issue in regards to the *visibility* of practices though, where staff in the park are content going about their business with little thought to those 'elsewhere'. Some staff in the park similarly lamented the lack of recognition or understanding of what they "*do*" in other areas of the organisation as well:

> Most people [the general public but also some city staff] think the only people that work in parks are rangers. It's really only a small percentage of staff in the park that are [rangers]. People assume that they're the ones that are out in the park doing all the work, when the reality is they're most likely in the office planning the work. It's the field service officers who are out there doing most of it.
> *Lorinda, Tourist Services & Education. WPNP*

Lorinda is talking about the lack of *visibility* those in the park have to those outside of it, whether that be staff in the city or the general public. However, the kind of *alterity* generated by this *distance* and *visibility* was perhaps most heavily felt in the Bourke Street office itself. During interviews with the NVM team, a number of participants commented on the difficulties they have in getting staff in the parks (not just WPNP, which was mentioned to be "better than most") to engage with them in activities such

as experiment design and monitoring projects. When asked about when people in parks contact them, Mark responded:

> It's random. Some people don't know who to come to for help [with monitoring]. When they do, they don't know exactly how we can help a lot of the time.
>
> *Mark, NVM Team. Bourke Street*

Whilst this talks to the lack of *visibility* that previous quotes raised - "*people don't know who to come to*" - it highlights that the staff in the city were aware of the perceived distance between them and the parks, and that these distances are defined by geographical locations, yet extended to mean much more than that. The phrase "*how exactly we can help*" highlights a sense of 'otherness' that extends beyond location to sets of *practices*. This was further illuminated by Marie in response to the same question:

> Not everybody would [contact us]. There are very practical people on the ground who probably think [my] research is too "boffin-y".
>
> *Marie, NVM Team. Bourke Street*

Whilst Marie is still talking about the difference in approaches based on staff's geographical location, she is also highlighting a different set of issues. She is not assuming a lack of *visibility* in her interaction with staff in the park, but is bringing to light something that is more aptly described as *legitimacy*. Marie is discussing how she thinks her work is perceived in parks: *"too boffin-y"* is a phrase that refers to something that is abstract or esoteric, a view that was commonly attributed to those in the Bourke Street office who were seen to possess something more akin to 'text book' knowledge, rather than the 'practical' experience of park staff. *"Very practical people"*, on the other hand, is a phrase used in reference to staff in the park who are *"on the ground"*, and in this case it is used almost as a euphemism for 'disinterested' or 'disengaged'. Both of these aspects of Marie's response reinforce the notion that locations within the organisation are equated to a distinct set of practices and interests. Additionally, she is also highlighting a tension between the *types* of skills and practices people in those locations stereotypically possess and the *legitimacy* of each.

Glen, another member of the NVM team, also alludes to the issue of *legitimacy* in the following comment:

> I spent 12 years in a park before I got here (in the city office). Once people realise that they are a bit quicker to call on me for advice on how to do this stuff.
>
> *Glen, NVM Team. Bourke Street*

This is highlighting a connection between each of the issues of identity, location and legitimacy that has been seen up to now. Glen currently works in the Bourke Street office, and expresses similar difficulties in gaining recognition of his skills and experience. However, interestingly, he states that once people realise he has significant experience in a park - "*I spent 12 years in a park before I got here*" - staff are "*quicker to call*" him. He is suggesting that once staff in parks understand that his range of experience might cover what they "*do*", that he might possess the kind of local and 'practical' knowledge that they value, they are quicker to involve him in their projects. Essentially, Glen's knowledge of monitoring protocols and procedures - a stereotypically 'city' thing to know - is legitimised by him having an assumed knowledge of parks that is more 'authentic', and *closer* to what parks staff value. For Glen, his past experience helps mitigate some of the perceived *distance* between the city and the park.

It can therefore be seen that geographical location, as a source of *alterity,* is a clear signifier of identity within the organisation. Similarly, spatial *distance* is seen as a proxy to a *distance* that is more akin to practice, experience and understanding than any geographical separation, and this distance raises issues of *visibility* and *legitimacy* of practices across those locations and/or identities. This *space of alterity* is seen then to define groups of people around distinct knowledge and practices. Similar to the ways in which the management areas within the *spaces of management* defined the different priorities and perspectives of each management team, the self identities of staff are closely tied to the physical location of their usual workplace.

Rather than wanting to position *alterity* simply as a source of tension or segregation within Parks Victoria though, this section wishes to highlight that *alterity*, with its notions of the 'other' formed through spatial *distance*, is an important way that identity is formed within the organisation. Indeed, rather than being an overly negative exploration of the ways groups define themselves through excluding others, this section positions *alterity* as a tool for recognising that there are distinct sets of practices and knowledge within different *networks* of people, and that once issues of *visibility* and *legitimacy* are overcome, a great deal of collaboration and participation occurs.

Glen's quote, whilst highlighting the issues of *visibility* and *legitimacy* prevalent in this section so far, is also an example of how knowledge and experience flows across the organisation's geographical locations. Glen highlights that, once staff knew what he did and trusted that he understood and could apply his knowledge to their own circumstances, they were much quicker to call upon him to help with monitoring projects. Once these perceived *distances* in practice and knowledge are understood, they can be overcome. Indeed, throughout this research, and particularly during the 'follow-the-thing' study, people that were exposed to recordings and pictures from different areas of the organisation recognised the value of these perspectives. The *space of alterity* was one that essentially fostered collaboration through different networks of people and practices.

When presented with a diary entry describing a change in vegetation that had occurred due to a recent fire in the park (2009), a number of staff commented on the value of this to them. In this diary entry, the participant was highlighting what had changed in recent years (since the 2009 bushfire), and was reflecting on whether a planned burn was needed to restore the landscape to its previous state. It highlighted the tension between planned and unplanned burning.

Staff in the Bourke Street office made comments about the usefulness of the entry for their own work, and commented favourably on being exposed to a different set of knowledge and insights that are typically not accessible in the city:

> This stuff never finds its way to me. This would be a great thing to communicate to people on Facebook for instance. It tells a good story.
>
> *Jon, Communications Officer. Bourke Street*

> This would make a good discussion point on connecting aboriginal fire use and the ways fire was used to maintain the landscape rather than change it. I'd want to include this in a discussion paper.
>
> *Rebecca, Cultural Heritage Officer. Bourke Street*

The entry was even seen as useful and insightful for staff in the park itself:

> I didn't know that! I've just come back from talking about fire to kids, where I was explaining that fire is good for the park. This tells me something different. I need to know this stuff so I can incorporate it into education.
>
> *Lyndon, Education officer. WPNP*

Each of these comments highlights the benefits of the flow of unique local knowledge and perspectives across the organisation. Jon and Rebecca comment on the value of gaining a perspective of the park that they would not otherwise obtain. Lyndon, despite working in the park itself, did not have the same sets of experiences as the participant who made the entry, and was excited to have access to it. So, despite working in largely different areas of the organisation, the same diary entry was interpreted and appropriated in different ways depending upon the geographical location of staff, and similarly the *networks* and management areas they worked within. Rather than *alterity* being a source of tension or segregation, there was a tacit recognition that, due to the entry coming from an 'other', there was value in gaining different perspectives and insights from across the organisation.

With this, we can begin to see that there is a pluralistic notion of space that sits within a *space of alterity*. In this space, geographical location is a means through which group identities evolve and define themselves. Whilst this was sometimes a source of anxiety or frustration for some people, it ultimately led to the construction of unique understanding and perspectives on the parks managed by the organisation. Indeed, once the issues of *visibility* and *legitimacy* were overcome, the pervasive view of the 'other' as something tied to geographical distance ultimately acted as a means through which unique perspectives were sought and shared. The *space of alterity* ultimately facilitated flows of insight and experience across the organisation by providing a clear signifier and index to sets of attributed knowledge. In this, geographical *distance* was a source of identity and difference, but also a way in which groups of people were free to engage in their own practices and eventually be recognised as custodians of a certain type of experience that could be sought.

The *space of alterity* then is something that not only defines sets of practices based on geographical distance, but also sets up the conditions under which those groups interact. It is with this notion of interaction between groups, where groups define themselves based on notions of geographical proximity and distance, that *alterity* can be seen not just as a source of difference within Parks Victoria, but one of opportunity. The ways in which different networks of people and practices define themselves against an 'other', then, is important to consider. If the last section showed that networks of people and practices produce unique and valuable understandings of a park, then it becomes possible to imagine the park not just as an entity produced from these overlapping perspectives, but out of the *differences* between them; the gaps between people and their practices.

4.3 An Historical Space

Before it can ever be a repose for the senses, landscape is a work of the mind. Its scenery is built up as much from strata of memory as from layers of rock

Schama, 1996. p.6-7.

The previous sections explored the ways in which the management areas of the organisation have led to a top-down formation of *networks* within which a prescribed set of management practices produce unique understandings of the park. In these *spaces of management*, groups within the organisation interact with parks in ways that are dictated by their management goals. The *space of alterity* then investigated how groups defined themselves against an 'other', revealing how spatial distance was as much a source of difference as any management goal. In these, both the notions of *networks* of management structures and *alterity* of distance create their own spaces within which particular knowledge of the park is produced.

This section will now focus on how meaning, experience and knowledge are constructed around specific geographical areas of the park itself. Specifically, it will examine how these are constructed over time. If the previous sections have looked at *networks* of people and place and the *flows* of experience and practice between them, then this section will examine the *temporality* of WPNP. That is, it will examine the ways in which a number of historical spaces coalesce to produce an understanding of the park in the present. Chapter 3 laid the foundation for this exploration by showing that spatialised temporalities combine to influence views of the present. In that chapter, the different ways in which history is spatialised was explored, where phenomena such as cultural memory is viewed as essentially spatial rather than temporal. To fully understand space is to gain an appreciation of the various histories that are constructing its present. As Massey (1995) states, "the past is present in many different ways".

Temporality plays a significant role in how WPNP is understood within Parks Victoria. Just as Lefebvre describes cities as places where 'temporalities collide' (2004), the park can similarly be viewed as the meeting point of various temporalities. These temporalities take form in the numerous official databases within the organisation which aim to formalise and index the park for management purposes, through to the ways in which the past practices of traditional land owners are investigated and

incorporated within the organisation's operations. Similarly, the lived experience of staff within the parks themselves becomes a source of historicisation, where their interactions over time lead to the park becoming a site of memory (Nora, 1993). Within each of these, the landscape of the park itself becomes an important part of a dialogic relationship between staff and their understandings of it. This section will be dedicated to exploring these different temporalities as they occur within the organisation.

4.3.1 Historicising through Data Archiving

Within Parks Victoria, the historicisation of parks is, on the surface, primarily a story of attempting to formalise what is known about certain areas of a park into accessible and actionable data. 'Historicise' is used here to describe the process by which some aspect of the park's past is constructed into a form to be disseminated within the organisation. Whether it be the scientific monitoring of places over time, efforts to gather what factual information is available about a park's fire history, or attempts to 'attach' scientific research to certain places within a park, much of the effort of the organisation around historicising is through this accumulation of atomised, observable information. Within this, disparate archives of their parks are built up over time: stored in legacy GIS systems, personal *Excel* spreadsheets or *PowerPoint* presentations with limited visibility to the organisation, or simply in the form of documents in a filing cabinet. Although in this often informal historical space, the park is nevertheless viewed as something of value to document and record.

Figure 4.2 – 'Stakes in the ground' are literal markers of historicisation. This indicates that scientific monitoring has occurred at this point.

The desire to collate temporally derived data through historicisation filters down from the management perspectives that are dictated by scientific measurement and observation. The picture above (Figure 4.2) was taken on a tour with staff rangers, and shows a stake in the ground, indicative of where a 'measurement plot' has been constructed. There are hundreds of such plots within the park, and they represent areas where longitudinal studies have or are currently being conducted. The locations of these experiments are recorded, via GPS, as being conducted in these places and the findings are used to generate any number of academic reports and documents. The stake becomes an indicator to those in the park that 'scientific knowledge' has been recorded there. Not unlike the ubiquitous 'pin on a map' that has come to represent location-based data in a plethora of Web mash-ups, the physical stake acts as a signifier and an index to rangers who happen across them. However, beyond simply knowing that *something* was done in these places, the findings of these experiments do not often make their way back to those who are operating in the park on a day-to-day basis. Indeed, at the time of this research, there was a project under way which aimed to construct a map-based representation of WPNP upon which scientific reports could be 'attached'.

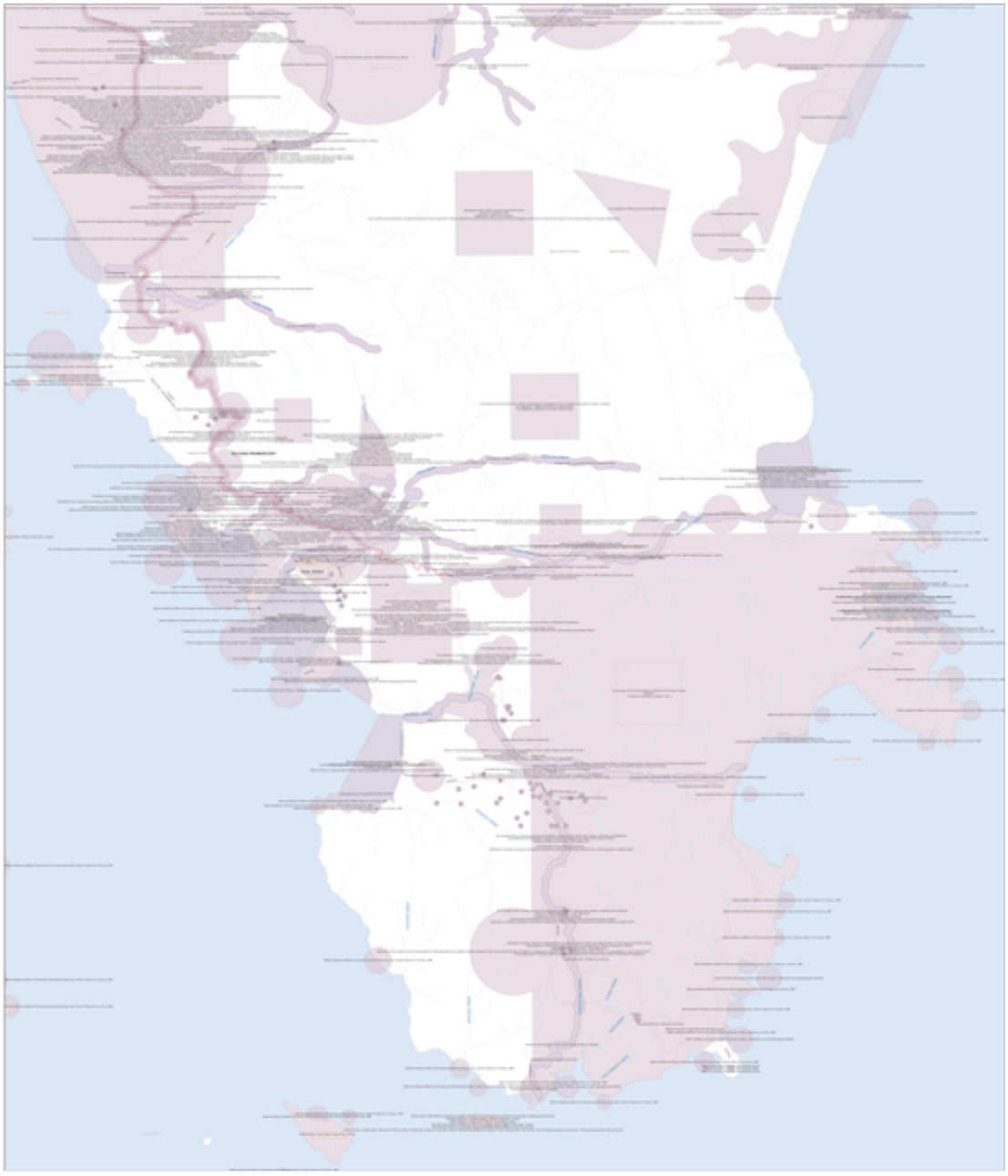


Figure 4.3 – A map of areas in the park that have research reports on them. Reports were obtained from filing cabinets within the park and manually added to the map.

The picture above (Figure 4.3) is the result of the research mapping project, whose aim it was to represent the hundreds, if not thousands, of research documents that represent an area of WPNP. Shaded areas represent regions and sections of the park that have had scientific reports written about them, and the titles of these reports are displayed across the map itself. Whilst this map does not reference time explicitly, it is an example of the kind of historicisation that is being addressed here. By accumulating

scientific reports, the map forms a history of the scientific activity of the park, where 'location' is the index to it. It is an artefact that embodies a certain historical perspective, grounded in measurement, with the purpose of disseminating this perspective through the organisation.

This form of historicisation - where recorded data is constructed into a summarised, more accessible form - is typical of the organisation, wherein historically relevant information is seen as something to be derived from these accumulated data sets, and where temporality is seen simply as the driving force in the accumulation of this data.

Beyond the representation of fairly static data in forms of location-based document management systems, little else is reported in this form of historicisation. These historical archives are primarily used to study trends and patterns and, according to one member of staff, these data stores are very much used in a museological sense where, like in a museum, things are simply indexed and stored to be later drawn upon.

> The kinds of databases we use are a very limited view [of the park]. It's very much just about recording 'stones and bones' … it's best to think of them in a museological way.
>
> *Rebecca, Cultural Heritage Officer. Bourke Street*

Whilst Rebecca is discussing the limited view these databases allow on cultural heritage related information - *'stones and bones'* is shorthand for a view of cultural heritage that is overly informational and ignorant of actual cultural influences - the view of these databases as lacking in some way is widely accepted in the organisation. Indeed, given this research's overt focus on 'technology', many interviews and conversations started with participants pointing to the ways in which they thought the processes involved in this historicisation could be improved.

> [I've] just brought in some of the monitoring cameras we've got and I'm going through the images. There's 90 cameras worth to go through. One has 8000 images because it malfunctioned. Most have around 200 images.
>
> *Jim, Project Manager. WPNP.*

> Today I've just been doing data entry and just sorting out the photos. Not a very exciting day, but this is all going towards putting together presentations for Friends of the Prom and other community groups.
>
> *Emily, Field Service Officer. WPNP.*

Both Jim and Emily are describing scenarios at the end of a monitoring or assessment project carried out in WPNP where they are required to collate vast amounts of recorded data. This collation again provides an example of the historicisation; "*going through*" and "*sorting out*" imply acts of constructing this data into a meaningful form, a form that is meant to convey some useful information about a particular aspect of the park for a particular purpose. Indeed, many of the activities of staff within the park are around the construction of such datasets, with the aim of having them available for future trend and pattern analysis. In this sense, historicisation can be seen as an act of *archiving*, where staff gather data about areas of the park and construct them into forms suitable for storage and dissemination within the organisation. It is these datasets, when viewed as a whole, that provide an historical perspective of the park that might be described as a history of archival data. It is an historical space which is constantly being built upon; it is often ad-hoc in the technologies used and as such it is as closely related to the experiences and perspectives of staff who collate this data as it is to the technologies which capture and store it.

4.3.2 Landscape as a Site for Cultural Practices

There is a particular temporality of the park that lives within numerous formal and informal databases, and these databases are often constructed in an ad-hoc manner by staff whose aim is to *historicise* this data - to build a story around it that illuminates some aspect of the park to be accessible across time. The goal of this is to contribute to the long-term monitoring of the park, a priority that is derived from the management perspectives of the organisation that privileges observable and measurable data. In addition to numerous monitoring sites across the park, and the construction of historicised stories, these databases are also used to maintain a record of cultural heritage sites and artefacts. The database that stores this information is an example of the museological limitation of this informational view of aspects of the park; rather than containing much on cultural practice, it is simply a record of the culturally relevant *'stones and bones'* that have been found in the park. However, it is also a good example of how these databases are used in connection to the landscape of the park to reveal other histories that are resonant within it - the histories of cultural practices.

The database contains a number of different records, including the location of discovered artefacts, such as stone axes, and the location of *middens* - a feasting ground where groups of traditional land owners once congregated to eat seafood and other

game. This objectified database of cultural coordinates sits in a system that is accessible only to certain qualified officers in the organisation - its two anthropologists, as well as those involved in cultural heritage management. Whilst the database is relatively static - in a '*museological*' sense - its data has been used in conjunction with ecological monitoring and observations in the landscape of the park itself to provide clues as to the movement and practices of traditional owners. In this sense, its data has been used to illuminate the rhythms and patterns of the traditional landowners in a way that connects it to the landscape itself.

To achieve this, the data in this database have been one piece of a 'picture' of the park that has contributed to the construction of a *seasonal calendar*. This calendar is a representation of the cultural practices of traditional landowners, and ties together notions of movement and management to the landscape of the park, whilst mapping these practices to certain periods of the 'western' year. What this begins to highlight is the ways in which the data from historicised aspects of the park are used to provide clues to practices within the landscape itself. It also highlights that the efforts to historicise the park through *archiving* is done in parallel to the ways in which the landscape may already be resonant of these practices.

Indeed, this effort to historicise the park is in parallel to the ways in which the park is already meaningful to those who are regularly based there, and who have built up experiences of the park over time. The diary study demonstrated how resonances from the past are present in the landscape of the park already. Here, the landscape holds lessons from the past that reveal themselves through spatialised records of ecological change.

Figure 4.4 – Jim's picture at Squeaky Beach

> I'm at the Squeaky Beach turn off, just taking a shot of the hill looking up towards Mount Bishop. This has always been open heathland, but since the '09 fire it's been coming up very thick in brown stringy bark. So that's all changed the vegetation type at this site due to that particular fire.
>
> *Jim, Project Manager. WPNP.*

Jim's diary entry is highlighting the change in flora that has occurred over time as the result of a fire in 2009. He is drawing upon his past experience and knowledge of the park - "this has always been open heathland" - but is primarily participating in an act of historicisation here. By taking note of the change that has occurred, Jim is drawing attention to his recognition of something that has historical significance; he is constructing a story about this location based on the way in which it is meaningful for him. Here, the landscape itself becomes a tool for Jim to draw upon in his understanding; indeed, it becomes a home for the resonances of the past that he sees within them (Figure 4.4).

When showing this same note to other people in the organisation, the role of the landscape as a meaningful embodiment of some past practices or event became even

clearer. In the previous section on *alterity*, Indigenous research officer Bec commented on the entry with great interest. Mainly, she saw it as a great discussion point on the use of fire to manage the landscape.

> It makes me think of the 'Prom being burnt, and what the traditional owners have said about the 'Prom being burnt. When fire has opened up the area, the stringy bark seeds - dormant in the ground - are given the opportunity to spring up… usually landscape change is due to agricultural impacts, or human activity, but this was a natural change. It's probably a good thing… this would be good in a discussion paper on fire [use] today [as a management tool] and how it can effect biodiversity, when our biodiversity benchmark was the time when Aboriginal people were looking after the land. Fire was an important management tool for them.
>
> *Bec, Indigenous Research Officer. Bourke Street.*

For Bec, this diary entry - and by association, the landscape referenced in it - became a proxy for the discussion of traditional land management practices. For her, the seeds laying *"dormant"* in the ground spoke to a departure away from the land practices of traditional owners, where the organisation, for a significant period of time, had a policy of extinguishing any wild fires whilst putting a halt to planned burns. During this time, any fire was seen as risky, unpredictable and bad for the landscape. In this sense, the fire that went through Squeaky Beach in 2009 can be said to have revealed a form of cultural memory that was inherently contained in the park itself; for Bec, the fire revealed cultural ecological practices that lay dormant in the landscape, and provided ecological clues on the management that traditional land owners undertook. In this way, Bec saw the landscape as a site of cultural practice.

4.3.3 Landscape as Sites of Memory

Beyond attempts to historicise the park through formally recorded data, and beyond the *reading* of the landscape for evidence of past practices, the park itself became a site of memory for the staff that work within it. This speaks to a different form of *temporality*, one that speaks directly to the experiences and interactions of staff within the park gather over time. Individual staff form a kind of personal history of the park through their daily, routine behaviour, and these singular histories of the park combine to form a collective experience. In this sense, the park can be seen as a *site of memory* for these staff - the home for their personal histories.

By *sites of memory*, I am drawing upon Nora's (1993) view of spaces as spatialised individual histories, where places can become memorialised and where the actions of people within a place allow them to attach past experiences to them. During the diary study, a common type of entry involved recording some kind of personal recollection or insight about a particular location within the park. Some of these were of a nature already discussed: noticing a change in the landscape, or talking about what a place used to be like compared to the present. These spoke to the ways the landscape held resonances from past practices and events, where meaning revealed itself to those who had certain sets of knowledge or perspectives. What has also been discussed is how the organisation as a whole historicises the park through formal and informal data collection and archiving. An exploration is now given of how this happens in relation to the landscape itself, where personal and collective experience as a form of memory builds up in a landscape over time.

The accumulation of meaning over time is one way in which the landscape becomes a site of memory for staff. During the diary study, Jim recorded many entries that were personal views on areas of the landscape: his recording at Squeaky Beach was one where he wished to document a change in the landscape he had observed. In another entry, Jim commented on a seemingly trivial thing he had noticed in the park over time. The tone of the entry was matter-of-fact and reflective, and the picture accompanying the entry is included below.

Figure 4.5 – Jim's note describing his regular spotting of a kangaroo at a specific point in the road

> I'm up the point where 5 Mile Road meets the main 'Prom road. Taking a snapshot of an old male kangaroo. It's just an interesting observation that at this spot you can often see old male kangaroos, they are attracted to this particular spot. I don't know [why], but I've seen it happen over the last 30 years. There's regularly one here.
>
> *Jim, Project Manager. WPNP.*

The content of the note is inconsequential to Jim: he was not sure if it would be useful or not. Importantly though, despite the content of the note, he is highlighting his ability to accumulate observations over time. Through his vast experience and time spent in the park - "*over the last 30 years*" - his observations of seemingly innocuous occurrences in the park make that place meaningful to him. Whilst the landscape itself does not contain resonances from past practices or experience that are visible to Jim, it does contain meaning in a way that is personal to him. The entry and its picture (Figure 4.5) were recorded from the road in Jim's vehicle as he moved from one place to another, and through his daily movements within the park, Jim has built up a canon of experience about such places. His own movements through the landscape allow places such as this to become sites of memory for him - in this case, the *memory* of seeing similar fauna in the same place.

The park was a site of memory on a more collective scale too. If Jim's entries have indicated how his lived experience of the park, over time, has made seemingly innocuous places meaningful to him, then the same is true for groups of staff who share these experiences. One example of this was evident during a meeting of the 'Fire Management Working Group', a team of people whose task is to mitigate the risk of an unplanned fire through planned burns. In this meeting, the role of the park as a home for the group's individual and collective experience became evident. During a conversation with Whelan after the meeting, he explained why this meeting might be of interest to the present research.

> These sessions are quite powerful because a lot of the membership of the working group were involved in managing the fires in 2005 and 2009. They are all very experienced fire managers and many of them are approaching retirement. There is a very good chance that the next time we get large fires on the 'Prom these people will not be around.
>
> *Jim, Project Manager. WPNP.*

Whilst Jim is obviously talking about the practical problem that Parks Victoria has around 'knowledge management', and of wanting to capture the tacit knowledge of the experienced members of the group, he is also highlighting that the value he puts on the experience of those people is due to the fact they were "*involved*" in the fires *within the park*. He does not mention general fire experience; instead, he specifically refers to their presence in the park during major fire events. When prompted on this, he expanded:

> Scenario planning requires an intimate knowledge of the park's topography, vegetation, fuels and access, [and] also a good understanding how fire behaves in that landscape under various weather conditions. All of that information is pulled together to predict where a fire will travel over designated time periods and hence, where and how the fire will be fought. That combination of knowledge can only be gained through experience under real fire conditions [as was gained during the '05 and '09 fires].
>
> *Jim, Project Manager. WPNP.*

For the members of this working group then, the park's landscape - through its *"topography, vegetation, fuels and access"* and an understanding of the behaviour of fire in that landscape - became a home for their experience. Through witnessing these major fire events and the way in which they traversed the landscape of the park, landscapes became a site of memory for those that witnessed it. The landscape of the park becomes something to draw upon where the "*combination of knowledge*" the

people have of fire produces a form of collective memory. In this way, the organisation and its staff can be seen as forming histories through their memory of events in the park, and whilst there is still a desire to *formalise* these histories in ways that make them archivable, it is clear that the landscape of the park itself becomes an important tool. It is through the dialectic relationship between people and the park, through their movements within it and the events that they have witnessed there, that individual and collective memories are spatialised.

4.3.4 Rhythms and Scales in Historical Space

This section has shown that understandings of the park sit within numerous *historical spaces* that are derived from various rhythms and scales. Formal attempts to *historicise* the park take the form of official monitoring and recording projects whose aim is to contribute discrete artefacts to numerous kinds of databases, and where the form of this *historicisation* is often dictated by the materiality of the systems that store it. In this sense, many of the activities of the organisation are aimed at constructing a history of the park that speaks about its ecological state at any one point, from any number of perspectives. This *historicisation* often happens in parallel to the lived experience of staff within the park whose own experiences over time form an *historical space* that is based more on personal and collective experiences than any formal recording. In these, the material landscape of the park holds resonances of past practices that are able to be 'read' by those who have an understanding of the changes that have occurred in that landscape over time. Indeed, the park itself can become an important tool in the formation of memory within the park, where the accumulation of individual and collective experiences over time make the park meaningful to those within it.

The formation of these histories happens on different scales and through different rhythms. The scales that stretch furthest back in time are seen as being the most desirable as they provide a stable point of reference to sets of management practices. In this *historical space*, there is a version of the park, from the past, that is seen as ideal and desirable, as a baseline from which to measure against. Attempts to formalise the park through accumulation of data over time are the ways in which the organisation constructs its own histories in a way it deems will be most useful to them in the future. At the opposite end of this time scale is the lived experience of staff within the park. Through movement and repetition within the landscape, they build personal histories

that accumulate and evolve. It is these movements and repetition – these *rhythms* – that will be the focus of the next section.

4.4 A Network of Habitats

The last section provided an exploration of the ways in which the park is historicised by the organisation and its staff. Whilst much of the formal efforts of Parks Victoria are around the monitoring, capturing and dissemination of observable data about the park, it highlighted that the accumulation and repetition of individual experiences in the park were equally as valuable as any formal data recording or storage. This has contributed to the overall work of this chapter, which has shown how experiences of the park are formed and enacted out of the everyday practices of the organisation. This section will explore this in greater detail, by showing that the rhythmic repetition and enaction of movement and practices by staff produces a valuable source of knowledge about the park. It does so through the frame of *habitats*, detailing the ways in which the park is a site of habit for staff. It will explore the ways in which practices are spatialised through repetitive action within the park, and how these repetitions of practice and movement – these *rhythms* – form unique understandings. This section therefore details the ways in which that park is a habitat for those that work within it. Before detailing the ways in which habitats are formed for staff, a definition of habitats will be provided through the frame of Lefebvre's (2004) rhythmanalysis.

4.4.1 Habitats and Rhythmanalysis

Habitat is obviously a 'loaded' term when used in reference to a national park; for most people involved in ecological management, it would reference the natural environment in which some kind of organism lives (Coyne, 2010). Whilst the park most definitely is a habitat for any number of plant and animal species, for *human* communities though, habitat is something that supports the development of *habits* (ibid.). It can be seen as the result of "patterns of regular doings" (Douglas, 1991), the spatial correlation of any number of different rhythms, repetitions and routines. As such, it is related to notions of the "everyday" (De Certeau, 1984), where these rhythms imply the ordinariness and repetitive occurrence of everyday experiences of the world. To examine what constitutes a habitat then is to take part in what Lefebvre (2004) calls a 'rhythmanalysis', focusing on the ways is which rhythmic flows order and influence

experiences of place, whilst drawing attention to the "steady, intermittent, volatile or surging" qualities of those flows (Edensor, 2009. p. 3). It is a notion that is close to 'home' (Douglas, 1991), and for this research it draws attention to the flows of everyday patterns, movements and cycles that take place within and around the park.

Lefebvre (2004) famously wrote: "Everywhere there is interaction between a place, a time, and an expenditure of energy, there is a *rhythm"* (p.15). So, if *habitat* is taken to be the formation of individual notions of home, where home is defined as the space of rhythms, routine and habit, then the park can be viewed as a *network of habitats*. Each member of staff has particular responsibilities and duties, each moves between particular locations within and beyond the park that are unique to them, and each have been based in the park for varying periods of time. These variations in movement, priority and duration produce an understanding of the park that is embedded within these everyday rhythms, where patterns of movement and practice entrench themselves as habit over time, and from which an understanding of the park "establishes itself … through repetitive organisation" (Lefebvre, 2004. p.7).

4.4.2 The Park as a Habitat

Examples of how the park becomes meaningful through the interactions its staff have with it have already been provided. In the previous section, an exploration of how meaning builds up at places over time was provided. Whilst the focus of that section was on highlighting the role of past experience and historicisation in the park, where its landscape becomes a site of memory, underlying the examples of individual and collective memory were the notions of repetition and rhythms, that is, of *habit*. Jim's point on 5 Mile Road where he repeatedly noticed the presence of an old male kangaroo only became meaningful to him because of the regularity of his movement through that area, and of the *habit* of paying attention to that phenomenon. Jim did not deliberately seek that spot to test some hypothesis about why old kangaroos might go there; it was simply an observation he had repeatedly made through his rhythmic activity within the park. He had made the note while in his car, further highlighting the chance nature of the observation. It was his movement within the park, over many years, that made his regular path to and from certain places meaningful to him.

Rhythms and patterns that comprise a *habitat* may be fleeting or more persistent; they establish themselves and change over time (Vannini, 2012a). In this way, staff in the park establish habitual paths for themselves through both long- and short-term

projects in which they might be involved. Jim's example of the kangaroo is something that has been the result of decades of activity within the park. Others are based simply on a few days' activity. Derek, a field service officer within the park, made a number of diary study entries that showed the emergence of one such pattern of movement.

31st May, 2011

9:50am*: "I'm at Tidal River, looking for signs of pest animals. I shall be laying some traps today, so we'll see how that goes."*

11:15am*: "I'm setting down cat trap 1. There's evidence of cat tracks next to the drains here, so I decided to set down a trap.*

4:05pm*: "Signing off for today. I've laid about 10 traps. It was a productive day."*

Here, Derek is describing the establishment of a new pattern of movement for himself. With the aim of capturing pest animals, his day involved exploring Tidal River, the administrative and tourist centre within the park, and laying traps in areas he thought showed signs of these animals. Demonstrating this new pattern in the days following this he returned to these areas to check on these traps and continue to lay new ones:

1st June, 2011

9:14am*: "After setting the traps yesterday, I'm commencing this morning in Tidal River to check them. The first trap has caught a crow unfortunately. Tracks surrounding the cage indicate that a fox and cat were present. Hopefully I'll remedy this situation by releasing the crow and resetting the trap."*

1:36am*: "I'm laying down more fox traps at the moment … I'll leave these overnight and potentially the next night so the foxes get used to the idea that something has changed. Foxes are very clever and cunning animals. After that, I'll then bait them with Kentucky Fried Chicken. The foxes love it."*

2nd June, 2011

10:03am*: "I've just completed checking the traps that I have out, and once again no pest animals were caught. I'm going on with different duties now."*

4:35am*: "Good afternoon, it's knock off [finishing] time. During the day I checked cat traps again and so forth, just a few mundane jobs and routine stuff like that."*

Derek's days-old pattern of checking the pest animal traps quickly become routine and mundane for him. However, it also became a meaningful rhythm within which he accumulated some knowledge of the park where he would notice pest animal tracks around the traps and become aware of the presence of non-pest species, adapting his trap location and bait strategy in accordance. In ways similar to Jim's kangaroo observation, the regular movement between his collection of traps allowed him to form an understanding of pest animal movements. He gained experience on what worked and what did not. For Derek, the trap locations became increasingly meaningful as the repetition of checking those traps became entrenched. During this week, Derek's *habitat* was expanded to incorporate the checking of these traps, and it was in this *habitat* that his understanding of the park was adapted and produced.

This demonstrates how places become meaningful for staff for the duration that they are a part of their *habitat*. For Derek, the trap locations become sites to make observations and to compare over time, and it was the regularity and repetition of moving between these that allowed him to achieve a deeper understanding of pest animal behaviour. On a longer-term scale, Jim's observation involving the kangaroo was the result of his 30 years of movement through that area. This highlights that any form of sustained repetition, no matter its duration, can become meaningful.

Even someone like Jim, who has many decades of experience in the park, adapted his *habitat* on a regular basis. Throughout his diary study, he described his involvement in the setting up of various monitoring sites. At these locations, Jim described how he sets up a number of remote sensing cameras to monitor native animal behaviour. Despite being spread over many different areas of the park, Jim would refer to the group of locations that had cameras in them as a single destination.

> "I'm just out collecting the cameras from our monitoring sites…"
>
> "Just brought in some of the cameras from the monitoring sites…"
>
> "I'm heading out to the monitoring sites, and I thought I'd explain what I do on the site to set the cameras up…"
>
> "This morning I'm setting up a corner post that marks the north-west corner of some permanent monitoring sites we're installing."

In the same way that "the traps" became a meaningful constellation of locations (Cresswell, 2006) to Derek, "monitoring sites" became a cluster of meaningful sites for Jim. For both of these staff, these constellations became destinations to incorporate

into their regular, daily routines, and it was through the regularity of moving to and through these destinations that meaning emerged from them. Movement is known to change our experiences and representations of a location (Ibid.). The *habitat* of both Jim and Derek included the repetition of movement to these places, and the otherwise innocuous locations which housed this equipment became meaningful for the period of time Derek and Jim maintained them. By giving these constellations - the various locations that held this equipment - a name, it not only set up a destination to be travelled to in their daily routine but also signified what kind of knowledge might be gained 'at' those destinations. For Derek's 'traps', this destination became one where he had learnt about patterns in pest animal behaviour, but also about the practice of *trapping*. He reinforced his prior experience (spotting tracks, setting traps) and gained more specific knowledge about the park (non-pest animal behaviour). For Jim's 'monitoring sites', they became destinations where he was not only monitoring animal behaviour, but where he enacted his knowledge of *monitoring*.

