How Bicycle Maps and Trip Planners Can Represent Experience

by

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B.Sc., Washington State University, 2000

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Abstract

People who take utilitarian trips by bike – e.g., cycling to work, or to visit friends – do so because it’s fun. They choose pleasant and enjoyable routes. But existing bike trip planners neglect experience; it’s hard to know how enjoyable their suggested routes will be. By describing fun and enjoyment (or the lack thereof), an experiential trip planner could increase rates of cycling and improve cyclists’ quality of experience.

In this thesis, I address the design of experiential trip planners: what they should communicate about experience and how to communicate it. My work has three major parts: (1) a framework describing the aspects of cycling experience; (2) a design exploration, culminating in prototype trip planners which try two different strategies of conveying experience; and (3) a qualitative study, to better understand the needs that an experiential trip planner can fill, and to evaluate the prototypes’ strategies for conveying experience.

Keywords: Bicycles; cartography; interaction design; experience
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1. Introduction

“Most maps are entirely about doing a job,” wrote Ira Glass, producer and host of This American Life, a radio show. “They are dull salaried who clock in early and spend their days telling you where stuff is with unrelenting precision. They never vary an inch from their appointed rounds” (2010, p. 6).

Most maps, but not all. Denis Wood created evocative, expressive maps in his book Everything Sings: Maps for a narrative atlas (2010a). In contrast to the maps Glass described (in the introduction to Everything Sings), Wood’s maps are playful and curious. Each map shows one slice of life in Wood’s neighbourhood, such as the colours of the autumn leaves or the route of the mail carrier. Together, they show “what it is to live in the neighbourhood” (Wood, interviewed in Glass, 1998). Wood’s maps “breathe with human life” (Glass, 2010, p. 7).

This idea – that maps can convey life as it is lived, felt, and experienced – is at the root of a new approach to promoting cycling as urban transportation. Many people who use bikes to get around do so because they enjoy cycling; it’s fun (Aldred, 2010; Jeff Smith, 2007; Taylor, Kingham, & Koorey, 2009). When choosing a route to take, cyclists consider how enjoyable the route will be. And since cyclists use bike maps to plan their routes, shouldn’t bike maps convey the experience of the routes?

Conventional bike maps, as well as interactive trip planning tools for cyclists, neglect experience. They are Glass’ dull salaried, describing the trip with precision but not passion. Google Maps, for example, has a tool for planning bicycle trips that presents a few alternative routes; it is easy to compare alternatives by distance, but not by fun. Will you stop a lot? Can your mind wander? What will the scenery be like? Similarly, a printed cycling map of Vancouver, Canada, where I live, (TransLink, 2010) warns of unpleasant experiences: troublesome intersections and steep hills. Yet it is silent about the enjoyable aspects of the trip. I propose creating experiential bicycle maps that celebrate the enjoyable aspects of a trip, in addition to providing sober warnings about aspects which are unpleasant or dangerous.

In this thesis, I address the design considerations of experiential cycling trip planners: what they should communicate about experience and how to communicate it. My work has three major parts: (1) a framework describing the aspects of cycling experience; (2) a design exploration, culminating in prototype trip planners which try two different strategies of conveying experience; and (3) a qualitative study, to better understand the needs that an experiential trip planner can fill, and to evaluate the prototypes’ strategies for conveying experience.

Wood is not the only person to convey a sense of place through maps. Other works are collected or discussed by Katharine Harmon (2009), Margaret W. Pearce (2008), and Rebecca Solnit (2010).
1.1. Why experiential cycling maps

Experiential cycling maps can support two goals: a public benefit of increasing cycling levels, and a personal benefit of improved quality of experience.

Many North American cities have policy goals to increase rates of cycling as a form of transportation (e.g. Boyd, 2009; Wisniewski, 2011). Supporting lasting behavioural change – switching from driving to cycling – requires both logical and emotional persuasion (Heath & Heath, 2010). It is not enough for the mind to desire change, the heart must want it, too. Experiential cycling maps can compliment other, logically persuasive, cycling promotion strategies by providing emotional persuasion. Helping people have more fun while cycling will help them stick with cycling.

Because of this policy goal, my work focuses on urban, utilitarian cycling. That is, trips made in cities with the purpose of reaching a destination. Cycling to work, to the market, to the movies, or to visit a friend are all utilitarian trips, since the reason for cycling is reaching a destination. In contrast, purely recreational trips are motivated by cycling for the sake of cycling – perhaps for exercise, or to take in the countryside scenery. This definition of utilitarian is common in urban planning circles (e.g., Dill & Voros, 2007, p. 12).

The second benefit of experiential cycling maps is an improved quality of experience for the cyclist. Utilitarian cycling can transform mundane transportation into a pleasurable experience, and this pleasure is meaningful to cyclists. Helping cyclists have more better cycling experiences, through more informed route choice, is a worthwhile end unto itself.

1.2. Research questions

In this work, I address three major questions:

1. **What makes up the experience of cycling?** In order to represent the experience of cycling, I need to understand what, exactly, is being represented. I address this by categorizing aspects of cycling experience into a framework (Chapter 3).

2. **How can cycling experience be represented in a map?** And, as a sub-question, how cartographic representations can combine with other media (text and images) to convey experience. I address this through a review of prior maps (Chapter 4 and Chapter 5), then by designing new experiential bike maps (Chapter 6 and Chapter 7) and in a user study where cyclists used the new maps (Chapter 9).

3. **What makes an experiential trip planner valuable?** That is, what information is important to convey and what benefits come from having that information. I address this in the user study results (Chapter 9), by developing an information hierarchy, and describing...
what participants found valuable. And in Chapter 10 I discuss additional uses for an experiential trip planner.

1.3. Outline of the thesis

My thesis is organized into the following themes (Figure 1 on page 4):

- **Frameworks and theories:** In Chapter 2, I review existing theories about the nature of experience. These are general theories that do not specifically apply to cycling. Then in Chapter 3, I develop a framework that categorizes aspects of the experience of cycling. My sources for the framework are existing works about cycling experience, across a breadth of domains, which I supplement with my own interviews with cyclists. Throughout the thesis, I use the framework and theories as lenses.

- **Review of prior maps:** In Chapter 4, I look at how bike maps represent experience. Or, rather, how they generally do not represent experience, although a few bike maps do. Then in Chapter 5, I review non-bicycle maps that are designed to convey experience. These maps provide design inspiration for my experiential bike maps.

- **Designing new maps:** Chapter 6 discusses a printed atlas of experiential bike maps, which I created to try new approaches for representing cycling experience in maps. Many of the concepts from the atlas are refined in Chapter 7; there, I present prototypes of interactive experiential trip planners, and the design considerations behind the prototypes.

- **User study:** The prototypes from Chapter 7 were the research instrument in my user study, where cyclists planned trips using the prototypes. In Chapter 8, I describe the study design; in Chapter 9, I present the study results.

- **Discussion:** In Chapter 10, I reflect back on the frameworks, the existing maps, the prototypes, and the user study results to discuss (1) how an experiential trip planner can represent the experience of cycling, and also (2) what an experiential trip can be for — what this kind of tool can help cyclists do.
Figure 1. Organization of thesis chapters
2. Useful theories about experience

In this chapter, I introduce several theories that informed my thinking about the experience of cycling.

- Place theory is useful for considering how the experience of cycling is influenced by the locations the cyclist travels to: the things that are physically present, and the social conditions there.

- Cycling can be a challenging activity; the challenge-skill balance describes how the challenges of cycling, and the cyclist’s ability to overcome those challenges, affect the experience of a trip.

- Cycling can also be a meaningful activity; cyclists talk about the personal and emotional significance of cycling in their lives. Aesthetic experience is a framework for understanding how prosaic, everyday experiences can become meaningful.

- The notion of unfinalizability helps to consider the ways in which a bike trip can be open to several possible futures and outcomes.

- Finally, narrative has long been used as a means of representing experiences. Narrative provides tools that maps can use to convey experience.

2.1. Place

The experiential maps in this thesis describe experiences that are situated in specific locations; they describe how the locations along the ride affect the experience of the ride. Place theory, from human geography, addresses that interplay between location and experience. It is concerned with how spaces become meaningful through lived experience (with an emphasis on social practices). Place is a means of understanding “the ways in which we inhabit and experience the world” (Cresswell, 2009, p. 172).

There are three components to place, originally articulated by John Agnew (Cresswell, 2004, p. 7).

- Location is the where of a place, its spatial position. It separates here from there (Cresswell, 2004, p. 7). Related to location is the size and scale of a place. A place can be large: a whole city, a neighbourhood, a bike route. A place can also be small: a flower garden, or a corner market. What matters for place is that the location be meaningful (Cresswell, 2009, p. 170).

- Locale is the “material settings for social relations - the actual shape of a place where people conduct their lives. . .” (Cresswell, 2004, p. 7). It includes both “the visible and tangible aspects of a place” (Cresswell, 2009, p. 169);
that is, locale is both the contents of a place and also the aesthetics of those contents.

- Sense of place encompasses “the more nebulous meanings associated with a place: the feelings and emotions a place evokes” (Cresswell, 2009, p. 169). Cresswell expands on this, writing that:

Meanings can be very personal and connected to individuals and their personal biographies – places where we fell in love, or where loved ones are buried, or where we went to school. But meanings are also shared and, in some important ways, social. The Twin Towers of the World Trade Center in New York for instance had many shared meanings as they projected American power, the importance of capitalism, phallic masculinity, and so on. (2009, p. 169)

Place theory also addresses how different places have different socially-acceptable behaviours. For example, slowly riding two abreast and chatting is acceptable on a recreational trail. The same behaviour, performed on a busy bike route leading downtown on a Monday morning, would be aggravating to the cyclists rushing to work. Activities that transgress against socially-acceptable uses are called out-of-place; non-transgressing activities are called in-place (Cresswell, 2004, pp. 102–103).

Before using place theory to examine cycling, there is a theoretical hurdle to clear: Many geographers have argued that traveling is antithetical to forming a sense of place (Cresswell, 2004, p. 74). A few, however, take the position that intra-urban travel can be compatible with place-making (Jensen, 2009; Spinney, 2007). Ole Jensen’s argument is theoretical; Justin Spinney’s is empirical. Spinney presents ethnographic data describing the ways cyclists form meaningful connections to the places they ride through. He argues that since cycling is highly physical and cyclists are sensorily engaged with the surroundings, cyclists experience senses of place in the locations they ride through.

### 2.2. The challenge-skill balance

The level of challenge in cycling shapes the experience. As in any activity, the “balance between perceived ability and task demand” (Boniface, 2000, p. 60) colors the emotions of the experience. The most well-known introduction to the challenge-skill balance is in Mihaly Csikszentmihalyi’s book *Flow* (2008, p. 74), where he describes how challenge and skill result in two emotions: anxiety and boredom. When challenge exceeds skill, anxiety results; when skill exceeds challenge, boredom results. In further work, Csikszentmihalyi refined his challenge-skill balance model to include eight different emotions (Figure 2). Csikszentmihalyi calls these the eight channels (Boniface, 2000). This model distinguishes, for example, between boredom and relaxation; between anxiety and arousal.
Building on Csikszentmihalyi’s challenge-skill balance, Peter Martin and Simon Priest developed the adventure experience paradigm as a way of describing the balance between risk and competence in adventure recreation (such as white water canoeing). Priest (1990) describes how disappointment can result from inappropriately estimating the risk and competence. Novices often under-estimate their competence and overstate the risk, resulting in unsatisfactory experiences where they are not fully challenged (Figure 3). Meanwhile, “arrogant and fearless people underperceive the risk (this is going to be a breeze) and overperceive their competence (I can do this the best). . . . A condition like devastation and disaster may result [Figure 4]” (1990, p. 159). In contrast, when an adventurer correctly perceives her skill, and the challenge facing her, she has peak experience: the most rewarding experience possible given her skill level (Figure 5).

Although urban cycling is not traditionally considered an adventure sport, the lesson of the adventure experience paradigm applies. Describing the experience of cycling requires conveying a realistic sense of the challenge or risk that the cyclist can gauge against her own skill level. Furthermore, risk in urban cycling extends beyond the risk of bodily harm. Priest defines risk as “the potential to lose something of value” (1990, p. 157). The thing lost may be time, as a result of getting lost or cycling slowly. A cyclist may also risk losing his self-image, by appearing to look foolish, unfit, or strange (I discuss this further in Section 3.3.2).
Figure 3. Under-perceiving risk and competence leads to a less-satisfying experience
*Figure adapted from Priest (1990, p. 159).*

Figure 4. Over-perceiving risk and competence can lead to devastation and disaster
*Figure adapted from Priest (1990, p. 159).*
2.3. Aesthetic experience

In their book *Technology as Experience*, John McCarthy and Peter Wright explore analytical tools to “view interactive technology in general as an experience” (2004, p. 12). They come from a human-computer interaction background, and feel that HCI lacks tools to understand the felt experience of the interaction with technology. To develop such tools, they build on pragmatist philosophies of Mikhail Bakhtin and John Dewey. Their starting point is Dewey’s concept of the aesthetic experience, “refined forms of everyday, prosaic experience in which the relationship between the person (or people) and the object of experience is particularly satisfying and creative” (2004, p. 18). Aesthetic experience can describe meaningful experiences with the everyday, the mundane, not just experience with fine art.

So why is a theory developed for HCI appropriate for analyzing the experience of cycling? There are two reasons. First, the theory of aesthetic experience is defined in a way that doesn’t limit itself to human-computer experiences. The foundation of McCarthy and Wright’s work comes from Bakhtin and Dewey, who wrote about experience in

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1 Note that in aesthetic experience, in contrast with analytical aesthetics, the emphasis is on the experience, not on the formal properties of the object of experience” (McCarthy & Wright, 2004, p. 18)
general, without a digital focus (since their work pre-dates digital computers). Even McCarthy and Wright use many non-digital examples when explicating their theory. Second, a desire for aesthetic experiences forms a motivation for cycling. Cyclists talk about how traveling by bike lets them form meaningful connections to their surroundings, and how they experience joy while biking. These are kinds of aesthetic experiences. Therefore, it makes sense for an experiential cycling map to communicate the kinds of aesthetic experiences that may arise. To be clear, not all cycling is an aesthetic experience. It can certainly be prosaic – sometimes a ride is just about getting from A to B. But highlighting the ways in which cycling can become an aesthetic experience is within the aims of this project.

McCarthy and Wright identify four threads of aesthetic experience in the pragmatist literature. These threads should not be seen “as fundamental elements [of experience], but as a pragmatic tool for thinking about experience” (2004, p. 103). They help analyze the way that events and surroundings are processed through personal “values, needs, desires and goals” (2004, p. 85) to shape experience. The four threads of experience are the sensual, emotional, compositional, and spatio-temporal threads.

The sensual thread deals with the way the experience engages the senses: “the concrete, palpable, and visceral character of experience” (2004, p. 80). This thread overlaps with the aesthetic aspects of locale from place theory. Both are concerned with how visual appearance shapes experience. The sensual thread is not limited to visual senses – sounds, smells, touch, and embodied experience are all included.

The emotional thread addresses how the things, people, and events of an experience combine with the person’s “values, needs, desires, and goals” (2004, p. 85) to engender an emotional response. Emotions are situated within an activity; they “do not exist separate from the person, the situation, or the feelings of the person toward the situation” (p. 83). The situated way of looking at emotions lets us think of the emotion of cycling as being far richer than free-floating concepts like anger, worry, fun, or happiness. A cyclist is not simply worried, she is worried about something: biking with cars, crime (San Francisco Municipal Transportation Agency, 2008), being hassled by the cops (Weigand & Graves, 2010), how cycling will limit her ability to carry out her role as a mother (Dickinson, Kingham, Copsey, & Hougie, 2003), or many other factors.

The compositional thread is the “relationship between the parts and whole of an experience” (McCarthy & Wright, 2004, p. 87). In a narrow sense, it addresses how the parts form a coherent whole that helps move towards closure. In a broader sense, the compositional thread addresses how this experience fits in with the other things going on in the person’s life, and the person’s sense of self. That is, “the way in which person and event relate to each other” (McCarthy & Wright, 2004, p. 87). The sense of self colours the experience, and the experience colours the sense of self:

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2 I discuss this more in Section 3.3.
One of the most impressive features of making sense of experience is the always-emerging self that it evokes for us. In the process of making sense of our experience, we get a sense of part of who we are. (McCarthy & Wright, 2004, p. 122)

The spatio-temporal thread addresses the way the experience shapes the senses of space and time. “Time may speed up or slow down, pace may increase or decrease, spaces may open up or close down” (2004, p. 91). Additionally, the spatial-temporal context of an activity shapes the experience of the activity.

2.4. Unfinalizability

Where place theory describes how experience is shaped by externalities – physical and social contexts – aesthetic experience also addresses a person’s internal state. This presents a problem for experiential mapping. On one hand, fully conveying a sense of experience involves conveying these internal characteristics. On the other hand, since internal characteristics are personal and fluid, they are difficult to represent within the context of a map. There is a tension between these two forces: interpreting the experience and closing off possibilities versus avoiding interpretation and conveying experience less fully. Should an experiential trip planner declare the warehouse district to be unpleasant, representing one cyclist’s internal state? Or should it stay neutral, accommodating the cyclist who finds it sunny with interesting buildings?

Bakhtin advocated for conceiving of experience as having potential for multiple potential futures, and being open to interpretation in many ways. He called this viewpoint unfinalizability (McCarthy & Wright, 2004, p. 69). Unfinalizability is a useful property for an experiential trip planner to have. Not only is the cyclist’s interpretation of the ride variable, the events of the ride itself are variable since the trip represented by the planner is a potential future. Maybe, on the day of the ride, it will rain. Maybe an unfriendly driver will shout at you. Maybe a friendly cyclist will say hello. Maybe you will marry him, someday.

The creators of Cyclopath3, a trip planner that incorporates user-submitted numerical ratings and comments, found cyclists to be sceptical of trip planners that interpret the world differently than they do. In a user study, Priedhorsky et al. found that “cyclists do not agree on which quality factors should be considered [when recommending a route] and what their relative importance should be. . . . [Study participants expressed] either a general concern that their own notion of what made for a good byway might differ or else that they had actually encountered ratings they disagreed with” (2007, p. 96). Priedhorsky et al. are discussing rating systems instead

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3 I will discuss Cyclopath in more detail in Section 4.2.
of rich descriptions, but the underlying concern applies here: the interpretation of an experience is personal and contested.

2.5. Narrative

The theories I discussed previously in this chapter are about framing the nature of experience. Narrative, however, is a way of describing experience. In later chapters, I will use the lens of narrative to examine existing experiential maps and to inform the design of my own maps.

Narrative techniques provide one way of describing the experience of cycling. Narrative is “an important medium for putting our experiences into circulation” (2004, p. 119). It also ties in with place, and how place shapes experience: “Place and narrative are also mutually constituted. Narrative produces place, and place in turn fosters and produces narrative (Tuan 1991)” (Pearce, 2008, p. 21). So narrative is a toolkit for describing experience (however it is not the only toolkit).

For an experiential cycling map, I am particularly interested in narratives of travel to places; what Henry Jenkins calls spatial stories, “which often take the form of hero’s odysseys, quest myths, or travel narratives” (2004, p. 122). This is in contrast with other forms of stories, such as “the internal dialogue of Proust’s Remembrance of Things Past” (2004, p. 120). In spatial stories, “in many cases the characters – our guides through these richly developed worlds – are stripped down to the bare bones, description displaces exposition, and plots fragment into a series of episodes and encounters” (2004, p. 122).

The story of a cycling trip fits Jenkins’ description of a travel narrative. First, it contains a series of encounters with different environmental conditions: crossing a busy street, which is followed by a downhill, etc. Second, the protagonist, the cyclist, is very under-developed as a character since she is unknown. The experiential cycling map does not know the cyclist to whom routes are being presented. Finally, since maps are depictions of space, they are a sensible medium for spatial storytelling.

Spatial stories are often about the character’s reaction to new places. The nature of that place (i.e., the cause) leads the character to perform actions or undergo emotional changes (i.e., the effect). This kind of cause-and-effect connection is a fundamental part of narrative. Indeed, one definition of narrative is “a chain of events in a cause-and-effect relationship occurring in time and space” (Bordwell & Thompson, 2010, p. 79).

To understand how cause-and-effect can help convey experience, consider the following two descriptions of the same trip. One includes the affective effects of place, the other does not.

1. To start, you’ll cross a busy street at an intersection with no traffic
light; it’s super-frustrating and you’ll feel like you don’t belong. But once you get past that, you’re in a pretty residential neighbourhood. Let go of the stress from the intersection while you relax and check out the gardens. Just before the end of the trip, you’ll dash through an unfriendly industrial district; be careful not to run over the broken glass.

2. To start, you’ll cross a busy street at an intersection with no traffic light. But once you get past that, you’re in a residential neighbourhood; many homes have gardens. Just before the end of the trip, you’ll go through an industrial district; watch for broken glass on the road.

Including both cause (what is in the world; the locale) and effect (the cyclist’s reaction to it; the sense of place) in description (1) makes it a more evocative description, but also a more finalized description. It closes off the possibility of finding the residential neighbourhood monotonous, or of seeing beauty in the industrial area. There is a tension between adding enough effect, enough affect, to effectively convey experience and keeping the possibility of the experience unfinalized.
3. A framework for cycling experience

To make a map that describes the experience of cycling requires an understanding of what that experience is, and the factors that influence that experience. The theories about experience in the previous chapter, while helpful, do not specifically address urban, utilitarian cycling. Therefore, I created a framework that places the experiences of cycling into four categories. I gathered most of the content for the framework by reviewing existing literature about cycling experience; I also conducted a few interviews with cyclists.

The categories in the framework are: (a) the cyclist’s relationship to cars and drivers; (b) the surroundings; (c) exertion, rest, and recovery; and (d) movement and awareness. These categories are a tool for analysis, and for establishing breadth. Each category represents a major aspect of experience. Completely representing experience requires describing all the categories.

These categories are not necessarily the categories that cyclists would use when describing their experiences. For example, many cyclists bring up safety when describing their cycling experiences. This framework identifies several kinds of safety, across several categories – such as collisions with cars, falling from the bike, and crime – because it is helpful to keep in mind the wide range of experiences. But a communication with cyclists could easily describe all those factors under the topic of safety.

Likewise, a particular physical thing may cause experiences in several categories. Broken glass on the road (part of the street conditions) causes the cyclist to move around it (movement and awareness). Blackberry bushes (surroundings) can be an opportunity to stop and eat (exertion, rest, and recovery), but when the thorns grow onto the roadway, they become a roadside hazard (street conditions; movement and awareness).

For the literature review, which makes up the bulk of the framework, I examined works from a variety of sources and traditions. Many works partially describe the experience of cycling, by examining an aspect of experience through one lens. For example, Justin Spinney (2007) used ethnography to investigate cycling as an embodied experience, and Shawn Granton (2007) wrote a personal journal describing one particular trip. Since no single type of source addresses the breadth of cycling experience, I drew on varied sources, including academic research, professional reports, and personal accounts.

Conducing my own interviews was useful for getting initial insights into the factors that make up cycling experience. However, the existing literature addresses cycling experience with more breadth and creativity than I could achieve on my own. Therefore, my framework draws mostly on the literature and is supplemented by my interviews.
I provide the framework with these caveats:

- It focuses on urban, utilitarian cycling. It does not describe the many kinds of recreational cycling.

- It identifies factors that shape the experience of cycling, but it does not fully identify the varied ways in which people react to those factors.

- It is not representative of all cyclists. Most of my sources describe adults without disabilities who live in the United States, Canada, or England. Many studies do not describe the composition of their participants in terms of race, ethnicity, or socioeconomic class; marginalized groups are probably underrepresented.

### 3.1. Interviews with cyclists

Near the beginning of my thesis work, I conducted two kinds of interviews with cyclists: opportunistic interviews and a focus group bike ride. These early interviews led to an early version of this framework, which inspired the literature review to develop the framework further. Towards the end of my work, after developing this framework, I conducted a user study where participants used prototypes of experiential trip planners. After that study, I refined this framework slightly.

The opportunistic interviews were unstructured and semi-structured discussions with cyclists about their experiences. The interviewees were six people I met in Vancouver, B.C., Seattle, Wash., and Portland, Ore., through my involvement in the cycling community. Their backgrounds ranged from occasional cyclists to daily bike commuters. These interviewees were not compensated. In the interviews, we discussed what factors influence the experience of cycling. For most interviewees, this was an unstructured discussion where I let the interviewees describe the topics they wanted to. With two interviewees, I conducted semi-structured interviews, giving them prompts about topics like variety in bike routes, smells and tactile feelings, or how they use bike maps.

In the focus group bike ride, the participants (n = 2) and I took a 10 km (6 mile) ride through Portland, Ore. We stopped to discuss the experiences on the ride, and prior cycling experiences. As a take-home activity, participants were given postcards with prompts such as “I had an enjoyable ride, let me tell you about it” or “I rode somewhere new. Here’s what I saw (or did).” Participants wrote about their cycling experiences on the postcards. I recruited participants by listing the ride on the calendar for Pedalpalooza (http://pedalpalooza.org), an annual festival of community-organized bike rides. I compensated participants with a picnic dinner at the end of the ride.

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1 The number of participants is small because one session was rained out, and the other had many no-shows.
I analyzed the opportunistic interviews and focus group transcripts, along with the literature, in an affinitization activity. I wrote summaries, quotations, and topics onto Post-It notes. I labeled the notes with interviewee names or references to sources, so that I could go back and see the original context. Then I grouped the post-it notes on the walls of my workspace. This was an ongoing, iterative process.

After completing the affinitization and developing the framework, I conducted a study using prototypes of experiential trip planners. In that study, participants described their cycling experiences and the factors that shape their experiences. For the complete design of that study, see Chapter 8.

This chapter describes the revised framework, tweaked to reflect findings of the user study. These changes are relatively minor.

Before the user study, what is now the street conditions category had been the relationship to cars and drivers, a category that only included the physical and behavioural relationship to cars (Section 3.2.1) and cycling being in-place (Section 3.2.2). Other street conditions – such as potholes, debris, construction – were part of the surroundings, as were pedestrians and other off-street path conditions. The bounds between the categories of surroundings and relationship to cars was fuzzy.

After the study, I expanded the discussion of other street conditions (Section 3.2.3) and off-street path conditions (Section 3.2.4), placing them into the street conditions category. The boundary between street conditions and surroundings is clearer: surroundings start at the curb.

3.2. Street conditions

The experience of cycling is greatly affected by the physical and behavioural relationship to motor vehicles and drivers, the degree to which cycling is an in-place activity, and other things on the street. Off-street paths, being separate from cars, have a distinct set of experiential factors.

3.2.1. Relationship to cars and drivers

The cyclist’s relationship to cars and drivers is partly physical, dealing with the type of bicycle facilities, other types of infrastructure, and the geometry of the road. It is also behavioural, affected by the cyclist’s and driver’s awareness of and reactions to each other.

Many cyclists prefer to ride away from motor vehicles, and will go out of their way to avoid automobile traffic (Dill & Gliebe, 2008; Larsen & El-Geneidy, 2011). For some,

2 Although Dill and Gliebe observed that this effect diminishes when the cyclists are travelling to work or school and are, presumably, in a hurry to arrive on time.
this is motivated by wanting to avoid the noise and odour of cars (Winters & Cooper, 2008). However, safety and the desire to avoid a collision are bigger motivators.

Feeling unsafe is a powerful emotion in cyclists. Dave Horton reports on a study in the UK that found “47 per cent of adults ‘strongly agree that “the idea of cycling on busy roads frightens me”’ (UK Department for Transport, 2007, p. 2)” (Horton, 2007, p. 133). Near misses and disrespectful behaviour by drivers can be greatly upsetting. Kevin Shankwiler asked bike commuters to describe zones that make them feel uncomfortable. Many answers dealt with the threat that cars pose, such as “cars speeding past,” “not respected,” “invisible,” “cars [are] too close,” and “crap, a car is going to run me over” (2006, p. 35).

Because of the fears that cars instil in cyclists, the experience of cycling is shaped by cars. Hunt and Abraham report, in a literature review, that many studies have found cyclists’ route choice to be affected by “motor vehicle speeds and driver behaviour, [as well as by the] volume or mix of motor vehicle types, including proportion of trucks” (2006, p. 455). Buses, too, can influence the experience of cycling. In a video ethnography, one of Aaron Dolan’s participants said, “You’ve always go to gauge buses ahead of time. And down here [in the city centre], you’re always playing a game with buses. But obviously . . . buses can kill you, so you’ve got to be careful” (2012a, 9:15).

Physically separating cars and bicycles is a way of increasing safety and improving the experience for cyclists. Therefore, many cities are building bikeways with such separation. These tend to be popular (Monsere, McNeil, & Dill, 2011; Portland Bureau of Transportation, 2010), and some studies have shown they improve safety (Pucher, Dill, & Handy, 2010). For example, bike boulevards are low-traffic streets with amenities for cyclists, such as bike-activated traffic signals. Cycletracks are another kind of separated bikeway (Figure 6); these are wide bike lanes, often on busy streets, with a physical barrier between the bicycle and automotive lanes (Pucher & Buehler, 2011, p. 36).
However, it is not practical for cyclists and motorists to be completely separated at all times; when they interact, the experience is shaped by both parties’ behaviour. A common truism among cycling advocates is that “bicycling is safer when awareness and visibility of road users is enhanced and movements are well defined and universally understood” (Geller, 2007). I will now consider how awareness and understanding affect experience.

Awareness refers to drivers expecting cyclists to be on the road. This can happen through repetition; when a road is routinely used by many cyclists, drivers expect the cyclists to be there. Jacobsen found that “the likelihood that a given person walking or bicycling will be struck by a motorist varies inversely with the amount of walking or bicycling” (2003, p. 205). That is, increases in cycling lead to decreases in collisions. “The behaviour of motorists controls the likelihood of collisions with people walking and bicycling. It appears that motorists adjust their behaviour in the presence of people walking and bicycling” (Jacobsen, 2003, p. 205). However, in a discussion about the experience of cycling, it is important to distinguish between perceived and actual safety. Even if increased levels of cycling increases actual safety, it does not necessarily make an individual cyclist feel safer around cars.

Awareness of cyclists can also be enhanced through signs and roadway markers. For example, shared roadway markers (colloquially known as sharrows3) are pavement markings on roads that otherwise have little indication that they are bike routes (Figure 7). They remind drivers that they may encounter cyclists, validate the presence of cyclists on that road, and have been shown to cause drivers to leave more space when passing bicycles (Alta Planning + Design, 2004).

Universally-understood movements refer to the ability of cyclists and motorists to communicate with each other, behave according to shared norms, and predict each others movements. Unfortunately, there are many reasons why communications can be muddled, and behaviour unpredictable. Miscommunications can be as simple as a driver not understanding a cyclist’s hand signal to indicate a turn, or the cyclist not knowing how to make those hand signals (Weigand & Graves, 2010). Right-hook collisions are a more ambiguous situation; these collisions occur when a motor vehicle turns right, across a bicycle lane, and collides with a cyclist traveling straight4. In some cases, such as when the cyclist and driver had both stopped for a traffic signal, both the cyclist and motorist have the legal right of way (e.g. Klein, 2008; Ruiz, 2008). Due to ambiguous behavioural norms, a cyclist can be killed through no wrongdoing by either party.

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3 The name is “a combination of ‘shared (lane)’ and ‘arrow’” (Angelico, 2011).
4 In countries that drive on the left-hand side of the road, this becomes a left-hook collision and the bicycle is to the left of the automobile.
3.2.2. **Cycling being in-place**

A recurring theme in this discussion has been the degree to which roadway spaces are seen, by cyclists and drivers, as being “for cyclists.” Infrastructure such as bike boulevards and sharrows give cyclists explicit permission to use a road. Heavy cycle traffic helps claim a road for cyclists. In place theory, the concepts of in-place and out-of-place describe how places have acceptable and unacceptable behaviours. To transgress against a place’s acceptable behaviours ostracizes the transgressor, and risks provoking a hostile response (Cresswell, 2004) (see Section 2.1).

The degree to which driver behaviour and infrastructure make cycling in-place has a substantial effect on the cyclist's experience. When Shankwiler asked his interviewees about what makes a place comfortable or uncomfortable for cycling, one of the factors was the “expectation of bikes by drivers vs. drivers surprised/angry by bicycle presence” (2006, p. 34). One of Dolan’s interviewees spoke highly of the respect he got in his neighbourhood, as a cyclist:

> Most of the drivers are really great. You get passed by a truck with a trailer in it, and it's a little bit rude. But in general they're a great bunch of people who live around here. A lot of them probably ride bikes themselves. You get a lot of respect. (2012a, 1:25)

Infrastructure that makes cycling in-place can also have a positive effect on cyclists. One of my interviewees described the excitement he felt the first time he encountered a bike-specific traffic signal. After arriving at an intersection, he saw it “had one of those bike signals . . . and I was like, Whoah! There’s a bike! It’s got a green light! And it’s for me!”

Finally, cyclists take various stances towards sharing the road, and dealing with feeling out of place. Some of Shankwiler’s participants found comfort in ensuring that cars have their space, enjoying places where they are “not an obstacle, [or] not an annoyance for drivers” (2006, p. 35). However, some cyclists find meaning in transgressing into spaces seen as being for cars. Elokin and Pamela write, in a poem about the meaning of their bikes, that “[my bike] becomes a fuck you to angry drivers who want me off ‘their’ streets” (n.d., p. 5).

3.2.3. **Other street conditions**

While interactions with cars dominate the street conditions, cars are not the only things on the street that affect cycling experience.

The surface quality of the street itself can provide a poor cycling experience. One opportunistic interviewee changed his commute in order to avoid a street that was so bumpy, it “was like riding on brail.”
Debris on the street can be a safety hazard. One popular bike route near my house is canopied by large trees. When the leaves fall and the rainy Vancouver winter begins, the leaves become a slippery surface.

Finally, road construction can be an annoyance to cyclists. Several participants in the study of the prototypes described the effects of construction. It can mean taking an awkward detour, debris on the road, or delays. As one user study participant put it:

... it can take a lot longer to [travel] if you have flag people ... They can stop cyclists. Where on a regular stop sign, you can make a judgment and go. When you have flag people and construction, it's almost as bad as being in a car. You can't get around this person with a stop sign; they just won't let you.

3.2.4. **Off-street path conditions**

When riding on streets, cars and drivers dominate the experience. But on off-street paths, where there are no cars, the dominating factors are pedestrians and the condition of the path.

Being away from cars is a big draw to being on an off-street path; it makes the experience more pleasant. However, these paths tend to have pedestrians on them, which can cause cyclists to slow down. How bothersome pedestrians are depends on the cyclist. The two focus group participants demonstrate the range of responses:

It’s more peaceful [to be on a path]. ... I think it’s easier to slow down [for pedestrians] than to try to ride fast to keep up with cars, if you’re on a busy street. It’s better for that reason.

... if there’s too many people [on the path], you’re not even hardly riding. That’s bothersome.

The physical conditions of off-street paths was a concern for several participants in my user study (see Section 9.4.5). They described paths that were unpleasant due to poor visibility (increasing the risk of colliding with a pedestrian), narrow width, or paver tiles that are difficult, and dangerous, to ride over.

3.3. **Surroundings**

On a warm autumn afternoon I’m heading downtown ... The sky is bright blue, and most of the leaves on the trees are still green, while others are turning a fiery yellow-orange. I spot a bald eagle perched on a church steeple. I stop briefly to return a ball to some kids who’ve kicked it over their schoolyard fence. They yell happily and wave at me as I leave. (Lowe, 2011, p. 16)

Terry Lowe’s description of his trip touches on many of the ways that cyclists engage with their surroundings. Weather, things in the world, and other people all shape the
experience of a trip. Furthermore, since cyclists travel without a barrier to the world, they can interact socially with passers-by.

### 3.3.1. Taking in the world

Physical surroundings form the background for the trip. Sights, sounds, and smells can make a trip pleasant or odious. Meghan Winters and Adam Cooper found their focus group participants were reluctant to ride in areas with air pollution and industrial zones. Participants desired “an area that was safe, calm, and aesthetically pleasing” (2008, p. 4); they were more likely to cycle in areas that are primarily parks or primarily residential areas. The aesthetics of the surroundings defy easy categories like residential and industrial, however. Even within a residential neighbourhood, aesthetics are influenced by architectural styles, gardens and landscaping, views, and many other factors.

The surroundings – particularly the small details, such as Lowe spotting the bald eagle – can transcend being mere backdrop; cyclists often make meaningful connections to things in their environment. Rachel Aldred’s interviewees “could talk vividly about their favourite routes and how the bicycle enabled them to experience places differently, and to access histories, sights, and sounds that otherwise they might not have found” (2010, p. 46). One person reported: “[On a bike], you stumble on these little Olde Worlde [sic] bits. Little bits of real old Cambridge [U.K.], little alleys or gateways” (2010, p. 46).

The built environment, and its character, affects the cyclist’s experience of the surroundings. One of my interviewees described how she enjoys riding past businesses in busy areas; places with new shops, restaurants, and nice street fixtures. She was frustrated that such interesting environs are often on streets with heavy auto traffic. On the focus group ride, the two participants had different reactions to riding through a warehouse district. One participant had a low opinion of the warehouse district, stating: “going through the long, low buildings which was to me kind of the worst area to ride in . . . for an enjoyable ride. And then all of a sudden [we got to the Willamette river and], boom, there’s the water. That was nice.” The other participant saw the industrial area positively: “I kind of like the [warehouse] buildings, and it’s really sunny because they’re so low. . . . The falling-apart buildings are cool.”

Many cyclists also value a connection to natural environments, such as trees, parks, and bodies of water. For example, this is how one cyclist describes a lake he passes on his early-morning commute: “Look how beautiful the lagoon is. Just the name Lost Lagoon. It’s like the land that time forgot. . . . It’s so primeval. So much of Stanley Park, with the trees and when it’s foggy, it feels like a lost world” (Dolan, 2012a, 6:36).

Weather is well-known for its effect on cycling experience. One of the participants in the rolling focus group described the effect that sunshine had on his morning commute: “The sun rose and cast a beautiful orange glow on the tree tops as I rode west
toward the Coastal Range of Oregon near Portland. I arrived warmed up in the sunshine and went to work.” Even rain has its fans. Says one bike commuter: “I like rain. It's soothing and relaxing. Rain is much nicer to ride in than heat or winds. I've ridden when in sub-freezing, over 90 degree [F, 32º C] and into 25 mph [40 km/h] winds. Give me some rain anytime!” (Rasmussen, interviewed in Larkin, 2004, “Interview,” para. 16).

Sounds make up part of the surroundings, particularly noise from cars. Auto noise can help a cyclist identify where a car is (Spinney, 2007, p. 33), and is often perceived as being unpleasant. At one point in the rolling focus group ride, we left a waterfront path to ride on a separated bikeway on a bridge with six lanes of auto traffic, in proximity to a highway. One participant described that experience like this:

And then when we got up on top of the bridge where it was loud because of the freeway, that totally kills the mood of the ride, basically. Even though it's safer, it's still that noise. Not very pleasant.

Finally, smells are also part of the surroundings. While many urban smells can be unpleasant – one of my interviewees dreaded a particular block on his commute with a strong sewage smell – pleasant smells can be a touchpoint for cyclists. Another interviewee of mine rides past a brewery on her way to work and a coffee roaster on the way home, and enjoys the smells.

### 3.3.2. Social relations

Dave Horton points out that drivers travel with a barrier, their cars, shielding them from view by the public; cyclists travel without any such shield. This can lead to social anxiety, since “there is surely an existential vulnerability to performing physical activity in public space” (2007, p. 134). Horton is right to point out the social sense of vulnerability, but his essay's focus on fear causes him to overlook some of the positive aspects of being unshielded. Had Lowe been shielded, he could not have returned the ball to the children.

With the public watching, some cyclists consider and manage the way they are perceived. Some aim to prove, through their behaviour, that they are “good” cyclists, as opposed to the “bad” cyclists portrayed by “hostile media coverage” (Aldred, 2010, p. 42). Clothes are also managed, with some cyclists refusing to wear Lycra because of body image issues (Aldred, 2010) or dressing stylishly to be seen (Walker, 2011). The act of cycling itself can be seen as a signal of class – appearing too poor to drive. Some cyclists of color feel this judgment heavily, since they already face the stereotype of being perceived as poor, even without a bike (Green, Steinbach, Rebecca, & Datta, 2009).

There are some people who perceive cycling as exposing them to a risk of crime (San Francisco Municipal Transportation Agency, 2008, p. 13), or who have concerns about personal security (Atkins, cited by Dickinson et al., 2003, p. 60). Other cyclists
see the bicycle as an opportunity to flee a troublesome situation. As one of Aldred’s participants said: “You do feel a lot safer. I’d never walk across the park at night ever. Never. . . . Whereas I would cycle through one. (female, forties)” (2010, p. 47).

Cycling is also an opportunity for positive social engagement. One of my opportunistic interviewees spoke fondly of the people she met: saying hello to people she rides by, or to other cyclists she meets in the bike lane. And a focus group participant liked having other people around, until they become obstacles:

When I go out on a pleasure ride, I like some people [around]. I feel like I’m kinda socializing in a sense. Just the fact that there’s people out and about. On the other hand, if there’s too many people, you’re not even hardly riding. That’s bothersome.

3.4. Exertion, rest, and recovery

The physical effort required to make a trip is part of the experience. Is it a hard trip, where the cyclist pushes herself, sweats, and needs to rest afterwards? Or is the trip more lackadaisical, requiring little exertion? The obvious factors that influence exertion are the distance of the trip, and hills along the route. Exertion also depends on the speed at which the cyclist is riding. Riding in automobile traffic can cause cyclists to slow down for caution or speed up to match the speed of cars (e.g. Spinney, 2007, p. 38). On paths shared with pedestrians or slow-moving cyclists, it is often unsafe for a cyclist to ride fast. Being in a hurry a common reason to ride fast – perhaps to get to work on time (Dill & Gliebe, 2008), or to escape an imminent storm (e.g. Granton, 2007, p. 7). Finally, exertion is increased by carrying a heavy load, such as groceries or children. A sufficiently-heavy load can make hills more strenuous, or cause the cyclist to re-route to avoid the steepest hills (e.g. Richings, 2011, p. 160).

The consequences of exertion also shape the experience. Benches, shelters, and other stopping points allow cyclists to rest. At drinking fountains, coffee shops, and markets, cyclists can re-hydrate and eat a snack. Finally, showers at the destination give cyclists permission to sweat more during the trip.

3.5. Awareness and movement

Cyclists do not simply exist on their bikes, they move. Active motion shapes the experience of a trip. On a cognitive level, this includes wayfinding and manoeuvring to avoid hazards. Physically, motion brings about the embodied senses of travel. Emotionally, being in motion and working the body to move bring about intense sensory and emotional experiences.
Wayfinding, the process by which a person reaches a destination, consists of three parts:

*Decision making* and the development of a plan of action. *Decision execution*, which transforms the plan into appropriate behaviour at the right place in space. [And] *information processing*, understood in its generic sense as comprising environmental perception and cognition, which, in turn, are responsible for the information basis of the two decision-related processes (Arthur & Passini, 1992, p. 25).

The quality of a bike trip depends on the cyclist’s ability to plan well. Some novice cyclists will bike the same streets they would drive in a car; that is, they do not adapt their plan for a bicycle. This often results in unpleasant experiences (Bower et al., 2009, chap. 5, p. 6). Cyclists in general often face a trade-off between a route that is direct and in close proximity to motor vehicles and a longer route that avoids vehicle traffic (Dill & Gliebe, 2008).

For some cyclists, there is a reluctance to spend much time on trip planning. Two of my interviewees, both of whom are experienced cyclists, described wanting to spend as little time as possible planning a route. However, this may be a result of their experience and familiarity with bike routes. At my old job, I helped novice cyclists plan routes to work as part of a bike to work campaign. Those discussions lasted for several minutes, and covered the route in detail.

Executing the route plan involves riding the planned route, turning at the correct locations, and recovering from mistakes. The difficulty of execution is influenced by the complexity of the trip plan: Wayfinding is more challenging in areas where the urban form does not give good connectivity to cyclists, and requires cyclists to take indirect routes. Recovering from wayfinding mistakes can be challenging for cyclists if the mistake takes them into an area that is poorly suited for cycling. One of participant in the focus group by bike provided this account:

"Today I rode to a dentist app [sic]. But I didn't make it on time. It took forever to get to the right neighbourhood, but then I passed it by mistake. I went downhill on the bike path for about a mile (which was really fun) but then realized I had to turn around. By the time I got up the hill I almost passed out. Hah. So then I found my way there on busy roads without bike paths or sidewalks. It was a pain. I went a different way home that was much easier!"

For cyclists, information processing involves following explicit cues, such as signs, and implicit cues, such as the busyness of a street. In a car trip, many of the turns occur on arterial roads that are visually distinctive from minor streets; a busy street is a cue that the driver may need to turn there. However, a cyclist following a bike boulevard relies on subtler cues. Turns and jogs in the route often happen at nondistinctive intersections. Cities install wayfinding signs and pavement markers to help (e.g. Portland
Bureau of Transportation, 2010, p. 109), but such cues are not as visually prominent. Accidentally going off the bike boulevard can degrade the experience, since it means losing supporting infrastructure, such as traffic signals at busy intersections.

Discovery and exploration are a meaningful part of wayfinding for some cyclists. Mykle Hansen writes, in a personal essay, that the heightened awareness of the surroundings is intoxicating in itself, but it also has a way of stimulating and enhancing this human craving to explore, discover, and map places. When I’m in a strange area on a bike, searching the way to cross an insurmountable freeway or ascend an inconvenient cliff, the moment I adore is when I detect a shortcut: a footpath next to a Dead End sign, a narrow alley shunned by cars, an empty strip along the expressway, or a newly paved stretch of suburban slope. Aha! What is this? Where does it go? Let’s find out! (2011, p. 191)

Where wayfinding occurs on a large scale, manoeuvring occurs on a small scale: going around broken glass, yielding to pedestrians, shifting body weight to avoid the discomfort of riding over bumps, or stopping suddenly to avoid colliding with a car – all while staying upright on the bike. Shankwiler observed his participants continuously “preparing themselves for the possibility of certain external activities” (2006, p. 40) in order to deal with sudden occurrences. One of my focus group participants disparagingly compared riding on a bad street to mountain biking:

It’s kind of a pain if you’re constantly having to get out of your saddle [because of bumps and cracks and potholes] and you have to watch for things, too. And I like to mountain bike but if I’m gonna be watching for things I’m just gonna go off road and do mountain biking, right.

Being alert is stressful, sometimes overwhelming. Spinney describes Vauxhall Cross, a major intersection in London, as producing an “‘overload’ of sensory information [in Spinney’s interviewees] . . . where the senses of sight, sound, feel and balance are all bombarded with information” (2007, p. 38). And in a Minneapolis cycling guide, J. Gerlach warns about Hennepin Ave.: “Get ready for split-second braking and constant speculation over which cars are going to turn in front of you and how many cars are going to go through the next red light” (2005, p. 8).

In areas that require less alertness, cyclists can relax, letting the mind wander, or forming the meaningful connections to the surroundings that Aldred and Spinney describe. Relaxation can also produce a sense of freedom; Shankwiler’s interviewees described comfortable zones as “having free passage” and being “uninhibited” (2006, p. 35).

Being in motion on a bike can produce embodied sensory experiences, and even powerful emotions. There are the tactile sensations of feeling the road through the bike; the pleasures of smooth pavement or discomfort of bumpy pavement. And there
are feelings of motion: the strain of cresting a hill, and the thrill (or terror) of speeding downhill. Spinney (2007) argues that this embodied nature of cycling is why cyclists form meaningful connections to places. And Christopher Wilde writes of a bike ride providing him with emotional release after a falling-out with a close friend:

[...] felt a giddy rush as I whizzed through the Community College campus and onto the slippery sidewalks of Loring Park, I stopped on the bridge in the park and thought about what's been going on in my head these past few days. Last night, I had left [my friend's] house in tears after a fruitless discussion of tensions between us. I don't know what came over me. Something inside me snapped and tears flowed out of me. . . . I acknowledge I don't know what's going on in my head, but in those moments of riding a new found bike over patches of ice headlong into a freezing mist, I found pleasurable joy - a joy I haven't felt in such a long time. . . . [To find that joy,] I had to let go of everything and trust in a moment of fun and adventure. (1995, pp. 1–2)

The bicycle itself influences the experience of motion. Martin Heidegger’s concepts of ready-to-hand and present-at-hand (Dourish, 2001, p. 109) apply to the cyclist and her bicycle. Much of the time, the bicycle is an extension of the cyclist’s body with the cyclist’s attention focused away from the bicycle; it is ready-to-hand. Other times, the cyclist’s attention shifts to the bicycle; perhaps to shift gears, or because of mechanical trouble. Here, the bicycle is present-at-hand. Bicycles vary in the way they feel to the cyclist, both when ready-to-hand and present-at-hand; these changes affect the experience of motion and how the cyclist experiences the world (e.g. de Tourdonnet, 2011; Fae, 2009, p. 8; Megulon-5, 2011; Neale, 2011; Spinney, 2007, p. 34).

### 3.6. Context, motivation, and identity

A cycling trip does not happen in isolation; it happens in the context of the rest of the cyclist’s life; in the context of the cyclist’s motivations for taking the trip, her identity, her sense of self. Recall McCarthy and Wright’s compositional thread of aesthetic experience (Section 2.3), which is concerned with how parts form a meaningful whole. All the sections of this framework address the relationship between the parts and whole of the experience of a trip. But the ride itself is a component of a larger experience in the cyclist’s life. This section of the framework addresses composition in that way: How the ride fits into the activities and experiences of the cyclist’s life.

The experience of a ride is shaped by the context that ride occurs in. Cyclists are more willing to take an unpleasant route when they are in a hurry (Dill & Gliebe, 2008), perhaps to get to work on time, or to come home and feed a dog⁵. A context that allows the cyclist to get sweaty – such as riding to a workplace with showers – affords longer and faster ride. The context can also be internal to the cyclist. One of my opportunistic

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⁵ This was a concern of one of my opportunistic interviewees
interviewees talked about how his mental state affects his engagement with the world. When he had a lot on his mind – planning his day, for example – he paid just enough attention to the street to be safe, and largely ignored the surroundings. Other times – when he had fewer stressors, or when he wanted to relax after a long day at work – he found more pleasure in enjoying the surroundings.

In one sense, the motivation for a utilitarian trip has to do with the purpose for the trip: getting to work, buying groceries, going on a date. In a larger sense, motivation is also why the cyclist is choosing to ride as opposed to traveling by foot, transit, or car. Both kinds of motivation affect what makes for a satisfying trip. Motivations for cycling include the following:

- **Fun and pleasure:** “[It’s] always good to have that half-hour in the morning, 45 minutes in the afternoon, which are not work, not family. Not sleeping. . . . That’s a full hour per day that’s pure pleasure. That’s immensely valuable. No other way you can get that.” (Dolan, 2012a, 11:00)

- **Spending time outdoors** (San Francisco Municipal Transportation Agency, 2008, p. 11)

- **Cost or economic necessity** (San Francisco Municipal Transportation Agency, 2008, p. 11)

- **Health and exercise:** “Most exercise programs I tried weren’t good enough to keep doing. . . . I could get the exercise I need, spend less time getting to work, and have fun at the same time” (Rasmussen, interviewed in Larkin, 2004, “Interview,” para. 4)

- **A sense of control:** to know “how [the bike] works, how the ins and outs of the mechanisms [sic], and you know what your bicycle is capable of and what you are capable of” (Shelley, n.d., p. 26)

- **Convenience:** “Amsterdam is too small for cars, and then parking, I also like driving, that’s not the issue, but in the city centre bicycling is simple [sic] the most convenient.” (Interviewee, quoted in Pelzer, 2010, p. 6)

Finally, the cyclist’s identity shapes her behaviour and the meaning she makes from cycling. I use the term **identity** as follows:

[Identity] encompasses both people’s sense of who they are (what might be termed personal identity) and their sense of who they are like and who they are different from (what might be termed social location). (Skinner & Rosen, 2007, p. 83)

Cycling has implications for identity in terms of class, race and ethnicity, and gender (Green et. al., 2009), as well as other kinds of identity. Green et al. Interviewed a cyclist (of unspecified race) whose friends find her cycling to be “very middle class and they joke that it fits in with the lifestyle of gardening, listening to [BBC] Radio 4, [and]
eating organic food” (2009, p. 6); they contrast her with a Black cyclist whose community associates cycling with poverty, “so basically, it’s people who can’t afford to drive that actually will cycle. . . . I can recall even walking, for example, and having people from my community saying ‘Why are you walking?” (2009, p. 11). In terms of gender, some women find cycling a way of claiming an identity as self-reliant, independent women (Green et al., 2009). Erin Fae, on the other hand, faced challenges in reconciling her femininity with cycling:

I’m a queer high femme. I never wear pants. In the winter, I’m all bloomers and petticoats—layers and layers of skirts. I wear bloomers when I train acrobatics, go to yoga, or hang from the trapeze. How could I continue to perform my gender AND use my bicycle as my primary form of transportation? (2009, p. 7)

In his blog, Jonathan Maus wrote about riding with his daughter on a street with a bike lane. They did not fit two abreast in the narrow bike lane, so Maus edged into the auto lane rather than ride single file.

“. . . as a father of a 7-year old who is just learning to ride in traffic, [riding next to her] is something I feel compelled to do. . . . there was sort of an evolutionary magnet pulling me alongside my daughter as if to create a little cocoon of safety around her” (Maus, 2010, para 5).
4. Experience and conventional bike maps

Although conventional bike maps do not aim to represent experience, they manage to represent parts of the experience. The experiential aspects of conventional maps can inform the design of experiential maps. In this chapter, I analyze print and digital bike maps, and identify principles for design. Despite my critique, they are not inherently bad maps; simply maps designed for a different purpose.

This analysis considers the map to be more than just the graphics representing locations – it also considers the text, graphics, and other content surrounding the map. Denis Wood and John Fells call this content the perimap, a term that adapts Gerrard Genette’s concept of the peritext: all the “productions that surround and extend a text in order to present it” (Wood & Fels, 2008, p. 9). According to Wood and Fells, the perimap affects how the map is interpreted and used; it reveals the persuasive purpose of the map. Therefore, it is worth considering how the map and perimap together convey a sense of experience.

4.1. Street conditions

Urban bike maps, nearly without exception, show the type of bikeway, coded with line characteristics: color, thickness, or line style. Communicating experience effectively depends on the cyclist being able to recall the meaning of the lines, preferably without repeatedly checking the legend. Google Maps (Figure 8) supports recall through few categories and a strong visual hierarchy. In contrast, Local Cycling Guide (Geographers’ A-Z Map Co, 2007), a map of London, has difficult recall. It presents six categories of bikeways, each with a discrete color. The downside of a visual hierarchy is that it implies a value judgment: the Google color scheme portrays bike boulevards as the least-important kind of route, even in cities such as Portland, Ore., where they are the most popular form of bikeway (Portland Bureau of Transportation, 2010, p. 42).