Habitats then are not only related to the repetition and establishment of patterns of movement within the park, but also the practices that are enacted within them. Repetition, and therefore the notion of habitat, can be seen as "concerned with the preservation, transmission, and remembering of information and knowledge" (Coyne, 2011. p. 86). Just as how, in the absence of writing, repetitions and rhythms of *speaking* have provided various communities with continuity of knowledge (Havelock, 1988), the everyday cycles apparent in the park are themselves reinforced and enact various practices, simultaneously producing deeper appreciations of the landscape for those doing the enacting. Both Derek and Jim, through the everyday rhythms and repetitions that form their habitat, spatialise their knowledge of various practices.

This was further illuminated by the ways in which these sites were sought out by other members of staff. Dan, another ranger in the park, referenced the same 'monitoring sites' that Jim referred to. However, rather than being a destination of regularity for Dan, the 'monitoring sites' became somewhere from which to appropriate practice. Rather than hoping to maintain these sites as Jim did, Dan's aim in visiting this destination was to learn the technicalities of setting up such a site for himself.

> Had a good session with Jim Whelan out at one of his monitoring sites, during which I had a good conversation in regards to the setup of a remote camera program, which I'm intending to do out in Tidal River. So we spoke about the requirements of the set up, the pro/cons and issues he's encountered, and the issues he learnt along the way, in terms of number of cameras on site, distance, etc depending on the animal you're aiming for.

Dan, Park Ranger. WPNP

Over the course of two days Dan continued to assist Jim with his monitoring sites, *'picking his brain'* as he went. Here, Dan looked to take part in a small portion of Jim's everyday routine in order to learn from it. He looked to spend time within his *habitat* in order to learn practices he could appropriate into his own rhythms and routines. It can seen then that the *habitats* of individual staff are sites of unique knowledge production. Similarly, it can be seen that, when viewed through the lens of practice and understanding of the park itself, WPNP can be conceived of as a *network of habitats* that overlap and intersect.

4.4.3 Embedded Rhythms

It is not just through individual rhythms and repetitions that staff's *habitats* are produced. They are tied up in a broader *network* of rhythms and cycles; as demonstrated by Dan and Jim's experiences, rhythms intersect and often collide. They are also subjected to a number of different cyclical forces within the park and the broader organisation itself. Whilst the daily formation and enaction of movements and repetitions have highlighted how a *habitat* becomes a site of unique knowledge production in the park, staff are indeed subject to rhythms, cycles and routines that are of a different scale than their individual perspectives. Working within a national park, in a rural setting, with a major tourism role in the region, and managed by a State government organisation are obviously contributing factors to the activity of staff, and have some influence over the formation of individual notions of habitat. As Vannini (2012b. p. 253) puts it: "No rhythm is a finite entity, but rather an intersection of open events, some of which are regular and even repetitive in nature, and others which are unique and irregular". By scratching the surface of a few of these influences, further rhythms become obvious. Examples of the kinds of oscillating, repetitive and irregular rhythms that contribute to the formation of *habitat* in the park are presented below.

> Tourism to the park is punctuated by seasonal influxes of school groups, families and trekkers. The school holiday periods in April, June and September lead to significant spikes in tourist and visitors, as do the summer holiday periods, when the weather clears and multi-day treks are more feasible. Similarly, staff numbers spike during these times in order to meet the safety and administration needs that such influxes demand. One participant commented: "*The park takes on a different personality in these times. We interact with the public a lot more.*" Another participant

commented: "*My job changes somewhat, away from environmental concerns to looking out for people's well-being.*" During these peak periods, the increased presence of tourists tinges the daily experience of staff in the park, if it doesn't change it completely.

Some staff reside in the park itself. There are living quarters for permanent resident staff in Tidal River, where they have a detached house that would not look out of place in the surrounding country towns. As such, the demands of their personal lives are often enmeshed in their work. Given the remote location of the park, staff will often take the chance to do personal errands when they are out of the park for meetings. Fire prevention meetings in regional administration centres can be combined with trips to the doctor or the mechanic.

Some staff who grew up in Victoria had been visiting the park for years before they began working in the organisation. As such, their notion of *habitat* extends to patterns from their childhood, and some places have remained significant to them since this time. A participant remarked: "*Refuge Bay is one of my favourite spots in the park. I'm a boat person; we used to visit as a kid and I've had some good times down there. It's a special place for me and I still visit.*" Another commented: "*I spent a lot of time down at the 'Prom as a kid. I've always been interested in its environmental issues. A lot of what I know about it is from personal time there and personal research about it.*" Often these personal connections lead to 'pet' projects in their work that indulged their passion for certain aspects of the park.

Seasons are vitally important for Parks Victoria, and the spectre of summer looms large for the organisation. Summer brings with it the threat of fire, and much of the activity through the year is in relation to this threat. Autumn and spring are times to conduct planned burns to reduce fuel levels, and winter is typically a time to take stock of fires past, and to plan controlled burns as it is too wet to conduct them at that time.

The relationship to fire is cyclical and repetitive yet unpredictable. The ecological effects of a fire can be felt for years, as can the recovery efforts. A particularly severe fire will change the fire management plans for the park to allow areas of the park to recover, and these changes trickle down to the daily activities of staff within the park. Similarly, the frequency of fires has an overt effect on practices in the park. Fires that occur relatively close together have a greater chance of causing profound and permanent changes to the flora and fauna makeup of the park, and Parks Victoria generally increases monitoring projects to assess these long-lasting changes.

Every three years a State election is held, and there is the possibility of a change in government. This brings with it changes in funding models, in policy priorities, and in reporting requirements. Projects may be put on hold or cancelled. New projects may start that require concentrated effort to achieve the political expediency required to meet an election promise. The election of a new State government in Victoria in 2010 saw such changes occur, where the highly politicised issue of grazing on protected land underwent a number of policy shifts.

> Bad weather in the park dictates when and where work is possible. Traps cannot be baited if it is raining as the bait will dilute or dissolve, making it unlikely pest animals will be caught. For some staff who rely on mobile phone contact throughout the day, a storm will mean they have to relocate their work to one of the regional administration centres due to the effects of the storm on the quality of mobile phone reception in the park. *Habitats* are subject to the elements.
>
> Staff are sometimes forced to wait for vehicle access. Cars and utility vehicles are a necessary part of getting around in the park, where Tidal River is some 30 kilometres from the park entrance. Vehicles are limited, and staff are sometimes required to wait half a day to have a vehicle delivered to them before undertaking their duties. Their everyday routine is dependent on access to these vehicles, which is in turn dependent on the requirements of other staff. In this way, the requirement of vehicle access is one way in which *habitats* overlap, collide and influence each other.

This collection of rhythms of varying scales, durations and regularity highlight the broader influences on notions of habitat. The nature of park management means that staff are embedded within larger rhythmic patterns that are linked to tourism, fire, personal experiences, seasons, weather, politics and access. It is clear then that different staff have different rhythms - different *habitats* - and these are embedded within repetitions and cycles that are larger in scope than them. Individual rhythms of movement are adapted and enacted on a daily basis, and these rhythms spatialise the practices of staff within the park. Habitats collide and intersect with each other in ways that facilitate the sharing of this experience, and that provide order to the "everyday" (de Certeau, 1984). Staff are constantly involved in a process of "making do" (de Certeau, 1984), constructing new rhythms and habits on a near-daily basis, and their activities are ultimately dictated by larger repetitions and routines.

It has also been demonstrated that habitats ebb and flow over time; rhythms are smooth but also disjointed (Vannini, 2012a). They oscillate depending on the day, week, or season, and on any number of social and political factors that filter down through the organisation. It is within this oscillation though that the park becomes meaningful. The duration of certain activities in certain places means that, for that period of time, those places become sites of knowledge. It is through the repetition and routine of everyday life that connections to the park are formed, and it is within these habits that unique understandings of the park are produced. The notion of *habitat* is close to home, where home is defined as the space of routine and habit (Douglas, 1991). The park is a *home* for staff, the place in which they develop and evolve habits of rhythm and repetition. It is through the cultivation of various habitats, the ways they interact, overlap and collide with one another that an understanding of the park is

produced. In this way, through a version of "rhythmanalysis" (Lefebvre, 2004), the practice of park management can be seen as being produced from a *network of habitats*.

4.5 Conclusion

This chapter has provided an empirically grounded answer to the first research question of this thesis: *What is the relationship between technology, space and environmental understanding, and where is this relationship headed?* It provided an example of the ways cultural geography literature can be used to shed light on the relationship between people, space and environmental understanding. Rather than viewing WPNP as a single space in which technology might help erase or solve typical problems posited by technologists, this chapter has shown that the park can be conceived of as the production of a number of competing, overlapping, interacting and colliding spaces. It illuminated, through cultural geography literature, the relationship between space and environmental understanding by showing that *knowledge* of the park is tied up in the interactions, flows, resonances and rhythms that take place within it. Parks Victoria's management structures create groups of people and practices that interact with the park in unique ways, essentially forming *spaces of management* within which specialised knowledge of the park is produced. Staff's physical location within the organisation is a proxy for the kinds of practices and understandings they are meant to have of the park, and the *alterity* that results becomes the source of group identities, and ultimately a means through which these groups seek the insights of 'the other'. Locations in the park are *made* meaningful and are already meaningful in an *historical space*, where the park is something to be historicised, and where places in the park are sites of memory. The park is also a *network of habitats*, where the rhythms and daily routine of staff spatialised their knowledge of the park.

By showing that there is an alternative way of conceiving the relationship between space and environmental understanding, one where space is considered a relational and pluralistic production, rather than a static object, this chapter has also contributed to answering the second research question of this thesis: *How can we expand this relationship, in a conceptual way, so that this relationship is useful for designers?* Each of these spaces takes one particular perspective of the park and examines the picture that emerges from it. By illuminating the pluralistic nature of the park - where it can be seen as comprised of multiple dynamic and relational spaces that are in a constant state of production - it can be seen how technology might be designed not

simply as something to overcome the limitations of space, but as something that sits within the networks, flows and interactions that produce it. Within these relational spaces, rather than viewing a location as meaningless, or as being an index to invisible information to be revealed, places are already meaningful, and meaningful in different ways to different people. Similarly, distance and location are not something to be transduced through the use of technology, but are valuable sources of identity within the organisation that in turn creates the conditions under which collaboration can take place.

Thus, this chapter has built upon the theoretical foundation presented in Chapter 3 and shown, on a pragmatic level, what it might mean for designers of technology to consider pluralistic and relational notions of space. The following chapter will continue to build on this pluralistic representation of the park, and thus further strengthen this research's response to the research questions proposed. If this chapter was a study of the 'everyday' of the park, the next will form a study of the *spaces of a natural disaster*.

5

The Spaces of a Natural Disaster

In Chapters 3 and 4, a theoretically and empirically grounded answer to the first research question of this thesis was provided: *What is the relationship between space, technology and environmental understanding, and where is that relationship headed?* To answer this, Chapter 3 provided a review of literature that demonstrated how ubiquitous computing has treated 'space' as problematic and as something to overcome through the application of technical designs and solutions. It contrasted this positioning of space with that from cultural geography, offering an analytical framework wherein space is seen as the relational product of interactions, flows, temporalities and embodiments. Rather than the stage on which society acts, this literature treats 'space' as pluralistic and dynamic.

This analytical framework was used in Chapter 4 to investigate various productions of space within Parks Victoria, providing a multi-faceted exploration of how the space of a national park is produced through the day-to-day management of a national park. It did so in service of answering the second research question of this thesis: *How can we expand this relationship, in a conceptual way, so that this relationship is useful for designers?* In doing so, it further provided an empirical example of what it would mean for ubiquitous computing to consider non-problematic, dynamic and relational notions of space.

This chapter strengthens this understanding by exploring a second study based within Parks Victoria. If Chapter 4 was based around notions of the everyday within Parks Victoria and Wilson's Promontory National Park (WPNP), this chapter provides an exploration of the production of space in a non-typical situation. It does this by

examining the dynamism of environmental understanding within a time-pressured and highly sensitive time in the park: during and after a major flood. First, it provides an overview of the flood, recalling accounts from the night it occurred, the extent of its damage, and staff's initial reactions to it. Second, it examines the *disruptions* in practice, movement and landscapes the flood caused, highlighting that these disruptions were challenging but ultimately beneficial to the organisation. Third, the chapter then provides an examination of the *iconic landscapes* of the park, highlighting how iconic areas of the park became sites of comparison for staff as they struggled to contextualise the flood. Finally, the *affective connections* revealed by the flood are shown to have been an important driving force in the aftermath and recovery for staff, where staff wellbeing was seen as tied to that of the park itself.

Each of these examinations continues to show that space is pluralistic and dynamic, and that the analytical framework from cultural geography provides unique perspectives on the relationship between space, technology and environmental understanding. As such, the chapter further strengthens this research's response to the first research question of this thesis, showing that the spaces presented in both the previous and current chapter, derived from an investigation of a practical problem grounded in cultural geography and ethnographic methods, provide a solid foundation for explicating where understandings of the relationship between space, technology and environmental understanding may be headed for ubiquitous computing.

5.1 The Flood

To say that the research presented in this chapter was planned at the beginning of the project would be misleading. By March 2011, this research project had progressed to be a little less than half way through its planned duration. Initial interview rounds were complete, and a number of visits to the park, in an observational capacity, had been made. On one particular day, the 'Affective Atlas' team held a meeting with Parks Victoria in one of the regional administration centres in a small town in Eastern Victoria - named Kurrumburra - to discuss a direction for the remainder of the research. It was decided that the remaining research time was to be based around fire recovery, building off the 'Affective Atlas' team's BurnMap project (outlined in Chapter 2). It was a sunny day, with crisp blue skies and a light wind, and after the half-day meeting everyone left the small conference centre with a clear agenda for the next year's work. The date was 22 March.

That night, the skies turned from blue to black as a storm rolled in to the south east of Victoria. Around 6:30 pm, it became clear that the rain that had started just a few hours earlier would not relent. At Tidal River, camping areas had already begun to flood, and the river itself – the one from which the administration and tourist hub draws its name, and which is some 300 metres from the main visitor centre – had swelled into a fast moving torrent.

> I had a reasonable idea on the night that this was going to be something major.
>
> *Darren, Ranger. WPNP*

As the night progressed, the water levels increased steadily, and as the rain continued, staff began to realise the scale of the event they were witnessing. As the hours ticked by, the rain continued and the river - which stretches through large swathes of the park - became its depository. At around 9 pm, the water began to rise dramatically.

> I was standing in the office [300 metres from the river], and water started coming through the door there. Within 10 minutes it was knee deep. I said to the chief ranger on the phone that this was big. I knew it was going to be big.
>
> *Darren, Ranger. WPNP*

The office Darren mentions is the visitor centre and administrative hub in Tidal River that is 300 metres from the nearest point in the river, and sits on a gentle slope rising away from its banks. It is also the furthest structure from the river in the main part of Tidal River. Having broken its banks hours earlier, the river's water had now reached most areas of the small town.

However, the worst was not yet over. At 9:30 pm, a surge of water rushed down the river taking its depth from knee-depth to waist-deep. It also effectively changed the situation from one of caution and apprehension to one of deep concern for the 400 visitors and staff in the park. This surge became infamous amongst staff. Lorinda, some weeks after the flood, commented:

> It appears that a large surge of water came through at 9:30pm, in addition to the already flooded areas. Staff were rescuing people in flood affected cabins, and had to wade through waist deep, through fast moving flood waters. Colleagues were in vehicles, and those vehicles were getting swept away as well. All of this was happening in the dark as there's no street lights in Tidal River, and most of the electricity was out by then anyway.
>
> *Lorinda, Visitor Services Officer. WPNP.*

All accounts from those in the park on that night were ones of shock at the scale of what was happening, and where the safety of those in the park that night took precedence.

> On the night we were focused on visitor and staff safety. I wasn't thinking about the park too much at all. It was about getting through the night.
>
> *Darren, Ranger. WPNP.*

Staff would later discover that over 370 millimetres of rain were dumped in less than 24 hours (The Age, 2011). To put this into context, the average rainfall for WPNP over an entire year is 1054.9 millimetres (Weatherzone, 2012), meaning that over four months of rain was received in a single night. The flood would later be described as a 'once in three hundred year' event (Park Notes, 2012).

The next day, the extent of the damage became clear, and the worst suspicions of WPNP staff were confirmed. The single road to Tidal River had been subject to landslips, and parts of the bridge crossing Darby River were severely damaged. Other parts of the road had been completely washed away. Access to the visitor areas was limited and, with 400 people still stranded in Tidal River, the immediate focus on the day after the flood was on airlifting them to safety. Figure 5.1 and 5.2 below show the extent of the damage to the Darby Bridge. Figure 5.3 shows park visitors waiting to be airlifted out of WPNP.

Figure 5.1 – 23 March 2011. Parts of the Darby River Bridge had been completely washed away. Photo: Justin McManus.
Source: http://www.theage.com.au/travel/travel-news/storm-leaves-its-mark-on-prom-landscape-20110324-1c8hr.html.

Figure 5.2 – 23 March 2011. The damaged Darby Bridge. Photo: Justin McManus.
Source: http://www.theage.com.au/travel/travel-news/storm-leaves-its-mark-on-prom-landscape-20110324-1c8hr.html

Figure 5.3 – Campers waiting to be evacuated from Tidal River on March 23rd. Photo: Justin McManus.
Source: http://www.theage.com.au/travel/travel-news/storm-leaves-its-mark-on-prom-landscape-20110324-1c8hr.html

In the days and weeks after the flood, the focus of the entire park, and significant portions of the organisation at-large, shifted towards damage assessment and recovery. Areas of the park had become completely inaccessible, and large landslips through the park had changed the topography of entire areas. There was great concern on gaining an understanding of the ecological effects of the flood; however, the immediate focus of staff was around tourism and visitor services. The tourism-focused facilities in Tidal River would largely need to be refurbished, replaced or rebuilt, and the peak periods of Easter and school holidays were fast approaching. Given the scale of the event, it was not surprising that the flood placed a significant strain on the operations of the park for many months. It took upwards of three months for the roads to be repaired and reopened to the public, and the ecological effects of the flood were still being felt some 18 months after its occurrence.

Given this, and given the embedded nature of this research project, the flood's influence on this research was unavoidable. Schön (1983) and Sengers et al. (2005) discuss the need for researchers to adapt to the "back-talk" of a given project context, and the flood provided the most dramatic example of this. It was ironic that the storm took place on the night that a research direction had been settled upon, and given the

complete switch in focus for those working in the park, a new direction for this project needed to be decided upon quickly.

Access to both the park and to staff themselves had changed completely. Due to road access issues, it would be three months between the research direction meeting and the next visit to the Park, which placed a significant delay on conducting the next phase of the research. Staff that were happy to provide time to be interviewed about the fire (which itself was two years prior) were now completely focused on understanding the extent of the damage the flood had caused, and on bringing the park back to an accessible standard acceptable to tourism and general operations. Suddenly, time had become more precious, and staff were under much more pressure to complete repair works.

So, as an example of the "back-talk" that influenced this project, and the methodological bricolage that was necessary to respond to it, the research was redesigned to investigate the flood response and recovery itself, rather than an increasingly 'distant' event of the fires of 2009. Similarly, whilst the diary study had been planned as a supplement to the 'day-to-day' interviews that focused on the everyday management of the park, its focus was altered to incorporate reactions and responses to the flood. Carrying a device they could use for a few minutes a day seemed like much less of a time commitment than a number of long interviews, and it would similarly allow staff to give insight into areas that were no longer accessible to non-essential staff and visitors. By having this piece of technology embedded with staff during this time, it was inevitable that the study would yield data that concerned the flood. However, beyond this serendipitous presence of a recording device, participants were explicitly asked to make observations about the flood that they considered relevant. As a result, the research, interviews and observations that occurred around this time gave a rich account of the staff's reactions and response to the flood, interspersed with attempts to continue their usual routines and to "make do" (de Certeau, 1984) with the resources they had available to them.

With the extent and severity of the flood now clear, along with a brief overview of the ways in which this research was adapted in response to it, this chapter will now turn to an examination of the *spaces of a natural disaster*. Chapter 4 was concerned with notions of the 'everyday' within Parks Victoria and WPNP. The remainder of this chapter will look at the various productions of space that occurred during and after the flood recovery.

5.2 A Space of Disruption

This section will discuss the influence and effect the flood had on the daily patterns, rhythms, networks and flows in the park. If, as Chapter 4 showed, the *spaces of a national park* are produced from the daily enaction of various processes, then the flood can be seen as something that *disrupted* those same forces. This section will show that the flood disrupted the daily patterns of practice within the park by forcing staff to focus on the recovery effort it demanded. It will further show that the flood disrupted regular patterns of movement by cutting off access to certain areas of the park, and forcing a relocation of administrative centres. Ultimately, this section will show that, out of this disruption, the flood created its own *space* - one that was initially a space of apprehension, uncertainty and urgency, but that ultimately became a space of opportunity. Before moving on to a discussion of these influences and effects, a definition of disruption, based on Lefebvre's notion of arrhythmia (2004), is provided.

5.2.1 Disruption and Arrhythmia

The last chapter provided a description of Wilson's Promontory National Park (WPNP) and Parks Victoria as entities embedded within, and produced from, a number of different priorities, rhythms, networks and flows. It showed that they are produced out of the overlaps and interactions between a number of different and competing spaces, that are themselves the result of dynamic and pluralistic processes.

The dynamism of these spaces is important to consider. Rather than viewing spaces as predefined, constraining forces that "compel individuals to march to their beat" (Edensor, 2009. p. 15), the spaces presented in Chapter 4 should be viewed as a framework within which 'order occurs' (Hallam & Ingold, 2001), but that require effort to maintain. Rather than being stable and consistent, their consistency should be seen as contingent upon maintenance by those that enact them, where they "have to be worked to be sustained" (Hallam & Ingold, 2001. p.6). So, whilst the spaces presented in Chapter 4 describe the everyday management of a national park, their nature as products of dynamic and shifting processes should not be forgotten. Rhythmic routines are transient and fragile (Alheit, 1994), and therefore require a certain degree of maintenance. Given this contingent nature, their ability to be influenced and altered should also be considered. Sometimes this happens voluntarily, either seasonally - like when a celebration (ibid.) or festival (Jackson, 2004) allows the suspension of everyday

rhythms, or in a less cyclical, voluntary fashion, like a one-off vacation. Disruptions can also occur involuntarily, in disjointed and unexpected ways (Alheit, 1994). As Lefebvre states, "There is always something new and unforeseen that introduces itself into the repetitiveness" (2004, p.6). In the context of this research, the flood was this unforeseen influence.

The notion of *disruption* used in this section is tied to this concept of unexpected, involuntary altering of the daily rhythms and patterns within the park. Chapter 4 showed how the park is subjected to a number of reasonably predictable, cyclical disruptions. Shifts in the focus of the park during peak tourist seasons or in the approach to summer and its fire threat are forms of disruption for the park in that they influence the daily practices that occur within it. However, whilst they are not typically voluntary in nature, they are often predictable. Staff can predict and prepare for peaks in visitor numbers by paying attention to the calendar of school, state and national holidays. Similarly, they know with reasonable accuracy the likelihood of a fire in any given summer through monitoring weather conditions and fuel levels. In this sense, these seasonal disruptions are part of life in the park. Even a fire, which itself can be devastating, is a regular and expected part of park management. Many of the duties staff undertake are in relation to the risk of fire, and they are constantly vigilant against it. So whilst a primarily *seasonal* event - that is, one that can be predicted in a cyclical fashion - like a fire or peaks in the number of visitors to the park do provide some level of disruption to daily practices, they can be seen as acts of contingent maintenance of the everyday (Edensor, 2009; Hallam & Ingold, 2001) in much the same way as – drawing upon a more mundane example from Chapter 4 – being beholden to vehicle access is.

Disruption then, as it is used here, is not caused by these seasonal, relatively predictable events that require contingent responses in order to maintain the structure of the everyday within the park. Rather, it is used to describe something that fundamentally shifts and alters the 'emergent state' of the park (Crang, 2001). In this sense, the definition of *disruption* used here is closer to what Lefebvre calls arrhythmia (2004). Keeping with the notion of rhythms used in the last chapter, arrhythmia is a discordant state where the 'normed' activities of the everyday are thrown out of their usual rhythm. For Lefebvre, everydayness is an accepted state that carries on relatively smoothly. He describes this state of status quo as 'eurythmia', where rhythms unite with one another in a state of health. Whilst some level of maintenance is required, eurythmia is ultimately a state of "normed everydayness" (ibid. p.6). Arrhythmia then talks to the discordant state when these daily rhythms are thrown out of order. Unlike

the *seasonal* disruptions already discussed, an arrhythmic state is one that disrupts the 'healthy' state of processes in the park to the degree where the 'everydayness' of them needs to be redefined. A *space of disruption* is therefore one in which the everyday is *disrupted* - where the 'normed' processes and rhythms of the everyday need to be re-established. It represents a space that is a drastic shift from typical diurnal patterns, where reassessment is required, and volatility and uncertainty are prevalent.

In this sense, the flood threw the park into an arrhythmic state - a *space of disruption* where both existing rhythms were disrupted, and where, ultimately, new rhythms were formed.

5.2.2 Disrupting Habitats

Based on the definition of *disruption* provided above, the flood can be seen as an event that disrupted the *habitat* of staff within the park. Habitats were defined in Chapter 4 as borne out of regular patterns of movement and habits of practice, where these regularities contribute to a sense of 'home' that staff felt towards the park. After the flood, it was this notion of 'habitat' that was most noticeably disrupted. This section will detail the ways in which the flood disrupted the habitats of staff. First, it will show how staff were required to change their practice due to the focus on the flood recovery. Second, it will show how patterns of movement and access to the park were disrupted by damage to built infrastructure. Finally, it will show that this disruption of habitat formed a new space for staff, one of opportunity and renewal, where they were able to reassess and adjust their vision for what the 'everyday' in the park should be.

Given the definition of *disruption* as an unexpected and severe event that throws patterns out of rhythm, it should come as no surprise that it was the sudden nature of the flood that most effected staff.

> With a fire, you generally have some planning time. You know when it's likely to be. This came from nowhere.
>
> *Darren, Ranger. WPNP.*

In this sense, it was the suddenness as much as the severity of the flood that disrupted this notion of habitat, causing a state of *arrhythmia*. Within this state, staff in the park were required to shift their efforts towards assessing the damage caused by the flood, planning recovery efforts and managing the expectations of both the public and the

government. This meant fundamental changes in their duties and in their patterns of movement - in their *habitats*. One participant described his shift from a natural values role to one of customer service and accommodation in the aftermath of the flood:

> The duties [I am responsible for], reporting lines and responsibilities are now vastly different for me. I've moved into a customer service because of a previous life [an old job].
>
> *Scott, NVM Team/Customer Service, WPNP*

Scott is usually in the Natural Values Management team where he would be responsible for monitoring threatened flora and fauna in the park. In response to the flood, he was asked to oversee the assessment and recovery planning for tourist accommodation given his experience in a similar job he held six years prior. Scott described his new role as *"vastly different"*. When asked to explain exactly how it was different, he responded:

> My typical day now is dealing with HR [human resource] issues, basically chatting to people to see if they're alright, issuing refunds to tourists who have booked camping and cabins… I used to run a boat carrying researchers to the islands here, so you can imagine it's very different.
>
> *Scott, NVM Team/Customer Service. WPNP*

Others in the park spoke about similar shifts in their roles. Whilst not all were as drastic as a move from a NVM role to one of customer service, they were still considerably different to their standard work. Staff who were responsible for housekeeping in the Tidal River cabins were asked to collect quotes from furniture and household goods suppliers in preparation for the refurbishment of accommodation in the park. Education officers, who would typically run school group tours, were asked to work on the replacement of signage in the park. Even those staff whose usual job it was to monitor fire threats were asked to focus on assessing damage caused by the flood.

One of the major reasons for this shift was pressure from the State government to reopen the park for approaching tourist seasons. The flood occurred in March 2011, and the State government had publicly committed to having the park 'open' for the Easter holidays that coming April, some two weeks after the flood. As a result, park staff first had to define what 'open' meant in the context of the severe damage that had been sustained.

> We're working with the government to figure out exactly what that offering might be. It will be very limited, whatever we end up doing.

Brett, Ranger. WPNP.

The normal planning type stuff has been foregone to work on the flood recovery. We're just focused on reopening Tidal River now.

Darren, Ranger. WPNP.

Beyond the severity of damage to the park, it was primarily this pressure to *re-open* the park - itself a vague concept - that forced staff into roles of varying degrees of difference from their standard duties. Their *habitat*, as was defined in Chapter 4, was forcibly altered due to a shift away from their typical everyday practice to a focus on damage assessment, asset recovery, and forms of public relations with government.

Habitats were also disrupted in ways that are more the result of damage to the built infrastructure of the park, rather than any significant shift in their job role. The permanent offices in Tidal River were severely damaged, and a number of roads and trails through the park were washed away. So, whereas most staff would typically be based out of the Tidal River visitor centre, a temporary office had to be constructed due to flood damage to the building in Tidal River. This new administrative hub was located at the entrance to the park, in Yanakie, some 30 kilometres from Tidal River itself. Due to this, staff's patterns of movement within the park were forcibly changed. Whereas staff would typically move through large portions of the park as a consequence of simply 'going to work', they were now mostly working from the very entrance to the park. Most tellingly, staff who literally referred to the park as 'home' - some dozen or so that actually lived in Tidal River - had to be relocated to surrounding regional towns. Through being based out of a new office, and having different routines as a result, staff had to relearn the more mundane and taken-for-granted aspects of their work day.

I don't have mobile reception at the new office, so if I want to be available, or I'm expecting a call, I have to get in the car and drive.

Brett, Ranger. WPNP.

Everything you do has a little hiccup basically.

Lorinda, Visitor Services Officer. WPNP.

Indeed, it was the culmination of 'small things', like lack of mobile phone access, not having a computer with the required software, or simply not having a desk phone - the conveniences of an established office - that added to the sense of disruption, the

arrhythmia that characterised the time after the flood. The everyday rhythms of work and practice for staff were disrupted in small ways, consistently, over time.

Whilst small inconveniences contributed to this disruption, it was primarily severe damage to the built infrastructure of the park that most affected the staff and the park. In addition to having to relocate their offices, staff also had to contend with altered states of access, affecting their patterns of movement and their ability to assess damage.

> The main bridge to Tidal River being cut off has obviously caused a lot of logistical issues [like moving the office]. The flood also caused a lot of damage to other built infrastructure, like tracks, so gaining access to areas has been a real problem. This is especially important as we need to find out what's happened in those areas.
>
> *Brett, Ranger. WPNP.*

Brett is describing difficulties that arose out of the lack of access staff could obtain to certain areas of the park, in addition to the logistical issues of relocating the main office. Buildings in Tidal River had been flooded to over a metre in height, and the roads into and out of Tidal River had been subjected to landslips. The pictures in the last section show the damage that occurred to these roads, where parts had been washed away. Where the regular surroundings of staff were altered, shifted or cut-off, the daily practice and patterns of movement that comprise their *habitat* were also altered.

The power of the flood to drastically alter these built aspects of the park contributed to the sense of *disruption* felt in its aftermath. Beyond damage to built assets though, damage to the landscapes of the park was also a key factor in disrupting the rhythms of the everyday. Beyond merely preventing access to areas of the park, the flood was something that permanently altered its landscape. Given the importance of connections staff formed to landscapes of the park (as described in Chapter 4), this was a significant shift. In the below quote, Darren is discussing a major flood's ability to alter the park itself:

> [Compared to a fire], flood damage is a bit more permanent and extensive. Fire threatens assets. It's generally just a case of rebuilding assets in the same spot. A flood changes the environment. For example, a number of walking tracks through a small gully were washed away - that gully is now a ravine and we'll have to reassess where that track goes.
>
> *Darren, Ranger. WPNP.*

Darren is comparing the flood to the typical effects of the fire, highlighting that flood damage is more permanent than a fire. So, the flood not only managed to pause and alter many of the cycles that occur in the park, but actually placed some doubt in the minds of staff about the ability to return to 'normal'. In this sense, the *space of disruption* was one that comprised an entirely new set of circumstances for staff in the park. It was not an event that could be contextualised in a seasonal manner like a fire or peaks in tourism - it was unpredictable, sudden and severe.

This comparison between fire and flood is also important to consider in terms of staff grappling with how to respond to the flood. Across the weeks following the flood, there appeared to be a tension around exactly how to handle the its ecological effects. Even in an unplanned situation, a fire is often seen as a positive tool in ecological management. It may cause visibly noticeable damage to a park, but it is generally seen as a chance for renewal; and as a means of controlling and correcting imbalances in ecological habitats. It is also seen as a tool to bring the park back to an idealistic state - often in comparison to pre-European management. However, in an ecological sense, a flood has no such benefits. Given the custodial nature of Parks Victoria's relationship to the park, where they are required to maintain the park to certain ecological standards, the tension was around whether to bring areas of the park back to their pre-flood state or whether to leave them as they were.

> We will have to re-vegetate the areas around new built roads, back to its original state, as close as we can. I'm not sure I agree though. Nature caused it, nature will fix it in my point of view.
>
> *Darren, Ranger. WPNP.*

> I'm coming to Lillypilly to see if the friends group need to do any re-vegetation here or whether nature will just take care of itself.
>
> *Emily, Field Service Officer. WPNP.*

> Because the flood was a natural event, we need to decide whether we intervene - whether we replant areas, re-establish areas.
>
> *Brett, Ranger. WPNP.*

> Change is generally not seen as a good thing [in the park], but this has occurred naturally. The question of what to do is important.
>
> *Rebecca, Cultural Heritage Officer. Bourke Street.*

As these quotes highlight, much of the uncertainty was around whether to intervene in the ecological recovery of the park at all. This added to the level of uncertainty in the park at the time; the daily routines and practices of staff had been disrupted through issues of access and relocation; however, it was the ecological disruption, the fundamental shifts in the landscape of the park, that caused the most uncertainty.

5.2.3 Renewal in Disruption

Not all disruption was seen in a negative light however. Indeed, it was also this ecological disruption that was seen as a source of opportunity for the organisation. It did this in three ways: by opening up previously inaccessible areas in the park; by giving Parks Victoria an opportunity to reassess the placement and rebuilding of assets and, ultimately, through giving the organisation an opportunity to adapt its management practices.

The flood, through landslips and road damage, had blocked access to certain areas of the park, but it opened access to different areas that were previously inaccessible. This was seen as a great positive from a cultural heritage perspective. Similar to how fire had revealed evidence of past practices of indigenous land owners, as described in Chapter 4, the flood revealed culturally significant areas that had previously lay undiscovered. For example, a participant in the diary study described how the flood gave him the opportunity to explore new areas of the park, and how this had led to the discovery of a stone axe.

> The flood has opened up a lot of places, [for] myself culturally it has exposed some new sites. Sites that had not been previously recorded. There are some areas that I just couldn't access - ones that haven't been recorded before. So I took a dirt bike out and went exploring. I happened to find a nice stone axe. In a cultural sense, this storm has given the opportunity… it has given the chance for traditional owners, Aboriginal people like myself, to go out and find new things. It was quite a little gem to find.
>
> *Darren, Field Service Officer. WPNP.*

For others in the organisation, the flood gave Parks Victoria the chance to reassess the approach to such an event in the future. This was again taken in the context of traditional ecological management and cultural heritage:

> [The flood] makes me wonder about traditional ecological management. How would the flood have been managed traditionally? Would it have been managed at all? Would it just have been left? It really brings up that question of whether we should be mucking around with it too much at all. I'd like us to think about what the traditional owners would want done with this area.
>
> *Rebecca, Cultural Heritage Officer. Bourke Street.*

So for this participant, the flood gave an opportunity to take stock of current management practices and attitudes to the protection of the park. Having been shown photos from the region, the landscape here revealed questions to her about past practice in much the same way as did the 2009 fire (discussed in Chapter 4).

Outside of the context of indigenous land practices and cultural heritage, the flood was seen as an opportunity to reassess the built infrastructure of the park, and its relationship to significant cultural and ecological sites. Whereas previously walking trails and visitor facilities encroached upon cultural sites, they were argued to have been poorly placed to survive such an extreme event in the first place. Whilst the damage to the park was extreme, having to deal with such a drastic circumstance, where entire trails had been washed away, and where large amounts of built infrastructure would have to be reconstructed, gave Parks Victoria an opportunity to plan to rebuild such infrastructure in more suitable areas of the park.

> Obviously there's a lot of damage, the extent of it is big. But the flood is giving us a chance to look at some other things - it's giving us a chance to do some strategic thinking. We'll be able to relocate some of the walking tracks away from Aboriginal cultural sites. For Tidal River itself, we've had issues with car parking and things like that for a long time, so it's giving us a chance to look at Tidal River more closely. The [tourist] cabins got badly flooded, so we might look at moving accommodation [away from the river banks]. It gives us a chance to redefine what Tidal River looks like.
>
> *Brett, Ranger. WPNP.*

The kind of *'strategic thinking'* mentioned here is indicative of the attitude of the entire organisation during the flood. Once the initial shock at the level of damage had been overcome, and some pattern of normality had been re-established, staff in the park began to think about rebuilding the park in ways they saw to be an improvement. However, as shown here, this was not just about the buildings and roads in the park. Whilst built infrastructure was the primary consideration during this time, there was much work around rethinking what trails and the 'small town' of Tidal River should be, given the relatively recent discovery of cultural heritage sites. Additionally, there was an opportunity to reassess emergency management and recovery practices, where the

approach to such a large scale event was reflected upon by questions around traditional ecological management. The *'strategic thinking'* that Brett mentioned implies an outlook planning for the future, when the *rhythms* of the park would return to their normed state - the *eurhythmic* everydayness of the park (Lefebvre, 2004).

Whilst the *space of disruption*, the arrhythmic state associated with the flood, did disrupt the *habitats* of staff in the park, the forced change in daily patterns and rhythms in the park led to the formation of a new 'normed' experience in the park (Lefebvre, 2004). As the immediate after-effects of the flood receded, the organisation was able to consider what the daily practices it returned to would look like. Similarly, it gave them a chance to redefine the built infrastructure of the park in a way that more closely reflected their desired practice. By disrupting the ordinary rhythms of the organisation, the flood gave it a chance to realign and reassess those same rhythms. Whilst the damage to both built infrastructure and landscape was severe, the flood opened up previously inaccessible areas of the park, leading to cultural discoveries, disrupting the landscape and allowing cultural heritage officers to find more evidence of past traditional practices.

With this, the flood can be seen as an important chance for renewal for the organisation. Just as ecologists tout the fierce yet beneficial nature of fire on the landscape, a flood and its influences allowed WPNP to recreate itself. Whilst the *space of disruption* was initially one in which uncertainty and anxiety were prevalent, and in which the everyday rhythms that forced a sense of home were disrupted, it also allowed a reassessment of those same rhythms. Its arrhythmic state ultimately made the *space of disruption* one of reflection and renewal, one of opportunity.