Instead of describing the behavioural interactions between cyclists and motorists, maps more often attempt to influence them. Several maps describe appropriate

![Figure 8. Google Maps route lines and legend](Images © 2012 Google. Map data © 2012 Google. Used by permission.)
behaviour in the perimap, on topics such as hand signals for turning or how to share a lane with cars (e.g. grapheon.com, 2011; TransLink, 2010; Z Industries, 2010). Figure 9 shows a typical example. This sets norms for how to behave, improving experience by alleviating some of the transgressions that can occur when appropriate behaviour is unclear. (Influencing the behaviour of motorists requires other forms of outreach.)

4.2. Surroundings

To understand different approaches to representing surroundings, we examine three maps and how they present the West Bank neighbourhood of Minneapolis, Minnesota: Google Maps; Cyclopath (n.d.), a geowiki edited by local cyclists; and Routes I Know, a zine by J. Gerlach (2005) describing the author’s opinion on bike routes in Minneapolis.

Google Maps has several options for displaying bike maps. In this analysis, I focus on three options: Road maps with cycling routes, 45º hybrid satellite view, and street view. The road map, Figure 10, presents a picture of surroundings that are biased towards business and institutional uses of space. There are hints about the social practices of the West Bank – the university, and the bars on Cedar Ave. However, nothing in this view describes the sensuous character of the neighbourhood. This view also tends to portray residences as non-places: some of the university buildings are drawn, some of the businesses are listed, but none of the homes are represented. Presumably, this is due to Google lacking data about the shapes of residential buildings; gaps in data have experiential consequences.
Figure 10. Google Maps road map

Figure 11. Google Maps satellite view
Google provides two views with photography of the West Bank: Street View\(^1\) and 45° Satellite View\(^2\). Both show the character of the homes, and the trees lining the street. Street View shows the small details that cyclists find meaningful: porches, barbeques, and gardens. It also shows an ethnically-diverse neighbourhood with many pedestrians. One could build up a sense of the neighbourhood, albeit by tediously clicking through one photograph at a time. Satellite View, Figure 11, provides the overview that Street View lacks, showing photography of the entire neighbourhood. However the view is cluttered, with no composition to call attention to salient details. And the aerial perspective is unrepresentative of the cyclist’s viewpoint from the street.

Cyclopath (http://cyclopath.org) (Figure 13) is a geowiki that brings the collaborative editing properties of textual wikis to geographic data (Priedhorsky, 2010). Editors comment on places and route segments, providing a breadth of experiential information about the physical surroundings, social surroundings, and other categories of experience. (However, the Cyclopath interface makes that information difficult to access.) These comments\(^3\) on places in the West Bank, from anonymous editors, show typical experiential information:

- “Great view of the river from the bridge” (n.d., location: Unnamed bridge over 4th St. S, between University of Minnesota West Bank and 22nd Ave. S)
- “There have been reports of attacks on the bridge, but I have not experienced any problems using it” (n.d., location: Murphy Square Pedestrian Bridge)
- “Surface of road is very bumpy and full of pot holes [sic]. Watch where your tires go!” (n.d., location: 15th Ave. S, north of S 6th St.)

Priedhorsky found that Cyclopath users value the way it connects them to information from other cyclists, especially when they do not personally know enough other cyclists who might advise them (2010, p. 40). Cyclopath demonstrates the value of a mapping tool that lets cyclists provide each other with subjective and objective information.

In Routes I Know, J. Gerlach describes “some of the best routes I know for getting around Minneapolis by bicycle” (2005, p. 1), (Figure 12). In the zine, left-hand pages describe a strategy for getting from one part of Minneapolis to another; right-hand pages show a photocopied road map of the vicinity. Gerlach has this to say about traveling from downtown to the West Bank:

> Once you cross the freeways you are on the West Bank, home of cheap, ethnic food, The Hard Times Café, The Grease Pit, Hub, and Freewheel bike shops.

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\(^1\) The images described were viewed on maps.google.com in February 2012. The photographs were taken in June and July 2009.

\(^2\) A top-down satellite is also available. I discuss the 45° view because it shows the facades of buildings.

\(^3\) These comments were retrieved in February 2012.
Routes to and from:

This is a short list of routes to get you from one neighborhood to another. You can use these in combinations to connect all sorts of places or make up your own variations. For simplicity’s sake I will be talking about the routes as if you would be travelling in one certain direction (i.e. from Uptown to Downtown) – if you want to go the other way (Downtown to Uptown) you’ll have to work the route backwards, using the maps. The routes in orange are the main routes I talk about. Yellow is for alternate routes or for connecting to other parts of town. Good bridges in blue.

Uptown to Downtown

Route One – The faster, busier route

Take any residential street north (Dupont, Harriet) to 22nd St. Depending on what part of downtown you want to go to, take 22nd to either Lyndale or Nicollet. Using Lyndale, take the sidewalk past the Wedge co-op, cross Franklin and follow the sidewalk until it turns into a short, off-road bike trail (be careful crossing the freeway entrance and exit ramps!). The trail takes you halfway down the hill and the ends abruptly, forcing you to get back on the busy sidewalk or the busy street for another couple blocks until you get to Loring Park. Cut diagonally through the park (watch out for squirrels) and then through the community college campus, over the arty, seventies-style plaza to Harmon St. Take Harmon a couple blocks to 11th St, where you will make a left. Follow 11th one block to the Hennepin bike lane.

Or, take 22nd up to Nicollet, turn left and follow for ten blocks until it turns into the Nicollet Mall.
Figure 13. Cyclopath

Note the comment on the selected road segment.

http://magic.cyclopath.org. Used by permission. Map data by Cyclopath community and MNDOT.
To get to Dinkytown, take a left at the West Bank rail station, and then your first right on to 6th St. SE. Ride past the high rise apartments on your left and continue across Cedar, past Freewheel, and up a few blocks to 20th av. [sic] S.

Make a left on 20th . . . and follow straight, passing the North Country Co-op at Riverside Av. And onto the bike path that cuts onto the University campus . . . The path is painted on a plaza in between University buildings – pedestrian and novice cyclist alert! – which winds through the campus and then up a ramp onto the University double-decker bridge. There’s also the Tenth Av. Bridge option, if you like a gritty concrete bridge, fast-moving cars, and/or nice views up or down river. (2005, p. 26)

Gerlach weaves brief vignettes of experience into the directions, curating the description of experience by presenting just the salient details and letting the reader imagine the rest. Contrast this approach with the photography in Google Maps, or the descriptions in Cyclopath; those provide a larger quantity of data, but burden the user with the job of making sense of the data.

Of the three representations of the West Bank, Gerlach’s is the only one that frames the neighbourhood as a distinct place, having boundaries and local practices. Cyclopath and Google Maps describe a set of locations, but they do not tie the West Bank together into a cohesive whole. They leave it up to the reader to interpret the character of the neighbourhood from its parts.

### 4.3. Exertion

It is commonplace for trip planning tools to report the distance and estimated travel time of a trip, both of which help estimate the effort involved (e.g., Google Maps and Ride the City, http://ridethecity.com). And, of course, maps show the distances involved, which helps predict effort.

When representing hills, bike maps tend to take one of two approaches: Presenting an elevation profile alongside the map (e.g., Map my Ride, http://mapmyride.com) or noting hills with badges (e.g. TransLink, 2010). A separate profile provides a detailed representation of hills, but does not make it clear where the hills occur. Badges locate the hills, but tend to be used sparingly, only marking the steepest hills.

### 4.4. Movement and awareness

Online trip planners, by definition, support creating a plan for traveling. But planning is only one part of wayfinding; the plan must also be successfully executed. Some maps call attention to areas where navigation is tricky, in an effort to help the cyclist execute the plan. For example, the N Portland Bike/Walk Map (grapheon.com, 2011) has an inset area for Hayden Island which clarifies an area that is notoriously difficult to navigate.
If a bike map calls attention to places that demand manoeuvring, it is usually by drawing a red circle around the most troublesome areas (e.g. grapheon.com, 2011; TransLink, 2010). However, Kevin Shankwiler designed a novel form of map specifically to represent manoeuvres made by cyclists. His perception-activity-behaviour map shows the correlation between events in the world, manoeuvres performed in response to those events, and the cyclist’s resulting emotional state. Visually, the element that is simplest to decode is the cyclist’s emotional state, which is color coded on an ordinal scale. For example, one map (2006, p. 81) shows that the cyclist traveled a relatively short distance before reaching a segment that made the cyclist feel uncomfortable. The map describes the source of discomfort: the cars were increasingly traveling faster than the cyclist. The cyclist took the full lane when it was possible to match the speed of the cars; as the cars sped up the cyclist was forced to move aside, which is less safe. Once the cyclist was free of the cars, the cyclist relaxed and felt comfortable again.
5. Experiential, non-bicycle maps

Outside the domain of bike maps, many maps have been created with the deliberate purpose of representing experience. Some of these maps are in the realm of art or media works, not Western cartography. However, there is a growing body of maps that represent the three aspects of place – location, locale, and sense of place – within the Western cartographic language.

5.1. Experiential maps in art and media

The fine arts have long had techniques for representing the experiential aspects of a place. Many representative works are reviewed by the geographer Margaret Pearce (2008). However, as Pearce points out, the vast majority of artistic techniques fall outside the traditional language of Western cartography. This poses two problems for map-making. First, these artistic practices erase the logistical information about a place. Such erasure makes these artworks difficult, or impossible, to use for wayfinding. Second, they are not artifacts that a lay person would identify as a map.

Edward Imhof’s painting *Karte der Gegend um den Walensee* (1938) can be viewed as an experiential map; one that shows the sense of place Imhof felt in the mountains in the Walensee region of Switzerland. The map was “not adapted from a coloured aerial photograph, but stemmed rather from the free artistic interpretation of visual impressions gained during long walks through the mountains” (Imhof, 2007, p. 299). That is, he chose colours not to represent the literal look of the mountains, but to evoke the emotions he felt while hiking through the mountains.

In Imhof’s painting, there is only one visual layer. Not only does this remove much of the information that is commonly present in a map – scale, compass, place names, and so forth – it also provides no interpretation for Imhof’s experience. What routes did he travel? Which views did he find the most magnificent? The painting holds no answers to those questions. It shows the experiential effect, but not cause.

Another well-known experiential map also shows experiential effect without cause: *Guide Psychogéographique de Paris*, Guy Debord’s (1956) Situationist work. Debord and his compatriots embarked on dérives: “drifting and deliberately trying to lose oneself in the city” (Ford, 2005, p. 34). *Guide de Paris* documents the results of these dérives of Paris, identifying unités d’ambiance (unities of ambiance), “parts of the city with an especially powerful urban atmosphere” (Wood, 2010b, p. 187). These are shown as “fragments of commercial street maps” (Wood, 2010b, p. 187), connected with arrows indicating the “slopes that naturally link the different unités of ambiance” (Wood, 2010b, p. 196, quoting The Naked City, another psychogeographic map). So the *Guide de Paris*
identifies the unities of ambiance that produced a sense of place in Debord and his compatriots, but it does not reveal what that sense of place is.

Media works, also, have a history of representing the experience of traveling through a place. The Aspen Moviemap is an early example: this person sense of what it was like to travel through Aspen, Colorado. Michael Naimark reviewed (1998) his work on the Aspen Moviemap and similar media projects. The recurring theme was highly-immersive environments that give a sense of being in a place. These media works do not overview or summarize in the way a map does. Naimark wrote about trying to “represent everything” in a place (1998, “Some Personal. . .”, para. 14); I aim to create experiential maps that represent and summarize the salient details.

5.2. Place and maps

Since place theory addresses the relationship between locations and experience, it is appropriate to look at experiential maps through the lens of place: How do these maps represent the three aspects of place, which are location, locale, and sense of place (Cresswell, 2004, p. 7).

Location is the most straightforward aspect of place for maps to represent, but also the aspect with the least experiential content. Showing where things are is a primary purpose of so many maps. But simply placing lines and markers on a map does not imbue them with meaning (Pearce, 2008). To take one example, consider the Oregon Campground Guide (Oregon Parks and Recration Department, 1998), a road map that locates public campsites in Oregon. This guide is not particularly distinctive; I chose it because it is typical. The front of the map (Figure 14) shows where the campsites are. But it reveals almost nothing about the campgrounds themselves, except for the agency responsible for the campsite (green shields for the U.S. Forest Service, purple trees for the Oregon Parks and Recreation Department, and so forth). With this information, the reader is left to guess about the experience of a campground. For example, campground number 2 is located a short drive from a moderately-populated city, Bend, and it is next to a lake. Perhaps it is a popular campsite with a boat launch.

Turning the Oregon Campground Guide over, and examining the back of the map, shows a list of amenities at each campground (Figure 15). The reader learns that campground number 2 is named The Cove Palisades. Not only does it have a boat launch, it also has flush toilets, showers, RV amenities, and requires a use fee. This catalogue of contents begins to describe the locale of the campsite, but only partially. Locale is both what is at a place, the catalogue of contents, but also the “visible and

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1 I should also note that the 1998 edition of the Campground Guide I discuss is outdated and out of print. The 2010 edition (Oregon Parks and Recreation Department, 2010) is a multi-page brochure which does not contain the shortcomings I discuss here.
Figure 14. Oregon Campground Guide, Front

Figure 15. Oregon Campground Guide, Back

Figure 16. Oregon Campground Guide, Legend
Shown in three parts. Appears on the back of the map (adjacent to Figure 15).
tangible aspects of a place” (Cresswell, 2009, p. 169). It is this second half of the
definition, the aesthetics of locale, that is missing from the Oregon Campground Guide,
and from similar maps. At The Cove Palisades, what is the scenery like? How closely are
the campsites packed together? The Guide is silent.

Other maps do show locale more fully. I reviewed some of these in the previous
chapter; the maps that show surroundings (Section 4.2). Gerlach’s Routes I Know
(2005), for example, contains prose that describes the contents and aesthetics of locale.
But that discussion was limited to bicycle maps; there are also non-bicycle maps that
show both aspects of locale.

Flickr (http://www.flickr.com/map/) and Google Maps (http://maps.google.com)
display both aspects of locale, through their ability to place photographs on a map as
an overlay layer. Flickr shows a row of image thumbnails at the bottom of the screen
and locates the images with markers. Google Maps places the thumbnails directly on
the map. In both, the user can click a thumbnail to see a larger image. And while it is
possible to use these photographs to get a sense of locale, it is cumbersome to do so
because the tools are not designed to convey locale; they are designed to help the user
find interesting photographs. This leads to two drawbacks to using Google Maps and
Flickr to learn about locale. First, many photographs do not show the surroundings,
or show them atypically. There are many photos of the inside of buildings; photos
of a duck pond in the snow, or of bridges at sunrise. These are beautiful photos,
but not representative photos. Second, Flickr and Google provide an abundance of
undifferentiated photos. Where should the user start? And when has she seen enough
to understand the locale? These tools leave it up to the user to sort through the pile of
data, which is provided without curation or endpoint. My criticism of these presentation
of photographs is similar to my criticism of Google Street View (Section 4.2): going through
the data is an unmediated slog.

The loosely-curated, mountain-of-data approaches of Flickr and Google are in
contrast with more restrained and deliberate depictions in other maps. Elbie Bentley
judiciously used illustrations in her work Atlas of Explorations for the Pacific Railroad
(Bentley Cartographic, 2009) (Figure 17). This atlas recounts the Gunnison-Beckwith
survey, an 1853 expedition to identify possible routes for an American transcontinental
railway. The survey produced maps, topographic illustrations, and written accounts of the
trip. Bentley created “an atlas integrating the report components with new original maps”
(Bentley, 2009, p. 12). The atlas is a narrative; it “can be read like a novel” (2009, p. 12).
Bentley used images in her atlas for the same purpose as the survey’s topographer,
Baron von Egloffstein, did in his maps:

the inclusion of the landscape illustrations was not to display the beauty and
scenery of the surrounding country, but rather to give the viewer an impression
of its general character. The goal was to illustrate, through the fewest number of
April 5.

Spring was alive in the valley as we proceeded north along the edge of the mountains to our east. In the afternoon we reached the lower canyons of the Weber River, which we crossed and proceeded east, leaving our low water trail along its precipitous and rocky edge. As we emerged from the pass we turned the right and left forming an immense oblong amphitheater before us. We followed the Weber River to the junction of Ben Simons’ Creek, where we found our Delaware guide encamped with his brother, several squaws, and many little Indians. Here we encamped after a day’s march of 27 miles.

April 6.

We left camp and proceeded along the river bottom, which led through the amphitheater described yesterday, towards Sheep Rock. Turning the corner we left the soft flat plain and worked our way east along the river which wound so much we had to cross its icy cold waters 16 times before we finally made camp at the fork of Dry Creek.

April 7.

The rain poured down upon us throughout the night. We were without tents and the blankets we wrapped ourselves in did little to protect us. As a result, we departed camp the following morning with little sleep. The water in the creek was still low, being early in the season, so we could easily follow the Indian trail that ran along its bottom. The snow began to fall quickly as we made our way up the river, at one point we were obliged to dismount and walk for it to subside before we could proceed. By the time we encamped, we were encamped near the fork of the White Clay Creek the snowfall had come to an end.

April 8.

An extreme upsurge of the river was found the following day, which made our progress up the White Clay seemed endless. The tracks of the elk and deer were clearly visible, the deer having been quite busy feeding on the reeds and brush forage. We passed several large bodies of water, always encamping on the south side.
views, the mountains, canyons, valleys, and plains in relation to each other, so suitable passes could be clearly distinguished (Bentley, 2009, p. 46)

Egloffstein curated: he chose a few, key images. Each image had a purpose. He used images both to convey knowledge of the locale for its own sake (the general character of the surrounding country), and also for a practical purpose (to distinguish suitable passes). Bentley applied the same judicious curation to her atlas. The result is quite unlike the parade of images from Google Maps or Flickr: enough images to get a sense of the surroundings, each image distinct, and with a definite end to the reading.

In terms of integrating maps and images, Egloffstein provided images on separate sheets from the maps. Bentley, availing herself of more advanced design and printing technology, placed Egloffstein’s illustrations directly into her map. The images are placed on the periphery of the pages; they are “linked to their locations using number and letter symbols so the reader could visualize the location from which the illustration was made” (2009, p. 95).

Conveying location and locale alone does not fully convey place, or experience. Doing so requires the third part of place: the sense of place, “the feelings and emotions that a place evokes” (Cresswell, 2009, p. 169).

Margaret Pearce conveys a sense of place in her map, *The Intricacy of These Turns and Windings* (Journey Cake, 2005) (Figure 18), which tells the story of John Macdonnell, a voyageur moving goods by canoe through the Upper Great Lakes in 1793. Pearce created *Turns and Windings* as a way of exploring how to apply narrative techniques within a map, using Western cartographic language. She uses narrative in order to convey place, since the two “are also mutually construed. Narrative produces place, and place in turn fosters and produces narrative (Tuan 1991)” (2008, p. 21).

In *Turns and Windings*, the story is presented textually, through excerpts from Macdonnell’s daily journal. The story is also presented graphically: days of the voyage are indicated with coloured frames on the map, one frame per day. These frames show the pacing of the travel. They also show Macdonnell’s sense of place, the colours indicating his “changing emotional landscape” (2008, p. 25). A yellow and blue frame (Figure 18) uses bright colours to represent the mood seen in Macdonnell’s diary: “the day is a beautiful clear day and the sun shine [sic].” A gray and olive green frame (not shown) represents a day where Macdonnell and his crew “. . .were prevented from stirring by stormy weather – a cold raw day.” The colours of Pearce’s map describe the emotional effect; the text describes the cause.
Figure 18. Excerpt from *The Intricacy of These Turns and Windings*
6. A printed atlas of experiential bike maps

My first design for an experiential bike map was a small print atlas of bike routes in Vancouver. Working in print was a good way to try novel designs without the additional complexity of interactive design. The atlas describes four bike routes in Vancouver.

My atlas was inspired by J. Gerlach's zine *Routes I Know* (2005), which describes a variety of bike routes in Minneapolis (see Section 4.2). Each spread in the zine describes a different area of Minneapolis, the routes available, and the experiences along those routes. However, Gerlach uses purely textual descriptions and photocopied road maps. For my atlas, I drew from the lessons from prior experiential maps: to describe experience within the map itself, and to combine text and other media in the perimap.

Urban bike maps tend to be created at a scale that simply does not provide room for experiential information. For example, the City of Vancouver publishes a pocket-sized bike map (Figure 19) at a scale of 1:33,333 (3 cm to the kilometre). At such a dense scale, there isn't room for much information beyond the basic street grid. This was my motivation for zooming in. By creating a series of maps at 1:16,667 (6 cm to the kilometre), I had more room to explore how to add experiential information.

Figure 20 shows one of the maps from the atlas. The full atlas is available in Appendix F.

6.1. On (not) using an authoritative voice

In designing the atlas, I questioned the appropriateness of using an authoritative voice: of making value judgments and speaking from a particular point of view. I started with a desire to speak neutrally, and avoid an authoritative voice. This was an unrealistic stance. I concluded that some degree of subjective, authoritative voice is essential for
Figure 20. Ontario Bikeway
Design by the author. Map data provided by the City of Vancouver; available under these terms of use: http://vancouver.ca/your-government/terms-of-use.aspx#OpenData.

The full atlas is available in Appendix F.
an experiential map and that the question is in how to present the subjectivity in an appropriate way.

The argument against using an authoritative voice is that the experience of cycling is subjective and varies from person to person. The framework of cycling experience shows several examples of how cyclists differ in their reactions to situations, and it barely scratches the surface of the differences. Since experiential bike maps present a hypothetical future experience to a general audience, they cannot fully predict the nuances of the cyclist’s eventual experience. This is in contrast with several of the other experiential maps I reviewed in Chapter 5. Edward Imhof’s painting (2007) described his personal impressions of his hikes through the mountains in Walensee, Switzerland. Margaret Pearce’s maps of Champlain (Journey Cake, 2005) and MacDonnell (Hermann & Pearce, 2008) recount the journals of those explorers. For those maps, an authoritative voice is appropriate because they describe past experiences lived by specific people.

Marie Cieri (2003) started a mapping project because she felt that existing guidebooks for gay and lesbian tourism in Philadelphia took an authoritative approach that was not true to the experiences of lesbians living in Philadelphia. Those guidebooks represented one true experience for gay and lesbian tourists, when in reality there is a diversity of experiences. While Cieri succeeded in replacing one set of viewpoints with another set of viewpoints, the maps her participants make still speak with an authoritative voice, but just a different one.

So, based on those arguments against using an authoritative voice, I tried to avoid making value judgments when creating the maps in this atlas. However, this lead to the drawbacks of staying neutral, and I had to use a measure of authoritative voice. There were three drawbacks to using a neutral voice. First, it results in dry reading. Some text in the atlas is opinionated because otherwise it is too dull. Second, a neutral voice proposes that it is possible to look at experience objectively. Yet, “we can never step out of experience and look at it in a detached way. . . it is reflexive and ever-present as swimming in water is to a fish” (McCarthy & Wright, 2004, p. 15). McCarthy and Wright go on to describe perspectives for looking at experience, but they all take a particular stance or viewpoint. Third, not only does a description of experience take a viewpoint, but maps themselves also propose a particular viewpoint. Through authorial decisions in what to present and how to represent it, a map proposes one view of the world at the expense of other views (Krygier & Wood, 2009). The choices of what factors to represent, and how to represent them, introduce an authorial stance.

1 Although the voice in They Would Not Take Me There, the Champlain map, is not strictly authoritative, since it represents multiple perspectives. In addition to presenting Champlain’s perspective through his journal entries, it also represents the perspective of the Native peoples he interacted with (Pearce & Hermann, 2010).
6.2. Representing bikeways

The information presented in these maps can be put into two major categories: The bikeway routes themselves, and the neighbourhoods the routes pass through. I begin with a discussion of the bikeways.

The typical use of route lines in bike maps is to represent only the type of bike route (such as a bike lane, or a multi-use path). This is important information to convey – and I used colour coding to convey it in these maps – but it is possible for lines to convey more than just the type of bike route, through rich use of line style. As Pearce puts it, “to mark an individual’s path across a map . . . we draw a line. The problem with that line is that it does not reflect the fullness of the world as we experience it while traveling along a path” (2008, p. 25). Pearce goes on to abandon route lines altogether in the map she describes, *The Intricacy of These Turns and Windings*. That option was not available to me, since lines serve the practical purpose of identifying bike routes. Instead, I explored the expressive potential of route lines.

I was influenced, in my expressive route lines, by a recurring gag in Bil Keane’s comic strip, *The Family Circus*, where a dashed line shows the highly-indirect travel of Billy, age seven. In a typical comic (1977, p. 164), the line shows more than just where Billy went, it also shows how he traveled. The line implies running, jumping, climbing, and sliding. It suggests that Billy stopped to jump rope with his sister, and to peer into the engine of a car his neighbour was repairing. In the atlas, I explored how a route line in a map could be evocative of motion, by using the line shapes to describe travel speed and hills.

6.2.1. Travel Speed

Travel speed is one of the qualities of awareness and movement, from the framework of cycling experience. It has a practical aspect, for finding an efficient (or lackadaisical) route to a destination. It also has an embodied aspect, suggesting the feeling of speed or of a relaxed cruise.

The route lines represent travel speed through the length of the dashes. Long dashes indicate slow travel, and short dashes indicate fast travel. I did not develop a quantitative formula for determining travel speed, but I suggest that one could be developed. It could include stop signs; traffic signals; quantity of cross-flow traffic; quantity of pedestrian traffic, which slows cyclists down; and the presence of potholes, roadside debris, speed bumps, and other obstacles.

I chose this reading of the route lines – with short dashes representing fast travel, instead of slow – because people found it semantically meaningful. When I asked my colleagues for input about which reading they prefer, the consensus was for short lines to indicate fast travel speed. One colleague, with a musical background, described the
long dashes as representing whole noes in sheet music. Another described the shot dashes as representing pedalling at a fast cadence.

6.2.2. **Hills**

My objective for representing hills in the atlas, was to show a hill’s direction, slope, and length within the map itself (as opposed to showing them in a hill profile alongside the map). To do this, I changed the squares in the route lines to trapezoids. The wider the base flares out, the steeper the hill. And the narrow end of the trapezoid points uphill. As with the reading of travel speed, I informally tested this with my colleagues. This reading was the consensus.

One interesting feature of the hill trapezoids is that the literal denotation of the hill steepness is the opposite of the connotation. My colleagues read the wide trapezoids (the biggest glyphs) as representing the steepest hills. However, if the glyphs are taken as literal side views of hills, the wide trapezoids have less-steep sides than the narrow trapezoids. This suggests that people were viewing the trapezoids as an iconic representation, not a literal representation.

6.2.3. **Difficulties in representing bikeways**

Although the lines for representing bike routes conveyed meaningful information, there were some difficulties in placing them on the maps in the atlas.

The route lines are relatively thick; this causes problems when trying to place two lines near each other. This can be seen in Figure 21; the bike lane on Union St. and the Dunsmuir viaduct are about a metre apart in the real world, but the line width takes up more than a metre’s worth of map space.

There is also the issue of what to draw when two bike routes cross. Since the two lines often have differing styles, the result is that one line continues through the intersection and the other is interrupted. The Ontario bike map has several examples.

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2 The alternative reading would be for the narrow end of the trapezoid to point downhill. When I tested a similar design in my interactive prototypes, there was not a consensus about how to read uphill and downhill. See Section 9.5.1.
At the intersection of 10th and Ontario, the line for 10th appears interrupted because the line for Ontario is showing wide hills. And at 1st and Ontario, the bike lane on 1st Ave. seems interrupted, because the Ontario bikeway is shown with a different color and line style. It is not clear to me what to do about this, other than minimizing the problem by making the lines thinner.