5.3 A Space of Iconic Landscapes

The previous section discussed how the flood created a *space of disruption*, where the park entered an arrhythmic state that disrupted the daily routines and rhythms within the park. In this sense, the flood can be said to have disrupted the *habitat* of the staff in the park. In the weeks and months after the flood though, the *space of disruption* became the home for new patterns of movement and practice, where staff reflected on and proposed improvements. This showed that despite being a source of uncertainty, the flood and its disruptions ultimately gave Parks Victoria the chance to reassess management practices and to redefine important aspects of the park. In this way, the flood was ultimately a space for renewal.

However, it is not the intention of this focus on renewal to discount the tension and anxiety that was prevalent in the direct aftermath of the flood. Indeed, the level of uncertainty at what had happened, especially in the first days and weeks after the flood, was a major talking point and theme during that time. Issues of access discussed in the previous section only exacerbated this; with most staff unable to see for themselves the effects of the flood, they became reliant on reports from the relatively small number of staff who could be airlifted in to these inaccessible areas. In these reports, staff engaged in a dialogue with these landscapes, and the stories told about them, in order to contextualise the flood.

This section will focus on the ways in which landscapes of the park were used by staff as a tool to come to terms with the extent of the flood damage. It will explore how landscapes became iconic within the park and across the organisation through the stories that were constructed about them. It will also show how these landscapes were important sites of comparison for staff when it came to contextualising the flood and the damage it had caused, where dramatic landslips or previously well-known locations become indexical to understanding the flood as a whole. At the end of this section, a sample of the most iconic landscapes in WPNP at the time of the flood is given. This space of iconic landscapes, then, will be shown to be one where staff came to terms with the flood, but also where they are able to express their experiences of it.

5.3.1 Landscapes as Sites for Stories

Given the lack of access most staff had to significant areas of the park, they came to rely on first or second-hand accounts of the extent of the flood damage. One of the key ways this occurred was through an accumulation of stories, photographs or second-hand accounts about certain dramatic or notable effects on infrastructural or natural landscapes. This section builds upon work presented in Chapter 4, where landscapes of the park were shown to become *sites of memory* through repetitive patterns of movement and practice. It expands on this notion of landscapes being dynamic homes for environmental understanding by paying particular attention to the ways in which landscapes became indexical to understandings of the flood. Indexicality refers to the ways a natural setting (or 'landscape') becomes an interactant in communication (Garfinkle, 1967). Within this, the meaning that places hold for people evolves over time, and represents more than just its physical characteristics - they become sites for

cultural understandings, and reference points to shared context (Bidwell & Browning, 2006).

Landscapes within the park can be seen as indexical to cultural understandings of the flood. *Iconic landscapes* are used here to show how locations in the park became sites for stories that contextualised the flood for staff in its aftermath. Similarly, they are used to point to the ways the landscapes of the park were used in the construction of a shared context around the flood. They were *iconic* in the sense that they were previously well-known locations in the park, or had undergone such dramatic changes in their topography that they became proxies for understanding the extent of the overall flood damage. Similarly, they were made *iconic* through their growing notoriety within the organisation as a whole, where 'surrogates' for the landscape (Bidwell & Browning, 2006) itself, such as photos, became indexical in their own right.

However, it was in the immediate aftermath of the flood, within the park itself, that these *iconic landscapes* first emerged. Access was again a key factor in the creation of *iconic landscapes*; the level of uncertainty and anxiety around the flood damage was exacerbated by the lack of access most staff had to large sections of the park, including the administrative and work hub in Tidal River.

> Our understanding of the flood was a moving beast. We were flying blind a lot of the time.
>
> *Lorinda, Visitor Services Officer. WPNP.*

> This has affected the whole of the 'Prom. Our progress is impacted by road and trail damage… we simply don't have access to a lot of areas.
>
> *Mary-Lou, Community Participation Manager. Bourke Street.*

With pressure mounting to assess, recover and reopen the park, staff were anxious to get started. However, as the quotes above highlight, many staff simply could not comprehend the scale of the event, and much of this was due to a lack of knowledge about exactly what state '*the 'Prom*' was in. As these quotes further highlight, this was largely due to problems of access. Given the road damage and a number of landslips blocking access even by foot, staff were '*blind*' to the level of work that lay ahead for them. Even in the days after the flood, only a handful of staff with official assessment duties were able to access these areas. They were granted access by helicopter, and were flown in to areas like Tidal River for a few hours to take photographs and make initial assessments and estimations about the level of effort required to recover or rebuild

assets. They also did aerial tours of the park to assess road, ecological and topographical damage to other areas of the park.

Given this general lack of access experienced by staff, those who were able to be airlifted in and out of the park were treated as custodians for understandings of the flood. Indeed, during a number of visits to the temporary office in Yanakie, at the entrance to the park, numerous conversations were overheard discussing the damage the flood had caused with those who had undertaken a helicopter trip. These conversations took place around specific locations in the park: staff would either ask about a particular area of interest to them, or groups of staff would participate in a conversation around a commonly known place, like Tidal River.

> There was a lot of talking amongst ourselves with people who had been in, had a look and taken photos. We do have regular meetings [to be informed about what is now known], but outside of those I've heard a lot of stories about what happened in Tidal River that night, and seen lots of photos from different places.
>
> *Lorinda, Visitor Services Officer. WPNP.*

This participant is describing the general atmosphere of the Yanakie office in the days and weeks after the flood. Whilst meetings were important in passing on official information, it was the '*talking amongst ourselves*' around the office where much of the contextualisation of the flood happened. This often took the form of stories around the night of the flood itself, when Tidal River was inundated with torrents of water and staff and tourists needed to be taken to safety. Specific locations in the park also became central to conversations, as dramatic landslips and ravines were discussed and *'marvelled'* over.

> There has been marvelling at particular spots in the park as people have been able to access them and brought back photos, showing particular areas. For example in one area, what was just a little pond sitting behind a patch of sand, is now a raging torrent. It's a big change and it's changed the landscape of the park significantly.
>
> *Mary-Lou, Community Participation Manager. Bourke Street.*

Photography was a powerful medium in these cases, where staff on aerial tours would take photos of particularly dramatic landslips, or on the ground in areas such as Tidal River. Photographs were treated here as a surrogate for the landscape. Where access was as limited as it was, photographs represented the landscape in ways that allowed their indexical nature to flourish. Through the surrogacy of photographs, landscapes

became an interactant in communication (Bidwell & Browning, 2006), where stories and conversations that contextualised the flood occurred around pictures of particularly dramatic scenes. Whilst there were formal efforts to document the park photographically, a large portion of the photographs that were used in conversation were of a personal nature.

> Lots of photos were taken on personal cameras. Our teams work camera was lost during the flood, so some of the cameras were personal as I understand it.
>
> *Lorinda, Visitor Services Officer. WPNP.*

Indeed, some staff latched on to the importance of the photographs and began to collect together sets of them for use in more formal presentations.

> I was grabbing photos from people over the week. People were showing each other their own photos, and I began grabbing them and asking if they could label where they were and if I could use them.
>
> *Lorinda, Visitor Services Officer. WPNP.*

Given the lack of access most staff had, photographs became important interactants in the stories and conversations that helped contextualise the flood. They became indexical to an evolving and dynamic understanding of the flood that was based on the damage it had caused. For those staff who were not in the park on the night of the flood, or who had not seen the dramatic landscape shifts personally, it was through the surrogates of photographs that landscapes became sites of stories.

Similarly, it was through conversations, the sharing of stories, photographs and the group contextualisation that occurred around these that iconic landscapes were produced. Staff who had managed to gain access to areas of the park were custodians for understandings of the flood. They were sought out based on what they had seen, where they had been, and what they had to show. In this way, it was through the landscapes that were most affected by the flood that staff began to come to terms with exactly what had occurred, and it was the dramatic stories, first-hand accounts and photographs that helped produce these landscapes, that made them *iconic*.

5.3.2 Landscapes as Sites of Comparison

This section has so far discussed how landscapes were used to contextualise the flood through stories. Beyond being sites for stories, however, landscapes were also used as sites of comparison for staff as they sought to understand the extent of the damage caused by the flood.

There is no doubt that the flood was a dramatic and drastic event that caused a number of *disruptions*. Given the rarity and severity of the flood, contextualisation is the process staff underwent to begin to come to terms with the flood, to normalise it and to plan a return to the everyday rhythms of the park.

As such, locations in the park that were severely affected by the flood become points of comparison for staff. Whether through the surrogacy of photography or place names, landscapes became indexical to stories from the night of the flood and the changes that had occurred as a result of it. Whilst these stories were dynamic and shifting, being added to and discussed amongst different sets of staff, across different locations and different roles, it was staff's prior familiarity with particular areas that further contributed to the contextualisation that occurred.

Indeed, in the days and weeks after the flood, staff sought out information on places about which they were particularly familiar. These places may have been somewhere of personal interest to them, a regular place of work, or an area known to them for some other reason.

> Staff can get passionate about different areas. Sometimes it's because they know about a particular species that is in a spot, or they may have spent a lot of time working on a project somewhere. They want to know what has happened to those places.
>
> *Mary-Lou, Community Participation Manager. Bourke Street.*

What the quote above highlights is that iconic landscapes were not just iconic in the sense that they were shared. Individual staff in the park had built up unique connections to areas of the park. Whether it was through their experience of working in a particular place over time, or because they knew that place to hold some rare species of flora or fauna, locations had become meaningful for them. Given this level of familiarity that had developed from these personal connections, staff often sought out

information on these areas. In this sense, their intimate knowledge of a location became a benchmark from which to understand the effects of the flood.

> I certainly wanted to see the impact of the flood. I was there on the night, and I wanted to see the extent of the damage, and what it had impacted on. I'd done a number of projects in a fire recovery role where I'd rebuilt assets, and I was keen to see if those had stood up. Most of them haven't.
>
> *Darren, Ranger. WPNP.*

For this participant, who had been in the park on the night of the flood, his knowledge of particular areas and assets became points of comparison for him. Even though he had seen the ferocity of the flood waters first hand, he had commented that he still needed to *see* the impact of the flood before he could begin coming to terms with it. This participant went on to describe a number of aerial tours he had taken in which he examined most of the park for flood damage. However, it was the locations that had a personal meaning for him, where he had worked on projects, that provided the most pragmatic indication of the damage the flood had caused.

By seeing the level of damage at areas they were intimately familiar with, staff were able to comprehend the scale of the flood across the whole park. Indeed, others commented that despite having seen photos and heard stories and first-hand accounts of the extent of the damage, it was not until they were able to see these areas for themselves that they began to fully comprehend the extent of the damage.

> Some staff have been down since and seen what has happened. I think that's been the biggest thing. It was several weeks before I could go in. I just couldn't comprehend what had happened. I saw lots of photos and heard people's stories, but it wasn't until I saw it that I really got it. I needed to see it for myself.
>
> *Anonymous, WPNP.*

This desire to see what had happened was derived from the personal connections staff had formed to certain areas. This participant had worked in the park for 14 years as a house cleaner for the visitor accommodation. Given this, it was the damage to the visitor cabins that was most meaningful to her. She continued:

> To see where the water got to on the walls… it was really quite shocking.
>
> *Anonymous, WPNP.*

Her familiarity with those cabins gave her a point of comparison with which to comprehend the event as a whole. Whilst a cabin would obviously not be considered a 'landscape' in the traditional, ecological sense, it still holds true to the definition that has been used so far - where the cabins, as a part of the built infrastructure of the park, became an interactant in understanding the extent of the flood. For this participant, the cabins became a key part of the contextualisation of the flood; they were indexical to an understanding of the flood based on the damage it had caused them. The cabins were a place that had become meaningful to her over time, and it was through a comparison of their post-flood state to her knowledge of them prior to this that allowed her to begin grasping what had happened that night. As she stated, she *"needed to see it for herself"*.

5.3.3 The Iconic Landscapes of the Flood

Whilst places such as the Tidal River cabins and other built assets were iconic and indexical for individual staff, it was around the most broadly familiar locations in the park that much of the contextualisation of the flood occurred. This was especially true for the broader organisation and public at-large, where their connection to the park might not have gone as deep as to establish the intimate knowledge of particular places, either through acting within them or through experience over time. In this sense, the *spaces of iconic landscapes* for them were large or frequently visited locations in the park which they were previously aware of, or to which they had exposure.

Up to here it can be seen how stories were constructed around locations in the park, and how the landscape of the park itself provided an indexical connection to both shared and individual understandings of the flood. *Iconic landscapes* emerged in the aftermath of the flood as staff sought to contextualise it through storytelling, photography and site visits. In this regard, *iconic landscapes* were points of comparison, where the changes in familiar places became a proxy for understandings of the flood.

This section will provide an overview of some of the most well-known and widely discussed locations in the park, as they pertain to understanding the extent of the flood. Whilst most of these places have their own histories, their own stories and people's own experiences of them, during the flood new meaning about them was constructed. In the same way that other locations became indexical for groups and individuals within the park, these became proxies to sets of stories that helped contextualise the flood. Given the focus on particular iconic landscapes as locations, these are presented as places: the

township of Tidal River, Lillypilly Gully, Darby Bridge, the Lou-Ann Boardwalk and the Tidal River visitor centre.

Tidal River

Whilst damage to a number of well-known buildings within Tidal River was extensive, the most powerful stories that circulated around Tidal River were to do with the night of the flood itself. In these, staff told of having to rescue campers and hikers from the rapidly rising water, of having to do so with no electricity, and no means of communicating what was happening to people outside of the park.

First-hand accounts of that night were the most commonly discussed in the immediate aftermath of the flood, as staff who were not there struggled to comprehend just what had happened. Those who were there were sought out and questioned, and their accounts were passed along to others in the park, and, importantly, further abroad to the city office.

Large portions of the State of Victoria had been inundated with flood waters that night, and WPNP was not the only park to have suffered damage. However, given its significant place in the organisation's park network, and the important role it plays in tourism and commerce in the local region, the floods at WPNP were of particular concern to Parks Victoria. It was actually one of the most severely affected parks that night, but its iconic status in the State meant it received particular attention. As the administrative hub that most Parks Victoria staff would have been familiar with, Tidal River came to represent the effects of the flood on the entire park.

In this sense, Tidal River was perhaps the most iconic landscape. Its significance as the hub for tourism and administration within the park meant it was familiar to both the public and staff outside the park. Their past experience of Tidal River as a destination made it a site of comparison, an iconic landscape that became a site of stories about what it meant to witness such as event.

...

The Lillypilly landslip

Figure 5.4 – The Lillypilly Gully landslip was one of the most dramatic examples of the power of the flood.

Perhaps the most dramatic landslip took place at Lillypilly Gully, a popular walking destination within the park (Figure 5.4). It featured regularly in the diary study conducted for this research, and was often commented upon as being dramatic.

> This is very unpleasant to see.
> *Rebecca – Cultural Heritage Officer, Bourke Street.*

In the follow-the-thing study (explained in Chapter 2), a note discussing the landslip was included due to its resonance with staff. Like Tidal River, most staff who are familiar with WPNP as a whole are familiar with Lillypilly Gully. As it was with other particularly dramatic locations in the park, Lillypilly Gully became indexical to the flood damage as a whole, and given its familiarity across the organisation, became a site for stories and comparisons that contextualised the flood for staff both within and outside of the park.

...

Darby Bridge

The pictures of Darby Bridge, which have already been shown in this chapter, were perhaps the most widely reported images from the flood. Aerial video appeared on a number of televised news programs, and Parks Victoria's communications team used photos of the collapsed bridge across a number of social media outlets. The images became an indicator of the power of the flood - whilst landslips were dramatic, there was something that resonated with staff and the general public about the seemingly most stable and permanent built infrastructure of the park being severely damaged that led people to reflect on the flood's power.

...

Lou-ann Boardwalk

Figure 5.5 – An information board showing damage to the Lou-Ann Boardwalk, with the rebuilt boardwalk in the background.

The Lou-Ann Boardwalk (Figure 5.5) is perhaps the most visible piece of built infrastructure within Tidal River, beyond the administrative buildings and accommodation. It is a steel framed, wooden slatted bridge that stretches around 30 metres across the banks of the river, connecting the main 'town' of Tidal River to a variety of walking trails. It is a popular spot for visitors to the park, as it overhangs an estuary where young families are able to enjoy the water without being exposed to the

sometimes large waves of the surf beach some 100 metres away. Photos of the boardwalk in the days after the flood were used in communication boards that were placed around Tidal River once the park was opened. Staff in charge of this project had selected the Lou-Ann Boardwalk, in addition to other spots, because of its iconic nature to visitors.

The boardwalk is also a fairly new structure, and was a particular source of pride for staff in the park. On the night of the flood, the boardwalk was covered in water; an otherwise docile, family-friendly river dislodged the boardwalk from many of its anchorings, and twisted it so severely that it would have to be rebuilt. In a way similar to the Darby Bridge, both staff and visitors saw the damage to the boardwalk as a proxy to the power of the flood.

...

The Visitor Centre

Figure 5.6 – The visitor centre was severely damaged during the flood.

Whilst technically a part of Tidal River, the visitor centre (Figure 5.6) was a key site of comparison for staff and visitors alike. For staff, the visitor centre was the daily office in the park; it housed important archival information, numerous personal possessions stored in desk drawers, and was so intimately familiar to everyone in the park it

became one of the most frequently discussed locations. Partially because of its familiarity, but also partly because of its distance from the river itself, the flood damage to the visitor centre was particularly surprising and affecting for park staff. It is some 300 metres from the river, on an steady incline away from the river's banks, and the fact that water reached there at all was awe-inspiring to staff.

Echoing the motivations for including the Lou-Ann Boardwalk in communication boards around Tidal River, pictures of damage to the visitor centre were also included to inform visitors of what had happened on the night of the flood.

> We wanted to show pictures of damage to key popular structures like the Lou-Ann Boardwalk, the Tidal River visitor centre and the store… to some of the cabins. There was a lot of public question about why they couldn't get in. We wanted to convey that there were reasons they were still closed, and that we were responding as fast as we could.
>
> *Lyndon, Education Officer. WPNP.*

…

These *iconic landscapes* became known amongst the wider organisation and the general public as indicators of what had happened on the night of the flood, and were treated as indexical to the scope of work required to bring the park back to an acceptable level of safety. They were indexical to the damage of the flood, and became storied spaces (Brewer & Dourish, 2008) that evolved along with understandings of the flood itself. The *space of iconic landscapes* then was a space within which understandings of the flood were constructed and emerged out of the stories and observations people told and made about iconic locations in the park. They could be iconic for personal reasons, due to attachments that had built up over time, or they could be iconic due to their familiarity and popularity amongst large groups of staff and visitors alike. The space then was one within which the landscapes of the park - either natural or built - became key interactants in contextualising the flood. It was around these landscapes that the organisation began to normalise the flood, and plan its return to the everyday rhythms of park management.

5.4 An Affective Space

To here, this chapter has explored the effects of the flood on management processes within the park. Through an exploration of various forms of *disruption*, this chapter

has described how the park entered a state of arrhythmia, where the daily cycles of the park were thrown out of rhythm, and where the *habitat* that staff had built up within the park was disrupted, altered and ultimately renewed. Whilst that did show how this arrhythmic state gave Parks Victoria a chance to reassess their management practices and the built infrastructure of the park, it primarily highlighted how the various *disruptions* affected the lived experience of staff. Through problems of access, staff were disconnected from sites that were important to them, and their regular movements within the park were forcibly changed. It showed that this was an emotionally distressing time for staff, as they worked towards adjusting to the new reality of the park under various pressures and expectations. Building on this, the previous section showed how *iconic landscapes* became key tools for staff in *contextualising* the flood. It detailed the ways in which landscapes become iconic within the organisation, through the dramatic changes that occurred as the result of the flood. As sites of comparison, locations or built infrastructure in the park became proxies through which the organisation came to terms with the damage caused by the flood.

Whilst the initial disruption and the subsequent adaption and contextualising that occurred around the flood are important to document, underlying each of these examinations so far is notions of *affect*. In one sense, the last two sections in this chapter have served to illuminate the role that affect played in the immediate aftermath of the flood, where the flood was portrayed as the catalyst that revealed the importance of affective connections in the prioritisation of information seeking and recovery efforts. Affect has been an undercurrent so far in this chapter, and this final section will address the role of affect in park management more explicitly. This final section argues then that the park can be viewed as an *affective space* during the flood recovery, where affective connections to the park often dictated the priorities of staff in the immediate aftermath of the flood. In this *affective space*, affect, or emotive connections, was a key driver for management within the park.

5.4.1 Affect and Place

"Sentiment towards places builds over time up through the most humble of interactions with them."

Tuan, 1977

Affect is something that has tinged the account of the park and its flood throughout this thesis. In Chapter 4, a description of the park as a network of habitats was provided. It showed that through daily movements and actions within the park, staff cultivated a habitat for themselves where their knowledge of the park resided, and within which their identity within the park and the organisation was grounded. In the first sign of emotional connections to place, this notion of habitat was shown to be closely related to notions of habit and home. Habits are things that people take on and possess, as Coyne (2010) states, "as if wearing clothing". To *in*habit somewhere then is to take on, cultivate and construct a connection to that location where an individual or cultural identity is grounded (Coyne, 2010; Douglas, 1991), and where a person's daily practices form a sense of "home ground" (Bidwell & Browning, 2006). Home, then, can be seen as the spatial correlation of that practice - the place that is *inhabited*, and the site of those affective bonds.

In this sense, Chapter 4 showed that, in contrast to the primarily representational nature of spatial data within Parks Victoria, staff experience the park as a cultural and social entity - as a habitat within which their identity is grounded and through which affective bonds are formed. Through their *inhabitation* of the park, they necessarily cultivate and construct connections to it that inform their sense of self and belonging. For staff, the park is at once the home for "patterns of regular doings" (Douglas, 1991), and a home for their individual and collective experiences.

This focus on affective bonds to locations leads this section to consider what Chapter 3 referred to as embodied space, or *place*. In each of the spaces presented in this thesis so far, themes of networks, flows and temporality have been central. However, the kinds of affective bonds that are addressed in this section are more closely related to notions of embodiment (Galloway, 2004; Dreyfus, 1991). Through their inhabitation of the park, Parks Victoria staff form a sense of the park that is based on their embodied perceptions of it, where the entire gamut of available senses combine to emerge as a sense of place. However, it is important to consider that whilst their interactions with the park are "multi-sensory and corporeally replete" (Bidwell & Browning, 2006. p. 229), their sense of *place* is based as much on affective, aesthetic and cultural dimensions as on what can be seen, heard or felt in a tactile sense. Given their reliance on embodied experiences however, each of these relies on a consistent, regular interaction with the park and its landscapes and built infrastructures.

When this chapter talks about the various forms of *disruptions* that occurred after the flood, it is clear that any effect the flood had on the landscape of the park, on its built

infrastructure, and on the patterns of movement staff had cultivated there, would adversely affect those same notions of *habitat* and *place* that are closely attached to them. In this regard, this section draws attention to the ways in which the flood revealed the affective connections that staff formed to the park, where those connections contribute to a sense of *place*. The *space of affect* then is once in which these affective bonds, borne out of staff's embodied experience of the park, are explicitly revealed.

5.4.2 Affect and the Flood

Affective connections – related to notions of embodiment (Galloway, 2004; Dreyfus, 1991) – staff had developed to the park have tinged each of the accounts presented in this chapter so far. The *space of disruption* showed that the flood caused a certain level of uncertainty at what had happened and what needed to be done. The *space of iconic landscapes* further showed that certain meaningful locations in the park became sites of stories and sites of comparison that helped staff contextualise the flood. Whether it be *uncertainty* at what had happened on the night of the flood, *anxiety* at what would be changed as a result, *passion* for an area driving investigation in its aftermath, or *relief* that personal belongings had been recovered, the emotive nature of the flood's impact is clear in each of these sections so far.

Indeed, the affective connections staff had formed through their interactions and *inhabitation* with the park became obvious in interviews directly after the flood. In these, the emotional response of staff was often a key theme.

> I've worked in the park for 14 years. Seeing what had happened first hand was **devastating**.
>
> *Anonymous, WPNP.*

> There's definitely a level of **grieving** happening for people who had lost projects or personal belongings.
>
> *Mary-Lou, Community Participation Manager. Bourke Street.*

> There's a lot of **shock** at what has happened.
>
> *Jim, Project Manager. WPNP.*

Whilst the language emphasised here is itself emotive, there is no denying that they reference very real and raw responses that people had to the flood. Whilst dramatic accounts of the night of the flood, or the drastic changes to the landscapes of the park were popular starting points in these conversations, it often was not long before the affective impact of the flood became the topic of discussion. In this regard, staff themselves were often surprised at how much of an affect the flood had on them.

> Most people would be surprised just how much the flood has affected them.
> *Brett, Ranger. WPNP.*

Given this unexpected emotional impact of the flood, the management staff in the park in particular became concerned with staff welfare as much as any formal assessment and recovery efforts. Management held regular meetings updating staff on the state of certain areas, and there were regular one-on-one conversations with individual staff to *"see how they're doing"*:

> I'm basically talking to people to see how they're doing. There are people who are upset. One of our main priorities now is their welfare.
> *Scott, Natural Values Manager, WPNP.*

Whilst these concerns for the welfare of staff were not overtly stated, they were considered a strong undercurrent in the park at this time.

> None of this has been overtly stated. It just sits there as a bit of an undercurrent.
> *Mary-Lou, Community Participation Manager. Bourke Street.*

As this chapter has already begun to explore, the emotional impact of the flood can be ascribed to the connections staff had formed to the park, and the level of *disruption* the flood had caused. Indeed, this individual, subjective concern for areas within the park was recognised by management, and their efforts to address staff welfare often culminated in attempts to provide staff with information on areas of special importance to them. In this regard, the role of affect in seeking information on what had happened during the flood was also well noted.

> *[In the days after the flood] the information people were seeking was very individually focused. It's based on their history as an employee in the park.*
> *Mary-Lou, Community Participation Manager. Bourke Street.*

What this manager is highlighting is the individualistic and subjective nature of information-seeking about the park in the immediate aftermath of the flood. As background to the formal assessment duties taking place, this manager was also aware of the individual histories staff had within the park and recognised that staff would be motivated by these past experiences to comprehend the impact of the flood. Whilst the previous section examined how *iconic landscapes* became sites of stories and sites of comparison for staff to contextualise the flood, what is evident here then is that *affect* was a driving force in the seeking of this information. It were the bonds that staff had developed over time with certain aspects of the park that informed their immediate concern in the days after the flood.

> It might be they were working on a project that had just finished. The bridge at spot X, they might have worked on that for 3 months and spent two years trying to get funding for it, and now it's been washed away. There's grieving for that. There's also grieving around things that have no real monetary value, but have enormous emotional links. It would be the same for any kind of flood.
>
> *Mary-Lou, Community Participation Manager. Bourke Street.*

In this regard, parallels were drawn between the flood in the park and any other kind of natural disaster. At the same time in the state, many other regional centres and small towns had also been subjected to dramatic floods, and staff would often attempt to contextualise their emotional response to *disruptions* in the park to those of residents in surrounding towns. If residents of homes damaged by flood waters were upset, then of course staff who had worked within the park, and had become passionate about it, and attached to it, would also feel strongly about its damage. *"It would be the same for any kind of flood"*.

In this sense, affect can be seen as a key driver in investigating the damage caused by the flood. Whilst there were formal assessment activities taking place, personal requests from staff around areas of particular importance for them were being met between these official duties. Staff who were airlifted into Tidal River were asked for favours by those who were unable to access it, and those who were scheduled for aerial tours were asked to report back on specific locations. As the quote above also highlights, there were concerns for things that "*have no real monetary value, but have enormous emotional links*". The role of affect in driving these investigations was again recognised and, out of concern for staff welfare, management actively encouraged this seeking of information around personal requests. In this, there was recognition that the park was more than a collection of fauna, flora and infrastructure; it was an affective

place for staff, a meaningful home for experiences, memories and artefacts that evoked an emotional response.

> There were a lot of conversations, right after the flood, about individual's personal belongings. There was one I remember where the person had worked in the park for 20 years, and they wanted to know what had happened to their special brochures. Every brochure they had ever worked on was in the bottom drawer of their desk. They wanted to know if they were able to get those back.
>
> *Mary-Lou, Community Participation Manager. Bourke Street.*

> I had a lot of photos on my desk and in the drawers. Luckily someone was able to get them back for me.
>
> *Lorinda, Visitor Services Officer. WPNP.*

This focus on personal belongings that had particular emotional meaning for staff highlights again the role that affect played in the immediate aftermath of the flood. If the notion of *place* emerges from the embodied experience of a location - including affect that arises through attachment to aspects of those locations - then this focus by staff on personal belongings, and areas of personal interest to them highlights that the park is indeed more than just a collection of plants and animals. For staff, the park is a *home*. As Tuan (1974) describes, home, or 'homeland', is a place of a particular scale, and is the type of place that people are *rooted* to. By this, he means it to be a nourishing place that becomes "an archive of fond memories; achievements that inspire the present" (ibid. p. 154) and a permanent place that helps reassure those who dwell within it. In the context of this research, *home* for park staff spreads across the scale of the entire park, and is comprised of networks of meaningful places, objects and memories. This connection is summed up in the quote below:

> *Sometimes the welfare of the park and the welfare of individuals were inextricably linked. Individual and park welfare are the same, or have similarities.*
>
> *Mary-Lou, Community Participation Manager. Bourke Street.*

The *affective space* is also one in which staff's personal welfare was tied to the welfare of the park itself. This chapter has shown that the emotional welfare of staff was inextricably linked with the state of certain landscapes, artefacts or infrastructure within the park, and is explicitly stated in this quote from Mary-Lou. The connections people had fostered to locations, the memories of their achievements there, or the

presence of meaningful artefacts, meant that the *affective space* was one in which the sense of *place* for staff was most on display. It is also a space which reinforces the notion of the park as a *home* or *habitat* for staff. Therefore, an *affective space* of the park is one that highlights the park as not only *meaningful* to staff, but also *important* to them in an emotional sense through the connections they have cultivated there.

In this sense, the flood can be seen as providing the catalyst that staff required to express these affective connections. Their personal attachment to aspects of the park guided initial investigations into the flood, and gave them a starting point in contextualising it. Whilst the flood caused a number of *disruptions*, it were *affective* connections that guided staff's response to it. Through this, the flood ultimately revealed this *affective space*, and the sense of *place* staff felt within the park.

5.5 Conclusion

This chapter has strengthened the response to the first and second research questions proposed by this research. The first research question - *What is the relationship between space, technology and understanding, and where is that relationship headed?* - has been expanded upon by providing a further examination of what it might mean for ubiquitous computing to consider a non-problematic, dynamic and relational notion of space. Chapters 3 and 4 provided theoretically and empirically grounded answers to the first research question, and this chapter expanded on this empirical foundation. Through the examination of a non-typical time within the park, this chapter has shown that there are a multitude of ways that staff experience and know the park. It has shown that the flood was at once a disrupting force and an opportunity for renewal for Parks Victoria. It has also shown that the flood revealed the importance of affective connections to the park, where staff sought information on particular locations and aspects of the park that were personally meaningful for them. Within each of these, this chapter has highlighted the importance of the interaction *between* staff and the park, where the landscape of the park is an important interactant in contextualising the flood. In contrast to the impoverished notion of space that is common within much HCI research, Chapters 4 and 5 have shown that it is the interaction between staff and the landscape of the park itself that produces meaning.

With the understanding that the relationship between space and understanding is a dialogic one, and one based on relational and dynamic interactions, this chapter was able to turn to addressing the second research question - *How can we expand this*

relationship, in a conceptual way, so that this relationship is useful for designers of technology? Like chapter 4, it has provided a thematic analysis of a situation for which designers might design. By framing the examination of a precise set of perspectives and interactions within the park as a *space* in which certain forms of environmental knowing are produced, this chapter has provided a further example of how these relationships can be expressed. It is the contention of this research that these conceptualisations of the relationship between space and environmental understanding will provide inspiration for a set of design inspirations that put this dynamic, relational and pluralistic notion of space to use within a ubiquitous computing context. The remainder of this thesis will be dedicated to outlining these principles, and executing this new understanding through conceptual designs.

6

The Emergence and Seasonality of Space

Both Chapters 4 and 5 made contributions towards answering the first research question of this thesis: *What is the relationship between space, technology and environmental understanding, and where is that relationship headed?* Through an empirical, multi-sited ethnographic study with Parks Victoria, these chapters offered an alternative conceptualisation of space grounded in a practical context. Whereas Chapter 3 laid a theoretical foundation for re-examining the role of space in this relationship, Chapters 4 and 5 took this foundation and showed, empirically, that it is possible to conceptualise space in a relational manner. They showed that the park is not just a singular place, but a pluralistic and dynamic entity that is constantly made and re-made. Similarly, they have shown that the park is not an abstract, meaningless plane on which actors act and processes play out, but an active participant in the production of various forms of knowing in and around it. Indeed, the main achievement of these chapters has been to highlight that what constitutes environmental knowing within Parks Victoria, and particularly within WPNP, is the product of many varied and often competing interactions and processes, of which the park and its landscapes are important interactants. Rather than being a static and impoverished container, the Park, as a background to the daily practices of its staff, can hardly be considered inert.

Technology did not feature heavily in the previous chapters. Whilst the research methods incorporated various technologies in their *technique* (as described in Chapter 2), their role in this research was periphery and did not form part of the analysis of the processes, interactions and rhythms that occur within the park. This chapter will

therefore aim to link the interpretative and relational research presented in Chapters 4 and 5 with the issues surrounding technology and environmental understanding framed in Chapter 3. It does so by providing a discussion on the findings from Chapters 4 and 5 in the context of technology design, and in doing so, offers a *reframing of space* for ubiquitous computing. The discussion begins with two re-conceptualisations of space that reflect Chapters 4 and 5 in turn, showing that space is both *emergent* and *seasonal*. These alternative conceptualisations aim to illuminate where the relationship between space, technology and understanding may be headed, but also provide a way forward for issues of space and spatiality for ubiquitous computing.

In this way, this chapter will continue to address the second research question of this thesis: *How can we expand this relationship, in a conceptual way, so that this relationship is useful for designers of technology?* By providing a thematic discussion on the findings from Chapters 4 and 5, it aims to highlight that, through empirical work, the relationship between space, technology and environmental understanding can be expanded in a useful and actionable way. To achieve this, this chapter will present six inspirations for new design directions that ubiquitous computing might take: *Designing Pores*, *Designing Thresholds*, *Designing Anchors*, *Designing for Rhythms*, *Designing for Scales*, and *Designing for Oscillations*. By providing design inspirations grounded in the analysis of the previous chapters, it aims to present a conceptualisation of the emergent and seasonal nature of space that bridges the ethnographic field work presented so far, and the designs presented in the chapters that follow.

6.1 The Park is Emergent

This section provides a thematic analysis of the findings of the research study presented in Chapters 4 and 5 in the context of ubiquitous computing. The first of these themes is centred around the *emergent* nature of space within WPNP and Parks Victoria. Whereas Chapter 3 provided an exploration of HCI literature that treated space, either explicitly or implicitly, as an inert, static and meaningless container, Chapters 4 and 5 highlighted that space can be conceived of as *emergent*.

Whilst Chapters 4 and 5 were presented as a number of *spaces* produced from differing interactions between staff and the park, it was not their aim to report on the most obvious or common ways staff experience the park. Additionally, their aim has not been to form a representative model of the ways staff experience or know a National Park.

Staff's experiences of and in the park are obviously different depending on their job role, their level of experience, and their physical location. Instead, these chapters primarily described the *differences* between these most common experiences, and in doing so drew attention to the ways space is produced – how it *emerges*.

This focus on emergence is a key factor in interpretative and relational research (Vannini, 2012b). Rather than reducing a context to its constituent parts and describing what those parts are and how frequently they occur, the objective is "to describe and interpret how those experiences unfold" (Vannini, 2012b. p. 48), and how they are practiced and experienced. Following from this premise, the aim of these chapters has been to understand how the park and organisation work together to produce unique forms of environmental knowing, to understand how knowledge of the park is tied up in the processes that produce it, and how these processes emerge.

The main achievement of these chapters then has been to show that the park is an *emergent* entity that is contingently produced and in a perpetual state of making and re-making. This is in contrast to prevailing attitudes in HCI and ubiquitous computing, where space has been treated as static and inert, and the cause of problems that technology is positioned to help overcome. As Chapter 3 argued, by examining different ways of bringing things into alignment (Thrift, 2003), that is, different *spaces*, this thesis has provided an alternative conceptualisation of the role of space in the relationship between technology and environmental understanding. Rather than being the inert stage that houses social and cultural processes, the findings showed that the park is a *product* of them. Additionally, instead of viewing environmental knowledge as 'residing' in any particular one of these productions, these chapters have shown that it is produced *from* them. This repositioning of space from a singular and static entity towards one that is relational, pluralistic and emergent is the key point of departure of this research from prevailing approaches in HCI. Whilst Chapter 3 laid the theoretical basis for this departure, the previous two chapters have combined to show, empirically, that the 'background' - in this case, the park - is an *active participant* in the production of environmental knowledge.

Section 4.2 *Spaces of management ,* demonstrated that the top-down management structure of the organisation led to the formation of distinct sets of priorities and experiences that are closely related to this structure. In this, the park was positioned as a drastically different entity depending on the management priorities being examined. Concerns for ecological preservation and management, tourist safety and cultural heritage always overlapped and often conflicted, and each of these concerns led to

certain ways of interacting with the park. Rather than show the existence of one singular park, it highlighted that there is a multitude of conceptualisations of it that are both relevant and meaningful. Management groups hold their own unique perspectives of the park, and in doing so they produce a version of it that resides within them. Similarly, Section 4.3 *Space of alterity* showed that staff's physical location in the park came to represent stereotypical sets of knowledge, skills and experiences. Much like the management group that staff were members of, their physical location was seen as an index to a presumed set of perspectives on the park, where each perspective was as legitimate as the other.

By examining different networks of people – based either on their management group or their physical location – these sections aimed not to simply report on these networks, but to show that differences in networks matter. Similarly, it was not their goal to highlight that pluralism itself is problematic. Whilst differences in practices and perspectives within the organisation were, on the surface, the source of tension, each *space* was shown to produce a unique perspective on the park, and once these perspectives were understood they were recognised as valuable and became sought after.

This focus on pluralism and dynamism, of *emergence*, was further expanded upon through the frames of temporality and mobility. *An historical space* (Section 4.4) explored various temporalities of the park, where its landscapes were shown to be a site for past cultural practices and individual and collective memories. By focusing on the different interactions between staff and the park over time, it provided further evidence that the park is an active participant in the construction of different forms of environmental knowledge. Indeed, it showed that whilst much of the effort to *historicise* the park is through formal data archiving, it was the interactions between staff and the landscapes of the park that allowed meaning to accumulate. The key role of the park itself in the formation of environmental knowing was also apparent in *A network of habitats* (Section 4.5). By focusing on the mobilities of staff within the park, it showed that the patterns of regular movement and practices made the park a *habitat* for them. It examined how the rhythms and patterns that defined a *habitat* were themselves sources of environmental knowing.

In highlighting the different ways the park was meaningful to staff, through various temporalities and mobilities, those sections once again highlighted the pluralistic nature of the park. They also highlight that with this pluralism comes dynamism and *emergence*. Whether focused on management structures of the organisation, the

historicisation of the park, or on individual movements of staff, it can be seen that there is not only a multitude of ways of conceiving of environmental knowledge within the park, but also that this process is processual, dynamic and evolving. Management priorities shift based on state government policies, staff patterns of movement are altered or, as Chapter 5 showed, disrupted on a seemingly regular basis, and the meaning inherent in landscapes evolve based on the interactions that occur between them. If the park is taken to be the composition of its many spaces, then along with being a pluralistic entity, it is also necessarily an *emergent* one that is being constantly made and re-made.

It is this *emergent* nature of space that is in contrast to prevailing approaches within HCI and ubiquitous computing. As an emergent entity, the park is not an inert container but an active participant in the construction of meaning in and around it. Each space presented in Chapters 4 and 5 can be considered a different examination of processes and interactions between the organisation, its staff and the geographical location known as Wilson's Promontory National Park, and in each of these spaces unique forms of environmental knowledge is produced. As an emergent entity, it is the differences in how these spaces are produced that is of the most importance. Rather than posing problems, it is precisely this pluralism of space that allows unique perspectives, interactions and understandings of the park to exist. Further, it is from the co-interaction between staff and the park that the unique spaces presented here are formed, and it is from these *spaces* that environmental knowing is borne.

6.2 Space is Seasonal

The second theme for analysis deals with the notion of *seasonality*. Whereas the previous section highlighted the *emergent* nature of space to show that the park is contingently produced, pluralistic and dynamic, this section will highlight the cyclical and rhythmic nature of space within Parks Victoria. Whilst the emergent nature of space is important to consider for HCI, so too is the interplay between rhythms, disruptions and emergence that have been reported on in Chapters 4 and 5. It is the relationship between these processes that this section refers to as *seasonality*. Whilst the previous section showed that the notion of emergence necessitates a focus for HCI on the plurality, contingency and dynamism of space, *seasonality* will go some way to constraining that notion.

It is tempting to think of the process of *emergence* as procedural and linear – as a steady progression from one state to another. It is also tempting to consider this linear progression as the 'correct' and desirable way for space to emerge, where the interactions, rhythms, movements and practices that produce space are continuous and uninterrupted. However, Chapter 5 showed that disruptions to these forces of production are not unheard of, and can even be beneficial. So rather than viewing the production of space and environmental knowledge as a linear process, this section will argue that space is a cyclical and rhythmic phenomena. In this way, in addition to *emergence*, the *seasonal* nature of space is important to consider for HCI.

Seasonality refers to the relationship between rhythms, cycles and emergence inherent in the production of space. Whilst the use of the word *seasonal* has obvious connotations to seasons of the natural world, as a process its broader implications are ones linked to patterns of oscillation and a cyclical relationship to the past. In this sense, to say that the production of space within Parks Victoria is *seasonal* is to highlight the inextricable connection with the natural processes of "growth and decay" (Edensor, Geographies of Rhythm intro), their oscillations over different scales of time, and the repeating cycles of them. *Seasonality* therefore refers to this relationship between rhythms, cycles and oscillation. To further articulate *seasonality*, each of these will now be addressed in turn.

Firstly, *seasonality* implies rhythms. Chapter 4 showed that space and environmental knowledge is produced from the repetitive movement and enactment of practices, and that these rhythms created a *habitat* within which connections to the park were formed and became meaningful. It further showed how locations within the park became meaningful through repeated interactions with them – where landscapes become sites of memory for both staff and the organisation. Chapter 4 therefore showed that there is valuable knowledge in consistent, rhythmic interaction with locations, highlighting that it is from the repeated, dialogic relationship between staff and landscape that forms of environmental knowing emerge. However, rather than simply talking about the enaction of daily rhythms, *seasonality* is also about their *disruption*. Chapter 5 showed that the rhythms described in Chapter 4 are contingently produced and open to influences that disrupt them. The flood was an example of a disruptive force, where the diurnal patterns of movement and practices were shifted, changed or halted. Chapter 5 further showed that this *arrhythmic* state, whilst challenging for staff, revealed important connections to the landscapes of the park and gave the organisation a chance to assess and improve their practices. Space is tied up in the rhythms of the everyday, then, as well as their disruptions.

Secondly, *seasonality* implies oscillations. Chapters 4 and 5 highlighted the oscillating relationship between rhythms and arrhythmia inherent in *seasonality*. Both rhythmic and arrhythmic states help produce certain forms of environmental knowledge; however, it is the relationship and periodic switching *between* these states – oscillation – that is just as valuable as the time spent in each. Chapter 5 showed that it is the oscillation between states of comfort and stress in the park that created an interstitial space within which practices, built infrastructure and movements were assessed and renewed. The rhythmic states of Chapter 4 created a status quo in the park, whereas the arrhythmic states caused by the flood showed that rhythms need to be separated for them to be assessed and adjusted. The flood gave the organisation the opportunity to reassess the position of walking tracks and other built infrastructure. Just as organisms seem to require variations to thrive (Coyne, 2011), Parks Victoria requires periodic oscillations between stress and comfort in order to renew the emergent, rhythmic processes from which environmental knowledge is produced. It is this shift in states, their oscillations, that are meaningful themselves.

Thirdly, *seasonality* implies cycles. If a rhythm is based on repetition, and oscillations describe changes in those rhythms, then cycles can be seen as the completion of a journey between rhythmic and arrhythmic states: a single oscillation of a given process or production. Unlike rhythms, which are a steady, predictable repetition of practices and movements, cycles imply a connection to past events. Both Chapters 4 and 5 contained examples of cycles in the park that learn from past cycles and inform the next. The relationship to fire in the park is perhaps the most telling, where the annual cycle of fire preparedness, fighting and recovery produces staff who gain in experience, where behaviour can be analysed and improved on, used in training sessions, and ultimately reincorporated into the next annual approach to summer. In the cycle of fire fighting, then, staff learn from one cycle and apply their knowledge to the next. The cycle of tourism is another example that allows the organisation to assess appropriate education programs and staff levels and adjust these for the rhythms of the following year.

Not all cycles are predictable or stable, however. The response to the flood can also be seen as an example of a cycle; whilst it was an unexpected and drastic event, it is not the first time such an event has occurred. Whereas cycles imply the same progression through time that rhythms do, the example of the flood highlights that not all cycles are evenly distributed or predictable. At any point in time, the organisation is in some relationship to a natural disaster such as a flood, and this relationship is both

unpredictable and unevenly distributed. Chapters 4 and 5, when taken together then, provide an example of the cycle of one such relationship.

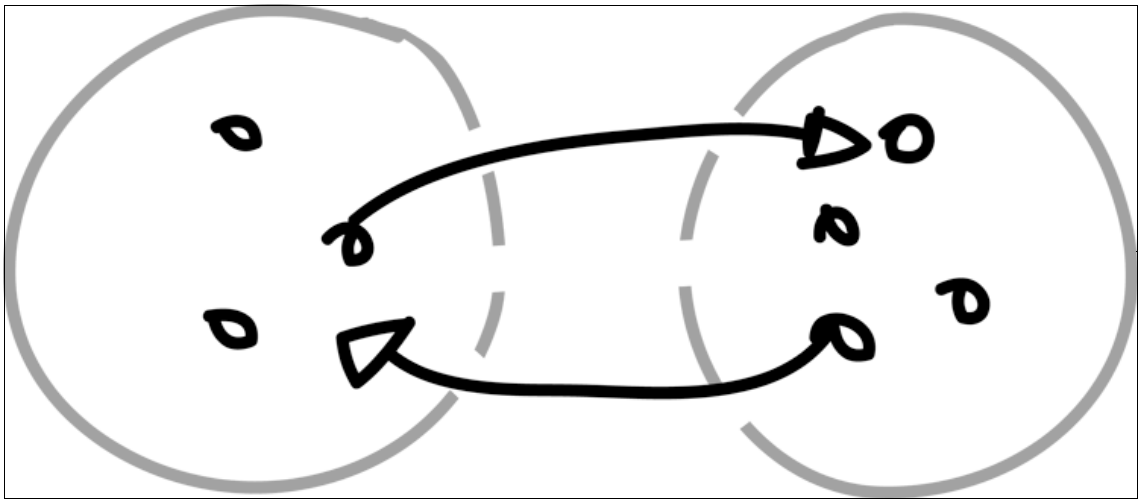
So if HCI should consider the *emergent* nature of space when designing technologies, then it should also consider the *seasonality* of space. Whereas the previous section described the ways in which space emerges, this section has gone some way to constraining that notion. It has shown that the production of space within Parks Victoria is closely defined by the relationship between rhythms, oscillations and cycles. Rather than a linear production of meaning, seasonality highlights that space and environmental knowledge are at once defined out of rhythms that oscillate and cycle across different scales of time. It is the notion of *seasonality*, along with *emergence*, that this thesis contends have expanded upon the relationship between space, technology and environmental understanding in a useful and actionable way. The remainder of this chapter will be dedicated to exploring these themes in the context of design inspirations aimed at providing HCI and ubiquitous computing with a way forward, utilising the emergent and seasonal notions of space that have been explicated in this section.

6.3 Design Inspirations

The themes of *emergence* and *seasonality* have provided a reconceptualisation of space in the relationship between space, technology and environmental understanding, and in doing so have further strengthened the response to the first research question of this thesis: *What is the relationship between space, technology and understanding, and where is that relationship headed?* Summarising the findings of Chapters 4 and 5 into these themes has provided an alternative conceptualisation of space that shows a way forward for HCI and ubiquitous computing. Not only do these themes summarise the notion of space as it pertains to Parks Victoria, or even national parks, but they also serve as an example approach to providing a set of conceptual resources grounded in empirical work that serve to expand on this relationship. In this way, this chapter is able to address the second research question of this thesis: *How can we expand this relationship, in a conceptual way, so that this relationship is useful for designers of technology?* The two themes presented here serve to show that a multi-sited ethnographic study can produce actionable and useful research for technologists and researchers, highlighting that the contributions of this thesis can therefore be seen as both its processes and its products. By engaging in ethnographic research with Parks Victoria, this thesis has provided a reframing of space for ubiquitous computing.

With these themes now established, this chapter can now turn to further exploring this second research question. It does so through an expansion of the two themes of *emergence* and *seasonality* into a set of six design inspirations that provide ubiquitous computing with a set of actionable conceptual resources, namely: *designing pores*, *designing thresholds*, *designing anchors*, *designing for rhythms*, *designing for scales*, and *designing for oscillations*. These six inspirations aim to inspire and guide designs that sit within the *emergent* and *seasonal* nature of space and environmental understanding. They also aim to demonstrate that the work presented in Chapters 3, 4 and 5 is both theoretically sound and practically applicable. Each of these inspirations will now be addressed in turn.

6.3.1 Designing Pores



Each of the various productions of space discussed in Chapters 4 and 5 can be seen as particular ways in which the park, and understandings of it, are produced. They are presented as *spaces* as they examine different orderings and interactions between actors, networks, temporalities, mobilities or embodiments. However, rather than presenting these *spaces* as singular, bounded entities that are separated from each other, or as 'layers' on top of the geographical area of the park, they are presented as relational and emergent orderings of the park that exist concurrently and overlap in complex ways. Each space is a different understanding of the park, where its landscapes are as active in its production as the staff that enact them. The theme of *emergence* also demonstrates that these spaces are also not stable, but dynamic and evolving, sometimes growing, sometimes receding, other times disappearing or beginning again.

In this regard, if the "product is the process" (Baines, 2002. p. 112), then the park *is* these spaces.

In contrast to prevailing approaches in HCI, this thesis argues for embracing the *emergent* nature of a pluralistic space rather than problematising a static, abstract notion of it. So, what would embracing an *emergent* understanding of space look like for technology design? Chapters 4 and 5 showed that each space produced unique understandings of the park. If each space has this ability, and the kinds of environmental knowledge within each are equally legitimate and valuable, then to embrace the *emergent* nature of space is to embrace this diversity of production. Rather than viewing spaces as something to *transduce*, or merge together, researchers and designers should consider ways of fostering this diversity of emergence. Therefore, to embrace the *emergent* nature of space, designers and researchers should focus on designing technologies that avoid the reification of understanding that typifies current approaches. Similarly, rather than viewing these spaces as separate entities, like 'layers' on a geographical area, designers and researchers should recognise that relational spaces overlap and interact in complex ways. This thesis argues that the notion of *porous spaces* is useful in addressing these concerns.

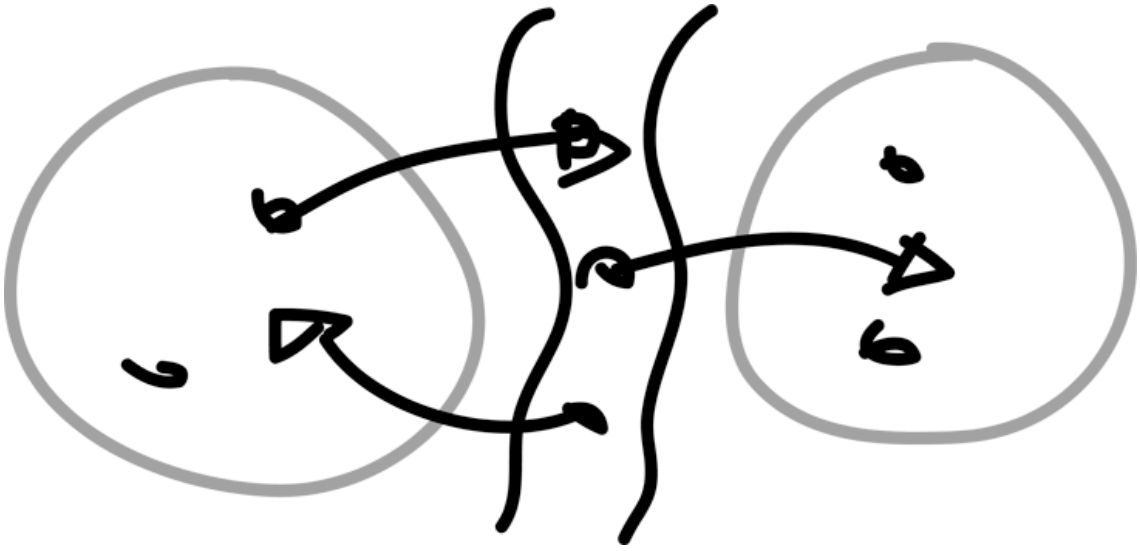
Pores are small openings in a surface, like skin or cells, that allow particles to pass through them. Porous spaces therefore are those that have pores, that allow interactions at their boundaries. By designing technologies that act as pores between spaces, their role can be to allow a space to both seep into and absorb from other spaces. Pores are an apt metaphor as they are also simultaneously open to some elements but closed to others. Rather than reifying the environmental understandings tied up in various spaces, technology can act as a conducive force that respects the unique perspectives of a space, but allows interactions between them.

By looking at the ways a *space* can be opened up to influences and interactions of other spaces, and through allowing them to appropriate from and contribute to the emergence of existing and new spaces, designers can respect the nuanced understandings that are produced within a space, yet embrace this diversification. By carefully selecting *what* moves back and forth through pores, designers and researchers have the opportunity of devising the conditions under which spaces interact. Whether spaces are formed through differences in management priorities, past experience within a park, or simply a difference in geographical location, designing technology around the metaphor of pores at once recognises the nuanced knowledge that is produced from various spaces, yet allows interactions between them. In this way, by

creating interaction points between various ways of environmental knowing, each space then becomes a platform for knowledge production that can be shared amongst Parks Victoria staff.

Through the notion of *porous spaces*, HCI and ubiquitous computing would benefit from a shift in focus to designing technologies that avoid reification, where spaces are free to emerge, shift, change and influence each other in beneficial ways, where they become platforms for environmental understanding.

6.3.2 Designing Thresholds



Technology's role in avoiding the reification of space may be through the design of *threshold spaces*. Whereas the notion of *pores* gives HCI and ubiquitous computing a way of conceptualising the interactions that occur between spaces, and the way each space may control this for itself, the notion of *thresholds* provides a useful metaphor for conceptualising spaces that are produced primarily through interactions with and through technology, and whose main aim is to connect other spaces.

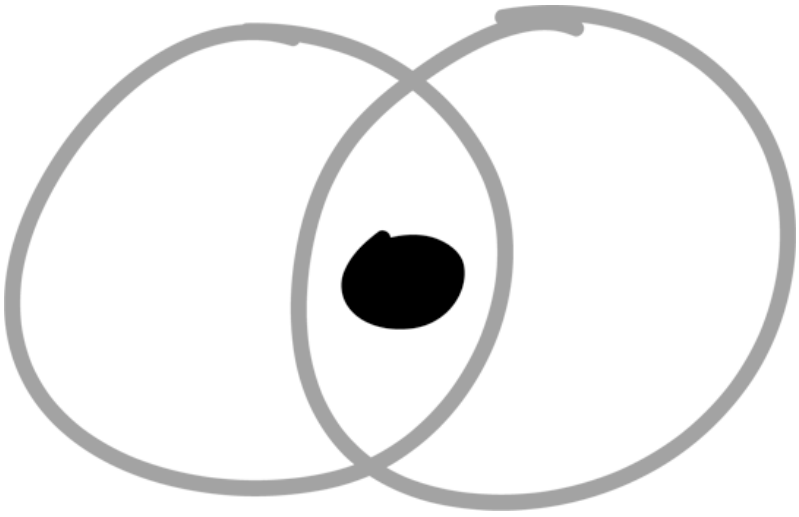
Thresholds, as an architectural term, describe a space whose sole purpose is to connect other spaces. For example, a doorway can be viewed as a threshold space as it allows people to cross from one room to another. Similarly, the foyer of a hotel can be viewed as a threshold space as it aims to connect people from the entrance of the hotel to the different floors, rooms and amenities offered within it. In Chapter 2, the 'follow-the-thing' study described a process whereby diary study notes were shown to participants across different roles and locations in the organisation. In this way, the study itself can

be viewed as a liminal space between participants, a *threshold*, whose daily practices and work flows varied greatly, and who may not have even know the originator of the entry.

In this sense, the metaphor of a *threshold* provides a way of conceptualising the spaces that emerge between other spaces, and whose role it is to connect them. What these examples show is that threshold spaces are only considered as such because other porous spaces allow things to seep across their boundaries. The hotel foyer is not a threshold space unless the rest of the hotel flows through it. Similarly, the 'follow-the-thing' study described in Chapter 2 could not have been considered a threshold space if it did not deliberately take diary entries from one participant to the next.

In embracing the *emergent* nature of space, designers and researchers might focus on designing technology that acts as a threshold between other relational spaces. Rather than viewing the disconnection or difference of spaces as problematic, the metaphor of *thresholds* permits designers to consider the design of technologies that themselves reside in the gaps between other spaces. Threshold spaces are relational, evolving and dynamic in the same way other spaces are, and are comprised of the flows between other emergent, porous spaces. Chapter 3 explored how seamful design focuses on revealing the seams between digital infrastructures and the physical, lived world; similarly, designed *threshold* spaces could be the dynamic, evolving seam between relational spaces.

6.3.3 Designing Anchors



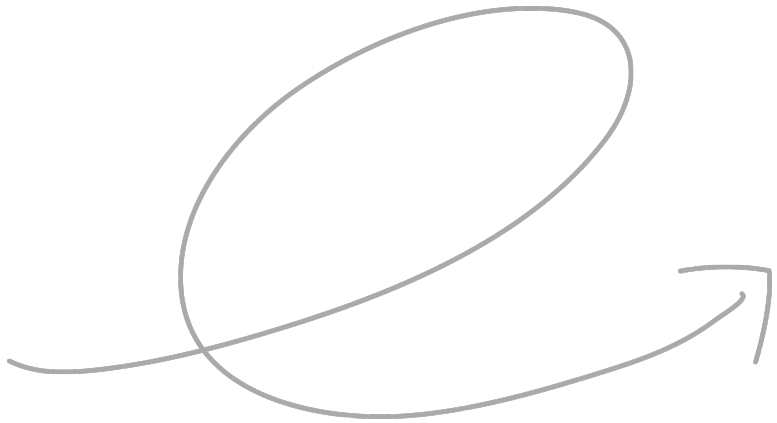
Whereas the metaphor of a *threshold* highlights the ability to connect relational spaces in a way that embraces their emergent nature, it also reinforces that connections between spaces are important. Indeed, the metaphors of both *thresholds* and *pores* open up the possibility for HCI to facilitate flows to, from and between relational spaces, and show that this is an important part of embracing the emergent nature of space. Rather than problematising their disconnection or difference, both *pores* and *thresholds* provide a means of embracing these attributes. In keeping with this, the final design inspiration aimed at exploring the *emergent* nature of space is based on the metaphor of *anchors*.

If thresholds connect relational spaces by emerging between them, then anchors are common entities that relational spaces revolve around. Examples of this have appeared throughout Chapters 4 and 5, where place names and landscapes were indexical to understandings that were shared between different relational spaces. Chapter 4, in *the space of alterity*, showed that the locations staff were based in were assumed to hold a certain set of stereotypical practices and experience, and that these assumptions became the conditions under which experience and advice were sought. The location known as "Bourke Street" or "the city office" was understood across the organisation to be the home of scientists and administrators who might have certain experiences but lack others. Similarly, staff within "the park" were assumed to have certain traits (such as pragmatism and local knowledge) that city staff did not possess. In this example, the work locations themselves acted as *anchors* between different networks of people and flows of information in that they came with certain pre-defined characteristics understood by each space. The locations were objects around which spaces built shared understandings.

Similarly, Chapter 5 showed that iconic landscapes in the park were important for staff in contextualising the flood. They acted as sites of comparison for staff, who used areas they were intimately familiar with to comprehend the severity of the damage. In this way, landscapes of the park became *anchors* for staff that allowed them to contextualise the disruption caused by the flood. The iconic landscapes of the park similarly became sites of stories that further allowed staff to contextualise the flood. Particularly dramatic landslips or infrastructural damage became *anchors* between staff across the entire organisation and, in ways similar to the work locations of Chapter 4, became an index to shared understandings that transcended any particular individual, group or work location.

If connection amongst relational spaces is important to consider for HCI and ubiquitous computing, then the metaphor of *anchors* provides these disciplines with a way of conceptualising shared understandings between emergent spaces that does not equate to reification. Whereas it was the commonality and shared access of place names and landscapes of the park that made them anchors between spaces, these attributes did not mean that anchors meant the same things to different people. Instead, they were entities around which conversations and interactions occurred, and from which a diversity of understandings were produced. The metaphor of *anchors* provides HCI and ubiquitous computing with a means of conceptualising designs that *pierce* spaces as a means of communication between them. As a means of embracing the emergent nature of space, designers and researchers may choose to focus on building technologies that facilitate the creation of anchors, or indeed become anchors themselves.

6.3.4 Designing for Rhythms



In addition to the need to consider the emergent nature of space within technology designs, HCI should also consider its *seasonal* nature. The design inspirations of *pores*, *thresholds* and *anchors* were each derived from a reflection on the emergent nature of space. In considering the seasonality of space, this section will argue that HCI needs to consider what it means to design for *rhythms*. Rather than the emergence of space being a linear production, this thesis has argued that it is in fact a rhythmic process based on various repetitions and disruptions. An important part of what this thesis has called the *seasonality* of spaces is tied up in the rhythms that produce them.

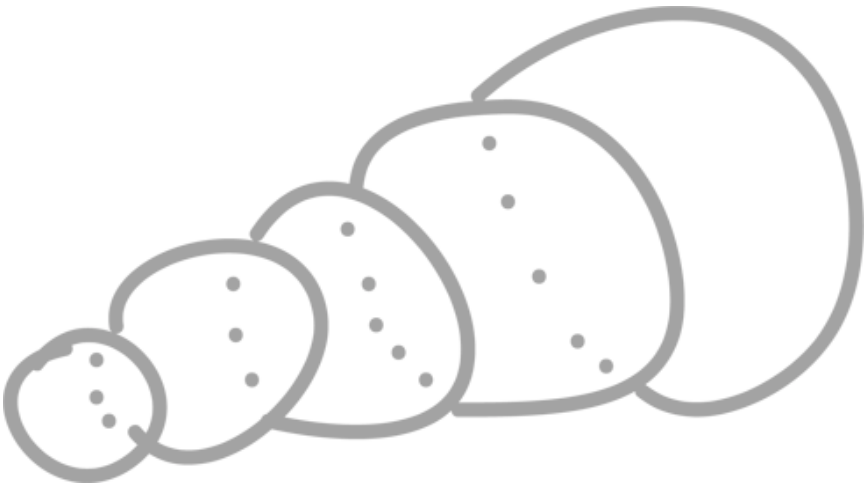
In order to embrace the seasonal nature of space, HCI and ubiquitous computing should consider what it might mean to design for *rhythms*. Currently, linearity is a

common assumption within current technology designs. In these, privilege is given to the most chronologically recent information, to stable progressions of understanding, and predictable movements between points. Example of this are pervasive: social media "streams" privilege the most recently generated content, and solutions to navigational problems focus on providing the optimum route from point A to point B.

In contrast to this, Chapters 4 and 5 showed that the spaces of the park are tied up in a variety of rhythms. Rhythms of movement formed habitats for individual staff that produced forms of environmental knowing. Additionally, staff numbers fluctuate with the seasons, and the types of activities different groups within the park undertake are closely tied to the peak tourism seasons, preparation for the summer and its various threats, along with the day-to-day experience of going to, leaving, working within and experiencing the park. The notion of *rhythms* provides HCI with the challenge of designing technology based on the assumption of rhythmic movements and interactions, rather than steady linearity. Within this, technologies should respond and be embeddable into patterns of movement, annual and seasonal influences.

A further challenge for HCI will be to design technologies that respond to the contingent nature of *rhythms*. As Chapter 5 highlighted, rhythms can be stable, but are also open to influences and disruptions. The flood was an example of an unexpected and severe event that disrupted rhythms, renewed them, and created new rhythms. To design for *rhythms* then in not to rely on stable repetitions of use, or on steady, predictable movements or cycles, but to consider technologies that are as open to disruptions as the rhythms of everyday life are. Whilst important knowledge is tied up in rhythms, they do evolve, change and recede over time. Designing for *rhythms* then, invites HCI to consider technology that reacts to and is embedded within all manner of contingently produced repetitions.

6.3.5 Designing for Scales



The seasonal nature of space also necessitates a focus on *scales*. If an important aspect of seasonality is the rhythms that comprise it, then the *scales* of those rhythms are of equal importance. Rather than arbitrarily focusing on the cyclical repetitions of various movements and practices, the notion of *scales* gives researchers and designers a means through which to limit the scope of the rhythms that their technologies are embedded within, produce, or support.

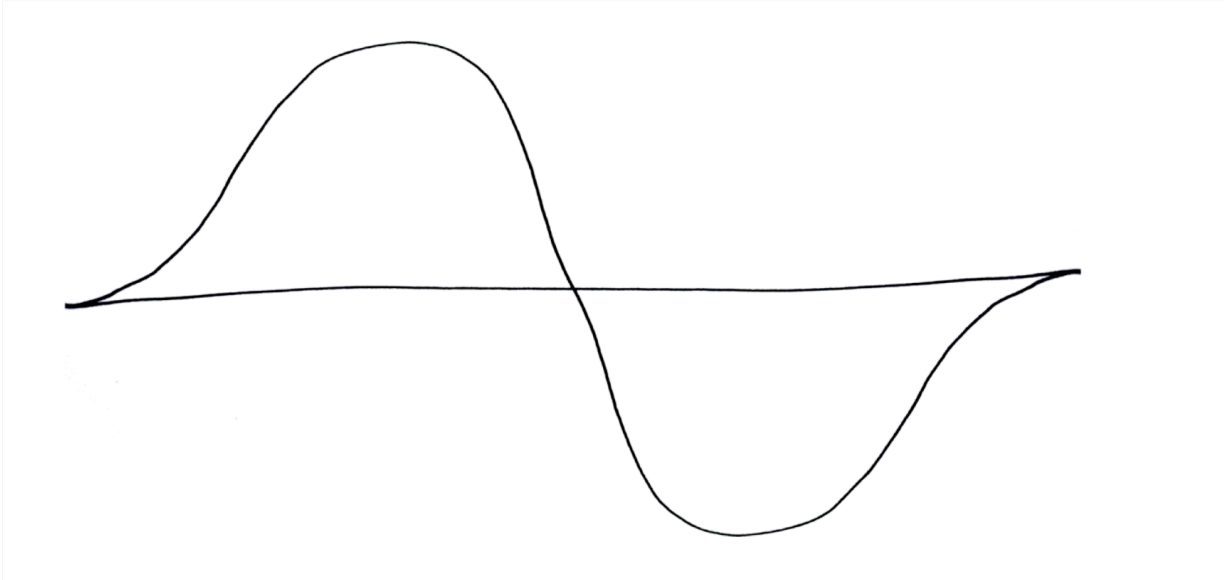
Seasonality, then, encompasses rhythms of different scales that define the scope, size and duration of a given rhythm. Chapter 4 showed that individual rhythms of movement produced valuable forms of environmental knowing. Amongst these patterns of movement, it also showed that these patterns can be of a duration lasting decades, or even a few days. The scale of these highlights is such that there are rhythms within rhythms, and that the daily practices of staff may be enacting any number of rhythms at the same time. In Chapter 4, this thesis explored how the participant Derek formed a rhythm of movement that lasted just a few days. By laying feral animal traps, he created a new pattern of movement for himself that he enacted over the course of a week. However, this relatively short lived rhythm can be viewed as embedded within any number of other rhythms of different *scales*. The lessons Derek learnt within this rhythm of movement are embedded within the broader history of animal trapping within the park, which itself has its own rhythm based on calendar seasons, endangered species priorities and influxes of particular animals. It is also embedded within the larger scale rhythms of Derek's own history of movement and experiences within the park and the history of those particular locations that had traps laid within them.

Chapter 5 showed that new rhythms can be formed en masse as the result of a disruptive event. Out of necessity, new rhythms were formed as patterns of movements were forcibly altered. The usual rhythms of practice and preparation around peak tourism seasons, and fire management were also altered or put on hold as staff focused on recovery efforts.

If the diurnal patterns of movement and practice were affected, and these were of a certain scale – of certain duration and distance – then the rhythm of the flood recovery itself can be seen as a larger order scale itself. This is not referring to the severity of the flood itself, but rather to the overall history of the relationship between the organisation and floods in and of itself. The cyclical relationship between a natural disaster, such as a flood, is of a decidedly different *scale* of rhythm than the daily movement patterns of individual staff, or even the predictable rhythms of practice associated with tourism peaks or fire preparation.

Seasonality then is comprised of rhythms that are of varying scales. Patterns of movement may cover varying degrees of distance and duration, as may other practices of rhythms. Rather than simply considering the design of technology that is embedded in rhythms, or create rhythms themselves, HCI needs to consider the various scales of distance and duration that technologies may support or enable.

6.3.6 Designing for Oscillations



Along with rhythms and scales, the seasonality of space implies *oscillations*. Whereas rhythms focus on the steady repetition of movements and practices, and scales focus on differences in duration and distance of these rhythms, the metaphor of oscillations refers to the repetitive variation of meaning within productions of space.

In order to support or embrace the seasonal nature of space, HCI and ubiquitous computing may choose to design technologies that sit within the oscillations that occur between various states.

As discussed earlier in this chapter, oscillations were apparent in both Chapters 4 and 5. With Chapter 4 describing the stable day-to-day practices that produce space, and Chapter 5 exploring various disruptions to those productions, when viewed together they point to the oscillation of space between steady and consistent productions, and a state that disrupts them.

The oscillating nature of space then indicates that the cycle of stability and instability in the production of space is itself an important notion to consider. In its implications for technology design, this kind of oscillation asks designers and researchers to consider fundamental shifts in the meaning of places over time.

Beyond these drastic shifts though, the metaphor of oscillations may also refer to the gradual shift or steady increase and decrease in the importance of given locations over time. Chapter 5 highlighted that it was only within a space of disruption that certain landscapes became iconic. For that period of time, places such as Lillypilly Gully and the Lou-Ann boardwalk became increasingly discussed, photographed and visited. Whilst these are well-known places to staff, their importance as sites of comparison and sites of stories peaked during the flood recovery, and then receded to their "baseline".

What the metaphor of oscillations highlights then is that there is not a binary relationship between meaning and places, where locations are either meaningful or not, but a relationship that oscillates within rhythms and scales over time. Whereas HCI has typically assumed that places are either meaningful or not in its approach to designs, this highlights that places are neither one nor the other, but are in a constant state of oscillation between them. Instead of being conceptualised as meaningless, not meaningful enough, or not meaningful in visible ways, the metaphor of oscillations highlights that places are not only meaningful, but meaningful in many dynamic ways. Oscillations then give HCI and ubiquitous computing a means of conceptualising this dynamic shifting of space and its meaning.

6.4 Conclusion

This chapter has shown that the ethnographic research presented in Chapters 4 and 5 can be applied to the second research question of this thesis: *How can we expand this relationship, in a conceptual way, so that this relationship is useful for designers of technology?* By summarising these chapters under the themes of *emergence* and *seasonality*, and using these themes to generate design inspirations, it is clear that relational space can be expanded in a way that is useful and actionable for designers.

Similarly, these inspirations have provided a concrete example of where the relationship between space, technology and environmental understanding may be headed. By highlighting the differences in conceptualisations of space illustrated in this thesis, and the prevailing approaches in HCI and ubiquitous computing, this chapter has provided an example of how ethnographic research can be used to generate new design directions. Further, the six design inspirations provide HCI and ubiquitous computing with a means of explicitly re-examining the relationship of technology to space and understanding.

With these design inspirations now explicated, the remainder of this thesis will be dedicated to applying them to the design of two conceptual systems.

7

Habitat

Chapter 6 presented two themes and six inspirations for new design directions for HCI and ubiquitous computing. The themes presented – *emergence* and *seasonality* – summarised Chapters 4 and 5 for the purpose of explicating where the relationship between space, technology and understanding may be headed, and serve as a reframing of space for ubiquitous computing. Additionally, the design inspirations presented laid the foundation for an answer to the second research question of this thesis: *How can we expand the relationship between space, technology and environmental understanding, in a conceptual way, so that this relationship is useful for designers of technology?* By highlighting the different conceptualisation of space inherent in emergence and seasonality, these themes began to expand the relationship between space and environmental understanding in a way that is useful and actionable to designers. However, outlining these inspirations is only the first step towards answering this question. To demonstrate their ability to inspire designs that take advantage of relational notions of space, it is necessary to explore how these principles might be used in the design of a new system. To do this, this chapter and the next will be dedicated to exploring the designs of two new systems that draw directly from these design inspirations.

The first of these designs, named *HABITAT,* will be presented in this chapter as a means through which to explore the utility of these design inspirations. The focus of this chapter then is on providing a description of the *HABITAT* system from an experiential and technical standpoint, but also on exploring the application of the design inspirations presented in Chapter 6. The chapter begins with a brief overview of the system. This is followed by a scenario depicting a typical use of the system, and aims to immerse the reader in the experiential aspects of its use. The scenario presented here sets the scene for a technical discussion of the system, which is then followed by a discussion of how *HABITAT* used the design inspirations from Chapter 6.

7.1 Describing *HABITAT*

This section will provide a brief overview of the *HABITAT* system, to be used as a foundation for the scenario that follows. Its three constituent parts will be described, taking into account that each part was inspired by the design inspirations from Chapter 6 in concert with the research techniques described in Chapter 2. Section 7.4 describes these influences in more detail but the following is a brief introduction:

> *HABITAT is a location-based platform for informal and tacit understanding in a National Park context, and is comprised of three parts. The first part is a smart-phone application that allows Parks Victoria staff to create notes containing pictures, audio, video and text. This same phone application allows rangers to download from and share notes with other staff through any number of both portable and permanent access points throughout the park. These access points are known as anchors, which come in three varieties. These comprise the second part of the system. Finally, all shared content is searchable in an organisation wide archive system.*

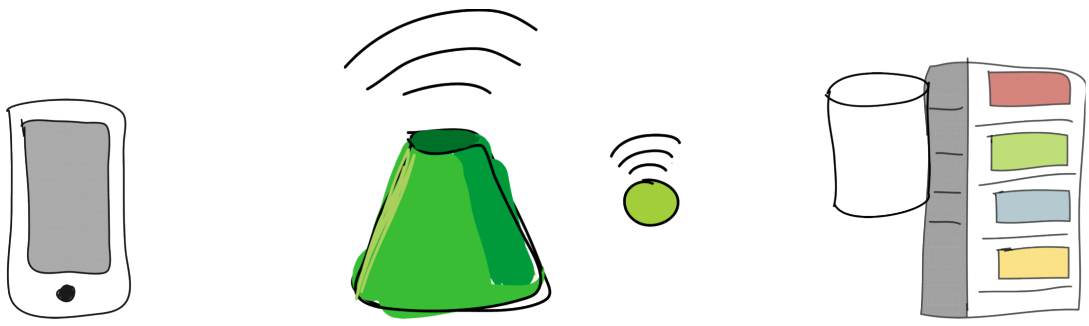


Figure 7.1 - The three parts of the HABITAT system. A) Represents the smart-phone application. B) Represents the portable infrastructure objects known as anchors. C) Represents the organisation wide archive and its desktop interface.

Figure 7.1 above depicts the three constituent parts of the *HABITAT* system. These symbols will be used throughout this chapter to illustrate different points. With this overview in mind, the scenario will now be presented.

7.1.1 A *HABITAT* Scenario

This section presents a possible scenario for use of *HABITAT*. Scenarios are useful as they provide insight into the motivations, expectations and attitudes surrounding the use of a system (Kuniavsky, 2003). As such, the purpose of this scenario is to illustrate the potential utility of the system through the experiences of a group of users who simultaneously interact with it. The overview of the system from the previous section relates to the scenario presented below. Parts of the system, as they are interacted with, are made bold in the text for clarity.