It is also worth noting that additional problems with this style of route line arose when I adapted it to interactive prototypes. I discuss this more in Section 7.6.

### 6.3. Representing the districts

Bike routes do not engender consistent kinds of experience along their length: the experience changes as the surroundings change. A route passes through a sequence of places, each with distinctive locales. Therefore, the maps in the atlas present the routes as a sequence of places, each one named and described separately.

My conception of these areas is informed by Kevin Lynch’s concept of districts. Lynch describes districts as “medium-to-large sections of the city, conceived of as having two-dimensional extent, which the observer mentally enters ‘inside of,’ and which are recognizable as having some common, identifying character” (1960, p. 47). While Lynch generally describes districts as having a larger geographic scope than the highly-local places I describe in my atlas, he does describe some districts as consisting of sub-districts (1960, p. 169), recursive districts within districts.

The qualities of the districts that are salient for cyclists are: Uses of the district, stressors that demand attention, bikes in-place, and the aesthetics of the surroundings.

#### 6.3.1. Uses of the district

Is this a residential area? Retail? Light industrial? The use of space carries many connotations about other factors. A residential area (in Vancouver) brings to mind trees, quiet streets, and low-slung buildings. Many of these qualities will be explicitly described in other parts of the map, but showing the use of the space gives an overview.

Because I wanted the use of space to be a prominent feature in these maps, I color-coded the areas. Visually, the areas are kept in the background by using colors with low saturation. In choosing colors, I paid attention to the connotations of those colors. (Although my ability to evoke through color was limited by the need to keep the colors de-saturated, in order for them to appear as background.) For example, residential areas are coloured brown for the connotations of wood: trees lining the street, and wood-frame construction of homes. Industrial areas are shown in a gray-blue colour.
Gray for the connotations of cement and industry; blue to visually contrast the pure-gray colouring of the streets.

The strict categorization of land use does not address transitional zones and multi-use neighbourhoods. The map presents abrupt transitions from one use to another, but the city itself changes more gradually. The map would represent the experience more fully by including transitional zones. It might be possible to use gradients for that purpose.

### 6.3.2. **Stressors that demand attention**

The need to be alert and aware significantly affects the experience of cycling. It is hard to relax while being constantly alert for hazards. (See Section 3.5 for more discussion about movement and awareness.) Therefore, an important question for these maps to answer is: Are there things in the surroundings that will force you to pay attention? And, conversely, are there things that make it easier to relax?

To represent these attention-needing factors, I rated the factors on a one to five scale (Figure 22). Each district gets its own set of ratings, with factors that are contextually appropriate. For example, residential areas don't have issues with heavy truck traffic, so that factor is reserved for industrial areas.

In creating the scale, one of the issues I faced was factors where a high rating is (commonly perceived as) better, and factors where a high rating is worse. More road width is a positive factor; more truck traffic is negative. But a quick scan of identical bubbles does not differentiate positive and negative factors (Figure 23). My solution was to use pictograms\(^3\) for some of the factors. Not all factors are conducive to representation as pictograms – road width, for example – and they get generic dots. But, conveniently, the negative factors are all representable by pictograms and the positive factors (with one exception) are not. Therefore, the pictograms show what the negative factors are. The exception is the presence of other cyclists; that is generally a positive factor, but also represented with icons. It is discussed in the next section.

### 6.3.3. **Are bikes in-place?**

In these maps, I use the presence of other cyclists as a way of suggesting how much cycling is in-place (in the place theory sense of being an appropriate activity). While there are other factors that can make cycling in-place, or not, I chose not to put them in these maps. Infrastructure to support cycling – such as signs, roadway makings, and bike-activated traffic signals – can signify that cycling is acceptable. But these kinds of infrastructure are commonplace in the close-in sections of Vancouver that the atlas

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3 These pictograms were originally developed by the U.S. National Park Service. They are in the public domain.
covers. For example, when a designated bikeway crosses a street, it is safe to assume that there will be a traffic signal the cyclist can activate. The behaviour of drivers also affects whether cycling is in-place; I did not include that due to my desire to avoid subjectivity.

These maps use pictograms to show levels of cycling in the various districts. Hopefully, some places that could be construed as unwelcoming to cyclists – such as the industrial area around Clark Drive – will be construed as welcoming, due to the high levels of bike traffic in the area.

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### Figure 22. Ratings of experiential factors with pictograms

<table>
<thead>
<tr>
<th>First Ave</th>
<th>Great Northern Way</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bike traffic</td>
<td>![3 stars] ![2 stars] ![1 star] ![1 star] ![1 star]</td>
</tr>
<tr>
<td>Auto traffic</td>
<td>![2 stars] ![2 stars] ![1 star] ![1 star] ![1 star]</td>
</tr>
<tr>
<td>Truck traffic</td>
<td>![1 star] ![1 star] ![1 star] ![1 star] ![1 star]</td>
</tr>
<tr>
<td>Road width</td>
<td>![3 stars] ![2 stars] ![1 star] ![1 star] ![1 star]</td>
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<tr>
<td>Road surface</td>
<td>![3 stars] ![2 stars] ![1 star] ![1 star] ![1 star]</td>
</tr>
<tr>
<td>Roadside debris</td>
<td>![3 stars] ![2 stars] ![1 star] ![1 star] ![1 star]</td>
</tr>
<tr>
<td>Bike traffic</td>
<td>![3 stars] ![2 stars] ![1 star] ![1 star] ![1 star]</td>
</tr>
<tr>
<td>Foot traffic</td>
<td>![1 star] ![1 star] ![1 star] ![1 star] ![1 star]</td>
</tr>
<tr>
<td>Path width</td>
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<tr>
<td>Road surface</td>
<td>![3 stars] ![2 stars] ![1 star] ![1 star] ![1 star]</td>
</tr>
</tbody>
</table>

An expressway for bikes:
You can go straight through uninterrupted.

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### Figure 23. Ratings of experiential factors without pictograms

<table>
<thead>
<tr>
<th>First Ave</th>
<th>Great Northern Way</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bike traffic</td>
<td>![3 stars] ![2 stars] ![1 star] ![1 star] ![1 star]</td>
</tr>
<tr>
<td>Auto traffic</td>
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<tr>
<td>Roadside debris</td>
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<tr>
<td>Bike traffic</td>
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<td>Foot traffic</td>
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<td>Path width</td>
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<tr>
<td>Road surface</td>
<td>![3 stars] ![2 stars] ![1 star] ![1 star] ![1 star]</td>
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</tbody>
</table>

An expressway for bikes:
You can go straight through uninterrupted.

Auto repair shops and warehouses dominate this short stretch of road.
6.3.4.  **Aesthetics of the surroundings**

When cyclists have a chance to disengage from an intense focus on the activity of cycling, it is common for them to take in the views of the neighborhood around them. So the question for my map, then, is what are the aesthetics of those surroundings. I chose to represent the aesthetics through line drawings.

When choosing how to pictorially represent the aesthetics, I chose illustrations instead of photographs. Photographs would have pulled the balance of the compositions away from the maps and included distracting details (such as telephone poles). I discuss this visual style further, in Section 7.4.2.
7. An interactive, experiential
cycling trip planner

The print atlas is a useful way of trying one approach to experiential cycling maps. But a good designer should explore multiple solutions to a problem. And there is still the matter of designing an interactive trip planner, instead of static maps. For these reasons, I created prototypes of web-based trip planners.

The prototypes are a way of investigating questions on two levels: design problems and design solutions. Problem questions get at what an experiential trip planner is for: what kinds of experiences are useful to show, and what can cyclists do with experiential information. Solution questions ask how to go about addressing the problems: how can a trip planner convey experience in a way that is meaningful and useful. Nigel Cross discusses the dialectic relationship between the design solution and the design problem:

Designers tend to use solution conjectures as the means of developing their understanding of the problem. Since ‘the problem’ cannot be fully understood in isolation of ‘the solution’, it is natural that solution conjectures should be used as a means of helping to explore and understand the problem formation. (2006, p. 80)

The prototypes, therefore, are Cross’ solution conjectures, designed to address both how to show experience (the solution) and the usefulness of an experiential trip planner (the problem). My approach to the prototypes draws on three sources of knowledge. First, I use theory to inform the design problem. I use the framework of cycling experience (Chapter 3) and other experiential theories (Chapter 2) to propose information to convey. Second, I use the maps I reviewed and created (Chapters 4, 5, and 6) to inspire design solutions, e.g., the prototypes. Third, I use the prototypes as research instruments in a user study. This is an empirical way of refining both the design problem and design solution. (I discuss the study in Chapters 7 and 8.)

As a research instrument, the prototypes should convey the possibilities of what an experiential trip planner could be. Since it is a new category of tool, the prototypes introduce the study participants to the concept of an experiential trip planner. The prototypes are a common reference point for discussion. They reveal how participants use experiential information when selecting a route. But I also need to be mindful of how having a common reference point can limit the study. Providing just one prototype, or prototypes that are very similar, would limit the breadth of the reference points. Doing so would frame the study in a way that makes it less likely to produce criticism of the prototypes (Tohidi, Buxton, Baacker, & Sellen, 2006). Therefore, I need to strike a balance. The prototypes should be coherent and concrete enough to elicit interesting observations and conversations in the user study. But they need enough breadth and
ambiguity to avoid prematurely closing off possibilities for what experiential trip planners can be good for, and how they can convey experience.

To strike this balance, I created a series of four prototypes, which vary along two dimensions: design and scenarios for use (Figure 24). The designs propose two possible ways of conveying experience. The scenarios provide two situations where an experiential trip planner could be used.

Finally, Saul Greenberg and Bill Buxton (2008) warn of the dangers of designing to a test, of picking a design problem just because it is amenable to performing well in a usability study. A usability study focuses on difficulties in the use of a tool, without considering the usefulness of the tool. Prematurely performing a usability study can lead to abandoning promising ideas before they have a chance to mature; it can also focus on issues that are minor, relative to the overall usefulness of a tool. I mitigate that risk in two ways. First, by providing a design critique in this chapter, a technique that Greenberg and Buxton recommend. Second, by performing a user study (not just a usability study) that does question the design problem being solved, and that does address the usefulness of the solution.

7.1. About the prototypes

I made prototypes of two different designs for web-based trip-planning applications. Each design takes a different approach, in order to learn the effects of the approaches. The designs emphasize different aspects of experience, and they present experience in different ways. One design, Design B, is objective and factual; it emphasizes hills and traffic, since these factors tend to dominate discussions of cycling experience. The other design, Design A, emphasizes the surroundings and the feelings they evoke; it (loosely) uses techniques from narrative to convey experience.

In making two designs, my objective is not to pick one as “better.” Rather, my objective is to understand the effects of the different approaches. Buxton (2007) describes design as consisting of elaboration and reduction. He illustrates this with a quote from the poet Paul Valéry: “Invention depends on two processes. The first [elaboration] generates a collection of alternatives, the other [reduction] chooses, recognizing what is desirable and appears important among that produced by the first” (2007, p. 145). Since I am designing a novel kind of product, my emphasis is on elaboration over reduction. Put another way, my emphasis is on “getting the right design” over “getting the design right” (Tohidi et al., 2006, p. 1243; see also Buxton, 2007, p. 78).

The user activity in the prototypes is trip planning; that is, finding a route between a start point and an end point. Other online maps, such as Google Maps or Bing Maps, include capabilities beyond trip planning, such as searching for a location (e.g., Stanley
Figure 24. The four prototypes
Map Data © OpenStreetMap Contributors. Elevation data provided by GeoBase ®. Additional map credits in Appendix A. Contains a photograph by Kyle Pearce; used by permission; additional information in Appendix D.
Like many conventional trip planners, these prototypes provide a few possible routes to reach the destination. However, where conventional trip planners provide little information to use in selecting a route, these prototypes provide a breadth of experiential information. Furthermore, since the user study involves selecting among the possible routes, the prototypes emphasize the availability of multiple routes. The prototypes show detailed information about all the routes simultaneously, including route lines. (Only one route is selected at a time; the other route lines are shown deselected, with greater transparency and less-saturated colours.)

7.2. About the scenarios

To apply the designs to different contexts, I created two trip-planning scenarios. This resulted in four prototypes: two designs by two scenarios. The scenarios vary in terms of trip purpose, terrain, and urban form. One scenario covers a trip to a picnic; the other, a ride to work.

The scenarios exist for two reasons. First, and most importantly, to give the participants in the user study varied motivations for planning a trip. How cyclists value quality of experience changes with trip context and motivation, so the scenarios provide breadth there. Since the scenarios take place in different parts of Vancouver, they are also an opportunity to apply the designs to different kinds of urban forms.

These scenarios should be distinguished from the interaction design technique which is also called scenarios. Those interaction design scenarios imagine how people will use a new tool; they provide not only a context and motivation for using the tool, but also the actions the user takes with the tool (Goodwin, 2009). These scenarios are narrower in scope: They provide context and motivation, but do not propose the user’s interaction with the prototypes.

In the to-picnic scenario (Figure 25), the cyclist is planning a trip to meet some friends for a picnic in the park (a trip with low time pressure). The route travels near the Vancouver city centre, a relatively flat area with distinctive, cohesive districts. The experience of the routes varies primarily in the relationship to cars and the surroundings. The area has high levels of cycling, and it is likely that participants will have some familiarity with these routes. The routes are generally the ones recommended by Google Maps (at the time), with minor adjustments, such as correcting an impossible turn.

In urban planning terms, a ride to a picnic is considered utilitarian and, thus, within the scope I set out in Chapter 1. The trip is utilitarian, since its purpose is to reach a destination, even if the destination is recreational.

The Google Maps directions routed the cyclist directly from the Seaside Bicycle Route onto the north side of the Burrard Bridge. That is not possible: you have to...
Figure 25. To-Picnic scenario routes
Shown in Design B. The routes are, from top to bottom: Via Expo Blvd., via Pacific Blvd., and via First Ave. Map Data © OpenStreetMap Contributors. Elevation data provided by GeoBase ®. Additional map credits in Appendix A. Contains a photograph by Kyle Pearce; used by permission; additional information in Appendix D.

Figure 26. To-Work scenario routes
Shown in Design B. The routes are (left) via Inverness St. & Windsor St. and (right) Via Argyle St. & Dumfries St.

Map Data © OpenStreetMap Contributors. Elevation data provided by GeoBase ®. Additional map credits in Appendix A.
In the to-work scenario (Figure 26), the cyclist is riding to work in the morning (a trip with high time pressure). The two possible routes travel through relatively undifferentiated residential neighbourhoods with a moderately-challenging hill and low levels of cycling (thus participants are less likely to already be familiar with biking in these areas). Since the routes are so similar in terms of surroundings, participants are likely to base their decision on other factors. I chose the start and end locations because they are somewhat awkward to reach by bike; this forces interesting trade-offs. One route, via Argyle and Dumfries, is more direct, but it doesn't follow a signed bike route, has more difficult wayfinding, and involves riding for a few blocks on a major arterial. The other route, via Inverness and Windsor, is easier to navigate, avoids traffic, but is 1 km longer. Google's suggested routes for this scenario had, in my opinion, low quality of experience. They primarily rode along a major street with no cycling infrastructure. So I developed the routes myself.

Time pressure is a major contextual factor in cyclist's choice of routes. Dill and Gliebe (2008) observed, in a GPS tracking study in Portland, Ore., cyclists taking direct routes to work (when they're under pressure) and relaxed routes home (less time pressure). Therefore, one scenario has a time constraint, the other one doesn't. The routes in both scenarios are 5 to 7 km long. That's slightly longer than the median trip length that Dill and Gliebe observed. (In that study, 36% of trips were longer than 6 km.) The lengths were chosen to be long enough to give some variety to the route, but not so long as to be unreasonable.

7.3. Emotion comments

Kevin Shankwiler’s perception-activity-behaviour maps (Section 4.4) draw a cause-and-effect relationship between locale and sense of place. The cyclist’s perception of the environment – that is, the emotions the environment brings about – is colour-coded and mapped. Shankwiler uses a limited range of emotional states: comfortable, cautious, uncomfortable, and intense (2006, pp. 81–84). Shankwiler’s states are all safety-related, and do not represent the full range of experiences of cycling.

To represent a broader range of emotions, I simulated user-submitted comments, which were inspired by Cyclopath. The text of the Cyclopath comments can give a sense of the emotions a place evokes, but the map symbols representing those comments do not convey their emotional comment. Thus, the comments in Design A are indicated with the emotional state they represent. A comment about rushing down a bridge is tagged with “exhilaration.” A comment about crossing a busy street is tagged “unwelcome.” This way, the emotional content of the ride can be scanned from the map. A full list of the comments is in Appendix C.
Some of the comments are deliberately provocative (in a way that Cyclopath comments are not). For example, a comment about riding on Kingsway, a four-lane arterial with heavy automotive traffic, proclaims “Going into town, you can totally keep up with the cars on Kingsway. Take the lane and push it!” While some cyclists would take that advice, others strive to avoid such high-traffic situations. Provocative comments such as this are a research probe, to explore the concern about recommender systems that provide recommendations the cyclist disagrees with.

Within the map, comments are shown with their label (the emotion name) in a word balloon; the full text of the comment is available by scrubbing with the mouse (Figure 27). Comments apply to one point, and have an arrow indicating that point. Cyclopath allows comments to apply to several blocks of a path, not just one point. This is a useful ability that I did not implement due to time constraints. The comments are also listed in the route directions (Figure 28), with both the label and the full text. This provides a way of quickly scanning all the comments, while still placing them along the route.

I am not addressing the question of what to do when there are many comments; more than can legibly fit on screen at once. While a deployed system would have to deal with that concern, it is out of scope for a prototype. The focus here is on understanding how people use the comments; such understanding would be useful in dealing with design issues such as crowded comments.

Including user-submitted comments in the prototype inherently implies that there would be a system for submitting and managing those comments. The route photographs I will introduce in the next section could also be user-submitted. Creating a participatory community to generate that content would require care, but it is possible. So, to keep this thesis to a manageable scope, I am simply stating that it is plausible to build such a community, without worrying about how that community would be organized. In addition to the body of knowledge from interaction design about how to
build successful online communities, there are also techniques for participatory map-making in the tradition of critical cartography (Wood & Krygier, 2009); these traditions should provide enough guidance to form a participatory community.

7.4. Pictures

The emotion comments describe points on the routes, but it is also helpful to show the route; to show the points on the route and districts the route travels through. The prototypes use two styles of pictures. Design A uses line-drawing illustrations to represent districts, since the emotion comments represent specific points. For Design B, which does not have place-specific comments, photographs represent both points and districts. Pictures, either photographs or illustrations, are useful for describing the surroundings: what this place looks like, what other people (or cars) will be around, what activities go on here. Pictures address the sensual thread of experience.

7.4.1. Photographs

Photographs can show specific points on the route, and suggest the character of a district. They represent the world with a specificity that, when it works well, conveys detail and triggers memories. But the specificity can also be a hindrance, being rooted in the situations when the photo was taken, and making composition difficult.

Photographs of distinctive points can illustrate the small details of the world that cyclists form meaningful connections with. Recall Aldred’s interviewee who “stumble[d] on these little Olde Worlde [sic] bits. . . . of real old Cambridge” (2010, p. 46). In the prototype, these kinds of points are shown with, for example, photos of a mural on a community centre (Figure 29), and a brief glimpse of the downtown skyline on a route that is otherwise blocked in (Figure 30). And, to an extent, photographs can give an example of what an area is like. The prototypes include photographs of a house with an architectural style that is typical of the Strathcona neighbourhood (Figure 31), and a tree canopy typical of streets in the Kensington neighbourhood (Figure 32). The line between distinctive point and typical representation is not clear-cut: the aforementioned flower garden is typical in the sense that several other houses on the street have gardens out front, distinctive in the sense that it is the nicest-looking garden on the street.

Photographs are also tied in with the specifics of the circumstances in which they were taken: the weather, time of day, season, traffic at that time of day, and the people who are (or are not) around. These specifics have consequences for how they represent experience: A photograph of a mixed-use trail will represent very different levels of pedestrian activity if it’s taken on a sunny Saturday or a damp Thursday. However, the fidelity of those specifics can be useful for evoking a sense of place. When describing
world building in comics, McCloud says that “adding realistic details and textures, if done well, can help trigger memories, not only of the appearance of subjects, but also the way they feel, or smell, or sound, and help bolster a sense of recognition on the part of the reader” (2006, p. 164). Although McCloud is writing about specificity in comics, his
point applies to specificity in photographs as well. The photographs in Design B evoke specifics of place in a way that the simple line drawings in Design A do not.

Composition of these photographs can be challenging: I found it awkward to opportunistically capture photographs that include a breadth of experiential elements. For example, when photographing the residential neighbourhood near Kitsilano Beach, I wanted to capture the character of the homes and the vibrancy of families walking about. I was able to take photographs that clearly showed the houses but did not have people or that showed people but obstructed the views of the houses (Figure 33). But I did not get satisfactory photographs with both houses and people. The difficulty I experienced in taking photographs suggests that it may be difficult to crowdsourcing these photos.

Because of the specificity of photographs, I chose to present them as a layer in the map (Figure 34). Each photograph is shown as a thumbnail, with an arrow indicating the place where it was taken. Clicking on the photograph expands the thumbnail. Because the thumbnails can get quite small when the map is zoomed out, the content changes with the zoom level. When zoomed out, the thumbnails are cropped to focus

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\[3\] By convention, web mapping toolkits number their zoom levels from 1 to 18, where smaller numbers are zoomed out. The prototypes use zoom levels 13 to 16. At
on one distinctive element of the photograph; without this, the photos are illegible in thumbnail form.

I took most of the photographs myself. Two photographs were provided by other photographers under Creative Commons licences that allowed for their use. Credits for these photographs are in Appendix D. That appendix also includes the photographs used in the prototypes.

7.4.2. **Illustrations and districts**

To address some of the problems with photographs in Design B, I used illustrations as a way of showing the surroundings in Design A. Where the photographs were limited by what I was able to capture in frame, the illustrations were composed. Where the photographs described both points and districts, illustrations represented only districts (since Design A also had emotion comments for describing points). The visual style of the illustrations were simple line drawings, using the lack of specificity to suggest an area instead of a point.

The districts described by the illustrations are districts in Kevin Lynch’s definition— a place made cohesive by “thematic continuities which may consist of an endless

levels 13 and 14, cropped thumbnails are shown; at 15 and 16, uncropped photos.

4 Although these districts are on a geographic scale that Lynch would consider a sub-district (1960, p. 169).
variety of components: texture, space, form, detail, symbol, building type, use, activity, inhabitants, degree of maintenance, topography” (1960, p. 67). Conveniently, the thematic continuities that Lynch describes tend to intertwine with the factors that shape the experience of cycling. For example, in the to-picnic scenario, as the cyclist rides from the Strathcona residential neighbourhood to the commercial Chinatown district, the buildings get taller, the sidewalks become crowded with shoppers, the streets get heavier auto traffic, and the flat land bends into a hill.

In the sidebar, each route has illustrations and names for two to four of the districts it passed through. For example, in the to-work scenario, the route via Argyle St. and Dumfries St. shows the Fraserview, Kensington, and Kingsway districts (Figure 35). The other route, via Inverness and Windsor streets, is shown to go through Fraserview and Kensington. (Showing that the two routes travel mostly through the same districts is a way of presenting the similarities between the options.) Presenting districts this way is a form of spatial storytelling (Section 2.5) – sequentially showing the places where the ride will occur.

Hovering the mouse over a district illustration caused the bounds of that district to highlight on the map (Figure 36); this helps connect the illustration with the map and reinforces the message that these are areas, not points.

To represent these districts, I used line-drawing illustrations with low levels of detail. According to McCloud, one of the communicative abilities of cartoon images “is the universality of cartoon images. The more cartoony a face is, for instance, the more people it could be said to describe” (1994, p. 31). The goal, then, is to create illustrations with enough specificity to represent the locale of a district and evoke a sense of place, but general enough to represent many locations within that district.

The illustrations are drawn using simple line drawings, so that they can be legible at a small size, and to give a sense of universality as McCloud described. The illustrations are deliberately composed, to represent factors in the district that shape the experience of cycling. They show people who are, and are not, around; cars, moving and parked; trees and greenery; the kinds of buildings, such as towers in Yaletown, fancy houses in Kitsilano, and simpler houses in Kensington; and the hardness of boundaries with the people in Chinatown and the approachability of the house in Kensington demonstrating soft boundaries, and the lack of accessibility in Charleson.

I composed the illustrations by hand. I composited several photographs into one reference image, and drew the reference image. This solved the problem I had composing photographs with all the elements I wanted. Note that the illustration for Kits Point (Figure 36) has both an interesting house and pedestrians, unlike the photograph (Figure 33). Although my process for creating the illustrations is manual, it is intended to suggest what could be possible with an automated, or semi-automated, process.

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5 Figure 35 and Figure 36 show all of the district illustrations in the prototypes.
Figure 36. Illustrations in the to-picnic scenario
The mouse hovering over the illustration for East False Creek is causing that area to be highlighted on the map.

Map Data © OpenStreetMap Contributors. Elevation data provided by GeoBase ®. Additional map credits in Appendix A.
It should be possible to deliberately compose illustrations using a painterly rendering system.

Near the Vancouver city centre, where the to-picnic scenario takes place, there is substantial overlap between Lynch-style experiential districts and the named neighbourhoods. But where the named neighbourhoods have defined political boundaries, e.g. Strathcona (Strathcona Residents Association, 2010), I altered the boundaries to better align with the thematic continuities. I also invented a district, when there was not a suitable district in common use. One of the routes runs along Charleston Rd. and Lameys Mill Rd. These roads have a distinctive character from the other districts around them, so I created the Charleson district.

The to-work scenario takes place in southeast Vancouver, where the thematic boundaries of the districts are not well-defined. For most of the trip, the two routes could be considered to be in the same district. According to the political neighbourhood boundaries, both routes occur in the Victoria–Fraserview and Kensington–Cedar Cottage neighbourhoods. I used these political boundaries in the prototype for two reasons. First, presenting only one district – as would be the case in the via Inverness and Windsor route if the districts were purely thematic – omits the sequencing that is an essential part of narrative. Second, political bounds give clarity in an area where thematic bounds are uncertain. If I didn’t put the bounds along political lines, where would I put them? Lynch (1960) points out that the thematic bounds of districts can be fuzzy, leading to districts of massive size. Enormous districts would interfere with the interaction where hovering over the illustration shows the bounds of the district, since the bounds could extend well beyond the screen.

7.5. Land use

As in the printed atlas I made (Section 6.3.1), Design B includes colour-coded representations of land use (Figure 37). Here, the categories of land use are residential, commercial, and industrial. The intent is still to provide connotations about the locale of these areas; to suggest the human activity, the aesthetics, the architecture, the environmental quality, and so forth. However, distilling a city down to three categories requires placing dissimilar neighbourhoods into the same category. The category for residential areas covers both high rises and single-family homes. Upscale and downtrodden commercial areas are grouped together. This leads to the risk that the connotations from the neighbourhood type will be too vague to provide meaningful information. The prototype addresses this concern by providing photographs to supplement the land-use colouring.

The GIS data for land use was provided by the City of Vancouver zoning data package (http://data.vancouver.ca/datacatalogue/zoning.htm). The City’s zoning
Figure 37. Land-use colouring in the to-picnic scenario

Map Data © OpenStreetMap Contributors. Elevation data provided by GeoBase ®. Additional map credits in Appendix A. Contains a photograph by Kyle Pearce; used by permission; additional information in Appendix D.
bylaw includes many districts that do not fall into residential, commercial, or industrial categories (City of Vancouver, 2007) – many of these are historical or mixed-use areas. In those cases, I used my judgment to categorize the zoning districts. In mixed-use areas, I classified them as commercial if they had ground-floor retail space. I gave the most care and attention to districts around the routes used in the prototypes; districts in other areas of the city received cursory attention.

7.6. Hills

The two prototypes use different approaches for representing hills: Design A adapts the hill lines I designed for the printed atlas, and Design B uses a more traditional hill profile.

Elevation graphs, or hill profiles, are a common way of representing hills. For example, Map My Ride (http://mapmyride.com) graphs the elevation of user-submitted bike routes. In Design B (Figure 38), the hill profiles for all the alternate routes are displayed simultaneously; these small multiples (Tufte, 1990, p. 29) facilitate comparing the hills across routes. One of the drawbacks of elevation graphs is that it can be difficult to correlate the graph with points on the map. To address this, I added a scrubbing capability where hovering the mouse over a point on an elevation graph shows that point on the map. (Map My Ride has similar functionality.)

The data source for the hill profiles is a digital elevation model (DEM) provided by GeoBase (http://geobase.ca). I used Quantum GIS (http://www.qgis.org) to sample the elevations along the routes, then smoothed the samples in Microsoft Excel. (The Excel smoothing functions were provided by Quantitative Decisions, http://www.quantdec.com/Excel/smoothing.htm.)

I had to manipulate the elevation graph for routes that cross a bridge. The DEM data follow the terrain, not the road. So rather than showing a small uphill when approaching the bridge (as the road does), the data show a steep downhill (as the terrain plunges into the water). I altered the hill profile in Adobe Illustrator, based on my personal experience of the height and slope of that bridge. The altered hill profile is inaccurate, but sufficient to test how cyclists use this kind of hill profile. This does, however, raise the issue that a production-quality experiential trip planner should use an elevation model that includes bridges.

The route lines used in Design A (Figure 39) are based upon the bikeway lines in the printed atlas; they represent hills with trapezoids embedded into the route lines. Since the hills are shown in the route line itself, it is straightforward to correlate hills with the locations where they occur. However, comparing routes to determine which has the steepest hills is harder, compared to hill profiles. One further benefit of moving hill information out of the sidebar is that it frees up space to show illustrations in the sidebar.

---

6 The bridge in question is the Burrard Bridge.
Figure 38. Hill profile and traffic chart, in the to-picnic scenario

The yellow dot on the map indicates the point on the Via 1st Ave route that the user is hovering over with the mouse.

Map Data © OpenStreetMap Contributors. Elevation data provided by GeoBase ®. Additional map credits in Appendix A.
Figure 39. Hill lines in the to-work scenario

Map Data © OpenStreetMap Contributors. Elevation data provided by GeoBase ®. Additional map credits in Appendix A.
The hill lines in Design A have a few small differences than the lines in the print atlas. First, unlike the atlas, the prototype does not indicate travel speed by varying the length of the squares (the non-hill sections of the line). I removed travel speed to reduce visual complexity, and to manage the number of concepts that the prototype conveys. Second, the interiors of the boxes (and trapezoids) are translucent; this makes it easier to follow the roads and bikeways underneath.

I created the route lines for Design A in Adobe Illustrator, with a different set of lines for each zoom level of the map. To find hill steepness, I used Microsoft Excel to calculate the slope of the smoothed DEM data.

7.7. Traffic

To show other roadway users, I added a traffic chart to Design B (Figure 38 on page 69). This chart, located below the hill profile, indicates route segments with substantial bicycle, automobile, and pedestrian traffic. The traffic chart shows three horizontal lines, one for each kind of traffic. The horizontal axis along these lines corresponds to the route, and is to the same scale as the hill indicators. Places with significant levels of traffic are highlighted on the traffic lines.

Representing the various kinds of roadway users presents different aspects of experience:

- Automobile traffic indicates part of the relationship to cars. Cyclists generally consider high volumes of auto traffic to be unpleasant. This traffic chart complements the colour coded bikeways, which show the physical relationship to cars (e.g., shared lane or bike lane).

- Bicycle traffic indicates the surroundings, by showing where cycling is in-place. Although having more bikes around is generally considered a good thing, since it makes cycling more welcoming, there is a risk that the traffic chart will frame cyclists negatively. Since the chart is labeled with the word “traffic,” it is possible that the negative connotations of that word will cause cyclists to focus on the negative aspects of bike traffic and overlook the positive aspects.

- Pedestrian traffic provides connotations for the surroundings, by suggesting the social uses of places. It also informs movement and awareness, by showing locations where the cyclist will need to slow down and manoeuvre around pedestrians. Since the traffic chart only represents pedestrians who share a roadway with cyclists, it does not address people who are part of the larger surroundings (e.g., people in cafes or walking on the sidewalk).

The traffic indicators are interactive in the same way that the hill profiles are. Scrubbing the route line with the mouse highlights the corresponding point on the map. To reinforce the spatial correlation between the hill profile and the traffic indicator,
scrubbing a point on one of those controls highlights the corresponding point on the other.

The data sources for the traffic indicators come from my own impressions. Although traffic counts are available for cars and bicycles, I did not use these sources, primarily because of time constraints. The threshold at which traffic levels are high enough to be listed on the chart is also based on my experience. I marked areas that I perceived as having moderate or high traffic levels.

One obvious enhancement to the traffic chart would be to show traffic on a scale (e.g., low, medium, and high) not as a binary value (traffic or no traffic). I chose not to add this enhancement to the prototype; partly because of the time involved in generating that data, and partly to keep the visual appearance simpler.

7.8. Miscellaneous design elements

The base layers of the prototypes were created using TileMill (http://tilemill.com), a tool for rendering and styling GIS data. MapBox, the makers of TileMill, provide a theme for street maps, open-streets-style (https://github.com/mapbox/open-streets-style). open-streets-style was a good starting point, since it uses many standard cartographic conventions for road maps. I removed many of the elements that open-streets-style displays by default (e.g., beaches and helipads) in order to visually simplify the layer upon which I built. The GIS data for roads, parks, bodies of water, and other features not specifically mentioned elsewhere come from Open Street Map (http://www.openstreetmap.org).

Bikeways are represented by solid colour-coded lines, indicating the type of the bikeway. To aid recognition, I wanted to use a small number of categories and, conveniently enough, my data source uses four categories. The bikeway data were provided by personal correspondence with Tate White and Jonathan Mark, who work for the City of Vancouver. (At the time, the City’s web site did not provide GIS data for bikeways that categorized the bikeways by their type.)

In order to address the rest and recovery aspects of exertion, Design A shows the location of drinking fountains (several are visible in Figure 39 on page 70). I chose to present drinking fountains – as opposed to benches, shelters, markets, or other opportunities for recovery – because the data and icon were readily available. In terms of the user study, the drinking fountain icons are intended to spark the idea that a trip planner could convey opportunities for rest and recovery, and lead to a conversation about what else the planner could say about recovery. The drinking fountain GIS data were provided by the City of Vancouver (http://data.vancouver.ca/datacatalogue/drinkingFountains.htm); the icon was designed by the U.S. Department of Transportation (http://thenounproject.com/noun/drinking-fountain). Informal usability testing has shown
that people may have trouble identifying the icon as a drinking fountain, but once the meaning is explained people perceive it correctly. To address this in the user study, I may have to explain the icon to participants. (The purpose of the study is not to evaluate the icon, but the data it represents.)

Design B shows the location of traffic signals, in order to indicate the difficulty of crossing major streets (Figure 37 on page 67). The GIS data were provided by the City of Vancouver (http://data.vancouver.ca/datacatalogue/trafficSignals.htm); I designed the icon myself.

To calculate the route distance and travel times, I entered the routes in Google Maps and used the values it reported. Similarly, the turn-by-turn directions were taken from Google Maps. However, I edited the directions to simplify them. There are several places where a minor jog in the road was reported as a series of turns; I omitted these.

7.9. Technology used in the prototype


ModestMaps combines several layers into one map (Figure 40). Two of these layers are tiled static images: the base layer and the layer for street names. (TileMill outputs this kind of layer.) Other layers are rendered dynamically in the browser, which enables them to be animated. For example, when the user hovers over a district’s illustration, the bounds of that district fade in. Or when a user clicks on a comment in a route’s directions, that comment is briefly highlighted in the map.

Since I created the route lines in Adobe Illustrator, they required some preprocessing to display them in the map. Recall that there was one Illustrator file per route, per zoom level. I wrote a script to break apart each Illustrator file into tiles, then assemble the tiles into the same file format that TileMill outputs (http://mapbox.com/developers/mbtiles/). From the perspective of ModestMaps, these are regular tiled static images.

The source code for the prototype is available as a supplemental file; see Appendix E.

7.10. Recap

These prototypes are solutions conjectures. They were made to explore how a trip planner can convey cycling experience, as well as to prompt discussion into the problem setting for an experiential trip planner – that is, what makes them useful. The four
prototypes consist of two designs applied to two scenarios. Design A emphasizes the surroundings, aesthetics, and emotions. Borrowing techniques from narrative, it uses illustrations as a form of spatial storytelling, and it uses cause-and-effect to convey emotions. The subjectivity of Design A may be problematic, since cyclists differ in their emotional responses. Design B focuses on objective representations. It emphasizes avoiding the unpleasant; aesthetics are secondary.

Table 1 lists the experiential factors from the framework of experience (Chapter 3) and how they are represented in the designs. There are some factors that are not represented in either framework; those were omitted to avoid excessive complexity in the maps. And not all of the factors fit neatly into the high-level distinctions between the two designs. Choosing which design got, for example, drinking fountain icons was not a

![Figure 40. Stack of map layers](image)

ModestMaps combines these layers into one map. Other types of layers include the emotion comments and photographs. Elevation data provided by GeoBase ©. Additional map credits in Appendix A.
matter of the high-level distinctions. Such decisions were made based on judgment calls, and a desire to balance the complexity of the designs.

Table 1. Representing the experiential cycling framework in the two designs

<table>
<thead>
<tr>
<th></th>
<th>Design A</th>
<th>Design B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Street Conditions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximity to cars</td>
<td>Type of bikeway</td>
<td>Type of bikeway</td>
</tr>
<tr>
<td>Being expected</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Road surface</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Universally-understood movements</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Pedestrians (as traffic)</td>
<td>Illustrations.</td>
<td>Traffic indicator</td>
</tr>
<tr>
<td>Other cyclists around</td>
<td>Illustrations.</td>
<td>Traffic indicator</td>
</tr>
<tr>
<td><strong>Surroundings</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large-scale character of the physical surroundings</td>
<td>Illustrations. Building outlines.</td>
<td>Land-use colouring. Photographs.</td>
</tr>
<tr>
<td>Small details to take in</td>
<td>n/a</td>
<td>Photographs.</td>
</tr>
<tr>
<td>People (out of cars) who are around; what are they up to?</td>
<td>Illustrations.</td>
<td>n/a</td>
</tr>
<tr>
<td>Risks of crime</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Exertion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance to travel</td>
<td>Distance in kilometres; time in minutes; shown on the map.</td>
<td>Distance in kilometres; time in minutes; shown on the map.</td>
</tr>
<tr>
<td>Hills</td>
<td>Embedded in the lines</td>
<td>Shown as a profile</td>
</tr>
<tr>
<td>Opportunities for rest and recovery</td>
<td>Drinking fountain icons. Parks.</td>
<td>Parks.</td>
</tr>
<tr>
<td><strong>Movement and awareness</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complexity of the trip plan</td>
<td>Can be implied from the directions</td>
<td>Can be implied from the directions</td>
</tr>
<tr>
<td>Difficulties in executing the plan (places where you can get lost)</td>
<td>Comments (e.g., confusing)</td>
<td>n/a</td>
</tr>
<tr>
<td>Information in the environment to help wayfinding</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Maneuuvring</td>
<td>Comments (e.g., alert)</td>
<td>n/a</td>
</tr>
<tr>
<td>Traveling</td>
<td>Comments (e.g., exhilaration)</td>
<td>n/a</td>
</tr>
<tr>
<td>Freedom of motion</td>
<td>Comments (e.g., trapped)</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Context, motivation, and identity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>
8. User Study Design

As I discussed in the previous chapter, creating the prototype trip planners raised many questions about how cyclists would use them, and interpret the experiential information they contained. The prototypes were designed to spark discussion about such questions, so I conducted a user study, focused on the prototypes. In this chapter, I describe the design of that study. In the next chapter, I present the results.

8.1. Research Questions

In Section 1.2, I described the three research questions for this thesis as a whole; two of them are research questions for the user study:

- How can cycling experience be represented in a map?
- What makes an experiential trip planner valuable?

Or, stated more specifically:

- How do cyclists use the prototypes to form an understanding about the experience of cycling trips? And how does that understanding affect the participant’s choice of route?
- What kinds of experiential information is useful for an experiential trip planner to show? In what contexts?
- For whom, and under what circumstances, is an experiential trip planner desirable? What makes it useful?

8.2. Methodology

As I discussed in Chapter 7, my work is more about understanding what an experiential cycling trip planner can be and do, and less about evaluating the two designs in terms of which one is better. Therefore, it was important to choose a study methodology that supports generating alternatives (what Buxton, 2007, calls elaboration). A traditional usability evaluation, with its emphasis on measuring problems, is a poor fit (Greenberg & Buxton, 2008). A better approach for research that seeks to explore and generate alternative designs is a user study that exposes participants to alternative designs (Tohidi et al., 2006).
8.3. Study format and activities

The study consisted of these parts:

- An introductory survey and background questions;
- planning trips with the prototypes;
- a card-sorting activity, to discuss more experiential factors than the ones shown in the map;
- and a few closing questions.

Sessions of the study lasted about 90 minutes.

8.3.1. Introductory survey and background questions

The study began with an introductory survey. It asked about demographic information (age bracket and gender), attitudes towards cycling, and the kinds of cycling trips taken. A full copy of the survey is in Appendix B.

I followed the survey with a semi-structured interview, asking background questions about the participant’s cycling experiences. This started out with follow-up questions about the survey (e.g., “you said you ride with your partner; can you tell me what that is like”). Then participants described two recent bike trips: one trip with no particular qualities, and one trip to a new destination. My questions were about topics such as: why participants chose a particular route, tools used to plan the trips, and experiences participants had on the trips.

8.3.2. Planning trips using the prototypes

Using the prototypes was the main focus of the study. Each participant planned trips using all four prototypes (two scenarios by two designs), making this a within-subjects study.

Before any trip-planning tasks began, I gave participants some background information. I explained that they would be using prototypes of bicycle trip planners that show the experience of a trip. I compared the prototype to Google Maps: given start and end points, the prototype was suggesting a few routes to reach the end point. I asked participants to use the prototypes to choose how they would reach their destination. They did not need to choose one of the routes the prototype suggested: they were free to choose a different route, or to travel by transit or car.

The trip-planning portion of the study consisted of these tasks:

1. First scenario (to-work or to-picnic), shown in the first design (Design A or Design B)
2. First scenario, shown in the second design
3. Compare and contrast designs for the first scenario
4. Second scenario, shown in the first design
5. Second scenario, shown in the second design
6. Compare and contrast designs for the second scenario

Within a trip-planning task, I started by introducing the scenario (for example, “Pretend it’s a sunny Saturday afternoon and you’re going to a picnic at Kits Beach…”). Then, participants used the trip planners to choose a route. Participants thought aloud as they worked: to explain what the prototype was telling them, what they thought, and so forth. I asked clarifying and follow-up questions. I used a topic guide for this semi-structured questioning.

At the end of a task, participants explained which route they chose and why. After participants chose a route, I asked questions about specific features of the prototype (e.g., “what did these photographs tell you about the route” or “did this [pointing to the hill chart] tell you anything about the route”). I tended to save these questions until the end of the second scenario, to avoid directing the participants to certain parts of the prototype. But sometimes the topic would arise in the first scenario, and I would ask the questions then.

After participants had seen both designs for a scenario, I asked them to compare and contrast the two designs. (Although participants offered up comments comparing the designs throughout the study, without prompting.) To facilitate comparisons, I used a dual-monitor setup, showing one design on each monitor1. At this point in the study, I also asked about factors that influence the experience of cycling that the maps did not show.

I altered the order in which I presented the designs and scenarios, to address two kinds of ordering effects. First, the design a participant sees first shapes that participant’s sense of place; an effect that carries over to the second design. Second, the scenario that is shown first affects the participant’s understanding of how to interpret the maps and use the prototypes. To mitigate these effects, I introduced the prototypes in the sequences shown in Table 2.

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1 However, in five sessions I did not have two monitors available. In those sessions, I showed participants how to change between designs using browser tabs.
Table 2. Sequences in which scenarios were presented.

<table>
<thead>
<tr>
<th>First Scenario</th>
<th>First Design A</th>
<th>First Design B</th>
</tr>
</thead>
<tbody>
<tr>
<td>To-Picnic</td>
<td>To-Picnic A, To-Picnic B, To-Work A, To-Work B</td>
<td>To-Picnic B, To-Picnic A, To-Work B, To-Work A</td>
</tr>
<tr>
<td>To-Work</td>
<td>To-Work A, To-Work B, To-Picnic A, To-Picnic B</td>
<td>To-Work B, To-Work A, To-Picnic B, To-Work A</td>
</tr>
</tbody>
</table>

8.3.3. Card-sorting activity

After the trip-planning tasks, participants performed a card-sorting activity to address a broad range of experiential factors, including those that were not shown in the map. The two purposes of this activity were to get a rough priority order of factors, and to discuss factors that we had not previously discussed.

I gave participants a stack of 48 cards. Each card listed factors that can affect the experience of cycling, such as “how many cars are around you,” “local animals (dogs, cats, skunks, crows, etc.),” or “construction.” Cards were not sorted in any particular order, and the order varied between participants. Participants sorted the cards into three piles: things that are always or usually important, sometimes important, and rarely or never important. Then, participants selected a few cards from the always or usually important pile that they wanted to discuss (they tended to choose about five cards). I asked participants to select cards on topics that we had not already discussed. We talked about why those factors are important. Then we discussed a few cards from the sometimes important pile, in a similar manner.

I came up with the topics for the cards based on my framework of cycling experience, and the factors that I identified there. The reason for including most of the cards should be clear. However, a few cards that need some rationale.

- History of the area: Many organized bike rides in Portland and Vancouver are historical tours (e.g., Bryan, 2008; Granton, 2010; Poyourow, 2010; Price, 2012). This demonstrates that some cyclists have an interest in combining cycling and learning about history. Also, hiking guidebook author Bill Sullivan (2006) incorporates history into his descriptions of hiking trails.

- Local animals (dogs, cats, skunks, crows, etc.): This was inspired by a homemade “skunk crossing” sign that used to be alongside a bikeway in Vancouver,

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2 The full list of cards is shown in Table 3 on page 85, along with the results of the activity.

3 The sign was on Woodland Dr., between 7th and 6th Aves.
Meeting spots that are important to cyclists: In a user study of Cyclopath, some (but not a lot) of the places that participants entered into the geowiki were meeting spots that are important to cyclists (Priedhorsky & Terveen, 2008, p. 273).

Numerical ratings that other cyclists have given a street (e.g., 3 stars): This is a method of feedback that Cyclopath provides, and is commonly used in other crowdsourced rating systems.

8.3.4. Closing questions

The study concluded with a brief, semi-structured discussion about how participants might use an experiential trip planner outside the context of a research study. I was particularly interested distinguishing participants with vague praise from ones who can articulate specific trips where an experiential trip planner would have helped. Like other parts of the study, the questions were semi-structured. I asked questions like “what do you see as the biggest advantage of a trip planner that shows experience? The biggest drawback?” and “Can you think of a trip you’ve taken recently where having an experiential trip planner might have helped you enjoy the experience more?”

8.4. Data Collection and Analysis

For this research, I needed a qualitative data analysis method that is suitable for addressing both pre-conceived questions and emergent issues. I chose the framework approach (Ritchie & Spencer, 2002) for its ability to examine both kinds of issues.

Some of my research questions are focused and specific: questions about how the two designs will be interpreted and used. These pre-conceived questions, and the background research I did to develop the cycling experience framework, make analysis methods such as grounded theory unsuitable for my needs. In grounded theory, the researcher avoids a priori theories and, instead, develops theory entirely from data gathered in the field (Creswell, 2007, p. 56). However, it would be insufficient for my analysis to be entirely constrained to pre-conceived questions. With this study, I also seek to refine my understanding of what experiential trip planners are useful for. This requires being open to emergent results; to encounter surprises that “[force] the designer to reconsider her basic assumptions” (Löwgren & Stolterman, 2004, p. 25). The framework approach allows for investigation of “a priori issues (those informed by the original research aims and introduced into the interviews via the topic guide), emergent issues raised by the respondents themselves, and analytical themes arising from the recurrence or patterning of particular views or experiences” (Ritchie & Spencer, 2002, p. 313).
The framework approach has other useful properties, too. It is a grounded approach, which is “heavily based in, and driven by, the original accounts and observations of the people it is about” (Ritchie & Spencer, 2002, p. 310). Also, it supports between-case analysis, which is helpful for my research questions about variations across participants.

Data collection in the framework approach is usually conducted on notes and transcripts from semi-structured interviews. I took notes during my study sessions, and referred to those for most participants. For four participants, I made complete transcriptions of the sessions and analyzed those instead of notes. Additionally, I referred back to the video recordings when the notes or transcripts needed to be placed into context.

Ritchie and Spencer (2002) wrote the seminal description of the framework approach. But they describe a pencil and paper approach. I did my data analysis with NVivo (QSR International, v. 10), a computer program for qualitative analysis. Therefore, my process was more similar to the process described by Smith and Firth (2011), who also used NVivo. In my analysis, as in Smith and Firth’s, the boundaries between the stages of the framework approach are less strict than what Ritchie and Spencer describe. That is okay, however, because Ritchie and Spencer call the stages “highly interconnected” (2002, p. 310).

The first stage of my analysis was to review the data (notes and transcripts), identify themes, and indexing (or coding) the themes. Ritchie and Spencer use the term indexing to describe a process that is similar to open coding from grounded theory: annotating the notes and transcripts to assign passages to categories. I continued to refine the codes throughout the analysis process.

The next stage was to create matrices (or tables) with rows for participants and columns for selected themes and codes. For example, the matrix for hills had columns for codes such as “hills’ affect on cyclist behaviour,” “comparing hills between routes,” and “hill lines: reading uphill/downhill.” Creating the matrix usually involved taking a high-level code like hills and refining it into more granular codes. Cells in the matrix contained a summary of the participants’ statements and behaviours for that code. (NVivo keeps a link back from the matrix cells back to the transcripts, which helps keep the summaries in context.)

In the last stage, I reviewed and analyzed the framework matrices. I looked at the range of responses that participants gave; I categorized the kinds of responses, and (when appropriate) described reasons for the differing responses.
8.5. Recruitment and Pilot Studies

A pilot study with three participants was followed by a study with eight participants. The pilot study was used to refine the questions asked in the study, as well as to identify and correct minor flaws in the prototypes. Since the changes to the study and the prototypes were minor, I am including data from the pilot study in my results in situations where the pilot participants experienced similar conditions as the study participants.

The pilot study participants were recruited from among people I know. The other study participants were recruited in three ways: by posting a recruitment message on Facebook groups for Vancouver cyclists (seven participants recruited this way), a friend of a friend who was referred to me (two participants), and a recruitment e-mail sent to students at another university (one participant).

Study participants each received $25 for their participation. The eligibility criteria for participants were (a) being age 16 or older and (b) riding a bike for transportation at least five times in the previous year.

8.6. Participants

In total, thirteen people (seven women and six men) participated in the study. Four participants were in their twenties, seven in their thirties, and two in their forties. Two of the participants lived in Portland, Ore., the rest in Vancouver. I included Portlanders to get the perspective of people who were less familiar with Vancouver. However, it turned out that both Portland participants had recently returned from trips to Vancouver where they cycled extensively.

No participants were colour blind, nor did any participants have visual impairments that would have prevented them from clearly seeing the computer screen.

Most participants are frequent, year-round cyclists. When asked how often they ride, seven participants said they ride weekly (or more) all year. Three participants ride weekly in the summer and less often in the winter, and two participants ride less than once a week all year. There were no summer-only cyclists.

The participants also tended to be willing to ride in traffic. Eight of them identified with the statement “I’ll ride my bike in almost any street conditions, even if it means sharing a busy street with cars,” and four identified with “I try to stay on facilities for bikes, such as a low-traffic street or in a bike lane.” However, most of the participants who were willing to share a busy street with cars had a strong preference not to. They were willing to ride in traffic if they needed to, but described going out of their way

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The total does not add up to thirteen, because the first pilot participant took a survey that did not include these questions. Nor was he asked about the traffic conditions he rides in. He is not included in the discussion of those topics.
to avoid traffic when they could. One participant, Adrian, was an exception. He was unwilling to deviate from the major streets he perceived as being the most direct route.

In total, six of the participants were both year-round cyclists and comfortable riding on busy streets. The sustainability goal of this project is to increase cycling, and such already-committed cyclists are not the people who need to be convinced to cycle more. However, they are still worth including in the study. First, they were generally able to identify situations when an experiential trip planner would be useful to them, meaning that they might use such a tool if it existed. Second, because of their experience, they were often able to articulate their concerns well and offer thoughtful criticisms. Third, many of these participants have idiosyncratic preferences that broaden the topics the study covers. For example, Lisa, the participant who was most interested in conversing with other cyclists, was one of the committed cyclists.

The criteria for participation in the study asked that participants rode for utilitarian purposes at least five times in the prior year. One participant, Hong, did not meet that criteria. She had only owned a bike for a month or two, and rode primarily for recreation, although she had been on a few utilitarian trips. I am including Hong in the study results to obtain the perspective of a novice cyclist.

In a limitation of the study, I did not ask the participants how comfortable they are using maps. While no participant expressly stated that they are bad at using maps (and a few self-identified as being good at reading maps), “adults are not always very competent or confident in using maps in the real world” (Blades & Spencer, 1987, p. 64). Comfort with maps may have had an effect on how participants reacted to the experiential maps. Also, it is possible that people who find maps frustrating self-selected out of the study, since the recruitment advertisements invited people to “come try a new kind of bike map.”

5 The names of participants are pseudonyms.
9. User Study Results

The findings from the user study fall into three broad categories of knowledge.

1. Additional information about the context and motivations for cycling trips, as well as participants' views on the value an experiential trip planner could provide.

2. The kinds of information that are meaningful for understanding cycling experience. As participants talked about what was important, an information hierarchy emerged. The most important information describe avoiding unpleasant experiences, such as hills and auto traffic. Physical surroundings were less important, but a source of enjoyment and interest.

3. How well the media in the map represented experiential information. Participants were most drawn to the hill profile, the photographs, and the emotion comments. They critiqued all the representations, describing what made representations helpful or problematic.

9.1. Card-sorting results

At the end of the study, participants did a card-sorting activity, to provide a second perspective on the relative importances of factors that can influence the experience of cycling. I will refer back to these results throughout the chapter, hence their brief presentation here.

In the card-sorting activity, participants received a stack of cards listing experiential factors. They categorized the cards according to whether the factors were always or usually important, sometimes important, or rarely or never important. Ten participants completed this activity, and the results are in Table 3.

The most highly-rated cards were about street conditions and hills. After that came cards from other aspects of the framework: surroundings, movement and awareness, and so forth. I will go into more detail in subsequent sections, as I discuss the topics described by the cards.