…

> Damien is a field service officer in Wilson's Promontory National Park with three years' experience. He lives in the nearby town of Foster and begins each day at 8:30 am in Tidal River, the administrative hub of the park. He has a wide range of duties in his role, most of which require that he spend time away from the office and his desk. Today, he is in the middle of a project helping a colleague, John, set up remote monitoring cameras to assess the recovery of the park's wombat population after a recent fire. John has set up a project **anchor** on his desk, and before he heads off for the day, Damien wants to check it for any new information or instructions.
>
> Damien wanders through the Tidal River office and stops for a chat on his way to John's desk. Despite the quick distraction, he is close enough to the **anchor** to receive an alert that there's new data to be downloaded. The phone vibrates, and as the conversation has finished, he takes his phone from his pocket and opens the HABITAT **smart-phone application**. The application automatically shows the contents of the nearby **anchor**, with the latest content presented first. Damien can see there's a new map of today's monitoring locations, and what he presumes are some audio instructions from John. He briefly looks at the map and saves it to

the project collection on his phone, and also downloads the audio to listen to on his way out to the first location. Before leaving the office, he wonders if there's anything from late yesterday afternoon that he should upload to the anchor for John, but he can't think of anything and drops the phone back into his pocket. He often finds himself pausing in these situations, as he's been caught out with no data connection more than once during his field work, and while he's out of range of the anchor he won't be able to access or add to its contents.

Back in his truck, Damien double checks he has the remote monitoring cameras, loads the new monitoring locations into the truck's navigation system and tunes the radio to the phone's broadcast frequency. He pulls out of the staff car park and waves to a group of children who are running down to Norman Beach. He smiles to himself, rolls down the window and turns the volume up. John's voice crackles to life through the speakers, and he begins: 'Just a quick note to say I had trouble accessing one of the locations yesterday … if anyone needs to get past the landslip at Lillypilly it might be best to take a trail bike'. Damien realises it isn't critical information to him but he listens anyway. John often puts notes like this in his anchors, and Damien often wonders if he is using it as a memo to himself, or whether he intends it to be accessible in the Habitat archive once the project is finished. Satisfied that he is up to date with the project, Damien turns onto the road leading out of Tidal River.

After a short drive, Damien reaches the first monitoring location, and starts to unpack the truck. He pauses to take a look around, taking in the charred landscape that is only now starting to recover from last month's fire. There are signs of green regrowth sprouting around the area, and he notices a pair of herons perched in a tree nearby. Compared to even a few weeks ago, the park is looking much more alive. He takes the remote sensing cameras out of their protective carry cases and begins to lay out the equipment. As he begins piecing together the support apparatus he feels his phone vibrate, and takes it out. It is another alert from the Habitat smart-phone application. He hadn't realised, but there must be an anchor amongst the equipment. As he loads the application to see what it

might contain, he spots a small, sticker-like anchor on the side of one of the cameras. He locates it within the application and plays the audio that's contained within it. Another colleague, Emily, has left an audio recording on it: 'This camera has trouble with its macro focus, use it as a wide angle camera only". Damien is happy to hear this as he was just about to set the camera up as a macro, and it sounds like any data it collected would have been useless. He has been dubious about the role these smaller anchors might play, but this message on the camera has surprised him. He was given a sheet of these mini anchors to use himself, but he hasn't activated one yet. He'll try to use them more actively, he thinks.

He also has a few 'outdoor' anchors which are larger than the sticker-like one on the camera, and smaller than the one on John's desk. He uses these much more often, having been instructed to activate one near each of the remote sensing locations. These medium-sized anchors have been deliberately designed to remain outdoors, so they are fairly rugged and water proof. Once activated, they can be used as locator beacons, and are able to connect with other blue-tooth enabled devices around it to act as an aggregator of content. Once Damien sets this anchor up to 'scan', it will act as an archive for the photos the cameras take. He places the anchor underneath one of the tripods, and opens up the Habitat application once again. He flicks past the mini-anchor's content and selects the new anchor. Going through the set up steps, he makes sure it is recording its location correctly, and that it is communicating with the cameras. When it comes time to collect the remote monitoring data, this anchor will make it easy to synchronise the photos with a database back in the office where research scientists will run analyses. Compared to the old days when he would have had to collate every picture across every camera, this saves significant amounts of time. The HABITAT smart-phone application indicates that everything seems to be working.

Satisfied that everything here is set up correctly, Damien takes a minute to look around the area. He hasn't been to this part of the park in months. While he still has the application open, he decides to take some photos of some of the regrowth he noticed earlier. Even though there's no formal monitoring project for flora, he knows

there will be a few people back at the office interested in how areas of the park are recovering. He takes a few shots, watches them appear at the head of his long list of notes, and heads off for the remainder of his day's work.

Later that afternoon, back in the office, Damien is enjoying a cup of tea in the staff room when he strikes up a conversation with one of the new ecologists. Their chat inevitably turns to the recent fire, which is why the ecologist is in the park at the moment. He decides to show her the photos he took earlier in the day, and remarks how surprised he was at how fast the flora seems to be recovering. As they talk around the photos on his phone, the Head Ranger, Brian, walks in and overhears them. He comes over to join the conversation and looks at the photos. "These are really great, Damien", he comments. "Put them in that anchor behind you and we'll make sure the City get to see these. I'm sure there's a few boffins that'd be interested, and it can only help letting people know we're not completely charred out down here". Damien and the ecologist agree, and he turns to find the anchor Brian is talking about. He hadn't been aware, but someone had set up an anchor for people to contribute photos, video and audio to do with the fire recovery in the staff room. It's sitting above the coffee tin on a shelf, covered with a piece of masking tape acting as a label. On it is written: "Fire Reco". Damien browses through a number of available anchors on his Habitat application, locates the "Fire Reco" anchor – the anchor has been given the same name as its masking tape moniker – and adds his photos to it. As he does, Damien notices a few people glance at their own phones. Everyone else in the room who hasn't chosen to 'ignore' this anchor receives a notification of new content. One of them appears to open up the new photos, and a few people sharing the same table begin to talk about the fire too. This has become a reasonably common experience for Damien, but he constantly finds himself surprised that people take interest in his notes. Turning back to the ecologist, Damien notices the anchor must be set to automatically synchronise to the main archive. No sooner had the photos been added to the anchor than its data transfer light begins to flicker.

Three hundred kilometres away, in the Bourke Street office of Parks Victoria, Rebecca is finishing her own cup of tea. It's been a busy day filled with meetings, and she's only just getting time to clear her head now. As she sips, she casually checks her emails, and then flicks over to the HABITAT desktop application she keeps open in the background throughout the day. She prefers this over email, she thinks. Email has become far too formal for her, and its used for far too many things. It seems like every third one she gets these days is a meeting invitation. She's been noticing new content appearing in her HABITAT stream throughout the day, and she wants to browse through it to see if there's anything useful for her current projects. Rebecca works in public relations and marketing, and has just had a morning of meetings discussing the impact of the recent fires on the upcoming school holiday season. Visitor numbers have been well down on the same time last year, and there's a theory floating around that it might be because people aren't expecting to see much in the park as a result of the fires. She scrolls up and down the content quickly, and switches between "picture" and "everything" view to see if anything grabs her attention. Nothing jumps out immediately, but just as she's about to close the HABITAT desktop application a new set of images appear in her Stream. They are of sprouting foliage in a fire affected area – Damien's photographs. She clicks on one, and is taken to a screen that shows where and when the picture was taken, and by whom. With another click she is shown related photographs (including others that Damien has taken), and feels a spark of inspiration: Wilson's Promontory is a popular park, and if people know that it's well on the way to recovery, and that it looks so pretty as it recovers, they might be more inclined to visit. She groups the photos into a new collection within HABITAT, and sends them to her manager with an idea for an article she wants to write for the tourism newsletter.

Across the office, Sarah, a member of the Natural Values Management team, saves one of the same pictures to a collection in her HABITAT desktop application named "Wildflowers". She had noticed one of the sprouts in Damien's photograph is of the plant she has a particular passion for, and has been collecting casual data around it for the purposes of putting together a formal monitoring proposal. She also thinks they are just beautiful plants,

and will often set the desktop image of her computer to her new favourite wildflower photograph. She adds a publicly readable comment to the photograph commenting on how much of a relief it is to see the park recovering so quickly, before shutting down her computer and heading for the train home. She checks the HABITAT smart-phone application quickly, noticing the new picture in her collection has made its way there already, and sets it as her phone's home screen image. She waves goodbye to Rebecca as they cross each other's path on the way out the door.

…

This scenario serves to introduce the potential of a system like *HABITAT* and its interrelated and interconnected parts. In keeping with the design inspirations provided in Chapter 6, this scenario has intended to highlight the potential role for technology in the emergence and seasonality of space and environmental understanding, and how this may influence the experiences of staff within Parks Victoria. This scenario highlights that a single system can reside within the complex and contingent productions of space detailed through this thesis so far, and that such a system can be designed to foster these productions rather than attempt to transduce, augment and reveal aspects of them. With this experiential scenario of use now established, the next section will focus on the technical and interactional aspects of the system itself.

7.2 The Design of *HABITAT*

This section will discuss the interaction design of the *HABITAT* system and its genesis over the course of this research project. Whilst some technical explanations will be provided, the discussion around the system's interactional elements will focus on themes that act as a lens through which to examine the effectiveness of the design inspirations presented in Chapter 6. As such, the technical details of the system should be viewed as secondary to the analysis that follows.

As illustrated in the scenario provided, *HABITAT* is comprised of three distinct yet deeply integrated parts: a smart-phone application installed on devices held by individual staff within the organisation; permanent and portable bluetooth and data-enabled media hubs named anchors; and an archival system with a desktop interface. Each of these components is directly related to design concerns that were identified out of the research presented in Chapters 2, 4, 5 and 6, namely: *Personal Habitats*, *The*

Sociality of Infrastructure, and *The Historicisation of Space*. In this way, *Habitat* can be seen as an embodiment of these design concerns. When designing this system, these themes were used as touch-points for a number of design decisions that made their way into the final concept. The design of *HABITAT* will be presented, then, through the lens of these three themes.

Whilst the technology to implement the *HABITAT* systems exists today, it is worth noting that full prototypes of the system were not deployed within Parks Victoria. Even though the research methods used *techniques* that closely resembled aspects of the *HABITAT* system (as described in Chapter 2), logistical and technical constraints meant that a fully functioning and integrated system was not feasible. Gaining approval to deploy technology within a government organisation is challenging, and the project was constrained by the realities of constructing the kind of ad-hoc hardware necessary for full functionality. With this in mind, the main contribution of this chapter is not any specific technical specifications, or particular interface design, but the ability of this conceptual system to illuminate the design inspirations presented in Chapter 6. However, it is still important to note that this system does not rely on any great technological leap for it to be made a reality. To further highlight this, a brief technical discussion on the three parts of the system will be given in the context of the *techniques* of this research, before moving on to discuss the interactional elements of the system.

7.2.1 *HABITAT* and the Techniques of Research

On the surface, there are parallels between the *HABITAT* system and the research methods used in this research (as described in Chapter 2). This section will discuss these parallels with the aim of highlighting the feasibility not only of the technology, but of the scenario presented earlier in this chapter.

The first part of the *HABITAT* system, the smart-phone application, was inspired in part by the diary study conducted with participants in Wilson's Promontory National Park (WPNP). Participants embraced not only the overarching goals of that research method, providing valuable qualitative data that contributed significantly to this research, but also the technology involved in carrying out that research, that is, its *technique*. At the time of writing (in early 2013), smart-phones were still a fairly novel technology amongst the user group, and their enthusiasm for it was surprising. One participant even commented they wanted to keep the phone provided to them as they found the activity of note-taking useful for their own work. This was further validated

by follow up interviews with participants, who lamented that they wanted to use such technology immediately.

The second part of the system, the anchors, were inspired in part by infrastructural problems in the park itself, but also by the behaviour observed around content from the diary studies. Data and voice coverage in the park is concentrated on certain highly-frequented areas, and staff would often complain, casually, about the inconveniences inherent in access to this infrastructure. In other informal situations, conversations were observed around objects and media the staff were bringing from other areas of the park, particularly during the time of the flood recovery. The idea for a type of media archive that also acted as a piece of communications infrastructure was borne out of these overlapping observations.

The third part of the system, the archive, was inspired again by a research method described in Chapter 2 (Figure 7.2). The follow-the-thing study took selected diary entries and presented them as interfaces to that same data to people across the organisation. In that sense, the primary researcher acted as the archiving and synchronising system – collecting data from 'far flung' places and making it available to those in other areas of the organisation.

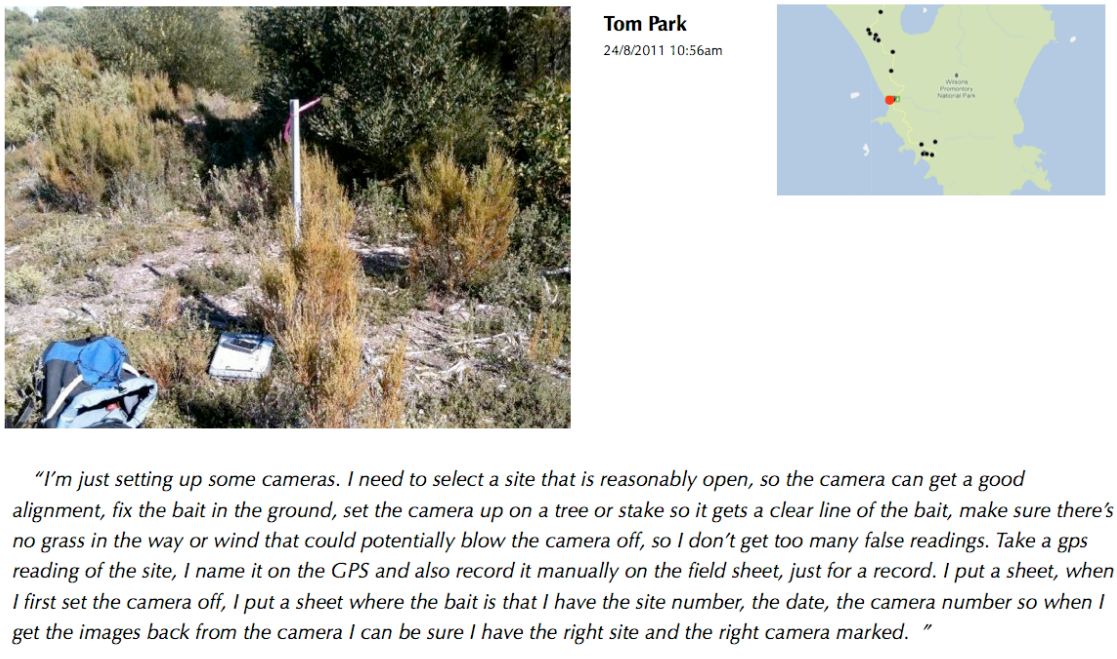


Figure 7.2 - Data from the diary study was presented in a simple interface during the 'follow-the-thing' study. Positive responses to this interface inspired the *HABITAT* desktop application.

The parallels between the technology used throughout the research and the design of the *Habitat* system highlight both the technical and practical feasibility of the system. In this way, the *techniques* of the research, as described in Chapter 2, acted as a discontinuous prototype for the *Habitat* system. With the validity of both the scenario and the technical possibilities in mind, this chapter will now turn to an analysis of *Habitat's* interaction elements. This will be done through the frame of three primary design concerns that arose from the research, namely: *Personal Habitats*, *The Sociality of Infrastructure*, and *The Historicisation of Space*.

7.2.2 Personal Habitats

The starting point of the *HABITAT* system, both metaphorically and literally, is the smart-phone application that is installed on each staff member's mobile phone. Each member of staff is able to download the application onto their personal device and use their existing username and password credentials to 'log in' to the system. The system would be built on top of existing infrastructure in this regard, where Parks Victoria's own identity management system would be leveraged. This identity system already contains identifying information for each staff member, including the user's personal details, location, job role, team and group memberships.

HABITAT is a system that thrives on user-generated data, and the smart-phone application is seen as the metaphorical starting-point of the system as the majority of this data is envisaged to be generated from it. However, despite the overarching system's reliance on shared content, the smart-phone application is designed to be usable and useful in its own right. In this way, it is envisaged as a personal note-taking application that users would find useful in isolation from any other part of the system. When opening the application for the first time, after logging in, users are presented with an interface that presents their existing 'notes' – mixed-media entries – and allows them to begin taking new notes. These notes allow any combination of audio, photography, video and text in their creation. Taking the diary study as inspiration, common entries may involve a picture with an audio description, or simply a photograph on its own. Each note, at the time of creation, is geo-tagged, time-stamped, and identified as being created by the logged-in user. This meta-data is included in any future transfer of the note and its contents.

As users go about adding a variety of notes, they are able to create collections of notes that help them sort and keep track of them. Collections are a way of grouping together related notes under a common theme. They are mostly private in nature, and act as 'folders' within the application that notes can be moved into and out of. Each note can belong to any number of collections, and each collection can contain any number of notes. In this way, as the data set of notes grows through use of the application, it invites users to consider the nature of the notes and create a local taxonomy that houses them. Like the 'tagging' common in numerous web systems, this taxonomy is unique to the user - it emerges and evolves.

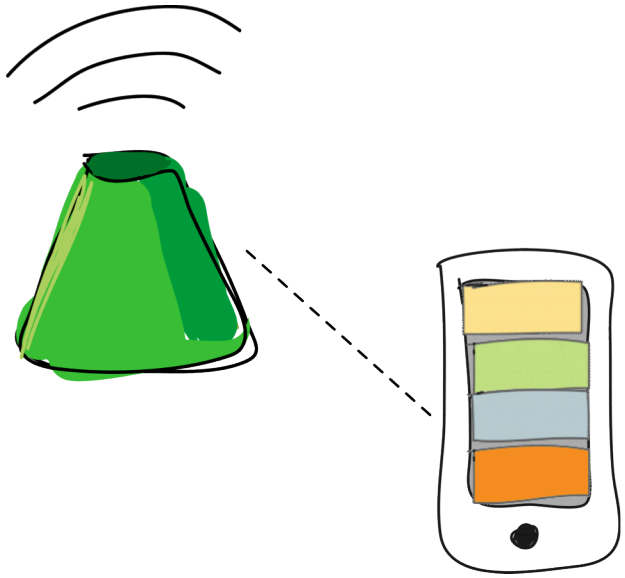


Figure 7.3 - When in physical range of an anchor, users are able to browse its contents via the smart phone application. Content from the anchor can be saved to the phone for future use, and notes from the application are able to be contributed to the anchor.

As shown in Figure 7.3, when in range of an anchor, users are able to browse the anchor's contents. Within this section of the application, they are able to sort notes within the anchor and can choose to 'save' the note to their smart-phone application, and subsequently, to one or many of their personal collections. Similarly, just as they might add a note to one of their own collections, they are able to send a note to an in-range anchor. In this way, the anchors appear in a similar way to the user's local collections, but are able to contain notes from any number of different users. If the user of the smart-phone application is in range of an anchor as content is added to it from another user, they are notified of the new content and invited to view it. The smart-

phone application includes an option for users to 'ignore' an anchor if they do not wish to receive their notifications.

When a mobile data connection or an anchor is available, the application synchronises any new notes, collections and orderings of these to the user's personal, private storage space in the larger *HABITAT* archive. In this way, the data contained in the phone application is, as much as possible, accurately reflected in this central database. In this way, the *HABITAT* archive acts as a cloud storage facility for the smart-phone application, and allows users to switch devices, or maintain several devices in parallel without concern about missing content. Additionally, within the application (and the desktop application) all notes are sortable and searchable by their various meta-data, with a view to allowing users to easily locate their content. Users are able to sort by content type, time, and location. Sorting by content type and time simply reorders the notes presented in the main view of the application, whereas the 'search by location' feature allows users to interact with a map interface to query their application's data.

Overall, this focus on personal utility is designed to encourage the creation and growth of a valuable, independent personal database of notes that reflect, however completely or partially, the experience, expertise and interests of the user. Without ever having to download content from other users, the application is designed to be useful. However, the value of the application grows significantly when used to interact with content generated from other users. In this way, the smart-phone application can be seen as a kind of *personal habitat*, where its contents grow with the habits, movements and rhythms of the user's own experience within the park.

7.2.3 Sociality of Infrastructure

Whilst the smart-phone application is the starting point of the *HABITAT* system, and it is designed to provide utility to its users in the absence of other parts of the system, the second part of *HABITAT* – its anchors – is designed to facilitate selective sharing and dissemination of content. In fact, hidden in this desire for the smart-phone application to be useful on its own is the source of inspiration for anchors. Mobile data and voice coverage is sporadic at best in many of the areas managed by Parks Victoria. Whilst voice coverage is much better, relying on the mobile phone network for the kinds of data requirements inherent in a system such as *HABITAT* is, at best, ambitious. Anchors are intended as both portable and permanent infrastructure that supports the

sharing and dissemination of the mixed-media notes being captured through the smart-phone application. In this way, they can be seen to allow the creation of dynamic ad-hoc network infrastructure within both office and outdoor environments.

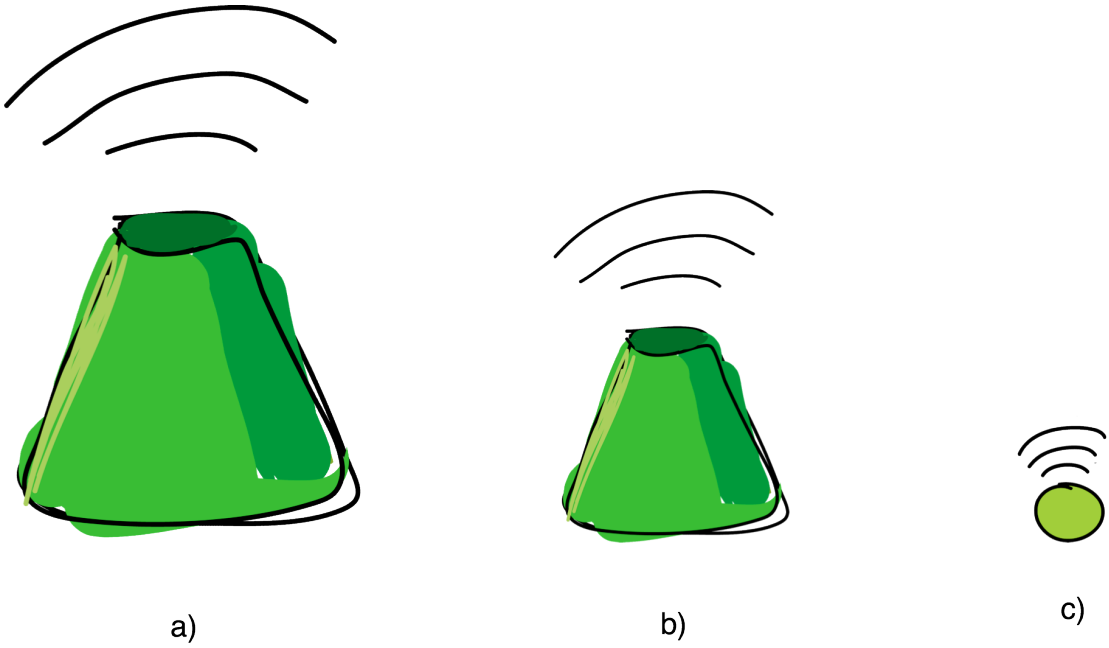


Figure 7.4 - There are three varieties of anchors. A) represents a 'standard' anchor, designed for use indoors. B) represents a smaller, 'medium' anchor which is designed for outdoor use, and is more rugged. C) represents a 'mini' anchor, an RFID sticker that can be attached to an object.

There are three types of anchors mentioned in the scenario, shown in Figure 7.4 above, and it is worth providing an overview of these now. The first anchor mentioned, on John's desk, is an 'indoor' anchor. These are designed as both bluetooth and WiFi access points that have a media storage capacity, and are able to interface with the *Habitat* smart-phone application. When setting up an anchor, users load the *HABITAT* application, and locate the anchor they wish to configure. Each anchor can be given a unique name, and an optional access password. These standard anchors are able to connect to any wireless access points around them, and if connected can be configured to automatically synchronise its contents to the centralised *HABITAT* archive. Users are also able to manually synchronise the contents of the anchor at any stage through the smart-phone application. When synchronising, the anchor will upload its contents into either a public or private collection that is available across the organisation. If it is marked as 'private', only those who have contributed contents to the anchor, or have been invited to view it, can access the media it contains. If it is marked as 'public', then

it and its contents become available and searchable across all *HABITAT* users through the desktop application.

The second anchor is described in the scenario as an outdoor anchor. This is a smaller ranged device than the indoor anchor described above, yet contains much the same functionality. It is designed to be positioned outdoors however, and as such has a much more rugged, waterproof and heat resistant enclosure. It contains a GPS unit, which is able to record its position and acts as a locator beacon. This position is used in the meta-data of all notes that lack location information when they are added to the anchor. The scenario highlights that it is able to be configured in the same way as an indoor anchor – through the smart-phone application – but additionally is capable of interfacing with other bluetooth enabled devices around it. The cameras in the scenario are included as an example of this interfacing, where the outdoor anchor acts as a bluetooth storage device for the photographs taken. These photographs are treated in the same way as a note from the smart-phone application, and the time and location meta-data is preserved in their creation.

The third anchor, described in the scenario as a 'mini' anchor, is perhaps the most unique of the three. Whilst users interact with it in the same way as the previous two anchors, a mini anchor is designed to be *attached* to a single object. Whereas the other two are equipped with a variety of sensors, the mini anchor is designed around a singular bluetooth chip and limited storage. The electronics are contained in the centre of a circular durable sticker, and able to contain up to 30 seconds of audio or a single photograph only. The 'mini' anchors again are interacted with through the smart-phone application, and media is able to be erased or added through the application.

Each of these anchors, then, acts as infrastructure that supports the dissemination of data recorded with the smart-phone application. They do so in a number of ways. Firstly, the 'standard' anchors are envisaged to be used in a mixture of permanent and temporary ways, where they are able to be left in areas of significant traffic and use. Whilst the scenario does not mention the presence of any long-term permanent anchors, it is not a stretch to imagine anchors being set up in the Tidal River office to represent media about that place, or for such an office to contain a dedicated 'field service officer' anchor where tips and experiences could be shared amongst staff with common responsibilities. The portability and flexibility of anchors then allow a flexible and evolving communications infrastructure that both reflects and facilitates the emergence of different kinds of social, operational and practical needs and desires; different *spaces*. The presence of an anchor in a given location indicates a certain level

of social interaction and activity that is reflected in a physical, infrastructural presence. Setting up an anchor as a project database gives an infrastructural embodiment to that project. In the same way, positioning an anchor amongst remote sensing cameras indicates that, for the period of time the anchor and cameras are there, that location is a meaningful place.

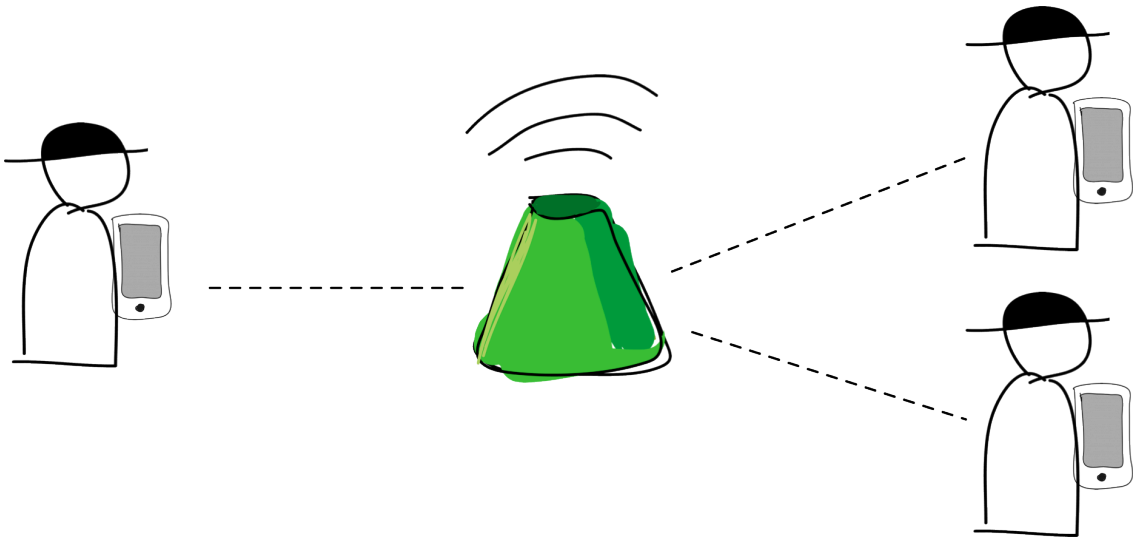


Figure 7.5 - Anchors act as both social and technical infrastructure. They provide connectivity to the smart-phone application, but also encourage sociality by 'pushing' notes to users in its proximity.

Secondly, these anchors acts as conversation points (Figure 7.5). The scene in the scenario where Damien adds his photos to the anchor highlighted that anchors not only provided a technical infrastructure, but social infrastructure too. By allowing media to be 'pushed' to people who share the same physical proximity, they aim to prompt discussions and conversations around that media. In this way, they act not only as archives, but as active participants in the social interactions that occur around them.

Finally, anchors allow objects to participate in this infrastructure. By attaching a mini anchor to a camera, Damien's colleague allowed that object to take part in the interactions that occurred in and around the monitoring location in an active way. Whilst there may have been some other physical evidence of the camera's macro focus problem, the mini anchor allowed it to be a more explicit participant in this situation.

Following from this, anchors can be seen then as both technical and social infrastructure, and it is this infrastructure that plays an important role in the *HABITAT* system, where it reflects and responds to the shifting sociality of the park.

7.2.4 Historicisation of Space

In addition to providing a kind of socially driven communications infrastructure, *HABITAT* is designed to allow the historicisation of space, where meta-data and interactive logs describes the history of objects, and where users are able to construct collections of notes about given places, topics or people. It does this through a centralised synchronisation and storage system; an archive that acts as the centre of the *HABITAT* system. Figure 7.6 depicts the relationship between these parts of the *HABITAT* system.

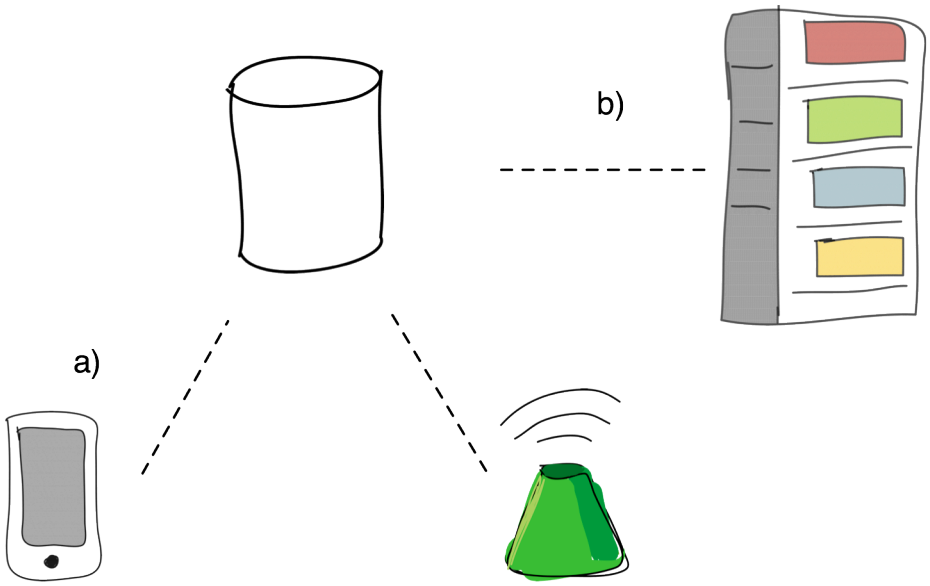


Figure 7.6 - A centralised archive, acting as a storage and synchronisation system, is at the heart of HABITAT. A) shows that both the smart-phone application and anchors are able to interact with the archive. B) shows the HABITAT desktop application acting as an interface to its stored contents.

If the smart-phone application and the anchors within *HABITAT* form an ad-hoc network of recording devices and infrastructure, then at the centre of the *HABITAT* system is an organisation wide multi-media archive. In the scenario, the archive doesn't appear as an embodied artefact as the smart-phone application or the anchors do.

Instead, it is implicit in a number of the interactions that occur through these artefacts. Each anchor and smart-phone application has the ability to synchronise its data to this central archive, and in this scenario it provides the link between anchors in the park and the *HABITAT* desktop application described in the Bourke Street office. The *HABITAT* desktop application provides an interface to the archive that is able to be searched by Parks Victoria staff, and as such reveals the most about the archive itself. The archive acts as a back-up service for the notes and collections within individual's smart-phone applications that is not searchable publicly. In this way the archive can be seen as conceptually divided into two parts; a 'public' archive of notes that is accessible across the organisation through the desktop application, and a 'private' cloud synchronisation and storage system.

The archive is a large digital store of notes, collections, and their associated meta-data. When an anchor synchronises its data to the archive, the data is stored in a collection that is named after the originating anchor. These collections contain meta-data, such as the location of the anchor, the last time data was synchronised, as well as a log of the activity of that anchor's collection of notes. This log acts as an historical record of the activity in that anchor, recording both the adding and removing of content, and a record of any number of interactions with those media. When Sarah adds a comment to the picture of the sprouting wildflower, her activity is logged not just against the picture itself, but the anchor "Fire Reco" from which the picture originated. Similarly, when Rebecca and Sarah add pictures to their own private collections, a log is recorded in the anchor's collection indicating this has happened, leaving a trace of this interaction. In this way, the archiving of an anchor's content and a recording of its history of interactions and evolutions serves to provide an historicised account of the activity that occurs around that anchor. From the perspective of an anchor then, the archive is a digital store-house that acts as a backup of its contents, a means of disseminating that same content, and a log of the various interactions that occur around it.

If an anchor is marked as public, then the archive makes its notes accessible from a view within the *HABITAT* desktop application. This view is called 'Stream', and acts as a chronological list of incoming public notes from all parts of the organisation. It allows users to view these notes in a way that is removed from particular anchors. However, a number of options are provided for users to sort through this potentially large quantity of information. As indicated when Rebecca switched between "picture" and "everything" view, the *HABITAT* desktop application allows users to filter their Stream by media type. In addition to pictures, users can also choose to view only notes with audio or text in addition to its default all-encompassing view ("everything"). In addition

to filtering by media type, users are able to query this data by anchor name, either the note or anchor location, or the note's author. They can do this either through a dedicated search interface, or by clicking on the trail of meta-data presented with each note. As Rebecca showed in the scenario, the *HABITAT* desktop application allows its users to quickly traverse the meta-data of a note through its interface. From the perspective of this desktop application, and its users, the *Habitat* archive is a data source that is able to be queried.

Rebecca also indicated an important interaction between this publicly accessible content and the private functionality of the *HABITAT* archive. By grouping together pictures of the regrowth into a collection, she effectively duplicates that public content and makes it part of her 'private' archive. These collections can be for any purpose a Habitat user may conceive of – if an anchor creates a collection by synchronising its data with the archive, then users are able to create collections by grouping notes into them. In the scenario, Rebecca chooses to share this collection with her manager, whereby she grants her manager viewing rights on that collection. However, as stated earlier, no other user is able to modify the collection she has created. Each user may have any number of collections, and they can be created or removed at any time. Notes within a collection are not deleted if a collection is deleted.

This brings us to the second half of the *HABITAT* archive – its 'private' half – where it acts as a storage and synchronisation system for the notes, collections and orderings for a given user. Whereas Rebecca chose to create a collection and share that with her manager, the collection itself is stored in the centrally located archive, and is considered an entity owned privately by Rebecca. In this way, the smart-phone application and the desktop application share some functionality; a user that creates a collection of notes on the smart-phone application, and then moves into range of a data connection will have that collection and its contents synchronised to the archive. Similarly, users who create a collection on the desktop application have that same collection available to them on their smart-phone application, given there has been a synchronising opportunity for the phone. This was demonstrated in the scenario by Sarah, who maintains a collection of wildflower notes. After adding a photo to her collection on the desktop application, this change was synchronised to the archive and her smart-phone application then reflected this change. In this way, the archive acts as a synchronising system for an individual's entire *HABITAT* data, making sure that interactions that occur in either the smart-phone or desktop applications are reflected in the other.

The *HABITAT* archive can be seen then as the 'middle-tier' of the *HABITAT* system. It allows the storage and dissemination of notes and collections from users and anchors, and keeps track of the various interactions that occur around them. At the same time, the archive also provides a back-up system for individual users collections and notes. This combination of public and private storage of notes combines with various meta-data that allow its users to query this data in a number of ways. The archive also logs the history of each object within the system: its creation and deletion, and the numerous interactions that occur around them. In all of these ways, the archive allows the smart-phone application, the anchors, and the desktop application to interact with each other in ways that tell stories about the objects it contains. Chapter 4 described the kinds of *historicisation* that occur within the park, where staff were engaged in deliberate attempts to construct data about places for the purpose of making this available for some future purpose. The *HABITAT* system then, through its archive and the interactions it logs, allows for both the automatic and deliberate historicisation of various spaces.

7.3 Habitat and the Design Inspirations

With both an experiential and a technical description of the *HABITAT* system now provided, this chapter now turns to a discussion on the ways that *HABITAT* puts to use and serves as a tool for exploring the inspirations for design presented in Chapter 6. In doing so, this section will provide further material in support of an answer to the second research question of this thesis: *How can we expand the relationship between space, technology and environmental understanding, in a conceptual way, so that this relationship is useful for designers of technology?* Whereas the first step in answering this question was to formulate the inspirations for design presented in Chapter 6, this chapter has explored the utility of these in the design of a system intended for use within Parks Victoria. The next step in answering this question is to explore the influence of these design inspirations on *HABITAT,* and in doing so show that the design inspirations are actionable and useful.