There are a few caveats to interpreting the card-sorting results. First, participants may have interpreted the meanings of the cards differently, which would affect the results. Also, there was a wide variation between participants in the size of the three piles. For example, the always or usually important pile had a median size of 17 items. But the size of the pile ranged from 6 to 24 items, with a standard deviation of 5 items. The other piles had similar variations in size. This could be due to some participants really having a smaller set of important factors, or it could reflect differences in interpretation between “usually” and “sometimes” important.
<table>
<thead>
<tr>
<th>Always or Usually Important</th>
<th>Sometimes Important</th>
<th>Rarely or Never Important</th>
<th>Framework Category</th>
<th>Card Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>1</td>
<td>0</td>
<td>Exertion, Rest, &amp; Recovery</td>
<td>Hills</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>0</td>
<td>Street Conditions</td>
<td>Poor visibility: hard to see others on the road or for them to see you.</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>0</td>
<td>Street Conditions</td>
<td>Type of bikeway: bike lane next to busy street, quiet street, separated bikeway, etc.</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>0</td>
<td>Street Conditions</td>
<td>Crossing a busy road without a stoplight</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>0</td>
<td>Street Conditions</td>
<td>How many cars are around you</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>0</td>
<td>Street Conditions</td>
<td>How many heavy trucks are around you</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>0</td>
<td>Street Conditions</td>
<td>Speed of auto traffic</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>0</td>
<td>Street Conditions</td>
<td>Where you'll be riding next to parked cars: Risk of being doored.</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>1</td>
<td>Street Conditions</td>
<td>Potholes</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>0</td>
<td>Street Conditions</td>
<td>Bumpiness of the road</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>2</td>
<td>Street Conditions</td>
<td>Where you'll be merging with cars or crossing auto lanes</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>0</td>
<td>Street Conditions</td>
<td>How many buses are around you</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>0</td>
<td>Street Conditions</td>
<td>Road Width</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>1</td>
<td>Street Conditions</td>
<td>Garbage or debris on the road</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>2</td>
<td>Movement &amp; Awareness</td>
<td>Can you go fast?</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>0</td>
<td>Surroundings</td>
<td>Viewpoints</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>1</td>
<td>Street Conditions</td>
<td>Construction</td>
</tr>
<tr>
<td>Always or Usually Important</td>
<td>Sometimes Important</td>
<td>Rarely or Never Important</td>
<td>Framework Category</td>
<td>Card Text</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------</td>
<td>--------------------------</td>
<td>--------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>1</td>
<td>Movement &amp; Awareness</td>
<td>How often you have to stop. e.g., routes with lots of stop signs</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>1</td>
<td>Movement &amp; Awareness</td>
<td>Landmarks to help you find your way</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>3</td>
<td>Surroundings</td>
<td>Parks</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>1</td>
<td>Misc.</td>
<td>Comments that other cyclists have given to a street or place</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>1</td>
<td>Surroundings</td>
<td>Train tracks</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>1</td>
<td>Surroundings</td>
<td>Trees</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>2</td>
<td>Movement &amp; Awareness</td>
<td>Do you have to go slow?</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>2</td>
<td>Surroundings</td>
<td>Public art: murals, sculptures, etc.</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>2</td>
<td>Surroundings</td>
<td>Weather</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>5</td>
<td>Surroundings</td>
<td>Washrooms</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>1</td>
<td>Misc.</td>
<td>Numerical ratings that other cyclists have given a street. e.g., 3 stars.</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>1</td>
<td>Surroundings</td>
<td>Shade</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>2</td>
<td>Surroundings</td>
<td>Distinctive buildings</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>2</td>
<td>Exertion, Rest, &amp; Recovery</td>
<td>Headwinds</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>2</td>
<td>Surroundings</td>
<td>How many people are around. (Not in cars.)</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>2</td>
<td>Movement &amp; Awareness</td>
<td>How much do you have to pay attention? Can you relax and let your mind wander?</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>2</td>
<td>Surroundings, Social</td>
<td>Meeting spots that are important to cyclists</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>2</td>
<td>Surroundings</td>
<td>Type of neighbourhood</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>3</td>
<td>Surroundings</td>
<td>History of the area</td>
</tr>
<tr>
<td>Always or Usually Important</td>
<td>Sometimes Important</td>
<td>Rarely or Never Important</td>
<td>Framework Category</td>
<td>Card Text</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------</td>
<td>---------------------------</td>
<td>--------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>3</td>
<td>Movement &amp; Awareness</td>
<td>Places where it’s easy to get lost</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>4</td>
<td>Exertion, Rest, &amp; Recovery</td>
<td>Drinking fountains</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>1</td>
<td>Street Conditions</td>
<td>Stoplights</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>2</td>
<td>Surroundings</td>
<td>Sounds / noise</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>2</td>
<td>Surroundings</td>
<td>Street lights</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>3</td>
<td>Surroundings</td>
<td>Gardens</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>6</td>
<td>Surroundings</td>
<td>Local animals: dogs, cats, skunks, crows, etc.</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>4</td>
<td>Surroundings</td>
<td>Cafes &amp; coffee shops</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>4</td>
<td>Surroundings</td>
<td>Smells</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>6</td>
<td>Exertion, Rest, &amp; Recovery</td>
<td>Benches &amp; shelters</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>6</td>
<td>Surroundings, Social</td>
<td>What other people are doing: shopping, sitting in cafes, playing, etc.</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>8</td>
<td>Surroundings, Social</td>
<td>What the other people are like: Fashionable/stylish, friendly,</td>
</tr>
</tbody>
</table>

### 9.2. Trip contexts

The prototypes used in the study were designed for specific trip-planning scenarios: riding to a picnic on a sunny Saturday afternoon, and choosing a route to work. But the kinds of trips cyclists take, and the contexts those trips occur in, are broader than the two specific scenarios I tested. The study revealed other contexts.

Participants cycle for a number of purposes. In the introductory survey, nine of the thirteen participants said they cycle for all of the following reasons: Going to work or school, shopping and running errands, visiting friends and family, going out for recreation (biking to the movies, to the pub, etc.), and purely for fun or exercise. Additionally, two participants ride to transport heavy loads, and one rides with his dog to the park. There were no participants who ride with their children (or who even mentioned having children).
The purpose of a trip is one part of the context a trip occurs in, but contexts can be broader than just the trip purpose. On one hand, a trip purpose of *take my dog to the park* causes a context of *riding with my dog*. On the other hand, contexts such as a desire for exercise, or the weather, occur independently of the trip purpose.

**Time pressure.** One of the goals of the to-work scenario was to investigate how being under time pressure affects participants’ route choice, since cyclists going to work are less likely to go out of their way for a pleasant cycling experience (Dill & Gliebe, 2008). That generally held true for the confident cyclists, the ones who said they were willing to share a busy street with cars. They tended to choose the most direct route, and stated that pleasant surroundings are less important when in a hurry. However, the less-confident cyclists usually picked the indirect route, and often justified the decision in terms of quality of experience. They were not as willing to give up a good experience in order to have a faster trip.

Among the eight confident cyclists, only two chose the indirect route; both of them said they would take the direct route if they were late. Adrian decided that neither route was fast enough; he would ride his motorcycle to work. The other five confident cyclists all chose direct routes. They tended to choose the routes because of the directness, and downplay the importance of nice surroundings.

[The indirect route] is a little bit squirrely, more wiggly than I would usually do if I was gonna book it. Just rolled out of bed and thrown on my clothes . . . and trying to get down there (Lisa).

I would pass by a community centre [on the direct route], which probably I wouldn’t care. I probably would not care how the townhouses would look like. . . . [I would care] about the nice view (Anil).

Four of the five less-confident cyclists chose the indirect route. And Dawn, who chose the direct route, selected it because it had a steeper downhill, which she would enjoy more. The justifications for choosing the indirect route were, similarly, about the pleasantness of the experience. These participants both sought out the pleasantness of a bikeway, and wanted to avoid the traffic on the direct route. (Several participants perceived the direct route to have more traffic than it actually did; see Section 9.4.3.)

One [route] is shorter, but it seems to go on main roads. . . . Still being a bit of a wimpy Vancouver cyclist, I'm just generally for pleasantness (Lane).

[I chose the indirect route] because it seems to not have that much of hills. It seems more flat than the [other route]. I think there is a playground. It seems nicer. It has more views on it (Hong).

1 Four took the suggested direct route. One planned her own route, which she believed to be more direct than either suggested route.
**Weather.** Vancouver and Portland are rainy in the winter, and this causes several participants to cut back on their cycling (although one specifically enjoys cycling in the rain). A few participants described how rainy weather will cause them to take lower-traffic streets, to avoid being splashed by cars, and because drivers’ visibility is reduced in the rain. Sunshine was also a concern – six participants worried about direct sun being too hot or causing sunburn. They wanted to know which routes would have tree canopy providing shade.

**Riding with friends.** Ten of the participants ride with a spouse or friends. When they described cycling with friends, participants primarily mentioned issues around conversational cycling: having space to ride two abreast, and a quiet enough environment to talk in.

Cycling with friends can also help participants be more comfortable. Hong, who is very new to cycling, rides with friends because “I am not very good. I am a little bit scared if I ride my bike alone.” Joyce finds riding with friends to be beneficial when going on inter-city cycle tours: “When I’m with a group of people, I’m less scared. . . . When I’m by myself, I always have a fear that I’ll end up on a freeway, or end up on a weird road.”

A few participants also described negotiating routes with their partners. Lane described a trip to lunch, where her boyfriend claimed to know where the restaurant was, but he got lost. While they made the best of it, exploring new shops and galleries as they searched for the restaurant, eventually the situation became tense – a result of feeling unsafe on busy streets, not finding the restaurant, and being hungry and cranky. Joyce, a rather confident cyclist, has an easier time negotiating routes with her partner:

Me: So how does riding with [your partner] change the way that your ride?

Joyce: Not so much. He pretty much lets me lead the route. In other relationships I’ve had, people had very [particular opinions] about how they wanted to ride. He doesn’t really care. [Laughs.] I go wherever I want to go, and he’ll follow.

**Riding with a dog.** Adrian bikes with his dog when they go to the dog park. While this is good exercise for the dog, it can be problematic because the dog is prone to stopping suddenly or running towards traffic. Adrian deals with this by taking side streets (normally he takes busy streets) and keeping the dog on the sidewalk side of the bike.

**Carrying a load.** Two participants, Joyce and Robert, often transport heavy in trailers behind their bikes. They are both comfortable riding with trailers. The major impact on route choice is avoiding hills. As Robert put it, “elevation is the primary concern; just about the only concern when you have lots of weight.” Joyce was less emphatic about avoiding hills; perhaps because she lives in Portland and faces fewer steep hills. Adrian sometimes carries groceries home by balancing the bags on his
handlebars. That doesn’t affect his route choice much, since the grocery store is so close.

**Desire for exercise.** In the survey, 11 participants said they ride for fun or exercise. But then surprisingly few talked about exercise during the rest of the study. Adrian doesn’t often consider exercise when choosing a route, but will sometimes tweak his route to take a bigger hill when he wants a challenge.

### 9.3. Benefits of an experiential trip planner

Participants described several benefits of using an experiential trip planner, and reasons why they would use one. Avoiding unpleasant situations, and choosing pleasant ones instead, was a recurring theme throughout the study, although few participants explicitly mentioned this as a benefit of experiential trip planners.

> [It’s] nice to see the flattest route, pick the easiest way. Or the shadiest way. Nice to know where the bike routes are, pick the safe way. (Robert)

Other benefits are: inspiring exploration and providing variety; tailoring routes to the cyclist's mood or the context of the ride; and improving the experience of a trip the cyclist takes regularly.

#### 9.3.1. **Exploration, variety, and spontaneity**

Several participants described using their bikes to explore, and see new things. They also desired variety in the routes they chose, trying new routes according to what suits them. They spontaneously make decisions to explore and seek out variety.

Exploration could mean finding new shops, seeing new art or parks, or just going somewhere new and seeing what is there. However, exploration is not appropriate for all contexts.

> I’m always happy if a route takes me somewhere I’ve never been before. And I’ve noticed that cycle routes often do, because they’re on quieter back streets. I like that. (Lane, discussing finding new shops on her route.)

> [An experiential trip planner is useful] to learn about other people’s experiences. . . I tend to get stuck in a rut. Sharing those experiences might actually introduce me to things I wouldn't explore myself. (Lisa)

> It’s interesting because I am a very curious person, I like to explore. But when it comes to just going to work I like to use my headspace while I am commuting to do other things [such as thinking about my day]. I mean I’m still watching the road and other stuff, but I don’t have to think about where I am going. (Joyce)
One of the perceived benefits of an experiential trip planner is the ability to inspire exploration and variety. Within the prototypes, the emotion comments and photographs sparked the most comments about wanting to explore. A few participants also used the land use colour coding to identify commercial areas they might explore.

Dennis expressed the most interest in using an experiential trip planner to spur exploration. He repeatedly asked for additional information about things to see and do, as well as interpretive historical information. For example, he wanted the photographs to explain “... why the picture is there. And what is there, around this area. Any attraction or any history or any special story about that.” The illustrations of the districts, likewise, would also be more useful to Dennis if they had enough information to inspire him to take a trip to explore an area. That is, they should provide him with a reason to visit the district.

Other participants were less motivated by pure exploration, but still saw the prototypes as having the potential to inspire them to explore. However, Hong was concerned that a tool that revealed too much would make exploration less fun, by lessening the pleasure of discovery.

Knowing where there was cool stuff to look at, like murals, or where there are interesting shops and things would be useful. (Laurelai)

Sharing those experiences might actually introduce me to things I wouldn’t explore myself. That seems useful, a way of recommending. (Lisa)

In a similar vein to exploration is spontaneity: going somewhere on a whim. When describing rides they have taken previously, several participants mentioned making decisions spontaneously. While many of these spontaneous decisions were in the context of exploring – making quick decisions about where to explore – participants also spontaneously decided to go to known places. Adrian, for example, told me about a time when he started riding home from work and spontaneously decided to watch the sunset from Stanley Park, instead of going directly home.

9.3.2. Tailoring routes to mood and context

Several participants talked about the ways they varied their routes by their mood. For example, Luke, who is not very comfortable riding with cars, will increase his exposure to traffic when he is “feeling adventurous.” This can be crossing a busy street without a light, instead of going out of his way to cross at a signal. Or it could be riding in the bike lanes downtown.

The prototypes gave participants “a couple of options, so you can choose your route according to what you feel like putting yourself through that day” (Anna).
Participants saw this as a benefit: helping them choose a route based on their mood and situational desires.

9.3.3. Improving an existing trip

A few participants expressed a desire to improve or optimize a trip that they take regularly. Some saw this as a useful application for an experiential trip planner; others said they would do this by exploring alternative routes on their bike, and settling in on one they prefer.

Two participants wanted to use an experiential trip planner to fix a problem in a route they take regularly. Anna often travels through downtown to visit her sister. She has two possible routes, and would like to see “. . . how [they] compare with time and distance and hills and everything else . . .” Lane’s boyfriend lives on a hill, in a neighbourhood with a poorly-connected street grid. Her attempts to find the most pleasant ascent have left her confused by streets that don’t go through.

In the to-work scenario, three participants described a hypothetical process of improving their commutes over time. They would start out on a route with simple wayfinding, “[b]ecause I don’t want to look at my map every five seconds trying to figure out where I’m going” (Joyce). Then as they get used to the neighbourhood, they would find a more direct route. Two of these three participants described the improvement process in terms of exploring on the bike; they did not suggest they would use an experiential trip planner to aid in this improvement. (The third participant merely said he would try the other route eventually.)

So when is trip amenable to improvement with an experiential trip planner, and when with non-mediated exploration? Two differences emerge: First, both participants who said they would explore to improve their routes are more experienced cyclists. In other parts of the interview, they showed a high confidence in their ability to recover from unpleasant situations (e.g., missing a turn and ending up at a busy, uncontrolled intersection). More experienced cyclists will likely be more confidence in their exploration abilities. Second, the optimization through exploration occurs near to these participants’ (hypothetical) homes, where they would grow familiar with the area. The participants who wanted to improve trips with an experiential trip planner, on the other hand, described having problems in areas farther away from their homes. This suggests that experiential trip planners may be more useful for improving existing trips that occur in less-familiar areas.
9.4. Meaningful information

As the participants used the prototypes, they talked about the kinds of information that are useful to know when planning a cycling trip: what factors they are interested in, and why. Analysing their statements and behaviours revealed a hierarchy of information — which experiential factors are most important.

The topics in this section loosely follow the framework of cycling experience (Chapter 2). But some topics from the framework have enough discussion around them that they are broken up into several sections. For example, in framework category of exertion, rest, and recovery, hills were the most important part of that category. So hills are discussed separately.

9.4.1. Information hierarchy

The prototypes provided a breadth of experiential information; some kinds of information were more consistently useful than others. The kinds of information fell into three categories:

1. The core category consists of information that was consistently important, across participants and contexts. Items in this category tended to be obstacles, hazards, and difficulties.

2. Information in the secondary category are important, but not consistently. Some participants found them more important than others. Or they were more important in some contexts than others.

3. Finally, the esoteric or uninteresting category consists of information that did not arouse much interest. At most, only a few participants expressed an interest in this information. Sometimes a participant expressed a strong interest, but if he or she was the only one to do so, I classified the interest as esoteric.

I developed the information hierarchy primarily by analyzing the participants’ discussion of the maps – paying attention to the information they said was valuable, and the factors they cited when explaining their route choices. I supplemented this with the results of the card-sorting activity.

Determining the relative importances of information can be challenging, because of differences in visual prominence in the representations of information. If, for example, a participant discusses hills more than the type of neighbourhood, is it safe to infer that hills are more important? Or is it just because the hill chart is more visually prominent than the colour coding of neighbourhood type? The photographs and comments are useful for addressing this issue, because they convey a broad range of information at the same level of visual prominence. A comment about the look of the surroundings is
Table 4. **Information hierarchy**

 cô Core category in the information hierarchy  
s Secondary category  
e Esoteric / uninteresting category

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<thead>
<tr>
<th>Exertion</th>
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<td>Hills</td>
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<td>Food &amp; Beverage</td>
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<td>Resting</td>
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**Street Conditions**

| Type of bikeway | có     |         |
| Type of street  | có     |         |
| Traffic levels  | có     |         |
| Width of street | có     | s      |
| Traffic signals | có     | s      |
| Construction    | s      |         |

**Off-Street Path Conditions**

| Pedestrians     | có     |         |
| Visibility      | có     | s      |
| Path width      | có     | s      |
| Surface quality | có     | s      |

**Surroundings**

| Viewpoints     | có     | s      |
| Shade          | có     | s      |
| Trees          | s      |        |
| Shops and cafes| s      |        |
| Points of interest and attractions | s |   |
| Social Surroundings | e |   |

**Movement and Awareness**

| Routes that are simple to navigate | có     | s      |
| Turns that are easy to miss       | s      |        |
| Other feelings of being in motion | s      | e      |
as prominent as one about the street conditions. And, happily, participants opined freely about which comments and photographs they found helpful and which they did not. Much of the analysis of X is more important than Y comes from participants explaining why one photograph or comment is more useful or relevant than another. (This is not to say that I ignored comments about relative importances in other contexts, just that the topic came up the most often with respect to comments and photographs.)

Table 4 lists experiential factors and their category in the information hierarchy. For several factors, the study results do not conclusively place them in one category; these are given two categories in Table 4.

9.4.2. Hills

Along with traffic, participants described hills as one of the two most important aspects of the cycling experience, with going uphill a bigger concern than downhill. In the card-sorting activity, hills were rated “always or usually important” more than any other factor (Table 3 on page 85). This importance was also reflected in participants’ comments:

[I’m a] serial hill avoider. Any information I get about hills is really good. (Lisa)

It is very difficult when I ride my bike uphill, because I don’t have much strength. (Hong)

My second consideration, after traffic, is the elevation gain. See how much uphill [and] downhill I will go [through]. (Dennis)

Participants had various methods for dealing with hills. Avoiding hills was a popular option. Lisa described a trip where, instead of following a neighbourhood bikeway, she took a combination of low-traffic streets and paths, since that let her reach her destination without losing elevation. And Anna combines bikes with transit, to let transit take her uphill, making her whole trip slightly downhill.

Several participants also said that, if they must go up a hill, it’s better to get it over and done with quickly.

I would rather get it [the hill in the to-work scenario] over with right away. Confront it head-on. This [route, via Inverness and Windsor] seems like it’s less extreme elevation, but it’s more up and down. I would just rather go up and then come down. (Adrian)

I’ll take a steep short hill over a long-ass hill any day. So, yeah. There’s places like parts of Main Street where I’ll take the huge-ass hill in order to avoid sort of going slightly uphill for hours and hours. (Lisa)
However, sometimes a route is just too steep. In Portland, some routes up the Alameda ridge are long and gentle; about 20 blocks east it is short and steep. Joyce tries to use roads up the ridge that balance length and steepness.

Dennis deals with hilly rides by bringing his mountain bike instead of his road bike. He did not say why, but it is likely because mountain bikes tend to have gear ratios that are more amenable to hills than road bikes do. And two participants described pushing their bikes up hills that are too steep to ride up.

Participants spoke much more vividly about avoiding going uphill than they did about enjoying going downhill. Some participants used words like “fun” and “nice” to describe the downhill at the end of the to-work scenario, but without the emotion that they did when talking about uphills.

9.4.3. **Type of bikeway and type of street**

Participants expressed a strong interest in knowing the type of bikeway, which is something the prototypes were designed to convey. They also described categories of streets that are not designated bikeways – major and minor roads – and several participants had difficulty determining whether a suggested route took them on major or minor roads. Both of these are core categories in the information hierarchy. They are also intertwined with the street conditions, which I will discuss in the next section.

Regarding the type of bikeway, participants expressed a general desire to be away from cars, although some are willing to ride with cars then they are in a hurry.

I would prefer the bike route [in the to-work scenario, as opposed to the route that is not a designated bikeway], just to be with other bikes. (Robert, a confident cyclist)

I’d rather avoid bike lanes if possible. I’d definitely choose [a] bike path or residential over shared road. (Luke, a non-confident cyclist)

Some of the less-experienced cyclists struggled with the terminology, using “bike path” or “bike lane” to refer to every kind of designated bike route, and asking me questions to clarify what the terms mean. One of my attempts to explain a shared roadway resulted in a significant misunderstanding, where a participant thought that a busy road would have no traffic. In the to-picnic scenario, Dawn was considering taking a road that was not one of the suggested routes. So the only information she had about the road was the bikeway type, “shared roadway.” She asked what that meant:

Me: So a shared roadway is one that will have some markings on the street. [I drew a picture of a sharrow. ] Have you ever seen a symbol that looks like this?

---

2 Main St., between Keefer St. and Terminal Ave.

3 For a description of sharrows, see Section 3.2.
Dawn: Oh, yeah, yeah, yeah.

Me: Roads with that kind of symbol on them are these light blue shared roadways.

Dawn: Okay. Oh, that is okay for me.

Me: Really?

Dawn: Because no bus will take this, right?

Me: No, buses will take this road.

Dawn: No cars either, right?

Me: Buses and cars do take these roads. . . . Main St. has a lot of cars and several bus routes on it.

I suspect that Dawn confused my drawing of a sharrow (a pavement marking) with the signs that delineate off-street paths between pedestrians and cyclists (Figure 41). This suggests that not only is there a need for a richer description of the types of bikeways, but that care must be taken in describing the types of bikeways.

Participants also described two categories of streets that are not designated bikeways: major and minor roads, the difference between the two being the amount of auto traffic. There were a variety of terms used to describe these categories – busy and quiet streets, side streets, and neighbourhood streets – but the concept remained the same. One of the two suggested routes in the to-work scenario, via Argyle and Dumfries, was largely, but not entirely, on minor roads. However, five participants had trouble determining that this was the case – they saw Argyle and Dumfries as being largely major roads, or were unclear about its traffic levels. This may have been due to a combination of several factors.
• The legend describing the colour-coded bikeways listed gray-coloured streets, which Argyle and Dumfries were, as “regular street (not a bikeway).” For some, the term “regular street” implied a busy street. “It says ‘regular street.’ I think I share the road with cars and buses” (Hong).

• Most of the participants who thought that Argyle and Dumfries were major streets saw Design A first, and inferred high traffic from that design. The arrangement of the comments may have been misleading: Two comments at the start and end of the route speak of traffic. These are the two sections of the route that legitimately have traffic. Since there was no indication of how much of the route those comments apply to, and since there was no other indication of a lack of traffic, participants may have taken those comments to apply to most of the route instead of two small segments.

• Additionally, the hill lines in Design A obscured the road lines in the map’s base layer; this made it hard to notice that the streets were drawn with a thin line, not a thick line.

• The title of the route, Via Argyle and Dumfries, may have had an effect, but I am doubtful that it did. The title comes from the streets that the route primarily follows – it follows Argyle Street, which is low-traffic, for about 1.5 km. But Argyle Drive is nearby, and it has moderate traffic. It is conceivable that the name Argyle in the route’s title brought up connotations of traffic on Argyle Drive. However, these participants said they were unfamiliar with the area. So it seems less likely that they would recognize Argyle (Drive) as a high-traffic street. Still, this is a reminder that street names can have inaccurate connotations.

9.4.4. Street conditions, and the look of the street

Beyond the type of bikeway and type of street, participants had a breadth of concerns about the street conditions. They also had distinctive sets of concerns about streets and off-street paths (I will discuss off-street paths in the next section).

Street conditions, as a whole, are a core category in the information hierarchy. However, it does not necessarily follow that every last detail of the street conditions are core, and it is not always clear which aspects are core (consistently important) and which are secondary. In this section, I am addressing the breadth of street conditions that came up, without breaking them down into core and secondary categories.

The discussions of street conditions focused on avoiding the negative. Participants discussed tended to discuss unpleasant or unsafe conditions that they wanted to avoid. Or, if not avoid, to know what they were getting into. Topics included car

4 Argyle is not the only Vancouver street name that refers to major and minor streets. Nanimo St. is busy north of 33rd Ave. and quiet south of there. Similarly, Fraser St. is busy south of Broadway and quiet to the north.
traffic, bus and heavy truck traffic, construction, difficult intersections, narrow road width, poor air quality, and poor road surfaces.

Participants repeatedly talked about street conditions in terms of “the look of the road,” a catch-all term that encompassed the many specific conditions they were concerned about. (Eight participants used that term, or one like it.) They valued photographs that showed a straight-ahead view of the road. Photographs that looked to the side of the road, or that did not show the road at all, were less useful.

Some of them [the photographs] are quite practical. The more practical ones, cycling wise, show what the cycle lane [a term she used to describe any cycling route] looks like. You can picture what it looks like. How big the roads are. Interesting to know what the neighbourhoods are like. (Lane.)

Adrian: You know, I like the pictures [the photographs].

Me: How come?

Adrian: They give me context. Like, if I see this picture [Figure 42] – I think it's Gore [Ave.] and Keefer [St.] – and I know exactly where it is. And what to expect. Obviously it's not live, but –

[Adrian opened a new picture; Figure 43.]

See, this would be – I'm looking at a picture of, I think it's West First [Ave.]. . . . And it would be nicer to see the whole street. As opposed to [this photograph,] it's looking towards the buildings from the middle of the street. I think it would be more helpful to see it from the street, right on.

I suspect there are several reasons why photographs conveyed the information so successfully. First, they gather all of the street condition information into one place. In contrast, Design B has indicators for bikeway type and vehicle traffic levels, but those indicators are in two different places on the map. There seemed to be value in bringing
the street conditions together in one place. Second, photographs are a familiar medium that do not require interpretation or decoding. Third, the photographs were visually prominent in the designs; that prominence made them attractive.

Most participants also found the emotion comments helpful for learning about street conditions, particularly comments that warned about problematic conditions (Table 5). They used these comments to choose another route, or to cause them to take some action during the ride.

This [“trapped” comment] tells me I need to slow down (Glory)

[The “unwelcome” comment is useful] just to know that there is a danger on the route. So if I get to that point . . . then I’ll be able to, hopefully, look for drivers. (Luke)

Train tracks were an important street condition for the Portland participants, but not for the Vancouver participants. This is an example of how the factors that are important to cyclists varies across cities. In Portland, there is an extensive light rail network that runs through the city centre at street level. Both Portland participants described safety concerns around train tracks. However, Vancouver’s transit system uses elevated rail, and the freight rail tracks are mostly separated from the streets. When Vancouver participants mentioned trains – and only three of them did – they tended to describe it as part of the visual surroundings: as something to look at, not worry about.

I will never ride in a train track and move back and forth. Ever. Because [an accident] is just too easy to happen. . . . Every friend of mine has fallen on a train track or wrecked their wheel, at one point or another. (Joyce, from Portland)

<table>
<thead>
<tr>
<th>Title (emotion)</th>
<th>Text</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trapped</td>
<td>Officially a bike route, really a narrow street with lotta [sic] cars</td>
<td>Keefer St., near Main St.</td>
</tr>
<tr>
<td>Alert!</td>
<td>Be careful in front of Costco. Lots of people getting in &amp; out of their cars.</td>
<td>Expo Blvd., southwest of the Dunsmuir Viaduct</td>
</tr>
<tr>
<td>Alert</td>
<td>You’re riding to the right of parked cars. Don’t get doored!</td>
<td>Pacific Blvd., near Davie St.</td>
</tr>
<tr>
<td>Trapped!</td>
<td>In rush hour, this is a seriously shitty place to ride. You can either sit in traffic behind the cars or squeeze between them while they change lanes</td>
<td>Pacific Blvd., near Granville St.</td>
</tr>
<tr>
<td>Unwelcome</td>
<td>Inattentive drivers going fast around a corner. Not bike friendly.</td>
<td>Argyle Dr. and Braeburn Pl.</td>
</tr>
</tbody>
</table>
And you have [views of] the helipad, the North Shore, and the train tracks. (Anil, from Vancouver, describing enjoyable things on a trip\(^5\))

I don’t worry about train tracks, myself. I would worry if I was taking someone [else with me]. (Robert; this was the only time a Vancouver participant discussed the safety of train tracks)

9.4.5. **Off-street path conditions**

When discussing off-street paths, participants had a different, and smaller, set of concerns than when discussing streets. Many of the unpleasant things that participants wanted to avoid on streets, such as cars and difficult intersections, are not present on paths. Several (but not all) participants had some concerns about off-street paths, primarily pedestrian interactions and the physical conditions of the path.

The caveat in this section, especially when it comes to comparing participants’ information needs for paths and streets, is that we spent far less time in the study discussing off-street paths. The paths we did discuss were almost always the Seawall routes along the north and south shores of False Creek; these were popular routes in the to-picnic scenario. Cyclists may have broader information needs for other paths, especially ones that are less well known among Vancouver cyclists.

Many participants expressed concern about pedestrian interaction: having to ride around pedestrians is slow, and there is a risk of hitting a pedestrian. There were also concerns about how well pedestrians and cyclists are separated: several participants felt that, even in areas where cyclists and pedestrians have separate paths, pedestrians walk in or across the bike path.

I can picture this place, where you have to weave in and out of people. It’s a cycle path, but it’s not that quick. (Lane)

I’m not really a fan of the seawall, except at night. . . . Too many [pedestrians] in your way. Go slow or you’ll hit them. (Robert)

And then we’re going along and realized that the bicycle [and pedestrian shared] path turned into pedestrian only. Which we didn’t even realize. We were saying hi to people, and they were giving us mean looks. And then we said, “Oh, shoot. This is pedestrian only.” (Joyce)

I fell from a bike because I tried to avoid someone. Because . . . he’s walking towards me and I got scared. I tried to avoid him, and I fell. . . . I think lots of people [around], it makes me very nervous. (Hong)

\(^5\) Anil is describing a route on the shore of Burrard Inlet, north side downtown, going west from Crab Park, underneath the Vancouver Convention Centre, and onto the Seawall.
Participants were also interested in physical characteristics of the off-street paths: the width, the surface quality, and the visibility. Visibility tied in with the concerns about running into pedestrians. Adrian described a section of the seawall that did not feel like “an official-looking bike route” because it “winds among all these restaurants and residential areas” with sharp corners; he was “afraid that someone would pop out at me.” Three participants disliked one area of the seawall, where the path is surfaced with small tile pavers. Joyce was particularly upset, calling it “really dangerous,” because:

They have all of these cracked tiles. And [the signage] says bikes can be there, but my tire kept grabbing those [tiles]. And I almost went over twice. And I was not going fast. It is a horribly dangerous area. . . . I really don't like routes that start as bicycle friendly and then switch over to pedestrian friendly without any warning.

Joyce made the same complaint, about paths that stop being bike-friendly, earlier when she was discussing the path where pedestrians were giving her mean looks (page 101).

Even though a few participants talked about off-street paths being “for bikes” or “official-looking,” they did not talk about the “look of the path” in the same way they did when discussing “the look of the street.” Photographs that showed street conditions were highly valued for showing the look of the street; photographs showing off-street path conditions were not similarly valued. I am not sure why that is, but I have some speculation. It might be an artefact of the test: perhaps participants were familiar enough with the seawall they did not need to be shown it. Or perhaps the topic simply did not come up because we spent less time discussing off-street paths, and the prototypes showed fewer photographs of paths. However, if the result is real, if the look of the path really is less important than the look of the street, it may be because there is a narrower range of negative things in off-street paths. Participants used “the look of the street” as a catch-all term to describe a range of factors (primarily negative, but not entirely). With fewer potential downsides to an off-street path, perhaps there is less need for a catch-all term.

9.4.6. **Wayfinding**

The prototypes had two cyclist-submitted comments that warned about places where it is easy to take the wrong turn (Figure 44). Reactions to that warning were mixed, and revealed a distinction I had not considered in my design: the difference between missing a turn and being lost.

Five participants had positive, but tepid, attitudes about the wayfinding warnings, three had mixed feelings, and two did not find them helpful. The other three did not express a preference.
That's a good little sign to note, the confusing. (Luke)

This one says confusing. I might take a note of how do I get there. (Hong)

The confusing part doesn't confuse me. If I've been once, I'll never get it wrong. It's a small issue. (Glory)

Luke and Hong’s comments were the strongest statements in favour of the wayfinding warnings. When discussing these comments, participants often inferred, or stated explicitly, that missing a turn is not a big deal because they can still reach their destination without any serious problems. As Laurelai put it, “given that we’re talking about urban riding, it’s not going to be that I end up going three miles out of my way because I missed a turn.”

However, even though participants were not highly concerned about missing individual turns, they still had a preference for routes with fewer turns. In the to-work scenario, one of the differences between the two routes was that one, via Argyle and Dumfries, had more turns than the other, via Inverness and Windsor. A few participants cited the simpler turns as a reason to take Inverness and Windsor. But even so, Inverness and Windsor being a designated bikeway was a bigger motivation to take that route.

The cyclists who were least concerned about missing a turn tended to be the stronger cyclists. This may be because their experience makes them more comfortable riding on streets that aren't designated bikeways, and because they have the skills to deal with make it to their destination on or off a bikeway. For example, one of the benefits of riding on bikeways in Vancouver is having bike-activated traffic signals when crossing major roads. Luke is reluctant to cross without a light, and he is also concerned about missing turns and going off the bikeway. Laurelai found the warnings marginally useful, and she is very comfortable crossing busy streets without a light.

6 Maps of the routes are shown in Figure 26 on page 57.
9.4.7. **Physical Surroundings**

Participants chose routes in order to have enjoyable physical surroundings, and several were excited or enthusiastic about at least one aspect of the surroundings. They sought out nice views, shops and cafes, and public art. However, the desire for enjoyable surroundings was contextual, with most participants willing to forego nice surroundings if they are in a hurry.

Not all of the discussion about surroundings was about pleasantness, however. Participants described avoiding unpleasant surroundings, and using surroundings to deal with uncomfortable weather. Shade was mentioned by seven participants, primarily as a way of avoiding heat and sunburn on hot, sunny days. On cold days, however, shade became less desirable – to two participants – because “that’s going to make my route even colder” (Laurelai). Noise was also something to avoid, since it is unpleasant, makes it hard to be aware of the surroundings, and makes it difficult to hear your friends.

Shade is important on hills. I have a really sunny hill on my commute that’s really hot. (Laurelai)

I don’t tend to plan my routes around sounds and noise, but I do use it for telling what is around me. . . . loud noises [can be] troublesome to my perception of what is going on around me. (Laurelai)

If it’s too noisy . . . [it is] not so enjoyable for biking. . . . Like the heavy trucks. Maybe the noise from the construction site. For example [on a street frequented by container trucks?7] I can often hear the heavy trucks. They make noise. For example, the noise from the brake. Or the noise from the bumpy road. So the container is striking on the frame [of the truck] itself, making the noise. (Wilson)

Some kinds of surroundings straddle the line between pleasant and unpleasant. When talking about shade, participants mentioned both avoiding the heat and also appreciating the beauty of trees. Likewise, commercial areas were seen by some as a thing to avoid because of heavy traffic. Other participants were drawn towards commercial areas, to find interesting shops or nice cafes.

There were many pleasant aspects to the physical surroundings. Views were especially popular; in the card-sorting activity, viewpoints was the highest-rated factor. Most participants had positive things to say about routes with waterfront views in the to-picnic scenario. Participants also talked about enjoying nice-looking buildings and public art.

[Viewpoints are] an enjoyable part of riding a bike, you get to enjoy the view. And I can think of a few spots, [where] I would take a higher hill to get to the viewpoint. . . . I tend to be a very visual person, and I think about what it’s going to look like. (Lisa)

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7 Knight St.
It is going to make the trip more interesting, if there is public art. (Hong)

Participants tended to use the photographs to learn about the surroundings, although they did not talk much about what makes a photograph useful for describing the surroundings. Most of their comments were about what makes a photograph useful for describing the street conditions; some photographs were criticized for showing too much of the surroundings and not enough of the streets (see Adrian’s comments on page 99). However, a few photographs successfully showed both street conditions and surroundings at the same time. For example, a photograph of a garden next to a moderately-busy intersection (Figure 45) sparked these responses, with one participant talking about pleasantness and the other, traffic. (Both of these participants are willing to ride in auto traffic.)

That kind of looks pretty. That makes me think twice about taking that route [which he had not been planning to take]. That's prettier than I thought it would have been. (Adrian)

This picture make me not [want] to choose the 1st Ave [route]. Because I see lots of cars and complicated traffic signs everywhere. (Anil)
A few participants got momentarily excited about a specific point of interest they saw in a photograph. However, when it came time to choose a route, the participant would, with one exception, either (a) choose a route that omitted the point altogether, or (b) choose a route that goes by the point, but not mention that point in the rationale for choosing that route. Lisa, for example, found two exciting points of interest: a mural (Figure 47) which she thought was “awesome” and “beautiful,” and House of Dosas (Figure 46), a restaurant, which she would “definitely go by” because “they’re really good.” Lisa mentioned neither when choosing her routes. The one participant who stuck with her point of interest was Glory. When she saw the photo of the Kensington Community Centre (Figure 48) she became interested in going there after work. She was even more interested when I told her the centre has a swimming pool, and she chose a route specifically to stop at the centre.

8 Technically, her task was to choose a route to work, not home from work. But she and a few other participants planned trips to and from work.
A more common use of surroundings photos, compared to specific points of interest, was to use a breadth of photographs to get a sense of an area, without any one photograph standing out. For example, Lane said:

It’s interesting to have an idea what the neighbourhoods are like as well [as seeing the street conditions]. There’s one of a mural [Figure 47]. And kind of heritage house [Figure 49]. The brewery. People drinking coffee [Figure 50]. And I guess you get an idea of which are the more urban downtown areas, and which are the quieter residential areas.

Lane was unusual in calling out which photos influenced her sense of an area. Other participants tended to look at several photos, then describe the area as a whole without giving much sense to which photos were helpful in giving that sense. Because if this, it is difficult to tell which photos were and were not useful in giving a sense of the area.

9.4.8. **Rest and recovery**

Participants did not express a great interest in learning about facilities for rest and recovery: drinking fountains, washrooms (public toilets), benches and shelters. Some participants did talk about stopping at cafes and coffee shops, but often in a way that suggests visiting them as a destination, not as a way of recovering from the physical exertion of cycling.

Design A had icons that showed the locations of drinking fountains. Participants who do not ride with water bottles found some value in these; there was also a sizable contingent of participants who always ride with a water bottle. Additionally, several commented that they would not need a water stop on a trip of this duration.

A few participants talked about needing to use washrooms while they cycle, but they also said that it is not that difficult to find one when they need it. Although washrooms scored moderately well in the card-sorting activity, with three participants rating it “always or usually important” (Table 3 on page 85), that importance was not reflected in the discussion.

Washroom important but not really a problem, you can always bike to a shopping mall or something. (Dennis)

I’m not sure I would plan my route in terms of where the water fountain was. . . . Although this would remind me to keep my eye out [when riding near one]. (Adrian)
9.5. Information representations

The previous sections in this chapter have analyzed the study results in terms of the information conveyed by the prototypes: hills, street conditions, and so forth. But it is also useful to approach the results in terms of the media used to represent information, such as the pictures, comments, and land-use colouring. Doing so allows analysis of concerns relating to the medium, as opposed to concerns about the message.

9.5.1. Hill lines and hill graphs

The hill lines in Design A (Figure 51) had legibility issues, primarily associated with distinguishing uphill from downhill. The legend in the prototype did not identify which direction is uphill and downhill, in an effort to identify if there was a “natural” reading of uphill and downhill. When I informally evaluated the hill lines in the printed atlas this way, there was a natural reading (see Section 6.2.2). However, in Design A, there was not a natural uphill/downhill reading. Seven of the participants read uphill and downhill as backwards, expressed uncertainty in their reading, or both. Confusion tended to persist even after I explained which direction is uphill. Only two participants consistently and confidently read the lines correctly.

There was a general preference for the elevation graph (Design B, Figure 52) over the hill lines (Design A). This was partly due to a lack of the legibility problems, but also because the elevation graph allows for quick comparisons between alternative routes.

[The elevation graph is] a little bit more intuitive. (Laurelai)

[The elevation graph] is more clear, with the visual, with the diagram. More visual to see how steep it is. (Dawn)

[It's] more detailed. (Benjamin)

[The hill lines don't] really allow you to compare and contrast the two the way the [graph] does. (Anna)

Numbers do not add up to 13 because I stopped asking once it was clear that the direction was ambiguous.
However, the preference for the graph was not universal. Lane had a preference for the hill lines because it “helps me visualize [the hills] more,” she can “picture the ups and downs more clearly.” She is “not sure if I can visualize what 50 metres to 100 metres [of elevation] would be like as a hill.”

The scrubbing feature of the elevation graph, where mousing over the profile shows the associated point on the map, was widely liked, with several participants commenting positively on it. Participants often used this to identify the start and end points of a hill, scrubbing back and forth to see its duration. While they were able to see the information they wanted, it took some work to get the information.

9.5.2. Photographs

Participants repeatedly discussed which photographs they found useful and which were less useful. The most useful photos showed the look of the road. That is, they had straight-ahead views of the road revealing its width, traffic conditions, surface quality,
and numerous other factors. The less-useful showed the surroundings, and gave participants a sense of what the areas are like, as well as suggesting specific points of interest to visit or look out for.

Two photographs elicited negative feedback from multiple participants, in terms of not being helpful. One, a photograph of a church (Figure 53), spurred comments like “I don’t go to church” (Dawn) or “probably, the church wouldn’t affect my route” (Anil). The other, a photograph of the Molson brewery¹⁰, produced more pointed criticism:

> The [brewery] photograph seems kind of pointless. Because it’s not attractive. It doesn’t represent the appearance of the area, you know? . . . It might just be that it’s not a very good shot. Because, like if it was angled a little differently, so you got it in context. But it’s not a picture of the neighbourhood, it’s just the one building. It kind of gives the impression that the whole neighbourhood is concrete. (Anna)

A few participants asked about the orientation of the photographs: which direction is the camera facing. Dawn wanted to know if a particular view (Figure 54) was facing west, so she could see a sunset on her ride home. And Anil got confused about a photo of an intersection and a park (Figure 55): the route turned at the intersection, but the photo did not indicate which street he would be turning on. He compared the prototype with the street view in Google Maps, which does indicate the direction the camera is facing.

### 9.5.3. Illustrations and districts

The illustrations that represent the character of districts were not well received. Only three participants spoke favourably about them. The other participants were unsure of the purpose of the illustrations, or did not find them to be a compelling representation.

The participants who found the illustrations helpful talked about how the illustrations “give a quick little idea of what it will be like there” (Benjamin), and they appreciated how the illustrations reveal “which portion of the ride is in each neighbourhood” (Anna).

The participants who did not find the illustrations helpful were able to correctly interpret the illustrations. When I asked them what the illustrations conveyed – and these participants tended not to discuss the illustrations until I asked – they could say, for example, that “near Strathcona [Figure 56] I’m going to be riding through a neighbourhood with houses and a few other bicyclists on the street” (Laurelai). But that legibility did not imply usefulness. Many participants were confused about the differences between districts in the to-work scenario, and they found the visual style lacking.

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¹⁰ The Molson brewery photograph can be viewed here: [http://www.flickr.com/photos/vanhoosear/3397946330/in/photostream/]
In designing the prototype for the to-work scenario, I used political bounds for two of the districts, because that part of Vancouver does not have bounded, cohesive districts in the Kevin Lynch sense of areas with “common character” (1960, p. 66). The illustrations of these districts were similar (Figure 57). Many participants found this confusing, and had wild guesses as to the difference: “I'm not sure quite what the difference is between these two. One is residential for people who don’t own cars, one is residential for people who do?” (Luke).

Participants also expressed disfavour towards the visual style, calling them “really generic” (Anil) or saying “maybe there’s a sense [I have] of not trusting them because they’re sketches” (Luke). Lisa was particularly articulate in explaining her issues with the illustrations:

Lisa  I find that the drawings are not very motivating or helpful. They have a similar quality between them. . . . So because of the style, because of the line drawing style, they look kind of similar when they’re together. Like for instance, this East False Creek one [Figure 56] . . . to me that actually doesn’t look very friendly, although I know that to be a very friendly route. And so the drawing doesn’t really capture the -- I think it’s because all the little riders and people are so far away. So as a visual tool, it’s not giving me very good clues. Like, I think there’s somewhere between those photos and the [illustrations]. [With the photos] I can just imagine better what the ride might be like.
I almost imagine the cyclist’s point of view. What do you actually see in front of you when you’re riding . . . Like literally capture what you would see. Because often if you’re in a busy street, you’ll see the parked cars really close and you’ll see the driving cars really close. And likewise if you’re on this false creek, you’ll see there’s a seawall and pedestrian and cyclist and water and a tree, and right in front of you.

Me So . . . you talked about having something that was between the photographs and the sketches. And I’m trying to imagine how you get between the two.

Lisa I guess using some of the elements from the photo, as in colour. Or possibly even using photography, but using it in a way that is more cyclist-eye-view.

Lisa’s request for cyclist-eye-view imagery gets at one of the reasons why I suspect the participants did not find the illustrations helpful: they say little about the street conditions and hills, the factors in the core category of the information hierarchy. Of the eight illustrations, only two have the kind of direct view of the road that the participants valued in the photographs.

9.5.4. Emotion comments

There are two ways to review the emotion comments: (1) in terms of the information the comments provide about traffic, enjoyment, and so forth, or (2) the way that the information is conveyed through the comments. That is, presenting the comments in terms of how places made cyclists feel, being opinionated, and conveying the information through text.

The comments participants found the most valuable described street conditions, the behaviour of drivers, and wayfinding. As Laurelai put it, “the ones [that] are useful to me are ones that are warnings just about how to avoid things that could be problematic.”

The following comments are among those commonly mentioned as helpful:

Unwelcome: Inattentive drivers going fast around a corner. Not bike friendly.

Trapped: Officially a bike route, really a narrow street with lotta cars.

The comments that were less helpful – the ones that participants did not talk about or, in a few cases, called out as unhelpful or inappropriate – were about the surroundings or the enjoyment of being in motion. This category of comments includes the following:

Unconstrained: Quiet streets, not a lot of stops.

Exhilaration: Go fast! Bomb down the bridge!
Participants had mixed opinions about the subjectivity and advice of the comments. Several of them found it helpful to know the feelings and opinions of other cyclists:

[These comments] tells me— it’s more like the feeling. Maybe it’s better than pictures. It’s people’s feelings. So these pictures, I may not get a feeling from them (Dawn)

I like to read people’s comments. Provide information about how the road is really like (Hong)

Other participants found some of the comments to be inappropriate for a map, because they provide subjective opinions, or give bad advice.

Joyce: “Trapped,” is a bit weird [in terms of a word to use on a map], too. People feel differently, and that’s an emotion. And I would just use a different language: “a lot of traffic during rush hour,” or I don’t know. . . .

Me: So something a little more functional than expressive?

Joyce: Exactly. I’m a pretty emotional person, but I don’t— Even like this [comment] “go fast, bomb down the bridge,” I don’t like it. That’s just kind of goofy. I feel a map shouldn’t be as goofy as this.

Although I’m not as bothered by “beautiful.” I don’t know why. “Beautiful” seems good. But that’s also subjective.

I would ignore [this comment]. It says “Few cars, go ahead and blow through the stop signs.” . . . It’s one thing to say “watch out for this,” it’s another want to give people bad advice. (Luke)

It should always be incumbent on the rider to check out bad surroundings. Not to take these things for granted. Not to have an expectation. (Lisa)

Despite those reservations about the comments, participants often found them useful. Many participants suggested that the comments and photographs should be combined into one map.

I think the pictures are more attractive than those comments. But the comments, they are useful because, um, I don’t know. Because when you say confusing, and then I know I have to be aware, because maybe I cannot find the way. Picture does not tell you that. (Hong)
Figure 58. Land-use colouring
Map Data © OpenStreetMap Contributors. Elevation data provided by GeoBase ®. Additional map credits in Appendix A. Contains a photograph by Kyle Pearce; used by permission; additional information in Appendix D.

9.5.5. Land use colouring

Design B coloured the background of the maps to indicate land use (Figure 58), depicting residential, commercial, and industrial zones. Participants tended not to pay attention to this colouring. In nearly all the sessions, participants did not begin talking about the colouring until I prompted them. And then, the usefulness of the data was low.

Only one of the participants found the colouring useful in his trip planning. From his prior knowledge, he had a vague sense that one of the routes in the to-picnic scenario (via First Ave.) went near an industrial area. He used the colouring to learn that the route largely skirts the industrial areas, going through residential areas instead. A few other participants came up for uses for land-use colouring after I pointed it out to them. Two saw it as potentially directing them towards shopping: “If I wanted an area where I can stop off on a café, [I] might veer more towards commercial areas” (Lane). Two others saw it as a proxy for traffic, with commercial areas indicating busy street. Benjamin concluded that it was a poor traffic proxy, since one of the major roads in the to-work scenario was zoned residential.

Three factors contributed to the lack of interest in the land use colouring. First, in order to have figure/ground separation in the map, the land use colours were desaturated and, thus, de-emphasized. This made it less likely for participants to read the data, regardless of its utility. Second, the data had only moderate utility. Not only were the data lower on the information hierarchy by virtue of being about surroundings, not street conditions, land uses were not the data that participants found meaningful about surroundings. They were most interested in trees and shade, art, viewpoints, interesting architecture, and so forth. Third, by the time participants started paying attention to the land-use colouring, they generally already knew what the land use was. Some of this was knowledge prior to the study: knowing, for example, that downtown is commercial.

11 Knight St.
But the photographs contributed, too. Because participants looked at the land-use colouring last, they had already seen the photographs showing which areas were residential. The land-use colouring did not add significant new information.
10. Discussion

Having presented the findings of the user study, how can those findings be applied to refine the design of experiential trip planners? There are three categories of recommendations: general considerations for presenting experiential information, across all categories of the framework; strategies for presenting information about the categories of the framework; and new uses for experiential trip planners. However, these results should be understood in terms of the limitations of the study.

10.1. General considerations

Not all of the considerations for an experiential trip planner fit into the categories of the framework of cycling experience; there are also general considerations about how to present experiential information. These include the tone of the information, and also how the planner presents routes that may be too challenging for the cyclist.

10.1.1. Tone

When I set out on this project, I hoped to create a tool that celebrates the enjoyable things about cycling, while also being realistic about alerting cyclists to the negative things. But then in the study, participants were more interested in knowing they will be free from negative factors than they were in knowing about the positive factors. This creates a tension in the design: how to provide the information participants wanted, while maintaining a positive tone that conveys the enjoyment of cycling.

In the study, participants revealed positive language that can be used, even when the topic is about avoiding negative factors. The desire to avoid traffic can be framed as quiet streets; the desire to avoid heat, plenty of shade. By using this kind of language, a trip planner can assuage cyclists’ concerns about avoiding unpleasant factors while maintaining a positive tone that frames cycling as enjoyable. However, this positive outlook should only be used honestly. Participants appreciated frank warnings about unpleasant situations, such as the comments alerting them to heavy traffic, and experiential trip planners should not shy away from such warnings.

10.1.2. Conveying the challenge-skill balance

Martin and Priest’s adventure experience paradigm (Priest, 1990) (Section 2.2) highlights the difference between a cyclist’s perception of her abilities and the challenges she faces, and her actual abilities and challenges. Underestimating challenge, or overestimating skill, can result in an unpleasant experience; it can also result in physical harm. In the study, there were two times when I became concerned about a participant’s
ability to ride the route they chose. These incidents suggest questions about if and how experiential trip planners should encourage cyclists to push themselves to new challenges.

Glory occasionally mentioned having trouble with hills, and having to push her bike uphill. Yet she was not concerned about her ability to climb the hill in the to-work scenario. I have my doubts. I suspect that hill would leave her sweaty, exhausted, and late for work. This would be frustrating but, hopefully, the sort of learning experience that Priest describes: teaching Glory to perceive challenges better. And if Glory were to successfully surmount the hill, this would give her more self-confidence to cycle to new places.

Hong’s route choice alarmed me. In the to-picnic scenario, with Design A, she chose the route on Pacific Blvd. This is a busy street where the bike lane disappears suddenly. Hong is a very inexperienced cyclist; I do not believe she has the skills to safely ride on Pacific Blvd. Although Design A has comments describing the traffic on Pacific, Hong believed they applied to a different route.

This raises the question of how cautious an experiential trip planner should be. Clearly, the prototypes should have given Hong a more realistic understanding of Pacific Blvd. But what about Glory? Being excessively cautious in a trip planner would forego the possibility of Glory learning that she really can climb that hill. Striking the right balance between caution and skill development is an area for further investigation.

10.1.3. Simplicity

The prototypes presented a breadth of information, and I asked participants to wade through the information to pick out what is most meaningful. That is a useful approach for a research instrument; less so for everyday use. Because of the study context, participants were likely willing to spend more time with the trip planner than they would otherwise.

Applying the information hierarchy allows a trip planner to present experience in a simpler way, by presenting a map with just the most important information. Secondary information can be presented upon request, if the cyclist is interested.

10.2. Representing factors in the framework

The framework of cycling experience (Chapter 3) identifies categories of factors that affect the experience of cycling. Those categories are the street conditions; the surroundings; exertion, rest, and recovery; movement and awareness; and the context and motivation for the trip, and the cyclist’s sense of identity. In the user study results, I refined the framework with an information hierarchy (Section 9.4.1). This prioritized
the framework; it identified contexts where certain kinds of information are important. The study also revealed strengths and weaknesses in the prototypes’ representation of experience.