The principle *Designing Porous Spaces* was a large influence on the design of *HABITAT*, where it was a primary goal to allow various spaces to interact in a way that avoided the reification of experience and understanding. The smart-phone application is the most obvious instantiation of this principle, where its users are asked to deliberately add to and share from the application. After creating a note, that note is only accessible to others if deliberately added to an anchor of some kind. Similarly, the

only way to add a note to the application itself (other than creating one) is by deliberately selecting notes to add to a local collection. If an individual *HABITAT* user creates a personal habitat for themselves through the creation and cultivation of any number of notes and collections in the smart-phone application, then that same application acts as a pore through which notes can pass, and where the user is the only controller of this process. Whilst the application does automatically synchronise itself to the *HABITAT* archive, it does so in a way that remains private to others in the organisation. The notion of *pores* similarly influenced the design of the anchors, and the ways users interact with them. By empowering users to make deliberate choices about what is shared in an anchor and what is not, anchors themselves are porous in ways that do not compromise the unique perspectives of individual contributors. The decision to give users the choice of configuring an anchor to be private or public, and to synchronise automatically or manually is further evidence of porosity's influence on the design, where deliberate fine-grain controls are provided to give agency to the users of the system. Ultimately, then, the notion of *porous spaces* inspired the prioritisation of deliberate choices around sharing, where individuals and groups feel empowered to choose when and what is made publicly available within the broader system.

In addition to *Porous Spaces*, the principle *Designing Threshold Spaces* was an equally important influence on the *HABITAT* system. The *HABITAT* archive, the 'middle-tier' of the entire system, is perhaps the most significantly influenced by the inspiration of threshold spaces. In Chapter 6, a threshold space was defined as one that exists primarily to connect other spaces. The archive, as a system that allows for the dissemination of notes within the organisation, exists primarily to ensure that perspectives from across Parks Victoria's many geographical outposts are accessible to any individual member of staff. It aims to provide a means through which informal knowledge recorded through the smart-phone application is able to be appropriated and discussed by staff who may otherwise not have access to those understandings and perspectives. It is also designed in a way to be *agnostic* to the concerns of those staff; if a threshold space is created through the interactions that occur around it, then the way the users use *HABITAT* make its archive their own. There is no inherent or assumed 'correct' order of notes or collections within the archive, where much of its structure is built from user interactions around that content. The archive can be seen then as the threshold space for the entire *HABITAT* system. However, rather than culminating there, the inspiration of *thresholds* is also apparent in the design of the anchors. In much the same way as the archive, anchors exist primarily to facilitate the dissemination of notes amongst staff. However, rather than being organisation-wide,

their role as thresholds is restricted to the physical proximity of its users. Users have to be located near an anchor to be able to interact with it – as such, it acts as a different kind of threshold than the archive. In the scenario, the anchor that Damien first encounters acts as a temporal threshold between himself and his colleague John, providing a store for shared content between them despite their absence from each other. The mini anchor attached to the camera acts in much the same way, where the *object itself* is turned into a threshold space that connects those who have come into contact with it. Later in the scenario, the anchor above the coffee tin is a different threshold again. In the scenario, it acts as a threshold between Damien and other people in the same room as him. When the anchor 'pushed' his photos out to those in its range, it provided a connection between those people that may not otherwise have existed, prompting conversations and reinforcing the value of Damien's notes. At the same time, it acted as an extension of the threshold space of the archive; by synchronising its contents, it can be seen as a local, limited version of that same archive.

The principle of *Designing Anchors* influenced the design of *HABITAT* in a number of ways, not least in lending its name to a key piece of the infrastructure of the system. Whilst anchors - the *HABITAT* infrastructural objects - perform the role of threshold spaces in a number of situations, they also act as a theoretical anchor around which different relational spaces can revolve. Chapter 6 defined an anchor as an entity that becomes indexical to certain sets of shared understandings within the organisation, whether that be a work location, a place name, or simply a photograph. As such, anchors are entities that permeate multiple spaces at once, and allow these understandings to pass between them. The infrastructural anchors of *HABITAT* act as theoretical anchors as they become indexical to certain presumed sets of knowledge. An anchor can come to represent sets of notes for any manner of purposes, including places, projects, groups or events. In the scenario, the remote monitoring project anchor is indexical to knowledge about that project, allowing the habitats, in the geographical sense, of John and Damien to overlap and interact. Similarly, the 'mini' anchor made the camera itself into an index for experiential knowledge of itself that could pass between people. By setting up an anchor with the remote monitoring cameras, Damien similarly makes that location indexical to the data collected there, and provides a presence to that location in the *HABITAT* system. Finally, the anchor in the staff room allowed data about that location to be disseminated to all those around it, for them to appropriate in ways that is useful to them. The inspiration *Designing Anchors* led to the infrastructural anchors of *HABITAT* to be conceived of in a way that

allowed the creation of ad-hoc informal networks around them, where they became the point around which forms of understanding were reached.

To a lesser extent, *HABITAT* also drew upon the remaining three design inspirations. Whilst it could be argued that simply by being embedded within the organisation, the park, and with individual staff, the *HABITAT* system is already part of their rhythms, the inspiration of *Designing for Rhythms* mostly influenced the focus on portability within the system. By designing two major parts of the system – the smart-phone application and the anchors – as largely portable devices, it is intended that *HABITAT* is able to adapt to new rhythms: new patterns of movement, new practices and any disruptions that may occur within the park. Similarly, the design inspiration *Designing for Scales* influenced a focus on the utility and scope of each of the three parts of the system. If viewed in scalar terms, with individuals, groups and the organisation as scales of interaction within the organisation, then each part of *HABITAT* can be said to be designed for those scales. The smart-phone application is designed to provide utility to individuals; anchors to groups of physically or temporally proximate people; and the archive to the organisation as a whole. Finally, the inspiration of *Designing for Oscillations* is again most evident in the inherent portability of the system – by allowing anchors to temporarily represent different projects, groups or locations, it allows for the ad-hoc creation of infrastructure that supports those entities. The example of the remote monitoring cameras is perhaps the most telling, highlighting the oscillating nature of meaning at locations. For the period the monitoring cameras are set up, that location becomes meaningful in a particular way. The portability of the anchor set up with those cameras provides that location with a particular presence in *HABITAT* for the duration it is useful to monitor there. At the end of that project, the cameras (and thus the anchor) would be taken away, and that location would recede in importance in that particular way. That is not to say that the data is lost – it is simply no longer an active producer of content in the system. In this way, *HABITAT* is adaptable to the *oscillations* of place that occur within the park.

7.4 Conclusion

The goal of this chapter has been to explore the application and utility of the design inspirations presented in Chapter 6 through a conceptual design named *HABITAT*. It did so in order to answer the second research question of this thesis: *How can we expand the relationship between space, technology and environmental understanding, in a conceptual way, so that this relationship is useful for designers of*

technology? With this question in mind, the exploration of the experiential and technical design of the *HABITAT* system has served to show that the principles in Chapter 6 are able to be applied in the design of a practical system. *HABITAT*, then, can be seen as the product of the combined influence of each of these principles, and shows that it is possible to design a system that is able to sit within, and even embrace, the emergence and seasonality of space. Whilst *Habitat* was designed with these principles in mind, the exploration of their precise role in this design showed that, whilst each principle had a distinct influence, the design decisions they inspired often overlapped. Whilst *Designing Pores* and *Designing Thresholds* were presented in Chapter 6 as separate design inspirations, they found themselves in the design of *HABITAT* in very similar ways. Similarly, the notion of portability that derived from these can also be seen to overlap with the inspirations of *Designing for Rhythms* and *Designing for Oscillations*. This chapter serves to show then, that whilst a designer may choose to focus on one particular inspiration over another, or even a subset of them, they are meant simply as heuristics rather than hard rules or guidelines, and that, ultimately, the design decisions provoked by these principles may in fact blend into each other, and indeed may have been reached through a different combination and focus of these same inspirations.

Additionally, whilst the discussion around how the design inspirations from Chapter 6 influenced the design of *HABITAT* showed that they are applicable and actionable in designing technology that approaches space differently, it is important to consider that the ways in which *HABITAT* used these principles is not the *only* way they may be used. *HABITAT* simply represents one way of ordering and using those principles. With this in mind, the next chapter will present an alternative design that deploys the design inspirations from Chapter 6 in an entirely different way. In doing this, it aims to strengthen the viability of the design inspirations, and show that the reframing of space they are based on opens up not just a single opportunity, but many future possibilities for ubiquitous computing.

8

Wayfarer

Chapter 7 detailed one way in which the design principles introduced in Chapter 6 might be applied in order to produce a novel design: *HABITAT*. It did so in order to answer the second research question of this research: *How can we expand this relationship, in a conceptual way, so that this relationship is useful for designers of technology?* Rather than viewing the design of a particular product or system as the major contribution of this research, Chapter 7 highlighted that it is the reframing of space, through an application of the design inspirations that were presented in Chapter 6 that is its main contribution. Examining how the design inspirations were used in the design of *HABITAT* acted as a point of reflection on how relational notions of space and environmental understanding can be incorporated into ubiquitous computing designs. In order to explore this in further detail, and to show that the design inspirations from Chapter 6 are useful in opening up an collective *design space* rather than a singular *design product*, this chapter will apply the design principles in an entirely different way than those of *HABITAT*. To do this, it will present a second design – Wayfarer – that has been crafted with different goals and priorities in mind, yet still draws upon the design principles presented in Chapter 6.

As Wayfarer is a system that differs in scope and aim from *Habitat*, this chapter will follow a different structure than that of Chapter 7. First, it will present an overview of the Wayfarer system, describing its constituent parts and its aims. The origins of the system's concept, and its roots in the research methods and techniques presented in Chapter 2, will then be discussed. Next, the chapter will cover the interaction design of Wayfarer and the ways it which it meets three main design concerns, namely: *Situated Understandings of Place*, *A Platform for Expression* and *Embodied Narratives*. Finally, a discussion of Wayfarer in the context of the design principles from Chapter 6 will be provided.

8.1 Describing Wayfarer

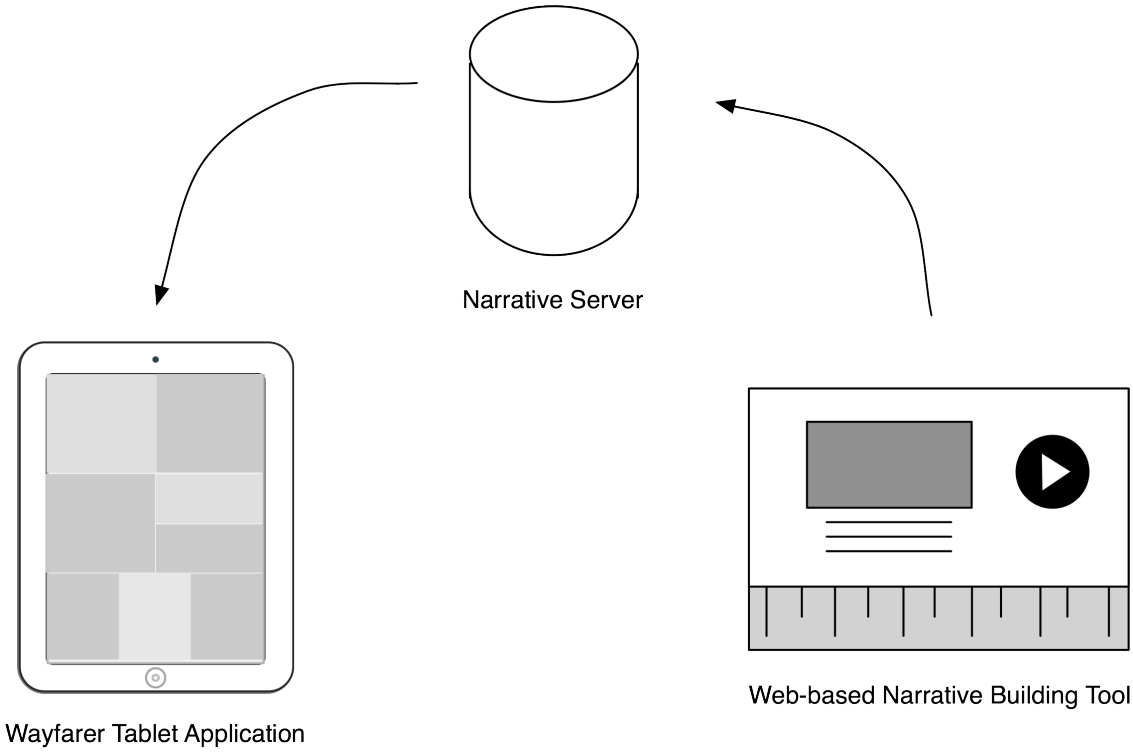


Figure 8.1 - The Wayfarer System

Wayfarer is a system(Figure 8.1) aimed at familiarising new Parks Victoria staff with the narrative histories, infrastructure and landscapes of a park. It is comprised of three parts: a tablet application, a web-based narrative building tool, and a narrative server. The tablet application is designed to be used in-situ by new staff as they familiarise themselves with a given park, and presents a geographical visualisation based on the location in which it is used. Each visualisation is comprised of a grid of media – either video, audio or photography – that is referenced, via geo-tagging, to that location. Importantly, the media presented in the visualisation also belong to any number of *narrative tours* of the park; by selecting media from the visualisation, users are able to launch into an associated tour. These tours guide users through areas of the park, telling a particular story about the locations the user travels through via these different media. Narratives are constructed via a web-based tool that is accessible across the

organisation. Each narrative consists of a number of narrative 'frames', and each frame is comprised of either photography, video or audio media. Frames can be specified as applicable to a given time and place. Referencing a frame to a location, through geo-tagging, then makes that media available in visualisations on the tablet application. When choosing to view a narrative, then, users are simultaneously guided through both a story and the park.

Unlike *Habitat*, *Wayfarer* is designed to be used in a deliberately reflective manner, separate from the everyday practices of the park. In this sense, it is intended as an educational or training tool, where those who wish to familiarise themselves with the narratives of a park use the tablet application to conduct tours. Wayfarer is also designed to provide staff with a platform for story telling. Through the web-based narrative tool, staff are able to construct stories about events or experiences that are closely tied to the park and its landscapes. A new member of staff, then, may be given *Wayfarer* as part of their general introduction to the park. Similarly, more experienced staff may choose to deliberately 'wander' the park for the purpose of reflecting on it in the context of these narratives.

Wayfarer, therefore, serves three purposes. First, through the web-based tool, it allows staff to construct a narrative history of the park. These might be based on some past personal experience, or can aim to cover broader historical narratives, such as the fire history of the park, or the progression of a singular event like a flood. Second, it allows staff to explore the park through these narrative histories. As staff familiarise themselves with the roads, trails and landscapes of the park, they are also given an opportunity to learn the stories that have been constructed about those places. Third, Wayfarer allows these new staff to reflect on a given location in the context of the stories that *pass through* it. By presenting a visualisation made from the media taken from these narratives, staff are able to gain perspective on how that location fits within the various stories constructed about it.

Each of these three purposes were derived from design concerns based in the ethnographic research conducted during this project, namely: *Situated Understandings*, *A Platform for Expression,* and *Embodied Narratives*. These design concerns will form a larger discussion on the design of Wayfarer to follow. Before moving on to that discussion, the next section will provide an exploration of Wayfarer's conceptual and technical genesis in this research.

8.2 The Origins of Wayfarer

This section details both the technical and conceptual origins of the Wayfarer system. Whilst the final form of Wayfarer has been designed with the design principles from Chapter 6 in mind, its technical and conceptual genesis lies earlier in the research, where technology probes and research techniques provided inspiration for each of its constituent parts. This section will therefore highlight the overlaps between the technical aspects of Wayfarer and technology probes and research techniques used throughout this research. It will also discuss the conceptual inspirations of the system, both in the practical concerns of Parks Victoria, but also in Tim Ingold's concept of a 'wayfarer' (Ingold, 2000; 2011), from which this system derives its name.

In parallel to considerations around the design principles presented in Chapter 6, *Wayfarer* is designed as a solution to one of the key practical concerns of Parks Victoria: that of introducing new staff to the nuanced understandings and past events of a given park. It is this foundation that led to the establishment of the first design aim for Wayfarer, that of *situated understandings*. Chapter 2 gave an overview of the practical concerns of Parks Victoria, describing how their main areas of interest in the project were derived from issues around the use of location-based data and of understanding tacit knowledge within a park. Whilst BurnMap (as described in Chapter 2) was proposed as a solution to location-based decision making, it did little to address tacit understandings of the park, and took a particular *representational* viewpoint when approaching data about a location. That is, it aimed to interpret and present factual, recordable data about the park for the purposes of group decision making. Wayfarer, on the other hand, takes an entirely different approach to the practical concerns around location-based data and tacit understandings. It chooses to take an *interpretative* approach to these concerns, allowing its users to reflect on narratives about the park in-situ. In this way, Wayfarer can be seen as conceptually inspired by the overlaps of these concerns: passing on tacit, interpretive understandings of the park, *within* its various and varied landscapes.

Additionally, the system was inspired by Tim Ingold's concept of the 'wayfarer' (Ingold, 2011; 2000). Ingold uses this term to describe his understanding of how humans inhabit and learn of the world. He believes that any form of knowing involves movement, where that movement is not necessarily between physical locations in space, but between different orderings and constructions of networks, the totality of which he refers to as a 'meshwork'. Rather than moving "across the surface of a world whose layout is fixed in advance", wayfaring describes how people "'feel their way'

through a world that is itself in motion, continually coming into being through the combined action of human and non-human agencies" (Ingold, 2000, p.155). To 'know' is then, for Ingold, a matter of being able to connect one's movements and life-path through this meshwork "to the narratives of journeys that have already been made" (ibid., p.155). Whilst Ingold does not intend his notion of movement to be taken literally, Wayfarer was inspired by the literal interpretation of 'knowing' being equated to moving through narratives of the world. It is this inspiration that informed the second design aim for Wayfarer, that of *embodied narratives*.

In addition to the practical concerns of Parks Victoria, and the theoretical concept of a 'wayfarer' (Ingold, 2000; 2011), the technical aspects of the Wayfarer system were inspired by a number of research activities that occurred throughout this project. Starting with the tablet application, the location-based visualisation aspect of Wayfarer was inspired by early research in this thesis around geo-visualisation (Marmo, Cartwright & Yuille, 2010; 2011). The BurnMap project, as described in Chapter 2, was designed as a geographical visualisation tool to assist with planning burn-offs, and with that as the starting point for this research, geo-visualisation was one of the earliest research areas of this project. This early interest, whilst ultimately not contributing to the theoretical basis of this research, did remain prominent during data collection. Chapter 2 described a number of visualisations that were generated from the diary study data, and the favourable response to these from Parks Victoria staff suggested that visualisations of the park would be well received. Over the course of the research, various informal, exploratory visualisations were also made out of open, public data from websites such as Flickr (Flickr, 2012) and The ABC (ABC, 2012) to investigate the potential of such a visualisation about Wilson's Promontory National Park (WPNP). Whilst Wayfarer does not ultimately draw on these sources, the potential for representing data about the park in a visual and interpretative manner was inspired by these experiments.

The web-based narrative tool was inspired by a technology probe used during the research. As a means of generating historical perspectives of the park, a key collaborator on the project was presented with a Timeline generation tool (as described in Chapter 2). This tool allowed the collaborator to use various media to construct timeline-based narratives of important historical events that occurred within and around WPNP. Whilst the prototype was used to generate qualitative data about the role of historical data in park management, the success of the prototype itself indicated that such a tool would be valuable in and of itself for the organisation. Similarly, the tool highlighted that there was currently no easy way of collating and sharing historical

information, in an interpreted manner, within the current information technology systems in use within the organisation. In this way, the Timeline tool was the basis of the last design aim for the Wayfarer system: providing a *platform for expression*.

The parallels between each aspect of the Wayfarer system and the research methods highlight that the concept is both conceptually and technically sound. The technology probe of the Timeline highlighted that a narrative tool would be welcomed within the organisation; similarly, the response to diary-study visualisations inspired thinking around interpretative visualisations. The practical concerns of Parks Victoria around location-based data and tacit understandings were then combined with Ingold's notion of a 'wayfarer' to inspire the Wayfarer system. With the origins of the Wayfarer system in mind, this chapter will now turn to an exploration of Wayfarer's interaction design. It does this through the frame of the three primary design aims outlined here, namely: *Situated Understandings*, *Embodied Narratives* and *A Platform for Expression*.

8.3 The Design of Wayfarer

This section will discuss the interaction design of the Wayfarer system, focusing on the experiential aspects of its use. The discussion will revolve around three themes, outlined in the previous section, that acted as guiding aims for the design of the system. Whilst the discussion will inevitably cover technical aspects of the system, its main priority is to shed light on how the system helps achieve these design goals. As with *Habitat*, it is important to note that whilst this chapter describes the specifics of a system that could be deployed within the context of a national park, its main contribution is in its ability to highlight an alternative use for the design principles presented in Chapter 6.

Wayfarer does not rely on any advancement in technology, nor, importantly, in the infrastructure of WPNP. Given that it is designed to be used across common tracks and trails in the park, and the majority of these are based in and around reasonably developed areas of the park, data coverage for the tablet application is not envisaged to be a constraint. With this in mind, a discussion of the systems interaction design will now be provided, where its constituent parts will be described in detail.

8.3.1 Situated Understandings

Wayfarer comprises two parts: a tablet application, and a web-based narrative building tool. Whilst these two parts are closely integrated, the system is designed to be experienced primarily through the tablet application. This section will start, then, with an exploration of the design of the tablet application.

The Wayfarer tablet application has two main features: the ability to present a dynamic mosaic visualisation of media based on the location it is used in, and the ability to launch into a narrative tour of the park based on those media. It requires a mobile-data enabled tablet with built-in GPS: when users open the application, the location of the device is recorded via the tablet's GPS unit and is used as an index to a variety of media that have been geo-tagged at that location. This location is passed to the Wayfarer narrative server where a set of 'near-by' media is calculated and returned to the tablet (the process for calculating this set will be covered later in this section). Once the application has a media result, it will begin to construct, in real time, a mosaic visualisation of all available media. That is, rather than being presented with a static visualisation, users who open Wayfarer are invited to watch as media is downloaded and constructed into its mosaic.

The visualisation itself is designed to be abstract, where media are devoid of any supporting context beyond what are already inherent in them. The mosaic is designed to be viewed at full-screen on the tablet, and its layout is responsive to the resolution of the tablet it is running on. Due to the resolution of common tablets at the time of writing, 12 individual media are able to be displayed in the visualisation, where media are computationally varied in size to fit into the mosaic. The layout of the mosaic also varies, depending on the size of the media to be displayed. Examples of potential layouts, and their evolution, are presented below in Figure 8.2.

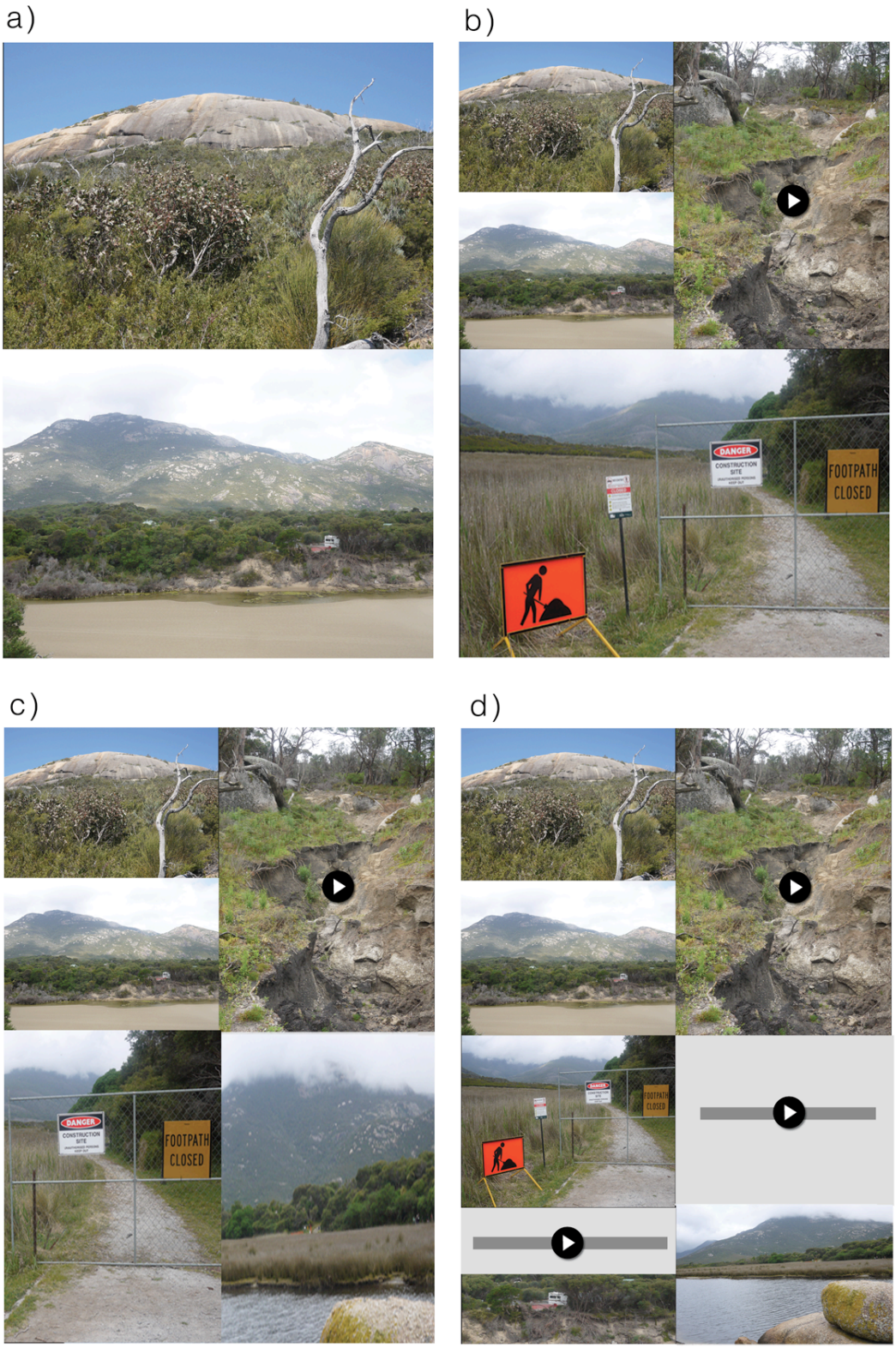


Figure 8.2 - Four potential mosaic visualisations. a) Shows the early stages of a mosaic construction, where the server has returned two photographs. b) Shows the evolution of that mosaic as other media are found, including video denoted by the 'play' button. c) one more picture is found. d) audio entries are found and added to the mosaic.

Upon loading the application, the mosaic is constructed in real-time as media become available and are downloaded. New media is animated into the view as it arrives, causing the layout of the mosaic to shift to accommodate the media. Second, after a period of time and given the availability of alternative media, media in the mosaic are switched for alternatives. This is done in a first-in/first-out (FIFO) manner, where the media that has been displayed for the longest amount of time is switched for a newer photograph, video, picture or audio recording. In this way, to view the mosaic over time is to watch an evolution in its presentation. If at any time there are no new media to display in this evolution, then previously used media are used.

The aesthetic qualities of the visualisation are intended to invite reflection on the media in the context of the location they are viewed in. Rather than informing or instructing users via a set of facts or graphs, the mosaic visualisation asks them to interpret the media in the context of the landscape surrounding that user and, conversely, to *interpret these landscapes in terms of the media being presented*. Wayfarer relies on the shifting and evolutionary qualities of the mosaic to inform users about these locations, where both individual media and the mosaic as a whole are to be interpreted together. Even if the user is stationary, the mosaic updates, shifts and evolves with little to no interaction, inviting users to find their own connections between the media presented and their location.

Importantly, the mosaic visualisation is designed to support movement within the park. Given media is always retrieved from the server based on the current coordinates of the device, the slow evolution of the mosaic, with its FIFO media switching, means that a mosaic may be representative of an entire region of recent movement, rather than a single, computationally measured location. In this way, the visualisation is intended not to inform users about a single location calculated at an x,y coordinate on planar space, but to allow users to interpret the entirety of an area they inhabit and move within. As users move through the park, the visualisation continues to evolve in a way that *reflects* that movement. Rather than segregating different locations into a grid, where each gridded 'box' contains its own set of media, the application is designed to allow users to interpret places as fluidly connected, where the visualisation *blends* from one place to the next.

The mosaic is a dynamic, evolutionary visualisation that encourages reflection on the landscapes it is used within, done so in the context of the narratives that, in a way, *pass*

through that place. Remembering that each frame in a narrative is geo-tagged, where frames act as guiding points, narratives can be viewed as paths that move across the landscape of the park. When the server is queried for new media by the tablet application, it uses the GPS-derived coordinate as an index to the narrative frames that pass through that location. Using a radius calculation, it is able to search through the frames of each narrative and collects the media from frames that have been geo-tagged as within a hundred metres of that location. It returns this collection to the tablet application, one media at a time, to be displayed in the mosaic.

The mosaic, then, is constructed out of media from narratives that pass through the user's current location (Figure 8.4). In further homage to Ingold's (2000; 2011) notion of the 'wayfarer', places within Wayfarer – represented by the visualisation – are the result of overlapping narrative lines at a particular location. Each narrative can be viewed as a thread across the landscape of the park (Figure 8.3), where each frame acts as a guiding point for that thread. Where threads overlap, they become entwined, as "the life of each becomes bound up with the other" (Ingold, 2011, p. 154). In this way, the mosaic visualisation aims to provide a *situated understanding* of places based on the narratives that pass through that location. Within Wayfarer then, "every place, is a gathering of things, is a knot of stories" (ibid. p. 154).

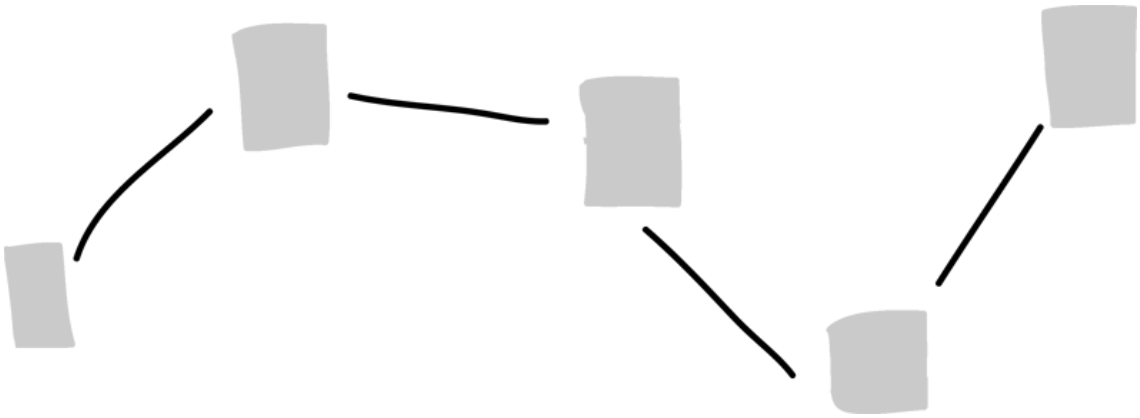


Figure 8.3 – Each Wayfarer narrative can be viewed as a thread across the landscape of the park.

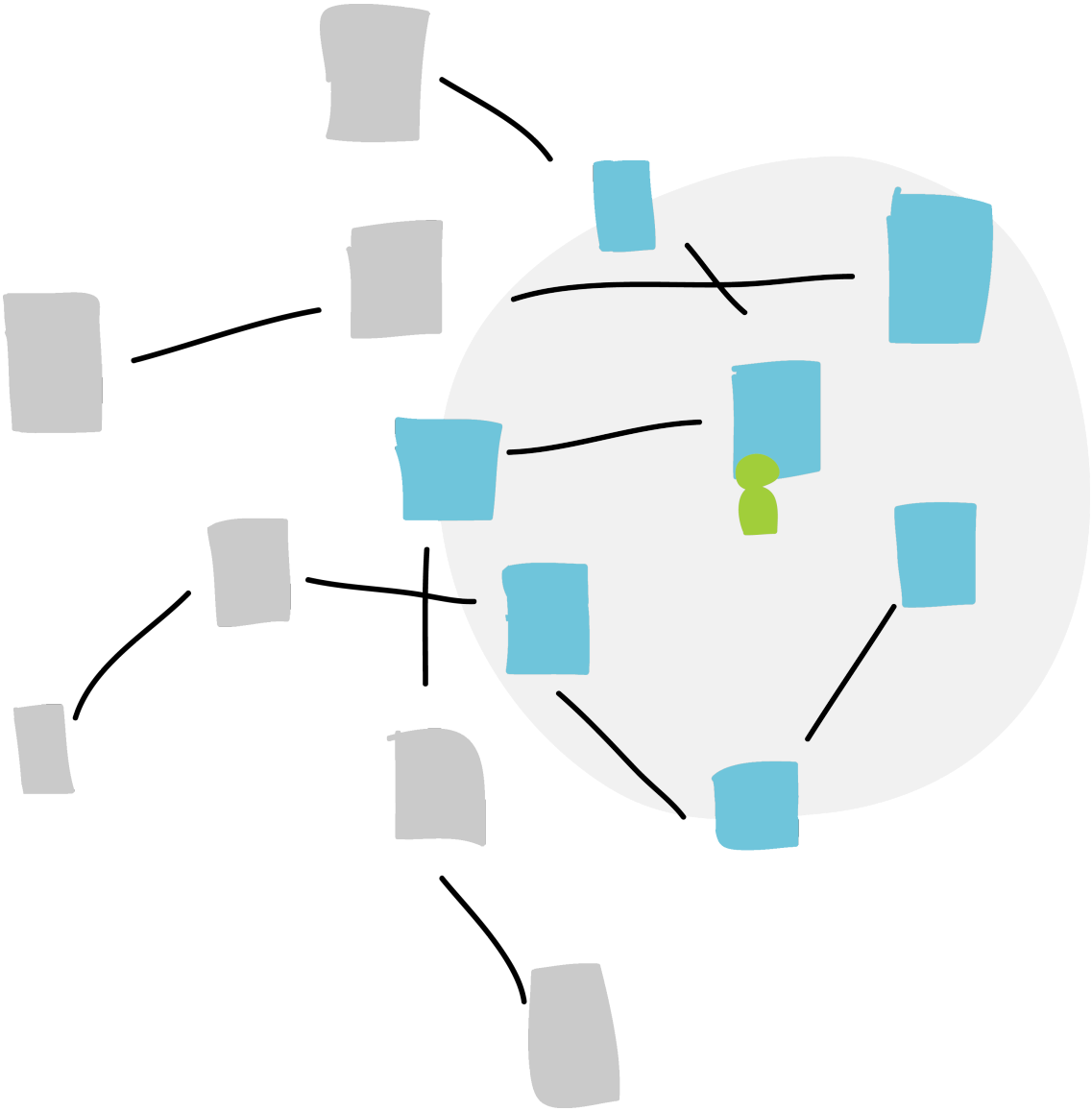


Figure 8.4 – The mosaic visualisation is constructed out of media from narratives that are within a radius of the user's current location.

8.3.2 Embodied Narratives

The second aim of the tablet application addresses the design goal of *embodied narratives*. Whereas the mosaic visualisation is aimed at providing a situated understanding of place, the tablet application also allows staff to discover the narrative context of the media presented within it, and supports the guidance of staff through these narratives. This section will examine the second main feature of the tablet application – its narrative tour feature – in order to shed light on how the narratives of Wayfarer are experienced by users within a park.

As the last section showed, the mosaic visualisation is constructed out of a number of media, taken from narratives that *pass through* the current location of the user. In this way, the visualisation, in addition to encouraging interpretative understandings of these locations, acts as an index to the narratives that pass over or through the user's current location. To begin to discover this narrative context, users are able to select individual media from the visualisation to be viewed in more detail. Selecting media from the visualisation enlarges the media, where users are able to examine it closely, or 'play back' the audio or video that it contains. In this view, meta-data about the *narrative* that this media is a part of is also presented. This meta-data is derived from the narrative frame it belongs within, including the title of the narrative, and the title of the frame itself. It also displays the time or period the frame refers to within the narrative. If applicable, the previous and next frame in the media's narrative are also displayed, in miniature, to the left and right of the media respectively. From this view (Figure 8.5), users are able to return to the mosaic or can elect to start the narrative tour, which begins the process of guiding users through the narrative.

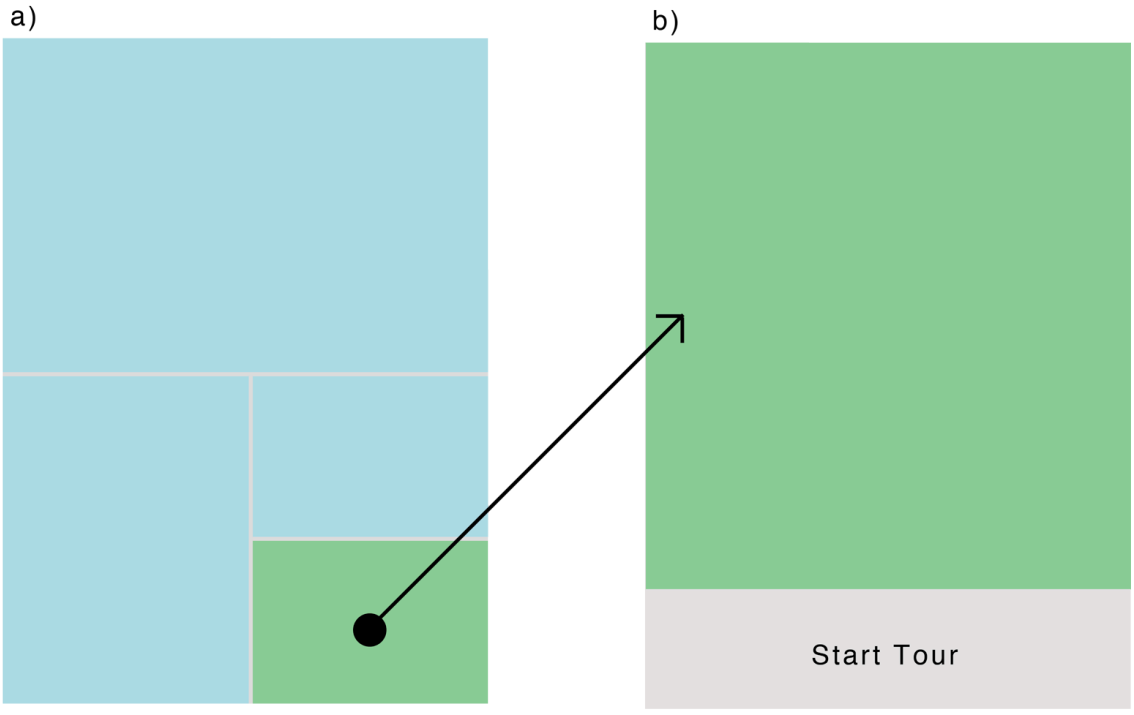


Figure 8.5 – Users can start a narrative tour (b) by selecting media from the Mosaic visualisation (a).

It is important to note that, when selecting media from a narrative, users may start a narrative from the beginning, or they may 'join' the narrative at some other point in its progression. Equally, it is possible that the media they select may be at the end of a given narrative. Given this, users are given the option of navigating through the

narrative in non-linear ways; they are able to move 'backwards' through the frames of the narrative they have chosen, being guided to those frames and the eventual beginning of the narrative, or they can continue 'forward' in the narrative, to the next frame and beyond to its eventual conclusion.

Once a narrative tour has begun, the media contained within a frame is given prominence in the tablet application (Figure 8.6). Added to the view is a guiding compass, which displays the location of the next frame in the narrative, and the path required for the user to get to that location. As users walk to and from the locations dictated by the frames, media from the frames automatically fade in and out of the view, again with the aim of providing a blended interpretation of the relationship between landscapes of the park. In this way, the tablet monitors the progression of the user through the park, and attempts to map their physical progression to that of the narrative. Once the user is decidedly 'within' the bounds of the next frame in the narrative, that frame is automatically displayed in full and, in the case of audio and video, its media is played. This is to limit the amount of time users spend interacting with the application itself, and allows users to engage with their surrounds whilst the media plays; that is, whilst the narrative is being told.

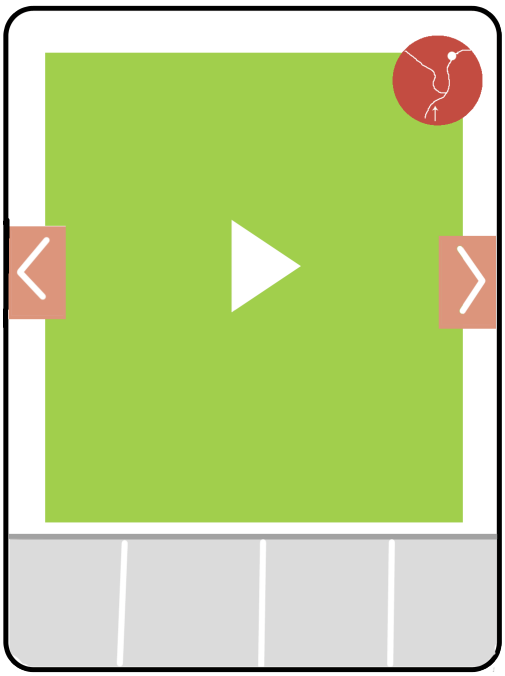


Figure 8.6 – A wireframe of the narrative screen, where navigation and media are displayed. Alternative narratives are presented below the main media, and users can navigate between frames.

Users are manually able to progress to the next frame in a narrative by selecting the miniaturised representation of that narrative to the left or right of the current frame. This makes it possible for users to navigate the narrative without physically moving. In addition to the automatic triggering of media, manual navigation is supported for a number of reasons. First, it may be possible for frames to be about the same location or region, and to view all frames applicable to a given location, users would have to manually move between them as the application would not know to automatically blend frames. Additionally, users simply may want to 'browse' through a narrative to see if it is something they would like to undertake before starting it. If they are uncomfortable with starting a narrative at some point other than its beginning, this manual navigation through a narrative also allows them to locate the starting point for it and travel there before beginning the narrative.

Navigation *between* different narratives is also supported. In addition to the main media, its supporting meta-data and its neighbouring frames, the Wayfarer tablet application displays miniaturised versions of media from other narratives that pass through the current location along the bottom of the screen. To support this, the application continues to monitor the user's location and query the server for surrounding media. Whilst this data is far less prominent than in the mosaic view, the continuing evolutionary nature of this set of media provides extra context to the narrative the user is currently taking part in. Importantly, this media acts as an index to further narratives, just as the mosaic visualisation does. Selecting media in this list also allows users to 'jump off' a given narrative path and on to another. Inspired by the intersections of physical paths through the park, each location within Wayfarer is continued to be viewed within the context of the narratives that overlap it. Participating in a narrative then is akin to the experience of walking along a trail that has other paths branching from it. At any one time in Wayfarer, users are presented with a number of alternative narratives. Narratives guide users along a certain path through the park, and whilst a user's physical movement through the park may be identical across different narratives, it is the difference in perspective on those same locations and landscapes within the park that Wayfarer aims to communicate.

In this way, Wayfarer aims to provide new park staff with a means of exploring both the physical paths, tracks and landscapes of the park, but through the lens of narratives told about those places. This reflects the main aim of the narrative tour feature of the Wayfarer tablet application – users are encouraged to explore the physicality of the park, with its built infrastructures and landscapes at the same time as exploring its narrative history. However, rather than presenting these narratives as a definitive

interpretation of locations, it provides alternative perspectives that contribute to the interpretation of these places. Whilst narratives contribute to situated understandings of the park, it is the *embodied* experience of travelling along a narrative path, where the physicality of the park is enmeshed with the stories that are told about it, that Wayfarer aims to allow staff to arrive at their own interpretative understandings of the park.

8.3.3 Platform for Expression

Whilst Wayfarer is designed to be experienced primarily through the tablet application, it is dependent on narratives that are constructed through the web-based narrative building tool. This tool is a secondary, yet key part of the Wayfarer system in that it provides data to the tablet application. However, it is envisaged to be a key tool within an organisation that currently lacks many processes or technical infrastructure for supporting the deliberate, reflective sharing of experiences. This last section, then, will provide an exploration of the interaction design of the web-based narrative tool, at the same time highlighting its ultimate goal of providing *a platform for expression* for parks staff.

The narrative building tool is a web-based system that allows staff to construct narrative tours of a park they are familiar with. The tool is envisaged to be openly accessible throughout the organisation. In the same way as the tablet application, it is considered a reflective tool, to be used deliberately outside of daily practices. Staff across the organisation would be encouraged to construct narratives when they have the opportunity, or when they have identified a story that would add to the existing 'meshwork' of narratives (Ingold, 2011).

Within a narrative, different media are able to be grouped into a narrative structure, and specified as relating to a given time period and location. New narratives are added to the system by giving them a title, and selecting a park within which they occur. Whilst supporting multi-sited narratives would be possible, this tool deliberately enforces a single-park view on narratives due to the logistics involved in using the tablet application. It would be unrealistic to expect staff, typically walking with the application, to continue along a narrative path between parks which could be many hundreds of kilometres apart. Additionally, the goal of Wayfarer is to provide a depth and nuance of understanding of a given park, and that depth may be missing in narratives that span many parks. Consequently, limiting the scope of a narrative to a single park also aims to encourage deeper insight about those parks.

Once a title and park have been provided, users of the narrative tool are then able to construct the narrative by adding *narrative frames*. A narrative can have any number of frames, yet each frame is unique to a single narrative. To create a frame, users are required to provide a single media for the frame. The tool accepts pictures, videos and audio in a number of different formats, and these can either be uploaded from the computer the tool is being used on, or referred to via a web address. If a web address is provided, the tool will retrieve the media from that address. All uploaded media are copied and stored in a dedicated Wayfarer server.

Once media has been provided, users are asked to provide three supporting pieces of data. First, users are optionally asked to provide a title for that frame. This is to provide some context to the role of the frame in the narrative. Second, users are asked to select, on a map, a point in the chosen park that the media is applicable to. Third, users are asked to provide a time period for the frame. Times can be set on varying scales, and a given frame can also be made applicable to a *span* of time. A given frame can therefore refer to a precise moment in time – down to the minute – or can be more broadly summative. Similarly, it can refer to a precise location in the park, or be applicable to a broader region.

Once frames are added to a narrative, users are able to reorder them, where the order of frames within the web-based tool is indicative of the order in which users of the tablet application will experience them. Once satisfied with the media and order of their narratives, users are able to save the narrative, which makes it available to users of the Wayfarer tablet application within a given park. Upon saving, a time span and spatial path for the narrative are also calculated, and each of these is used as contextual information in the tablet application. Unfinished narratives are able to be saved as 'drafts' to be completed later.

Whilst there are no deliberate collaboration tools built into the narrative tool, the decision to make it web-based allows for the collaborative editing of narratives. Each narrative is 'owned' by its creator, who is able to invite other staff to collaborate on their narrative. In this way, narratives can be added to and adjusted by those who feel they have something to contribute, but who may not feel they know enough to create their own full narrative. Similarly, this aims to encourage the view of narratives as living entities that have scope to grow, shift, and evolve in a way that invites this collaboration.

Figure 8.7 – A timeline of the "Fire History of the 'Prom", generated by a participant using the Timeline prototype (see Chapter 2).

The web-based narrative tool is an important part of the Wayfarer system. It is not intended as the primary way of experiencing the system – however, it is envisaged as an important tool for staff in expressing a variety of stories and experiences within a park that would otherwise go unrecorded. Allowing open and organisation-wide access to the tool provides staff within the organisation a particular way of sharing their experience of a park with others. In addition to providing situated understandings and embodied narratives then, Wayfarer can be viewed as providing staff with a *platform for expressing* their perspectives and experiences of a park through the stories they have accumulated about them (Figure 8.7).

8.4 Wayfarer & the Design Inspirations

With the origins, concept and design of Wayfarer now explained, this section will turn to a discussion on how Wayfarer both uses and brings a new perspective to the design inspirations presented in Chapter 6. In so doing, this section will bring this thesis to the completion of its answer to the second research question: *How can we expand this relationship, in a conceptual way, so that this relationship is useful for designers of technology?* By highlighting that these design inspirations were actionable – that is, *useful* – in the design of Wayfarer, and actionable in very different ways to that of *Habitat*, this chapter provides additional weight to the claim that relational notions of

space, and its emergent and seasonal nature, are a productive reframing of space and environmental understanding for ubiquitous computing. To this end, this section will explain how the design inspirations helped guide the design of Wayfarer.

The principle of *Designing Porous Spaces* was an important influence on the design of Wayfarer, despite being used in a very different way to *HABITAT*. Whereas in *HABITAT* the notion of pores inspired the design of controls for deliberate and considered sharing of user generated content, within Wayfarer the notion of pores was used in a temporal manner, where historical narratives 'seep through' to the present. The tablet application is porous in that it selectively presents historical perspectives about the places in which it is used. The mosaic visualisation only allows a certain amount of media to 'seep through' at any one time, where the evolution of its presentation is controlled in a way that encourages reflection on its content. The narrative tour feature of the application is porous in much the same way – by displaying a curated historical narrative about a park, the tablet application allows only select perspectives to emerge from some point in the past. Additionally, it allows the users of the application to select which narratives from the mosaic they wish to view. Rather than presenting these narratives in a definitive way, where users may feel a given narrative represents an official interpretation of a park, the aesthetic design of the mosaic places control over this to the user. In both *HABITAT* and Wayfarer then, the inspiration *designing porous spaces* has been used to consider how and what moves between different components of the system, and to privilege user agency in this choice. However, their actual realisation in the design of each system has been very different, where Wayfarer uses the notion of pores to consider ways historical information is brought into the present.

The principle *Designing Threshold Spaces* was also an important influence on the design of Wayfarer. In the same way that porosity was considered in a temporal manner, the notion of Wayfarer as a *temporal threshold*, deliberately designed to connect temporally separated perspectives on the park, was a compelling concept throughout its design. However, rather than viewing the entire system in this way, it is perhaps more useful to think of the individual narratives themselves as threshold spaces. Narratives are constructed to help connect perspectives and experiences of a location or region in a park. Through its web interface, the narrative tool allows narratives to be constructed in a collaborative manner, where they act as a threshold between shared or overlapping perspectives staff have on the same event or topic within a park. For those using the tablet application, narratives act as thresholds by *introducing* users to those same perspectives. Rather than acting as a single threshold

space, then, Wayfarer can be viewed as a platform for *creating* threshold spaces. So, whilst thresholds have been used in both Wayfarer and *HABITAT* to consider how technology can help bridge different relational spaces, the inspiration has been used in an entirely different way in each. Whereas in Habitat the archive was considered a single, organisation-wise threshold space that allowed the dissemination of notes, Wayfarer viewed thresholds as something that could be constructed through it.

The principle of *Designing Anchors* found its way into Wayfarer mostly in terms of the mobility of the system and its focus on locations. Wayfarer found inspiration in the realisation that landscapes in the park are used in an indexical manner – in a way that made them anchors around which understandings are constructed. By designing Wayfarer as a primarily mobile system, to be used in-situ, it aimed to respect and utilise this tendency of staff to use the landscapes of the park as a means of contextualising, constructing and interpreting knowledge. Each part of the Wayfarer tablet application is used in a reflective manner with the places it is used in. The mosaic is deliberately abstract in that it does not present any summative or instructional information; instead, it encourages users to consider its media in the context of the location where it is used. Conversely, at any point in the evolution of a mosaic, the surrounding landscape of the park is invited to be interpreted through the lens of the media being presented. It is this dialogical relationship between the mosaic and the landscapes of the park that invite users to reflect on those landscapes as meaningful entities, as anchors around which other people have contextualised their experiences (in the form of a narrative), and around which they themselves are invited to do so in-situ. Allowing narrative creators to geo-tag a narrative frame to a particular location or region further facilitates this indexical view of landscapes, where they are asked to reflect on the role these locations played in their experiences. Whilst narratives can be viewed as a path across a park, they are guided by waypoints that are selected with intent by their creators. When experienced on the tablet, each of these waypoints shows other narratives that pass through them. It is in this way that Wayfarer positions locations in a park as anchors; that is, they become indexical, in a dialogical manner, to shared understandings of them. Rather than individual components of the system being treated as anchors, as in Habitat, Wayfarer aims to take advantage of the indexicality of landscapes.

The principle of *Designing for Scales* was one of the most significant influences on the design of Wayfarer. In the previous chapter, scales were used as a way of thinking about the scope and range of use for each component of the *HABITAT* system. In this way, the notion of scales was applied to different experiences of use of *HABITAT*. In the

design of Wayfarer, the notion of scales similarly encouraged consideration around the scales of experience of the system, yet this concern expressed itself in two very different ways. First, it inspired a deliberate focus on the embodied experiences of staff within the park. If the experiential nature of technologies can be thought of in scalar terms, where certain systems – like Habitat – aim to provide utility and range across both small and large distances and for both individuals and large groups of people, then Wayfarer deliberately targets the scale of a single individual, experiencing a single location. As Chapter 3 highlighted, embodied perspectives of an environment can also be viewed as a certain scale of space, or "place" (Tuan, 1976), and Wayfarer is designed to reside within this embodied perception. The mosaic visualisation and the media contained within narratives, then, are each aimed at providing presence for historical narratives within an embodied perception of an environment. Second, scales influenced the decisions made to support varying ranges of locations and time in the construction of narratives. Each narrative can notionally be about a different range of distance, or span across varying degrees of time. Whereas certain narratives might be focused on relaying experiences that occurred within relatively compressed distances, or across a short period of time, others may span increasingly large areas of a park, or cover a period of time over many decades. Scales, when applied to narratives, inspired the support of these differences. Importantly, the notion of scales also influenced the decision to disallow narratives that spanned multiple parks, as narratives of this scale of distance would have contradicted the priority placed on embodied experiences within an environment.

As in *HABITAT*, the principle of *Designing for Rhythms* inspired a focus on the portability of the Wayfarer system. However, rather than aiming to be embedded within the daily rhythms of the park, as Habitat did, Wayfarer was deliberately designed to sit *outside* the diurnal patterns of movement and practice of staff. By designing Wayfarer as a deliberate and reflective tool, it provides an example of how technology might provide a catalyst for new rhythms. Through use of the tablet application, staff are likely to be guided to areas of the park they have not been to before. More importantly, they will be exposed to perspectives on those places that they are able to interpret and incorporate into their own practices. Whereas *Habitat* used the notion of rhythms to consider how it may be embedded within the diurnal practice of staff, Wayfarer can be seen as encouraging the formation of a new rhythm of movement and practice that is deliberately reflective.

The principle *Designing for Oscillations* was perhaps the least influential of the inspirations on the design of *HABITAT*, yet it is still possible to see how it might fit into

the concept of Wayfarer. If oscillations are thought about in terms of changes of meaning at a location, then Wayfarer's mosaic provides a means of investigating these oscillations. Rather than steadily presenting the same quantity of media for any location users to move within, the mosaic is dependent, and indeed limited by, the media it deems to be close by. Moving through the park, therefore, might highlight to users that certain locations are contained within more narratives than others. The mosaic reveals an *oscillating* nature of narratives across a landscape. Rather than problematising this oscillation though, Wayfarer embraces it as part of the interpretation of the park, where a sparsity of media in the mosaic is seen as just as informative as an overwhelming amount.

8.5 Conclusion

The goal of this chapter has been to further explore the application of the design principles presented in Chapter 6 in the design of novel systems. It did so in order to provide a conclusion to the second research question of this thesis: *How can we expand this relationship, in a conceptual way, so that this relationship is useful for designers of technology?* By exploring both the ways in which Wayfarer uses these design inspirations, and the ways in which they were used differently than in the design of *Habitat*, this chapter has shown that principles grounded in the *emergent* and *seasonal* nature of space can be used in the design of new systems. The design themes of *situated understandings*, *embodied narratives*, and a *platform for expression* also allowed Wayfarer to explore the application of these inspirations in a way that grounds them in the concerns of Parks Victoria and contexts studied throughout this research. As such, Wayfarer has demonstrated that the inspirations can be in a pluralistic manner where they are able to be approached and realised in different implementations. In this way, the design inspirations, based on the reframing of space presented in Chapter 6, can be seen as expanding upon the relationship between technology, space and environmental understanding in a way that not only inspires single solutions, but opens up a new design space for ubiquitous computing.

Both systems presented in this thesis – *HABITAT* and Wayfarer – have found inspiration in the reframing of space in different ways. They have also grounded their designs in the practical concerns of Parks Victoria through the design themes they were based around. These themes were derived from the ethnographic research conducted throughout the project, and were aimed at providing relevance to the organisation and the broader 'Affective Atlas' project. With these systems now explicated, and their

implications and significance for ubiquitous computing detailed, the next chapter will return to these practical concerns.

9

Implications for Park Management

With the first and second research questions of this thesis now addressed, this chapter will turn back to the practical concerns of Parks Victoria. In doing so, it is able to propose the third research question of this thesis: *Given this expanded relationship between space, technology and environmental understanding, what are the implications for Parks Victoria and, more broadly, parks management?* Whereas the first two research questions have been posited to contribute to the theoretical discourse around ubiquitous computing, this question aims to ground the research back into the concerns of the 'Affective Atlas' research partnership, as outlined in Chapter 2. To this end, this chapter will connect the broader theoretical implications of this thesis to the practicalities of Parks Victoria. This chapter is designed, then, to be used primarily by Parks Victoria as a summary of the outcomes of this research, and a roadmap for further research within their own organisation. It is not the aim of this chapter to dismiss other parts of this thesis's relevance to the organisation – it is indeed hoped that this whole thesis can provide insight for Parks staff. Rather, this chapter will explicitly provide space to discuss the findings of this research in the context of the organisation.

The chapter is, therefore, structured around three important themes for Parks Victoria. It begins with a critique of the role of codifiable knowledge within park management, where the distinctions between explicit and tacit knowledge within the organisation are shown to be problematic. Following this, a discussion on the role of technology in revealing the activities of knowledge workers will be provided. The "spectre of technology" within Parks Victoria will then be explored, explaining how the organisation's assumed negative attitude to new technology is stereotyped and ultimately unfounded.

9.1 ‘Knowledge’ in Park Management

As Chapter 2 has described, the early work of the ‘Affective Atlas’ group was based around the development of concepts and prototypes that were designed to assist Parks Victoria to more easily interrogate data that was deemed to be relevant to a given location. As an organisation they was interested in understanding what data they possessed was ‘location-based’, so that they could explore ways of making more informed decisions based on this data. This concern was not limited just to data in the organisation’s various databases and filing cabinets, but also included ‘knowledge’ that may be possessed by individual staff members. As a way of summarising these concerns, the ‘Affective Atlas’ project formed the following problem statement, where Parks Victoria wished to: “better utilise the knowledge the organisation and its staff possessed about the locations they manage”. There are a number of implicit assumptions in this statement relating to the nature of knowledge that is either explicit or tacit. This section will discuss these assumptions, ultimately showing that the concept of knowledge in this statement is problematic. It will argue that the outcomes of this research provide a resource for Parks Victoria to use to reframe the way it approaches issues around knowledge within it – away from one where knowledge is something to be *utilised* or possessed, towards one where knowledge is something to be *practiced*.

Firstly, in the statement above, there is a distinction made between knowledge that resides within the organisation and knowledge its staff possess. This distinction is important to consider, as much for the similarities it implies as for the intended distinction. On one hand, the *organisation* is understood as being concerned with monitoring, collating, analysing and reporting a wide range of observable data about the parks they manage. Section 4.2 detailed this to some degree, highlighting that the management structure of the organisation dictates the responsibilities and priorities of certain groups of employees, where they are obliged to report on their area of expertise. What is referred to by the ‘knowledge’ the *organisation* possesses, then, is the kind of explicit, codified knowledge that is produced out of the requirement for monitoring and reporting. On the other hand, what is implied by the knowledge that *staff* possess can be seen as a kind of tacit knowledge, where staff are assumed to know valuable things about performing their job, or about the parks in which they are based that have been

obtained through their experiences in those parks. In this view, staff are seen as the holders of certain unique understandings and experiences, and there is a value attributed to those. This kind of experiential knowledge, from an organisational perspective, is valuable in that it takes time for people to come into possession of it and, to borrow a common saying, time is money. So, in each of these, the first assumption in the problem statement becomes apparent: that knowledge is something that can be codified and atomised, and can be *possessed*.

The second assumption inherent in this problem statement is related to this understanding of knowledge. When Parks Victoria talks about 'better utilisation' of the knowledge the organisation has, it is evident that they are talking about the desire for better solutions to issues surrounding the collection, collation, interrogation, and reporting of the vast amounts of data they generate. These are valid and worthy concerns, and have even been the topic of investigation of another research student within the Affective Atlas project (Elsley & Cartwright, 2011). However, this assumption on the nature of knowledge, then, highlights that issues around its 'better utilisation' are related to the capture and dissemination of these objectified bits of knowledge, where the main difference between them is where they reside (in databases, or in people), and how they have come to reside there.

This approach has been criticised as it essentially equates knowledge with science, and assumes that "knowing is trans-historical and universal" (Foth, Odendaal & Hearn, 2007, p.1). It attempts to construct knowledge that is universally and eternally true, where some aspect of a park is held still, dissected from its surrounds, examined, documented and reported on. It also aims to separate people from what they are presumed to know, where the aim is to distil experience down to its essence, to separate it from any context it came from, and to transmit that essence to other people. This account of knowledge has been labelled by Nagel (1986) as the "view from nowhere", as it fails to take into account the social, cultural, economic and political contexts within which this form of knowledge is produced. It also implies that knowledge can be *transmitted* (Ingold, 2007) from experienced staff to inexperienced staff, or from database to database, where it can eventually be graphed and mapped, documented and stored.

Critics of this account disagree with this objectified approach to knowledge, and argue that it is not an objectified truth, but a 'complex-process' (Rubin, 1988. Cited in Ingold, 2007) where the *practice* of knowledge should hold priority over the *property* of knowledge. In this view, it is not a matter of people *applying* their knowledge in

practice, but rather people knowing *by way* of their practice; knowledge is not replicated, but reproduced (ibid.). This thesis contains a number of examples of this. *A Network of Habitats* (Section 4.5) provided a description of how the regular patterns of movement and practices of staff spatialised knowledge. It recounted data from the diary study that showed new patterns of movement forming for staff, and how the enaction of those patterns produced knowledge. One diary study detailed the work of participant Derek, where he was given the task of setting up a number of pest animal traps. Throughout the week Derek laid a number of traps throughout Tidal River, returning to them regularly to check on their effectiveness. By laying the traps, and returning to them over the week, he learned about the movement of certain native animals that allowed him to adjust his trap locations. He also learned about successful baiting strategies to target pest over native animals. Indeed, it was through the practice of trapping, then, that he was able to produce new knowledge that he then incorporated back into that practice. Similarly, diary participant Dan showed that it was when practices *overlapped* that new knowledge was able to be passed on. He described a scenario where he went to a monitoring site his colleague, Jim, was setting up, where it was through the shared practice of setting up the cameras that Dan was able to learn about the practice for himself. By Jim reproducing and acting out his knowledge of remote camera sites in the presence of Dan, he did not so much transmit knowledge about this practice, but showed Dan how he could begin his own practice.

What this research has aimed to do, is to reposition the problem of 'knowledge' in park management away from one of capturing, codifying, storing and disseminating atomised facts and experiences between staff, towards one where knowledge is considered the result of various processes and interactions; it is a move away from knowledge as a *product*, towards one where knowledge is a *process*. The processes, practices and interactions that this thesis has focused on through the frame of 'space' can also be seen, then, as examining particular *ways of knowing* that occur within the organisation. Rather than choosing to focus on ways of better utilising the knowledge that it and its staff possess, this thesis proposes that it is more productive for Parks Victoria to consider the ways knowledge can be more efficiently produced. It is hoped that, rather than viewing the problem of knowledge as something to be overcome through the use of technology, Parks Victoria will begin to see technology as something that can reside within this production. It is further hoped that the *HABITAT* and Wayfarer systems provide tangible and practical examples of how this could be achieved, and that the design principles outlined in Chapter 6 provide a useful

conceptual framework for the design of alternative systems that are not outlined in this thesis, but that meet this goal.

9.2 Making Knowledge Work Visible

As an organisation whose purpose is to manage a variety of natural resources, the primary work of Parks Victoria can be classified as knowledge work (Alvesson, 2004). Staff are hired for their expertise in a certain area, and their jobs entail applying that expertise. With the understanding from the previous section that knowledge can be viewed as a *process*, and not a *product*, then the question of concern for Parks Victoria shifts away from how to better *utilise* knowledge towards how to better *allow its production*. Subsequently, the role technology may play in answering this question is not in its potential to capture, store and disseminate knowledge, but in how it might take part in this production. This section argues that the embeddable nature of ubiquitous computing technologies position them as ideal tools for making the processes of knowledge work *visible*, where the existing opaqueness of the processes of knowledge work can be overcome through technologies.

One of the main tropes of ubiquitous computing has been the notion of making computing disappear into the environment, or become invisible (Weiser, 1991). Whilst some research projects have taken this endeavour literally, and aimed to hide, shrink or render invisible all manner of technologies, others have taken a different approach – one where technology has been seen only to be invisible *in practice* (Tolmie, 2011). This has at its core the notion that technology is so embedded within our environments that it becomes mundane and routine; it is part of our daily movements, practices and interactions, but not *actually* invisible. The promise of this vision of computing has an increased potential for us to interact and perform work *through* technologies, where they become part of the mundane set of tools that are used to get things done. This vision of acting through technology is important to consider for Parks Victoria. Rather than viewing the role of technology or computing in park management as something to assist in the aggregation, storage, interrogation or dissemination of vast amounts of data, this thesis proposes that a more useful frame for Parks Victoria is to think about the ways technology can be embedded within the daily practices of staff.

The embedded nature of ubiquitous technologies means they are able to make visible the routine and 'unremarkable' aspects of work (Tolmie, 2011) – the *processes* that produce knowledge. Making these processes visible is important, as they allow

tangibility to be provided to work that is otherwise intangible. In this context, Hill (2012) talks about the need for 'new smokestacks' for the 21st Century, drawing an analogy between the iconic imagery of the industrial revolution and today's ephemeral and less tangible knowledge and service economies. His argument is that the industrial architecture of the 19th Century, such at that represented in Figure 9.1, allowed work to be made visible: where people across an industrial city could see work being done, evidenced through the smoke rising from the city's factories. Importantly, this visibility allowed the essence, identity and character of the work to form an identity around the places they were located; cities and towns became known for their industries, and their citizens identified with those industries. The nature of modern knowledge work means that much of the 'smoke' that results from it remains invisible, and as such, identities are slower in forming around this work.

Figure 9.1 – Hill (2012) argues that 'new smokestacks' are required to provide tangibility to knowledge work. This is an etching of Manchester in 1852 by Edward Goodall.
Source: http://universaldickens.wordpress.com/research-project-1/

This thesis contains a number of examples where visibility around the routine practices of different groups of staff was seen as important. The Spaces of Park Management (Section 4.2) provided an account of how different management groups in the organisation produced different ways of knowing a national park, where it was their differences in practice that produced these unique perspectives. A Space of Alterity

(Section 4.3) further showed that whilst different individuals and groups in the organisation approach park management in different ways, it was ultimately through the shared understanding of what these practices were that allowed collaboration to take place. Within this, different locations in the organisation were assumed to contain stereotypical sets of knowledge and practices, around which identities of staff in those locations were formed. Whilst this often appeared to be a source of tension, it was ultimately the recognition of the legitimacy of these identities that allowed groups and individuals to seek the expertise of an 'other'. The 'follow the thing' study described in Chapter 2, and drawn upon in the design of the HABITAT system, also showed that exposing these practices is beneficial. By taking diary entries and showing them to staff across the organisation, the value of alternate perspectives became apparent. It allowed the practices of otherwise separated staff to become known by others who would not typically come into contact with their practices. It showed that staff are involved in a wide variety of tangentially related practices under the umbrella of 'park management', and that not all of these practices are currently known.

From the research presented in this thesis, two primary benefits to framing technology as something to be embedded within the daily practices of Parks staff become apparent. Firstly, ubiquitous technologies can provide visibility to the processes that produce knowledge, and this visibility allows greater degrees of reflection on those processes. Secondly, through this visibility, they allow stronger identities to form around knowledge practices. To help a form of organisational identity to develop around these activities then, Parks Victoria should consider technologies that are embedded within the practices of staff that aim to expose those work practices – especially across disparate locations, but also within management teams. It is hoped that both *HABITAT* and Wayfarer provide examples of how this might be achieved. However, these conceptual designs are not prescriptive – it is simply hoped that their example can help the organisation reframe the role of technology in their practice, whilst remaining as provocations to reframe the definition of their 'knowledge problem'. Importantly, it is also hoped that the design principles outlined in Chapter 6 provide a means of meaningfully scoping and focusing the design of future technologies that reside within this new definition.

9.3 The Spectre of Technology

A key challenge in the introduction of new technologies within Parks Victoria is around the presumed attitudes towards it within the organisation. Given the ostensibly

technology-focused nature of this research, many of the early research activities, including informal conversations, began with participants sharing current frustrations, hopes and desires for what 'technology' could achieve for them. However, rather than referring to any particular technical solution or problem, it became apparent that 'technology' was being used as a euphemism to discuss a number of different issues and attitudes within the organisation. The final discussion in this chapter is based around addressing attitudes towards technology within the organisation. It aims to address the 'spectre' of technology, whereby the word itself is bundled with many presumed negative connotations, either about the ability of staff to adapt to 'new' technologies, or towards the apparently conservative attitudes to change within the organisation. By pointing out that these connotations are unfounded, it hopes to highlight a way forward for Parks Victoria in the introduction of future systems within the organisation.

One of the first and most obvious connotations of technology or computing within the organisation was the implied meaning of technology as 'new' or 'progressive'. This is important to consider for Parks Victoria as it positioned technology as residing in a "proximate future" (Dourish & Bell, 2011) where the frustrations and opportunities staff experience towards their work are viewed as solvable through some near-future advancement. In this, staff often expressed frustration at operating the existing systems available to them, and when told about the nature of this research, were not hesitant in making suggestions on how to improve these systems for their existing practices. Common examples of this were laments around the mundanity of manually 'piecing together' a number of technologies to achieve some work goal, such as collating images from remote sensing cameras and geo-tagging them, or about the inability to find certain documents within the organisation's shared drives in an efficient manner. Just as frequently, staff would also optimistically talk about the potential of new technology or systems to either overcome these existing concerns with current systems, or to actually completely replace or substitute such mundane practices.

In each of these perspectives, 'technology', as a category of object or practice, was positioned as something entirely new and progressive. Existing systems, technologies and their related practices were only ever discussed in the context of defining what technology *should not* be. For staff, it seemed that the promise of technology to make their work easier or more productive was not being fulfilled; indeed, there was a lack of recognition of the complexity and sophistication of these existing systems, and of their ability to adapt them for their use in tactical ways. 'Technology', then, was seen as a set of idealistic 'near future' promises, represented by new and progressive technologies or systems that solved existing frustrations with practices.

Whilst this is, on the surface, a useful positioning of technology – if it is new and progressive, then this is surely a good thing – in practice, this view of technology encouraged the separation of it from the present, lived experience of staff; that is, as something that is apart from the daily practices of park management. The consequence of this was that anything broadly technology related is positioned as outside the core part of their work, where technology is seen as something to tolerate as part of their job, such as the computer on their desk that they must interact with as a supplement to their 'real' work. This positioning of technology as new and progressive, then, encourages staff to view it as something separate to their *core practices*, to the point where they question whether they possess the aptitude to properly comprehend or deploy it. Throughout this research, participants would often preface the start of their interviews with proclamations that they were not "technology people". In fact, many even questioned the legitimacy of their participation in the research at all, and it was only once they were reassured that their competencies or attitudes towards technology were not in question that they relaxed into interviews. It became apparent that the positioning of 'technology' as akin to 'new' and 'progressive', ultimately led staff to question their own capabilities, and saw it as an alienating category of objects and practices that was ultimately not a core part of their job. It also seemed a euphemism for 'unachievable', in the sense that there was almost an exasperated resignation that the promise of any positive change through technology would not happen within the organisation.

It would be easy to attribute this to an apparent conservative mindset towards technology within Parks Victoria, the apparent bureaucracy of a government department, or even to the self-reported lack of aptitude. However, what this section aims to do is highlight that neither of these is a correct assumption. Whilst it is not the place of this chapter to make broad sweeping generalisations about the attitudes and aptitudes of individual members of staff, what this research found was that it was, in fact, this *conceptualisation* of technology as new and progressive that led staff to mostly discount their current skills and practices, and to only look for faults in existing systems. The rhetoric around technology, in particular around those considered ubiquitous, often positions it as residing in some "proximate future" (Dourish & Bell, 2011). As such, it takes the focus away from current experiences, and allows researchers and designers to forego any responsibility for existing practices, infrastructure and systems. This rhetoric is deeply seated around technology, the consequences of which regularly position those who resist change as "inept, overly conservative or just plain ignorant" (Edgerton, 2008. p.9). However, resistance is an important part of adopting

new technologies, where their relationship to existing processes and systems needs to be vetted and considered. Similarly, in choosing one technology, people are necessarily resisting other alternatives (ibid.). This research found that Parks staff are actually quite sophisticated users of all manner of technologies, and existing systems, whilst sometimes seen as overly complex, are also quite sophisticated.

When it comes to introducing new systems and technologies for its staff, it is recommended that Parks Victoria should be careful about introducing technology as something that is apart from their core work, or positioning it as a progressive source of broad-sweeping change. Addressing the 'spectre' of technology is not a matter of addressing overly conservative attitudes to technology within Parks Victoria, or an apparent lack of aptitude towards them. Instead, technical solutions or systems should be framed as building on top of existing practices and systems. When technology is framed away from meaning 'new' or 'progressive', the self-reported lack of aptitude falls away to reveal sophisticated and intelligent use of current systems. Staff are intelligent users of technology, and any resistance is borne out of a well-founded scepticism about what technologies can do for them. By bringing the focus back to the processes and practices of staff, and showing that technologies can be embedded within them, Parks Victoria can reframe the role of technology in park management away from being something separate to the work of staff, to one that can be a valuable tool in its practice.

9.4 Conclusion

This chapter has attempted to reframe the problem of knowledge management within Parks Victoria, where knowledge is viewed as a codifiable object, and technology is seen as a near-future solution to its problems. It has highlighted that knowledge is better considered a process, not a product, where technologies can be viewed not as imposed solutions to issues of capturing, storing, interrogating or disseminating knowledge, but as tools that reside in the processes that produce it. In this way, technology's potential in making visible the knowledge work that occurs across the organisation is one consideration for Parks Victoria as it makes future decisions.

In this context, the systems proposed in this thesis provide examples of how this might occur. The problems around the kinds of codifiable knowledge discussed here are of course valid and worthwhile; there is no doubt a need to automate some processes, and to build better tools that allow the interrogation of this data. However, what this thesis aims to highlight is that there is also value in building tools that expose the practices of

staff across groups and locations; that there is value in building tools that allow staff to construct their own understandings of their work or a park organically; that there is value is using technology to provide staff with a platform for expression; and that there is no inherent lack of aptitude or conservative attitude that would prevent the adoption of such technologies. In other words, there is no need to position technology as something outside of the day-to-day work of park management. This thesis hopes to provide some cause for optimism around the incorporation of technology within Parks Victoria.

10

Conclusions & Future Directions

The research undertaken for this thesis focused on reframing the relationship between space, technology and environmental understanding for ubiquitous computing. As such, the overlaps and connections between these concepts have been the defining guide for this research. This final chapter will revolve around three themes that reflect this hybridity, where the key contributions of this thesis will be outlined, and questions for future work will be proposed. First, an overview of the reframing of space for ubiquitous computing will be provided. Following this, a brief discussion on the role of the social sciences in future ubiquitous computing research is given. Third, the blurring of traditional lines of ubiquitous computing research that this thesis represents is explored. The chapter, and this thesis, concludes with a set of questions for researchers who may wish to continue investigating the pluralistic and relational nature of space in the context of ubiquitous computing, and with some comments on the relevance of this research for Parks Victoria.

10.1 Reframing Space for Ubiquitous Computing

The two constituent parts of this thesis – its ethnographic research and its design work – when taken together, ultimately contribute a reframing of space for ubiquitous computing, away from the conceptualisation of space as a singular, abstract and static *stage*, to a pluralistic, relational and dynamic *production*. The main contribution of this research, then, is in providing the theoretical foundation for this reframing, in describing these productions for a given context, and in illustrating how this reframing can inform systems design.

By showing that space is a pluralistic and dynamic *production*, not a singular and static stage, this research serves as an example of what it would mean for ubicomp to consider non-problematic notions of space and spatiality, where technologies are seen as embedded *within* spatial productions, not imposed on top of them. Drawing upon relational notions of space from cultural geography, the ethnographic research of this thesis explored various productions of space through a multi-sited empirical study of the management of a national park. The research revealed that space is not an abstract, inert container that people and objects reside in and move across, but a contingently produced multiplicity that is the *result* of these actions and interactions. Geographical regions then, such as Wilson's Promontory National Park, can be seen as a combined product of a number of spaces that themselves are produced out of overlaps, repetitions and oscillations of various networks, flows, temporalities and embodiments. The analysis of the results showed that space is *emergent*, where the processes that produce it are contingently enacted, shifted and adjusted. Also, the results show that space is *seasonal*, where its production is tied up in rhythms, cycles and scales that are prone to disruption and renewal. Rather than environmental knowledge 'residing' *in* spaces, this research has shown that it is produced *from* them.

This understanding of space as an *emergent* and *seasonal* production, was then applied to the design of two conceptual systems by first formulating six inspirations for design based on the emergence and seasonality of space. These inspirations – *pores*, *thresholds*, *anchors*, *rhythms*, *scales* and *oscillations* – aimed to make explicit and available to designers the notion of spatial productions that the ethnographic work examined, where technology is considered something embedded within the production of space, not imposed on top of it. The *HABITAT* and Wayfarer systems then showed that technology can be designed to embrace the contingent plurality of space in a way that does not problematise their nature, but becomes an active and useful participant in their production. They also serve as examples of what it would mean for technology to make space 'legible in different ways' (Dourish & Bell, 2011). Rather than positioning technology as the mediator between people and environmental understandings, *HABITAT* and Wayfarer showed that technology that is designed as *pores*, *anchors* and *thresholds* allow overlapping and competing spaces to interact with each other; that makes them legible to each other in meaningful ways, and in ways that respect their alterity. Similarly, they showed that technology designed for various *rhythms*, *scales* and *oscillations* are well positioned to respond to the unstable, diverse and dispersed productions that this research has examined.

The reframing of space has significant implications for ubiquitous computing. Ultimately, it indicates potential directions for design and research. The view of space as static, inert and abstract has limited researchers to designing systems that provide solutions to the problems posed by spatiality. By reframing the relationship between space, technology and understanding, researchers will be free to think of technology not simply as a solution to a problem, but as something that is an active participant in the productions and processes that occur around it, as *embedded* within the production of spaces. Technologies already help produce the spaces we move, work and live within; however, by making this conceptualisation of technology explicit and available to designers, they will be in a better position to consider and examine, critically, the role of their systems in spatial productions. The discussions around the *HABITAT* and Wayfarer systems, and their application of the design inspirations presented in Chapter 6, stand as examples of this.

The reframing of space for ubiquitous computing ultimately exposed the need for further research around relational notions of space. Such research could investigate what it would mean for the notion of 'embeddedness' in ubiquitous computing to move away from a focus on placing sensors, displays and interfaces within built *environments*, towards one where they are considered simultaneously embedded within various *processes* and *productions*. If technologies are seen as embedded within productions, what is it about their nature and behaviour that can influence, destabilise or transform these productions? In what ways can ethnography and design be positioned together to further make this explicit and available for design? These questions are clearly worthy of further exploration, and the need for a reframing of space as argued in this research provides a starting point for future researchers.

10.2 A Role for the Social Sciences in Ubiquitous Computing

This research was conducted during a time of increased calls for the social sciences to take a larger role in the research agenda of ubiquitous computing (Dourish & Bell, 2011; Dourish & Mainwaring, 2012). In this context, given the dialogue between theory, ethnography and design that this thesis represents, the second contribution of this thesis is in providing a tangible example of the role that the social sciences and ethnography have in ubiquitous computing research.

The founding vision of ubiquitous computing as technology that disappears into the background of everyday life (Weiser, 1991) has led to a focus on exploring and exploiting the potential of sensors, systems and users, where, as Dourish & Mainwaring (2012) note, the role of the social sciences is typically constrained to that third element. The social sciences, then, are seen as a way of exploring what people want and do (ibid.), and as such are useful insofar as they 'gather requirements' for the design of some future system (Dourish, 2006b) – as a way of narrowing down the focus of effort to particular people in particular contexts. This research serves as a point of departure from this perspective, where ethnography and the interpretative framework of cultural geography have been used to open up new directions for design, where they have been used to provide rich descriptions of numerous spatial productions, and where technology is not just framed as a solution to a problem, but as an active participant in productions of space.

Ethnography was not limited to examining 'users' to inform design in this research, but instead has provided a rich account of numerous spatial productions that do as much to open up new directions for design as to constrain it to any specific solutions. The examinations of the everyday management of the park presented in Chapter 4 did not provide a list of potential problems to solve, or a constraining set of priorities based on an existing structure of the organisation or the park. Instead, it provided a description of the ways that various spaces are produced, and inspired the notion of *emergence* that is based on the contingent and dynamic orderings of work, movement and action within Parks Victoria. Similarly, the examination of the flood recovery presented in Chapter 5 did not aim to describe a discrete set of common responses to the flood – it provided a set of examples of how these responses might *unfold,* and in doing so showed that everyday productions are prone to disruptions: that they are *seasonal.*

When taken together, Chapters 4 and 5, and the ethnographic work they represent, provide an example of how the relational and interpretative frameworks of the social sciences can provide ubicomp with a means of moving away from the use of ethnography as a tool to generate a limited set of contextualised representations to be used as systems requirements. Rather than focusing on describing what common phenomena are and how frequently they occur, the ethnographic work of this research has been used to describe how diverse experiences "are practiced and experienced" (Vannini, 2012b. p.48), and as such has focused on the gaps between these productions as much as the productions themselves. By focusing on this relationality, it provided a set of design *inspirations*, rather than implications, that are intended to open up design considerations, not constrain them. Similarly, these inspirations are intended to

provide designers with a conceptual framework for considering how their technologies reside within and influence spatial productions.

Subsequently, *HABITAT* and Wayfarer can be seen not only as solutions to problems that arose during the ethnographic work, but two potential designs derived from the inspirations. They can be seen as embodiments of the dialogue between ethnographic, design, prototyping and theoretical work of this research rather than techno-centric solutions to problems posed by spatiality. Further, these designs are not situated in some 'proximate future' (Dourish & Bell, 2011), but are grounded in the technology and practices of the present.

In its broader implications for ubiquitous computing, this research highlights that a cross-disciplinary engagement with the social sciences and ethnography can provide ubiquitous computing with a framework for critically assessing the role of embedded and embeddable technology in environmental understanding. Rather than using ethnography and the social sciences as a tool to investigate users and their contexts, to generate lists of 'requirements', it has been shown to provide a means of positioning technology within the very contexts researchers desire to study, and on grounding this research in the here and now thus providing 'acuity to the present' (Dourish & Mainwaring, 2012).

For future research in this area, this thesis proposes the following questions: If focusing on the gaps between relational spaces is shown to be fruitful, then what alternative ways for communicating this to designers could be useful? Are *inspirations* for design the most suitable way of communicating non-representational theories of space? Or is embedded research, where the designers are also involved in the ethnographic research, the best way of bridging this gap?

10.3 Blurring the Lines of Ubicomp Practice

This research also represents a blurring of the lines of typical ubicomp practice, where the neat divisions between urban and non-urban, work and non-work contexts have been shown to be not so easily distinguishable. The final contribution of this research is around this blurring: where the focus on non-representational and relational theories have highlighted that existing delineated contexts within ubiquitous computing, in terms of urban and rural, work and non-work settings, cannot be easily assumed.

Whilst on the surface this research could be seen as an example of ubiquitous computing research within a work context, overlapping with previous studies in CSCW and HCI more broadly, it is worth highlighting that it does not neatly reside within any of these existing categories of research. Whilst it does hold insight for these disciplines, its main contribution is in highlighting how the focus on multi-sited ethnography, non-representation and relationality evident throughout this research can provide these disciplines with a way of positioning themselves within broader social and cultural contexts.

First, the multi-sited ethnography presented here has provided a way of tracking the dynamics of computing as it moves out into and disperses across a multitude of contexts, locations and socialities. People move, and technologies move with them. Within Parks Victoria, the simple dichotomy between 'urban' and 'rural' is not something that is overly indicative of practice or context. Whilst locations such as the 'city' and the 'park' do play a role in the work of staff, beyond acting as a backdrop for their daily work, they allowed for only loosely connected stereotypes that provided a foundation for collaboration. Staff moved physically between locations that could be categorised as either. Importantly, they also moved between *practices* that were site-specific; despite being located in an urban office, they drew upon specific local knowledge and practices gained in rural parks. Those in the parks similarly drew upon the expertise that would typically be classified as urban: constructing monitoring protocols, and reporting observed data to management and beyond. This research, then, should not be considered as a study based in a 'rural' setting, that then moved to an 'urban' office and back again. Rather, it has shown that its focus on the relationality of space is fruitful in examining how these typically dichotomous contexts influence and respond to each other, and how they are actually inseparable.

Multi-sited ethnography also provides ubiquitous computing with a means of understanding how work and non-work contexts blur together. People do not just move between physical locations or sets of practices, they move between the spaces of their everyday lives. This research is replete with examples of people drawing upon experiences and practices developed throughout their entire lives, where contextual boundaries merged or were completely removed; staff openly commented on the influence of their childhood experiences in WPNP seeping through to their management practices to this day, where 'special places' translated into particular fondness for certain areas of the park. The flood of 22 March 2011 revealed affective connections that more aptly described the park as a home than a workplace. Indeed, some staff actually do live within the park. As technologies become increasingly

embedded within different processes and practices, the lines between the contexts of investigation become less relevant, as they become increasingly blurred in the lives of individuals. Importantly, though, when looking at space in these contexts, this research has shown that to ignore personal, affective and historical connections to a place – whether on 'work time' or not – is to ignore much of the richness of space and environmental knowing. This thesis therefore serves as an example of how a multi-sited ethnographic approach is one way of moving beyond the typical delineation that occurs around ubiquitous computing's research contexts.

As technology becomes increasingly embedded within the lives of people, their environments, and their social and cultural practices, the contexts ubiquitous computing researchers choose to study will become increasingly complex. Multi-sited ethnography provides a means of moving beyond the typically bounded contexts of this research. The research presented here has not been about comparing point A and point B in cartesian space: it has shown that every context, every *space*, is comprised of multiple competing forces that influence and are influenced by each other. Every context of study, whether considered 'rural' or 'urban', 'work' or 'domestic' is by necessity connected to these broader processes and forces, and indeed is produced by the relations and overlaps between them. To investigate what it would mean for technology to be embedded within these productions, researchers will need to continue to embrace the complexity of these contexts: to investigate not *what* these contexts are, but instead focus on *how* they are produced. This thesis has presented an example set of methodologies, conceptual frameworks and analyses that attempt to do this in a way that is productive for ubiquitous computing.

10.4 Final Reflections

When considered together, the ethnographic research and the design work presented in this thesis interact to provide an answer to the first research question: *What is the relationship between technology, space and environmental understanding, and where is this relationship heading?* The juxtaposition of literature from HCI and cultural geography presented at the beginning of this thesis provided the theoretical foundation to answer this question. It gave an account of the current construction of this relationship, where technology is positioned as a mediator to environmental understanding, where space is considered abstract, inert and ultimately problematic. It then proposed relational notions of space as an alternative conceptualisation of space, and, through two empirical, multi-sited ethnographic studies with Parks Victoria,

showed that space is pluralistic and dynamic. Rather than being seen as a problematic stage then, it showed that examining space as a *process* that is inherently meaningful, contingently produced and enacted would be worthwhile to consider for ubiquitous computing. This foundation led into a consideration of the second research question: *How can we expand this relationship, in a conceptual way, so that this relationship is useful for designers of technology?* The ethnographic work, taken in concert with the analytical framework from cultural geography, provided a practical example of how this reframing of space can be used to expand the relationship between technology, space and environmental understanding for ubiquitous computing. Chapters 4 and 5 provided rich accounts of how space and environmental understanding are produced within Parks Victoria, and how the networks, temporalities, flows and embodiments that occur in and around the park help produce them. These chapters highlighted that space can be viewed as an *emergent* and *seasonal* production, and that a geographical region, such as a park, can be viewed as the product of these processes. The *HABITAT* and Wayfarer systems then provided an example of the utility of this reframing in practice. With these two questions answered, the research then turned to addressing its third research question: *Given this expanded relationship between space, technology and environmental understanding, what are the implications for Parks Victoria and, more broadly, parks management?* The ethnographic and design work presented here was then grounded back into the practical concerns of Parks Victoria and the 'Affective Atlas' project, arguing that knowledge should be considered a practice, not a product. From this, it argued that a key gap in current technologies in the organisation is in making the processes of knowledge creation visible, and showed that systems such as *HABITAT* and Wayfarer could achieve this. Finally, it provided evidence that the organisation's relationship to technology is not what it assumes, where attitudes and aptitudes towards it should not be seen as constraining forces.

This research has not been without limitations. Whilst the questions proposed in this chapter highlight a way forward for ubiquitous computing researchers, they also point to some of the aspects of the research that remain unexplored or under-utilised. A more in-depth reflection on methodological concerns borne out of embedded research, research as prototyping, and reflective design was outside the scope of this research but would undoubtedly be a worthwhile endeavour. The questions posed around the suitability of design *inspirations* in the previous section also hint at what else could be achieved. For example, are summative explanations, whether posed as 'inspirations' or 'implications' really the best way to bridge the gap between ethnography and design? Or are the insights around embedded research, where designers *are* the researchers, an

alternative way forward? In this regard, this research could have benefited from involving other researchers, and indeed participants from Parks Victoria, in more in-depth co-designing the two systems. It could also have explored alternative ways of presenting the ethnographic work. The design work of this thesis was inspired as much by involvement in the ethnographic work as by the design inspirations, and it would be worthwhile exploring how these two aspects could be more closely associated. Vannini's (2012b) work on 'innovative ethnographies' is an inspiration here, and given the richness of the data collected throughout this research, alternative presentations of the ethnographic data as design inspirations, involving mixed-media and dynamic, location-based data, would have been interesting to explore. It is acknowledged that it may have been desirable to incorporate another park within Parks Victoria's network into the study, or to contrast the spatial productions of this work context with another organisation, or perhaps a study of a traditional urban setting. However, these ideas would have been constrained by the 'Affective Atlas' project as well as the scope of the study. Nevertheless, the opportunity to obtain deep and unfettered access to the working lives of Parks Victoria staff was not taken for granted, and the structure of the 'Affective Atlas' project provides a model for how such a beneficial research partnership can be conducted.

Ultimately, rather than viewing space and its many contexts and processes as problems waiting for technical solutions, this research has provided an account of space that is non-problematic. It has shown that technology is already embedded within these productions, and has made this position explicit and available to designers and researchers. The technologies we design do influence the way the world is perceived, understood and constructed; however, they are just one of many influences, and to ignore other influences is to unnecessarily limit the scope and potential of designs. It is hoped that this focus on spatial production will draw the gaze of future researchers away from near-future utopian scenarios to the diversity, complexity and richness of the present. Further, this study highlighted that theoretical concerns, empirical ethnographic work, design and prototyping do not necessarily have to be considered different specialties. Whilst it will always be possible to specialise in one or the other, this thesis provides an example of what can be achieved when researchers embrace the bricolage required for studying the concurrently messy and rich contexts of technologies. Embracing this contingent ordering of the world, and all its variations and diversity, can be a rewarding experience for researchers, and can lead to novel technical designs grounded in these complexities. For Parks Victoria, this research

provides an alternative means of thinking about the role of technology in the organisation.

Whilst this research was limited to the study of a single organisation, within a single geographical region, the contributions outlined here highlight that technologies can and do enter and cross the boundaries of many spaces. Technologies are necessarily embodied with world-views, biases, compromises and prioritisations. As embedded parts of the production of the spaces of everyday life, the technologies we create help define them.

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Appendix A – Application to the Research Ethics Committee

Application Number (office use)		**Approval Date** (office use)	

1 PROJECT TITLE	Geoplaced knowledge: A location based service to assist decision making in natural environments.

Section 2: Researchers

2.1 PRINCIPAL INVESTIGATOR – STAFF RESEARCH

Title	First name, family name	E-number	phone	email

2.2 OTHER INVESTIGATOR/S

Title	First name, family name	E-number	phone	email
	Add rows as required			

2.3 PRINCIPAL INVESTIGATOR – STUDENT RESEARCH DEGREE

Title	**First name, family name**	**Student number**	**phone**	**email**[1]
Mr	Chris Marmo	3215471		Chris.marmo@students.rmit.edu.au

Degree	**School**
PhD Geospatial Science (Human computer interaction)	School of Mathematics and Geospatial Science

2.4 SENIOR SUPERVISOR

Title	**First name, family name**	**E-number**	**phone**	**email**
Prof	William Cartwright			w.cartwright@rmit.edu.au

2.5 OTHER INVESTIGATOR/S

[1] Use your student email address only – not your personal email address

Title	First name, family name	E-number / Student number	phone	email
Mr	Jeremy Yuille			Jeremy.yuille@rmit.edu.au

2.6 DISCIPLINE/SCHOOL/COLLEGE: Mathematics and Geospatial Science

3. PROJECT DETAILS

3.1	**PROPOSED DURATION OF THE WHOLE RESEARCH PROJECT**	From:	September 2009	To:	September 2012
3.2	**PROPOSED DURATION FOR THE DATA COLLECTION PHASE OF THE RESEARCH PROJECT**	From:	November 2010	To:	June 2011

Please note: it is a requirement that annual / final reports of your project must be submitted and are due during December for all research projects that have been approved by the CHEAN

The necessary form can be found at:

http://www.rmit.edu.au/browse;ID=6sqqx7sd0wkp#forms

3.3 IN PLAIN ENGLISH PROVIDE AN EXECUTIVE SUMMARY OF THE RESEARCH PROJECT

See NHMRC National statement on ethical conduct in human research (2007), section 1

Briefly outline, in simple terms the scope of your research project, the project aim(s), target population(s) method and possible outcomes. (150 – 200 words)

In partnership with Parks Victoria, this research will examine the potential for mobile technology and location aware services to assist park rangers with decision making. The topic of fire management has been central to the project thus far, and it is hoped that the current project will provide insight into:

1) The types of internal and external experts involved in the management of a park.

2) The types of decisions these people make, and what information is required to make them.

3) The role that location plays in their current practices.

4) Which tools, if any, currently support their practice and which are likely to be used in the future.

5) How and what type of location-aware, decision support system may assist them in their practice.

The research will focus on understanding the sociological basis for knowledge and information sharing that currently exists; with the aim of designing a holistic service with elements of mobile and location aware technology to assist rangers in making faster and better decisions.

In order to do this, a number of methods will be employed. These are:

1) An initial focus group to discuss the types of people in a park and the knowledge they possess.

2) A diary study where volunteers record notes as they move around a park conducting their daily business.

3) One-on-one interviews to discuss findings from the diary study and evaluate a system design.

4) A final focus group with volunteers to assess the system effectiveness.

The project will include staff volunteers already associated with Parks Victoria who are, as mentioned above, a partner in the research project.

As an outcome, it is hoped a usable and relevant location-based decision assistant will be developed.

3.4 Research Aims and Significance

State the aims, research objectives, key research questions and significance of the project. Where relevant state the specific hypothesis to be tested or in the case of qualitative research state the specific topic of inquiry to be investigated. Comment on its potential to contribute to existing knowledge and why your research should proceed and an explanation of any expected benefits to the community. It is expected that reference will be made to key literature informing the research project. (*approximately* 300 – 400 words)

This research will explore the potential for a location based system to assist with the retention and dissemination of information relevant to a decision making process. Whilst specifically about fire management in a national park, it will provide broader insights into how knowledge about a location can be effectively retained and communicated.

The main research question is: “How can Parks Victoria better utilise the knowledge it and its staff have?”. Currently, valuable park specific knowledge, obtained by rangers through years of experience, is

inaccessible to other rangers and vanishes completely when rangers move on. The research project is interested in understanding the varieties of people in a park, the types of expertise they possess, and how they interact with each other to share information and learn. Once this understanding has been reached, the research will explore the potential for location-aware technology to augment this process.

This research is relevant for the following reasons:

- It will provide insights into management, display and sense-making opportunities for large amounts of user generated data. Whilst the project has a limited scope – in national parks – the findings for particular visualisation interfaces and sense-making tools will be applicable to a large number of other problem domains, where location-based data is being generated at an increasing rate by large numbers of people, particularly in a mobile context. Further, it will provide insights into the human/user-centered side of visualisation in cartography, an area that has been flagged as one of great importance for the wider cartographic field (Fabrikant & Lobben, 2009).

- It will provide insight into the role of location-based technology, interface design and visualisation in the fire management process, and will result in the development of useful tools that assist in this management. This will be particularly timely for the wider community and those responsible for fire management given Victoria's recent history of wild fires. Particularly, it will aim to provide innovative exploratory interfaces for location based data to assist in decision making processes, a key area of research in cartography known as geovisualisation (Dykes, et al., 2005).

- Location based services are becoming increasingly ubiquitous, with the increasing use of devices that are location aware. This will provide the industry with a case study that is based on a deep and real need, and is both beneficial to the wider community (through better fire management) and specific organisational interests (through better decision making tools).

3.5 Research Methodology

Provide a summary of the proposed method/s including the number of participants required. Give a justification of your proposed sample size, including details of statistical power of the sample where appropriate or, in the case of qualitative research, the number of participants anticipated to be required in order to attain data saturation. List inclusion / exclusion criteria for the sample and how these have been established. (*approximately* 100 – 150 words)

As above, the following research methods will be employed:

1) An initial focus group of unpaid volunteers to discuss the types of people in a park and the knowledge they possess. This will inform the creation of "personas", or archetypal users.

2) A volunteered diary study where rangers and park volunteers record notes and annotate pictures and video as they move around a park conducting their daily business. Particular attention will be paid to the role of location in the types of information being recorded.

3) Interviews with volunteers from the diary study to further explore the role of location in their work, centred on their self reported diary entries.

4) A focus group to evaluate the initial design of a decision support system.

5) A re-evaluation of iterated designs with a focus group of volunteers to confirm effectiveness of the system.

The research to be conducted will be largely qualitative and thus will not require a statistically powerful number of participants. Approximately 10 focus group members will be required to give sufficient insight into current practice, and conduct diary studies.

These people will be invited based on a set of personas generated from the initial workshop, with each volunteer chosen to be representative of an archetypal user. Their role in the decision making process will be considered, along with their expertise and familiarity with technology. Both technically and non-technically minded participants will be invited to give a broad cross-section of users.

3.6 What data collection technique(s) will be used? [Tick as many as apply]

Survey questionnaire (attach a copy, or if a copy can't be attached, provide details including a citation) ☐

Web-based survey (you need to complete the document "are you planning a web-based survey" available on the HREC website) ☐

Interviews or focus groups (attach a question schedule or list of topic areas) ☒

Observation of participants with their knowledge ☐

Photographs of interviewees or events with their knowledge and consent ☐

Audio-recording of interviewees or events with their knowledge and consent ☒

Video-recording of interviewees or events with their knowledge and consent ☐

Use of equipment that records biosignals from the body surface and uses an electrical supply in any form (e.g. electroencephalography, electrocardiography, feedback audiometer) ☐

Accessing student data base (IExplore or other) ☐

Other *(Please give details. Use no more than 50 words):* ☒

A recording of the participant's location in a park as they undertake data collection

3.7 Based on your responses to 3.6, detail the tasks that participants will be asked to participate in. What exactly are participants asked to do? The description should be provided in sufficient detail so as to enable a research assistant, with minimal familiarity with the research area, to explain the procedure to a

potential participant and to then enact the procedure with the participant. (*Up to 200 words)*

Focus group volunteers will first be invited to a workshop, where they will be asked to describe the kinds of decisions they make and the information they require to make them. Particular focus will be given to interactions between people and the types of knowledge being passed between them. Participants will be asked to describe a typical day; who they interact with and why. Researchers will also pay attention to the role that specific locations have in these processes.

This information will then be collected and collated and archetypal users will be generated. Volunteers will be invited to participate in a diary study, in which they take notes and provide commentary on their day to day activities as they conduct them. This will provide a check against the kinds of biases that are common in self reporting, and allow the researchers to view participants unobtrusively and "in situ".

3.8 Explain how data will be analysed (50 words)

Qualitative data will be coded, paying particular attention to differing archetypal users in a park, the types of knowledge being shared amongst these users, and the role that location has as a context to that knowledge. It is planned, therefore, that researchers will generate a coded set of user, knowledge and location types that will be used to inform the design of a location aware system.

Similarly, data collected during the diary study will inform a set of common scenarios that people in the park are regularly presented with. Narratives and media directly from participants will inform the generation of these scenarios.

Once a system has been designed, observations of users making use of the system *in situ* will be made to assess its effectiveness. This data will be used only to inform iterations of the final design.

3.9 Provide a list of the references that have been used in this application *(Up to 20 references)*

Dykes, J., MacEachren, A., & Kraak, M. (2005). *Exploring Geovisualisation*. Pergamon.

Fabrikant, S. I., and Lobben, A. (eds.) (2009). *Introduction: Cognitive Issues in Geographic Information Visualization*

4. RESEARCHERS' QUALIFICATIONS, EXPERIENCE AND SKILLS

For each of the researchers listed in section 2.1 and 2.2 list their academic qualifications and briefly outline experience and skills relevant to this project (50 words for each investigator)

Chris Marmo

Chris holds a double degree in Cognitive Science and Computer Science from La Trobe university and has worked in the industry as an interface and interaction designer, as well as a user researcher. Chris has conducted ethnographic and exploratory research for a number of commercial projects over the last 5 years.

William Cartwright

William Cartwright is Professor of Cartography and Geographical Visualization at RMIT. He has published over 300 academic papers. His major research interest is the application of integrated media to cartography and the exploration of different metaphorical approaches to the depiction of geographical information.

Jeremy Yuille

Jeremy Yuille is an interaction designer, digital media artist and academic with a background in digital art, music, performance and architecture. He has a Bachelor of Design Studies from the Architecture department of the University of Queensland and a Masters of Design from the Spatial Information Architecture Lab at RMIT University.

5. PARTICIPANT DETAILS

5.1 PARTICIPANT DATA

Identified ☐ Potentially identifiable (coded)[2] ☒ non-identifiable/anonymous[3] ☐

5.2 TARGET PARTICIPANT GROUP

Students of this University	☐	Students of one or more other universities	☐
A specific target group (please identify in section 5.3)	☐	People under 18 years (please detail in section 5.3)	☐
No special characteristics	☐	Persons on a data base that has been sourced with permission	☐
Other (*please give details – up to 50 words*):	☒		

PARKS VICTORIA (LINKAGE GRANT #LP0883291 PARTNERS)

[2] This means that you, as investigator, know who the participant is – even though when you report on your research project, the report does not use research participant names
[3] This means that you, as investigator, do not know the names (or any personal identifying features) of your research participants

5.3.1 NUMBER, AGE RANGE AND SOURCE OF PARTICIPANTS

Provide the number of participants; indicate how many groups will be used and describe the characteristics of each group. Do you have any exclusion criteria?

Approximately 10 volunteers will be required for the initial workshop and follow-up diary study. Volunteers will be invited on the recommendation of project partners at Parks Victoria.

5.3.2 Age range of your research participants

Participants will be above 18 years old.

5.3.3 Source of your research participants (i.e. what group of people do you intend to approach to participate in your research?) *(up to 50 words)*

Participants will be sourced through the partnership organisation, parks victoria.

5.4 EXPLAIN HOW YOU WILL RECRUIT YOUR PARTICIPANTS AND INVITE THEM TO PARTICIPATE

Include in your explanation the precise details of the recruitment method (e.g. direct approach, networking, advertisements/flyers, accessing a database (are you authorised), talking to a group) – up to 200 words

Project partners will be contacted and asked to arrange a workshop time. An invitation will be extended to staff at Wilson's Promontory, the study site, to attend the workshop. Project partners will then be asked to recommend participants for interviews and diary studies based on our archetypal user criteria.

5.4.1 Explain, if applicable, the steps to be taken to ensure that participation will be purely voluntary and not influenced by, for example, the teacher/student, doctor/patient, manager/subordinate relationship (where there is a dependency relationship between the researcher and participant). *up to 200 words*

In any written and verbal invitation, researchers and project partners will inform potential participants that their involvement is strictly voluntary.

5.4.2 Detail, if applicable, the steps to be taken to ensure that the conduct of the research will not interfere with the primary teaching role of the class, provision of normal clinical care or conduct of normal business. *(up to 200 words)*

Up to 2 months notice of the workshop will be given, and volunteers will have the opportunity to nominate a time that is universally considered convenient for those willing to attend. Again, due to the voluntary nature of the workshops, volunteers will have the option of not attending if unforseen work commitments arise.

5.4.3 Include any steps that may be necessary to respect the cultural sensitivities of participants. *(up to 200 words)*

5.5 WORKING WITH CHILDREN CHECK

If you specifically intend to recruit children (a person under the age of 18 years) as participants, have the relevant members of the research team completed a "Working with Children" (WWC) Check?

Yes ☐ No ☐ N/A ☒

6. RESEARCH INTO TEACHING PRACTICE

6.1 IS THIS RESEARCH PROJECT SPECIFIC TO RESEARCH INTO UNIVERSITY TEACHING PRACTICE?

Yes ☐ No ☒

(If YES, please go to 6.2. If NO, please move to section 7)

6.2 Have you sought permission to recruit students for your research from the course co-ordinator, program director (co-ordinator) or Head of School[4]?

(Please note: it is important to consider the degree of exposure of students to staff research into teaching practice activities)

Yes ☐ No ☐

6.3 Do you intend to use class time to undertake your research activities?

Yes ☐ No ☐

6.3.1 If yes, please explain why this is necessary and detail how much class time will be taken to complete research activities. *(up to 100 words)*

6.3.2 Have you received written permission from your Discipline Leader or Head of School to use class time to conduct your research activities?[5]

Yes ☐ No ☐

6.4 Do you intend to use student assessment **grades** as part of your data?

Yes ☐ No ☐

6.4.1 If yes, you must ensure that students are aware that you will access their assessment grades as part of your data. You must explicitly state, in the PLS, that student progress will NOT be affected by their participation / non-participation in your research.

Please detail the steps you have taken to ensure that students are aware that their participation / non-participation in your research will not affect their assessment scores or progress through their program of study. (up to 100 words)

6.5 Do you intend to use student assessment **tasks**, or any other forms of activity, or participation in them, as part of your data?

[4] Please note: Final approval will only be given when appropriate approvals have been provided to the CHEAN

[5] Please note: Final approval will only be given when appropriate approvals have been provided to the CHEAN

Yes ☐ No ☐

If you answer YES, you must respond to 6.5.1 and 6.5.2

6.5.1 If yes, you must ensure that students are given an opportunity to "opt-in" to the research-associated assessment task or other forms of activity or contribution. Are students given the option to opt-in to the research associated assessment task or other forms of activity or contribution?

Yes ☐ No ☐

6.5.2 If you answered YES to 6.5.1, please describe the strategy you will use to allow students to "opt in" to the research associated assessment task. Note too that this information must be included in your information sheet (plain language statement) *up to 100 words*.

6.5.3 A second strategy is that the student is given an opportunity to consent to the use of information associated with their assessment task. Are students given an opportunity to consent to the use of information associated with their assessment task?

Yes ☐ No ☐ Not applicable ☐

6.6 Do you intend to access RMIT student databases (e.g. IExplore[6], Learning Hub email system / or similar) as part of your data collection or as a method to recruit students for your research?[7]

Yes ☐ No ☐

6.6.1 Are you authorised to access the specific database for the purposes of your research project?

Yes ☐ No ☐

If you responded yes to section 6.6, you must explicitly state this in the PLS.

Does the PLS explicitly state that you have / will access RMIT student databases as part of your data collection or as a method to recruit students for your research

Yes ☐ No ☐

6.7 Do you intend to use CES data as part of your research data?

Yes ☐ No ☐

[6] Data from IExplore can only be used for legitimate purposes – and such use must be consistent with the "rights and responsibilities" for using these data. IExplore must not be used to obtain lists of cohorts of students having specific characteristics – e.g. students of a specific ethnic origin.

6.7.1 If YES, you must inform students that their information will be used for research purposes.

Does the PLS inform students that their information will be used for research purposes as well as for quality assurance purposes?[8]

Yes ☐ No ☐

6.8 Do you intend to use student Blogs / Wikis or any other interactive IT conversational tool as part of your data collection method?

Yes ☐ No ☐

6.8.1 If YES, you must use the RMIT "statement to be included on Blogs" at the front end of your IT interactive conversational tool. Have you accessed / or will access and use/d the RMIT "statement to be included on Blogs"

Yes ☐ No ☐

Please note: Students must be informed if their participation will form part of aggregated data, and advised that before any individual contribution is quoted, specific permission will be sought from them

7. INFORMATION FOR PARTICIPANTS AND INFORMED CONSENT

[7] Please note that the university does not permit the use of global emails for research purposes. This system is for the purpose of communicating official RMIT information. "MyRMIT", the student portal can be used for research purposes.

[8] Note if you are only collecting CES data you may not require a PLS – you are still required to complete this ethics application.

7.1 INFORMATION SHEET (PLAIN LANGUAGE STATEMENT)

Participants will be given an information sheet that contains all items listed in Attachment A

☒

Please attach copy of your information sheet if applicable.

7.2 CONSENT FORM

Consent form not required[9] ☐

Participants sign a consent form[10] ☒

Consent assumed if participants return a questionnaire ☐

If using a consent form, please attach copy.

8.. PRIVACY AND CONFIDENTIALITY

8.1 DATA STORAGE

Data will be stored in a secure location

Yes ☒

Where will the data be stored?[11]

[9] This means that research participants are in no way known to you (either by name or appearance); an example here is observing human activity in a public place. You are not approaching any individual

[10] If you include a signed consent form you will be collecting personal data (research participant name – you must protect this personal information by storing it securely for 5 years. You now also have an ethical issues of confidentiality – you must protect the privacy of your research participant

[11] All electronic data should *normally* be stored on University Network systems. These systems provide high levels of manageable security and data integrity, can provide secure remote access, are backed up on a regular basis and can provide Disaster Recover processes should a large scale incident occur. The use of portable devices such as CDs and memory sticks is valid for archiving, data transport where necessary and some works in progress. The authoritative copy of all current data should reside on appropriate network systems; and the principal investigator is responsible for the retention and storage of the original data pertaining to the project for a minimum period of five years.

Hard copy data must be archived at the university. Each school is responsible for ensuring that appropriate archiving facilities are available. During data collection and analysis hard copy data

Data will be stored on the password protected university network, with data also stored on a university computer that is also password protected. Analysis and synthesis of data will only occur on a secure university computer – backups will occur as per best practice and these will also be stored on university computers.

Detail security arrangements for storage of data.

Access to personal computers will be password protected and transcriptions and diary entries will be stored in a locked filing cabinet and will be destroyed five years after the completion of the research degree.

Data will be stored for 5 years after publication of research findings

Yes ☒

Only the researchers will have access to the data

Yes ☒

Data will only be used for the purposes described in the participant information sheet

Yes ☒

If any of these boxes is not checked, please explain the arrangements that will apply.

8.2 REPORTING PROJECT OUTCOMES

(a) Will the project outcomes be made public at the end of the project?

☒ YES ☐ NO

Journal articles and conference papers will be written, and findings presented at relevant local and international conferences. Similarly, findings will be disseminated amongst the project partners.

(b) How will you protect the privacy of individuals be respected in any report / publication arising from this project?

There will be no reference to individual participants personal details. Each discrete diary returned will be recorded using a coded number. The data matching these codes to participants will not be made public. Any audio recordings will be transcribed and the recordings destroyed. Transcripts will be made available to participants if requested and any information requested to be removed from

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may be stored in a place with appropriate security provisions – i.e. locked filing cabinet, locked office.

transcriptions will be done so. All transcriptions will be destroyed 5 years after completion of the research degree.

(c) Will a plain language report of the project outcomes be available to participants at the end of the project?

☒ YES ☐ NO

The set of archetypal users, knowledge types and locations will be made available to those participants with an ongoing interest in the project. All project outcomes will be made available to the partnership organization as a whole.

9. Funding and Finance

Researchers should include any source of funding (e.g. departmental, commercial, non-commercial, government)

See NHMRC National statement on ethical conduct in human research (2007), section 5.4

(a) Has this research received any research funding or is this submission being made as part of an application for research funding

Yes ☒ No ☐

This research is being supported by ARC linkage grant #LP0883291, administered by RMIT, and is conducted under the umbrella of the Design Research Institute's "Affective Atlas" project.

(b) Will the researcher receive any remuneration and/or in kind funding to perform this research?

Yes ☒ No ☐

A fortnightly stipend of $982.28 is being received by the primary researcher, from ARC Linkage grant (#LP0883291).

(c) Will participants receive any payment or expenses for participation in the research?

Yes ☐ No ☒

10. OTHER APPROVALS

Is this protocol being submitted or has it been previously submitted to another ethics committee?

Yes ☐ No ☒

Attachment A

INFORMATION SHEET (Plain Language Statement) (if applicable)

Confirm that information sheet will:

	YES	NOT APPLICABLE
1. be printed on College / University letterhead as required	☒	
2. include clear identification of the University, the School(s) involved, the project title, the principal and all other researchers (including contact details and qualifications of investigators), and the study level if it is a student research project.	☒	
3. state the aims of the research project	☒	
4. advise that the project has received clearance from the HREC	☒	
5. advise why the participant has been approached (random, sampling method, specific target group, whether their contact details have been obtained from another source and who provided permission for this)	☒	
6. provide details of what will be required of participants (e.g., involvement in interviews, completion of questionnaire, audio/video-taping of events), and estimated time commitment	☒	
7. any risks/benefits to participants involved	☒	
8. state that involvement in the project is voluntary and that participants are free to withdraw consent at any time, and to withdraw any unprocessed data previously supplied	☒	
9. include a clear statement that involvement in the project will not affect ongoing assessment/grades/treatment	☐	☒
10. provide advice about what will happen to the information provided including arrangements to be made to protect confidentiality of data and secure storage of data	☒	
11. provide advice as to whether or not data is to be destroyed after a minimum period	☒	
12. state how privacy of the individual will be protected in any publication of the information (i.e. protecting the anonymity of participants)	☒	
13. provide advice regarding inherent risks associated with participation in research that uses web-based surveys	☐	☒

14. provide in the footer, the project HREC number, date and version of the information sheet ☒

15. provide advice that if participants have any complaints about the conduct of this research project that they can contact the Executive Officer, RMIT Human Research Ethics Committee, see http://www.rmit.edu.au/rd/hrec_complaints ☒