From that work comes a discussion of how to present experiential information. Chapter 7 addressed that topic, describing the design considerations of the prototypes. But it did so without the knowledge gained from watching cyclists use the prototypes. In the subsequent sections, I present refined strategies for representing experience. The strategies build on the successes of the prototypes, and suggest improvements where the prototypes fell short.

10.2.1. Exertion, rest, and recovery

The exertion factor that participants found most relevant was hills. They were less interested in trip distance and opportunities for rest and recovery; this may have been because of the distance of the trips in the scenarios.

Participants were very interested in knowing about the hills on their routes. They were more concerned about the difficulty of going uphill than the experience of going downhill. They also used the hill profiles to make fine-grained distinctions in the steepness between two routes. This argues against the approach taken by some maps, of only identifying the steepest hills (e.g., TransLink, 2010) (see Section 4.3); those maps do not provide the granularity that participants were looking for.

When participants compared slopes between routes, it often took them a concerted effort to do so. Further work could address this issue. One approach would be to categorize hills based on their difficulty. Another would be to explicitly code slope in the hill chart, perhaps by changing the line colour or thickness.

Participants also demonstrated interest in identifying the start and end points of the hill on the map. They often scrubbed the hill chart in Design B: hovering over the bottom of the hill to show that point on the map, then repeating with the hilltop. An improved hill profile might pinpoint the top and bottom automatically – hovering over a point on a hill could show that point on the map as well as the top and bottom.

One aspect of exertion that did not come up much in the study is exertion due to distance of the trip. When participants talked about trip distance, it tended to be in the context of arriving on time in the to-work scenario, not in terms of being exhausted or needing to rest. This is likely because the routes involved did not vary significantly in terms of distance, and because so many participants were fit enough to complete those routes without much difficulty. One should not assume that exertion due to distance is unimportant, simply because it was not a theme of the study.
Interest in facilities for rest and recovery ranged from tepid (for drinking fountains) to disinterested (for washrooms and benches). Again, this may be a result of the study presenting routes that participants felt they could finish without excessive effort.

10.2.2. *Street conditions and off-street path conditions*

Street conditions are one of the major influences on cycling experience, and are critical information for an experiential map to convey. The three major concepts addressing street conditions are the look of the street, the type of bikeway, and the type of street. Additionally, off-street paths have a distinct set of concerns.

Most of the concerns about the street conditions related to avoiding unpleasant things: car traffic, bus and heavy truck traffic, construction, difficult intersections, narrow road width, poor air quality, and poor road surfaces. These factors were, collectively, described as the look of the street. Photographs were a popular way of learning about the look of the street; particularly photographs with a straight-ahead view that focused on the street itself, not the surroundings to the side.

Using photographs to convey the street conditions leaves open the question of how to show an easily-scanable overview. Design B required the participant to open each photograph individually, which is cumbersome. Although curating the photographs makes this less cumbersome than using Google Street View to accomplish the same task (Section 4.2). Design A used illustrations to show an overview, but tied the illustrations in with a concept of districts that participants found confusing.

Comments can supplement photographs, conveying information that is not suited to photography – places with inattentive drivers, or where the bike lane suddenly ends.

The other two concepts about street conditions are the type of bikeway – a neighbourhood bikeway, a separated path, and so forth – and the type of street, whether a street is quiet or busy with auto traffic. Both of these distinctions are important, but the prototypes downplayed the difference between quiet and busy streets. Additionally, the use of jargon to describe the type of bikeway was confusing to novice cyclists.

Off-street paths have a different set of important factors than streets. Here, pedestrians, visibility, and surface conditions are paramount. However, these assertions are based on discussions of one well-known path. Future work should investigate off-street path conditions more broadly.

10.2.3. *Physical Surroundings*

The physical surroundings straddle the core and secondary tiers of the information hierarchy. In some contexts, cyclists’ interest in surroundings is an extension of their desire to avoid unpleasantness. In other contexts, they are increasingly appreciative of surroundings, and increasingly willing to put effort into planning a trip to have pleasant
surroundings and to go out of their way to attain those surroundings. Desire for surroundings is a continuum.

Avoiding unpleasant surroundings is likely in the core tier of the information hierarchy, although the evidence for this is more rational than empirical. A few participants talked about avoiding unpleasant surroundings, but we did not spend enough time on the topic to get a clear picture. However, since the core tier is dominated by the unpleasant things to avoid – hills, busy streets – it makes sense that unpleasant surroundings would also be core. So shade, noise, and a weather forecast could be useful to know in many contexts.

As for pleasant surroundings, the importance of them is more mercurial. Clearly, surroundings are important, sometimes. Participants described their routes in terms of the surroundings they go through; they ranked viewpoints highly, and spoke highly of waterfront views in the to-picnic scenario. Several were interested in public art, and architecture. But participants also made it clear that the prototypes – particularly the photography in Design B – emphasized surroundings over street conditions too much. A proper balance would be to represent less of the pleasant surroundings than the prototypes did, but to not completely remove them from the default view.

As for how to show the surroundings, and how to present an appropriate amount of surroundings, this can be done with photographs, comments, and land-use colouring. And since interest in surroundings is a continuum, the user should have some control over how much of the surroundings to show, and over what aspects to show.

Photographs that show primarily the street, with a bit of surroundings at the periphery, can deliver the basic information participants wanted about street conditions while still informing them about surroundings. Photos that focus specifically on surroundings should be supplementary. Supplementary photos of specific, distinct points – such as viewpoints, attractive or interesting architecture, and public art – work well. There was less interest in photos showing typical surroundings.

In the prototypes, the comments describing surroundings were not that helpful. They described visual things, such as nice views, that participants would rather see in pictures. However, the prototypes did not include comments about the general use and character of places. There was nothing analogous to Gerlach’s description of the West Bank in Minneapolis as “the home of cheap, ethnic food” (2005, p. 26) (see Section 4.2). Such commentary could have been useful. For example, it may have satisfied Lane’s interest in finding interesting neighbourhoods to explore and shop in.

The land-use colouring was valuable in theory, since the way it presents spaces matches the way several participants talked about those spaces. But participants did not find it helpful, perhaps because they learned everything they needed about surroundings through the photos. The reaction to the land-use colouring in the printed atlas was more positive. The atlas did not have photography – it used sketches and text to describe
surroundings. And in informal feedback, people said the land-use colouring was useful, because it has so many connotations for other factors. Perhaps land-use colouring would be more useful in a trip planner with fewer photos of surroundings.

10.2.4. Movement and Awareness

Movement and awareness covers the feelings of being in motion, being aware of wayfinding cues, and dealing with hazards – being aware of them and manoeuvring around them. Since this is a diverse category of experiences, the information needs vary.

Being alert for hazards is stressful, and participants appreciated the comments informing them of places where they would have to be on the lookout. Conversely, there was much less interest in flagging places with an absence of stressors.

Wayfinding consists of developing a plan, executing a plan, and gathering information to support the plan (Arthur & Passini, 1992, p. 25). In terms of developing a plan, participants preferred simple routes with fewer turns. But a few suggested that they would be more willing to deal with complex wayfinding on trips they take regularly, when they seek to improve the experience.

Participants were not particularly concerned about missing turns (a kind of difficulty in executing the plan). The comments warning about this elicited tepid support from several participants, placing this information in the secondary tier of the information hierarchy. This is also something that participants said they would keep in mind when riding, but would not cause them to choose a different route.

Feelings of motion did not come up much in the study. Participants did not say much about it. But the prototypes did not have much content about motion with which to spur a discussion – just textual comments about embodied experiences. Justin Spinney points out that “it is often difficult for people to express their experience of senses other than vision due to the limited vocabularies associated with non-visual dimensions ([Pow], 2000, 169)” (2007, p. 30). Furthermore, recalling embodied experiences can be difficult, since “many sensations, such as balance and touch, are often fleeting and hidden moments of existence which do not lend themselves to expression or capture in the same way as the visual or aural” (2007, p. 30).

Despite the difficulties, feelings of motion are a significant part of the experience of cycling, and further work in representing them would be warranted. Scott McCloud describes how comics use motion lines to convey a sense of motion. This is particularly effective when the motion is shown in a first-person perspective, as is common in manga. “‘Subjective motion’, as I call it, operates on the assumption that if observing a moving object can be involving, being that object should be more so” (1993, p. 114).

---

1 The term subjective motion sometimes refers to optical effects that cause the viewer to physically feel the sensations of motion. That is not what McCloud means. He is distinguishing between images where the point of view places the viewer “in
McCloud illustrates this concept with panels shown from the perspective of a motorcycle
driver, which are similar to the cyclist-eye-view imagery that Lisa desired (Section 9.5.3).

10.2.5. **Context, Motivation, and Identity**

In design, it is important to understand and consider the context a tool will be used in,
and the motivations for using the tool – what the user wants to achieve. The context
and motivations of use for a trip planner are influenced by, but distinct from, the context
and motivations of the ride. The context and motivation for the ride (as well as cyclist’s
sense of identity) are not things to display, like the other framework categories are. They
are things that affect what the cyclist wants to get out of the tool, the experience she will
desire while planning a trip, and the experience she will have while riding.

These considerations about context and motivation are most applicable in the
next section, where I discuss uses for experiential trip planners.

10.3. Other uses for experiential trip planners

I designed my prototypes to support the use case of getting from a known point A
to a known point B. But this is just one of the ways in which people travel by bike.
Experiential trip planners could support other travel and trip planning behaviours:
browsing a map to see what is there, tailoring the trip according to what you feel like
experiencing that day, improving an existing trip, and exploration.

10.3.1. **Browsing**

I omitted one common use of online maps from my prototypes: browsing through a map
to see what is there. Browsing can be done out of general curiosity, to find destinations
to go to, to learn where the bike routes are, to inspire exploration, and so forth. Browsing
is an obvious application for an experiential trip planner. But since the prototypes
focused on describing specific routes, supporting browsing would require design
changes.

Browsing may also change the information hierarchy. A user browsing for a
place to visit, or an area to explore, is considering the surroundings. Would it still be
appropriate to emphasize street conditions over surroundings? It seems more likely
that the emphasis would shift to surroundings, which raises the question of how the
information hierarchy for trip planning differs from the hierarchy for browsing.

Representing hills through hill profiles would not be viable when browsing the
map, since there would not be a route to profile. The hills would need to be indicated
the driver’s seat” (1993, p. 114) and those where the point of view is stationary,
observing a moving object.
another way: perhaps with topographic maps, or with improved hill lines that avoid the legibility issues found in the prototypes.

Finally, to discuss “browsing a digital map” calls to mind opening a site like Google Maps, and exploring with the pan and zoom controls. But that is not the only way to browse. *Routes I Know* (Gerlach, 2005) and my printed atlas (Chapter 6) are also a form of browsing: the reader browses through bike routes, one route at a time. This allows for rich descriptions of the routes, but requires the reader to re-orient herself with each page making. This makes it more difficult to visualize the route locations and to mentally chain two routes together. It might be possible to incorporate the rich descriptions of routes into the traditional web-map paradigm of displaying an entire region at once.

**10.3.2. Variety and “what you feel like putting yourself through”**

Participants saw experiential trip planners as helping to tailor the trip to “what you feel like putting yourself through that day” (Anna) (Section 9.3.2). They also valued suggestions for new and interesting places to visit (Section 9.3.1). There are varied ways of meeting these needs.

One approach is to ask the user what kind of trip she desires, when she is planning the trip. This approach is taken by Cycle Copenhagen (http://www.cyclecopenhagen.dk), among other tools. It asks the user for a start and end points, and the desired characteristics for the trip, such as a *safer*, *green*, or *quiet*. I propose that model could be extended to include characteristics such as *interesting art and architecture*, *challenging hills*, *gentle hills*, and *conversational cycling* (routes that are wide and quiet).

Choosing route characteristics works when the user has a destination in mind, but participants also desired an experiential trip planner that would suggest interesting destinations. Here, many city or travel guides can provide inspiration. Not only do these guides list attractions, they often contain curated, thematic lists: best restaurant patios in Vancouver (Purdey, n.d.) or holy sites of Mumbai (Karafin, 2012). A cycling experience take on these guides could suggest places to visit by bike: shopping districts, historical sites, public art, and so forth.

**10.3.3. Improving an existing trip**

Participants suggested a distinction between using a trip planner to plan a trip for the first time, and to improve a trip they already take (Section 9.3.3). The route to be improved can have a specific characteristic that the cyclist dislikes, such as Lane wanting a gentler
hill to her boyfriend’s house. Or it can be a route that the cyclist takes often, and wishes to generally improve. When Anna talked about improving the route to her sister’s house, she did not have specific complaints about her existing route; she just wondered if another route might be more enjoyable.

Providing capabilities for customization would help a trip planner support improving an existing trip. Choosing routes based on the characteristics of the trip (as discussed in Section 10.3.2) could be helpful. That would let Lane search for the gentlest hill. Choosing the kinds of information that the trip planner displays about the route would also be helpful. Finally, letting the cyclist directly manipulate the route – in the manner of the “Drag to change route” feature in Google Maps – would support improving a trip. It is a way for the cyclist to enter her existing trip, providing a baseline for comparison. It is also a simple way of running what-if scenarios.

10.3.4. Exploration

An experiential trip planner could suggest new areas to explore. Exploration was a theme in the user study (Section 9.3.1), with participants discussing exploration they do and ways the prototypes could encourage them to explore some more. Exploration also came up with the framework; recall Mykle Hansen’s “craving to explore, discover, and map places” (2011, p. 191) (Section 3.5), and Rachel Aldred’s interviewees who “experience[d] places differently [on a bike], and [had] access [to] histories, sights, and sounds that otherwise they might not have found” (2010, p. 46) (Section 3.3.1).

Inspiring and motivating trips to an area can take a range of approaches. In one approach, the experiential trip planner becomes a kind of tourist brochure, suggesting the entire reason for a trip. Two participants asked for these kinds of recommendations. A planner can also suggest places to stop at, or pass by, on the way to a utilitarian destination. This came up a few times in the study: Lane and her boyfriend finding new galleries as they looked for a restaurant (page 89); Dawn, deciding to stop in Chinatown in the to-picnic scenario, to pick up some food to bring to the picnic; and Anil, who, in the to-picnic scenario, chose a very indirect, but beautiful, route along the waterfront that added an hour to his travel time2.

10.4. Limitations

The user study should be understood with certain caveats and limitations. There are limitations to how the results can be interpreted and generalized, limitations in the study design, and limitations in the scope of the study.

2 Anil’s route went to Portside Park at the northern terminus of Main St. It then followed the waterfront all the way around Stanley Park, finally taking the Burrard Bridge into Kits Point.
The results of the study are intertwined with the specifics of the prototypes. While the prototypes were a necessary research instrument to convey the concept of an experiential trip planner, they also formed participants’ perceptions of what is possible. For example, several participants said that combining photographs with emotion comments would be ideal. In that finding, ‘ideal’ should be understood to mean the (expected) best presentation from the possibilities suggested by the prototypes, not a Platonic ideal of all possible designs.

The results are also coloured by the specifics of the scenarios – the trip contexts, and the places the trips occurred. Recall that the Portland participants were more concerned about train tracks than the Vancouver participants. There are likely several other location-specific details to the results. Vancouver is a compact, hilly city with an extensive network of bike routes on a well-connected street grid. Conducting the study in a city with different characteristics would have produced results that differ, to a degree.

The implication of these kinds of specificity is that the information hierarchy is also localized to Vancouver. For example, headwind was not a significant concern for my participants. But when I presented this work at a conference³, one of the audience members asked if the trip planner could show headwind, because that is a major concern in his city.

There are also limitations to the study design. First, only one researcher (me) conducted the framework approach. Having a second researcher coding and analyzing the interview transcripts would have uncovered additional themes and perspectives on the data. Second, the card-sorting activity is limited by having varied interpretations what the cards mean. I did not attempt to ensure that the cards had consistent meanings to the different participants.

Finally, there are limitations in the scope of the study. Most significantly, the participants never rode the routes they selected. This means that I cannot evaluate how satisfied they are with the prototypes’ representation of the routes. It also means that their self-reported behaviour about how they would ride will vary from their actual riding behaviour.

The study also does not address long-term behaviour change. The motivation behind experiential trip planners is to help cyclists have more fun, encouraging them to cycle more. A one-time study such as this cannot measure changes in enjoyment or frequency of cycling. It can (and does) suggest that such outcomes are possible.

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³ Velo-City Global, 2012. Vancouver, BC.
11. Conclusion

In this research, I addressed design considerations for a new category of tool, the experiential cycling trip planner. I explored how an experiential trip planner can convey information about four categories of experience: street conditions; surroundings; exertion, rest, and recovery; and movement and awareness. I considered how the fifth category of experience – context, motivation, and identity – affects the value that an experiential trip planner can provide.

Based on the results of a study where cyclists used prototypes of experiential trip planners, I developed an information hierarchy which prioritized the experiential information. I found a strong, primary concern for avoiding unpleasant factors – busy streets, uphills, and unpleasant surroundings – tempered by an appreciation for the pleasantness that cycling can bring – nice scenery, viewpoints, and exploration.

I also addressed means of representing experience in a trip planner. I found a preference for photography (preferably with a straight-ahead view of the street) as well as comments from other cyclists, and elevation profiles. I presented design considerations for creating these representations.

Finally, I considered the uses of an experiential trip planner, and what a cyclist could do with one. Not only can they help a cyclist plan a trip to an unknown destination, they can help improve enjoyment of an existing trip. They give the cyclist options, letting her tailor the trip to the kind of experience she feels like having. I found that cyclists would appreciate having these capabilities.

11.1. Contributions

My work contributes to three areas. First, it supports the public policy goal of increasing levels of urban, utilitarian cycling. It identifies a common activity, planning trips, that can be improved to (a) better meet cyclists’ needs for an enjoyable experience, and (b) promote cycling by emphasizing the enjoyment of the activity.

Second, I contribute to efforts to understand the experience of cycling. Prior works in that area have been siloed, addressing parts but not the whole. I synthesize such works into a comprehensive framework.

Third, I contribute to the work of cartographers creating experiential maps. Experiential cycling maps are a relatively new category of maps, and my work explores the representation of experience, and the use scenarios, more than prior experiential maps did (e.g., Priedhorsky, 2010; Shankwiler, 2006).
11.2. Future Work

Moving beyond the work done in this thesis, avenues for future work involve refining the design of the experiential trip planners, broadening the diversity of participants involved in studies, and more fully examining the value that experiential trip planners convey.

This research has found value in experiential trip planners, and the discussion suggested several ways of refining and improving the designs. Carrying out those refinements will result in better understanding of the design considerations for experiential trip planners.

The user study provided useful insights into the requirements of an experiential trip planner, and further studies with a more diverse set of participants would add more insights. Including participants who are interested in cycling but do not currently ride would inform an understanding of how an experiential trip planner can encourage prospective cyclists to become new cyclists. The study participants were younger adults (twenties to forties, with most in their thirties); younger and older cyclists can have different needs, which should be addresses. Finally, research should be conducted with cyclists across varied geographies, to uncover regional variations in the information hierarchy.

Future work can also address the value proposition of experiential trip planners: does having an experiential trip planner change the kinds of experiences that cyclists have? In what ways?

11.3. Final Thoughts

Denis Wood asked, “What if map-making were an expressive art, a way of coming to terms with place, with the experience of place, with the love of place?” (2010a, p. 14).

While I do not claim to have created maps as vivid as Wood’s – nor did I strive for such poetic beauty – I can claim to have explored and framed expressive map-making, recounting the lived experience of cyclists. I identified the factors that shape cycling experience, prioritized them, and represented them in maps.

So that’s the experience of place, but what about love of place?

In one sense, this project is quantifiable, measuring success as increased numbers of cyclists and decreased carbon emissions. It’s very practical. Dull, even.

I describe success not only with the thin description of statistics, but also by the thick description of enriched lives. Success is waving to more passers-by, enjoying more sunshine, and forming meaningful connections to more places. Success is more love of place.

Personally, one of my favourite things about cycling is the way it combines the mundane with the memorable. A simple ride home from the grocer can awe you with a gorgeous sunset and a murder of crows cawing overhead as they fly home to roost.
If cycling can be both practical and enjoyable, shouldn’t cycling maps be practical and enjoyable, too?
References


Dolan, A. (2012a, July 1). Kieran’s Commute Story [Video file]. Retrieved from http://www.youtube.com/watch?v=gkEKPe7JJs&feature=youtube_gdata_player Note: This video is part of Dolan’s reporting on interviews with cyclists; he presented this work in Dolan (2012b).


Shelley (n.d.). *Chainbreaker* (Vol. 2). New Orleans, LA: Self published. *Note: This zine is reprinted in Jackson & Clark (2007).*


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Appendix A.

Map Credits

The following are the full credits for the map data used in my prototypes (Chapter 7). The data providers have requested, or required, that these credits be made available.

Map data © OpenStreetMap Contributors (http://www.openstreetmap.org). OpenStreetMap data is licenced under the Open Data Commons Open Database Licence (ODbL; http://opendatacommons.org/licenses/odbl/). OpenStreetMap database contains data from: GeoBase ®, GeoGratis (© Department of Natural Resources Canada), CanVec (© Department of Natural Resources Canada), and StatCan (Geography Division, Statistics Canada).

Map data also provided by the City of Vancouver (http://vancouver.ca/your-government/open-data-catalogue.aspx), under these terms of use: http://vancouver.ca/your-government/terms-of-use.aspx.

Elevation data provided by GeoBase ® (http://www.geobase.ca).
Appendix B.

User Study Survey

The survey given to study participants (Chapter 8) is on the following two pages.
Please tell me a bit about yourself.

Name:

Age range:
☐ 16 - 19  ☐ 20 - 29  ☐ 30 - 39  ☐ 40 - 49  ☐ 50 - 59  ☐ 60+
☐ Prefer not to answer

Gender:
☐ Woman  ☐ Man  ☐ I prefer another term __________
☐ Prefer not to answer

During the summer, how often do you ride:
☐ Once a week or more
☐ Less than once a week
☐ Rarely or never

During the fall, winter, and spring, how often do you ride:
☐ Once a week or more
☐ Less than once a week
☐ Rarely or never

Which of these best describes you:
☐ I'll ride my bike in almost any street conditions, even if it means sharing a busy street with cars.
☐ I try to stay on facilities for bikes, such as a low-traffic street or in a bike lane.

(there’s more on the next page)
What kinds of trips do you take by bike (check all that apply):
☐ Going to work or school
☐ Shopping and running errands
☐ Visiting friends and family
☐ Going out for recreation (biking to the movies, to the pub, etc.)
☐ Transporting my kids
☐ Purely for fun or exercise
☐ Other: ________________________

Who do you ride with, and how often? (check all that apply):
☐ Spouse / partner. How often: ________________________

☐ Children. How often: ________________________
   Age: ☐ 0 - 4   ☐ 5 - 8   ☐ 9 - 12   ☐ 13 & up

☐ Friends / other family. How often: ________________________

☐ Dog / other pet. How often: ________________________

☐ Other: ________________________. How often: ________________________

What neighbourhoods do you ride to, or in:
Appendix C.

Emotion Comments

The following is a list of the emotion comments presented in Design A of the prototypes. See Section 7.3.

**To-Work Scenario**

<table>
<thead>
<tr>
<th>Title (emotion)</th>
<th>Text</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>beautiful</td>
<td>Huge old trees. Lots of cherry blossoms, too.</td>
<td>Windsor St., between E 30th Ave &amp; Ringwood Ave.</td>
</tr>
<tr>
<td>confusing</td>
<td>The bikeway turns left at a nondistinct corner. Watch for the (small) sign.</td>
<td>Inverness St. &amp; E 43rd Ave.</td>
</tr>
<tr>
<td>exhilaration</td>
<td>Going into town, you can totally keep up with the cars on Kingsway. Take the lane and push it!</td>
<td>Kingsway, between Knight St. and Dumfries St.</td>
</tr>
<tr>
<td>fun</td>
<td>Stop and watch a cricket match for a while.</td>
<td>In Memorial South Park, at E 43rd Ave. and Windsor St.</td>
</tr>
<tr>
<td>unconstrained</td>
<td>Nice downhill. Pretty views.</td>
<td>Dumfries St., between E 33rd Ave. and E 32nd Ave.</td>
</tr>
<tr>
<td>unconstrained</td>
<td>quiet streets. not a lot of stops.</td>
<td>Windsor St., between E 37th Ave &amp; E 35th Ave.</td>
</tr>
<tr>
<td>unwelcome</td>
<td>Inattentive drivers going fast around a corner. Not bike friendly.</td>
<td>Argyle St. and Braeburn St.</td>
</tr>
</tbody>
</table>

**To-Picnic Scenario**

<table>
<thead>
<tr>
<th>Title (emotion)</th>
<th>Text</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>alert</td>
<td>Lots of construction. Look out for junk on the road -- you don’t want a flat.</td>
<td>Columbia St. &amp; West 1st Ave.</td>
</tr>
<tr>
<td>alert</td>
<td>You’re riding to the right of parked cars. Don’t get doored!</td>
<td>Pacific Blvd. &amp; Davie St.</td>
</tr>
<tr>
<td>alert!</td>
<td>Be careful in front of Costco. Lots of people getting in &amp; out of their cars.</td>
<td>Expo Blvd., just past the Georgia Viaduct</td>
</tr>
<tr>
<td>beautiful</td>
<td>Pretty views of False Creek. But go slow -- lots of pedestrians!</td>
<td>On the Seawall in northeast False Creek, by the Plaza of Nations.</td>
</tr>
<tr>
<td>Feeling</td>
<td>Description</td>
<td>Location</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>confusing</td>
<td>It's easy to lose the bikeway around here. Watch for the signs.</td>
<td>Fir St. and W 1st Ave.</td>
</tr>
<tr>
<td>trapped</td>
<td>Officially, a bike route. Really, a narrow street with lotta cars.</td>
<td>Keefer St., between Gore Ave. and Main St.</td>
</tr>
<tr>
<td>trapped!</td>
<td>In rush hour, this is a seriously shitty place to ride. You can either sit in traffic behind the cars, or squeeze between them while they change lanes.</td>
<td>Pacific Blvd., under the Granville St. bridge.</td>
</tr>
<tr>
<td>exhilaration</td>
<td>Go fast! Bomb down the bridge!</td>
<td>Burrard St. Bridge</td>
</tr>
<tr>
<td>beautiful</td>
<td>The new Olympic village is pretty, even if it cost way too much.</td>
<td>Manitoba St. &amp; Walter Hardwick Ave.</td>
</tr>
<tr>
<td>fast</td>
<td>Few cars. Go ahead and blow through the stop signs.</td>
<td>Moberly Rd. &amp; Commodore Rd.</td>
</tr>
<tr>
<td>relaxed</td>
<td>A good alternative. Fewer pedestrians than the seawall; fewer cars than 7th. A few nice views.</td>
<td>Charleston Rd., just west of the intersection with Moberly Rd.</td>
</tr>
</tbody>
</table>
Appendix D.

Photographs

These are the photographs shown in the prototype trip planner (Chapter 7). When zoomed out, the photos were shown as a thumbnail; those thumbnails are included here. The locations of the photographs are also listed here.

Image files for these photographs are available in the supplementary files (see Appendix E).

Additionally, the prototypes used two photographs by other photographers:

- **Molson Brewery**, by Todd Van Hoosear
  http://www.flickr.com/photos/vanhoosear/3397946330/in/photostream/
  This photograph, of the Molson Brewery at the south end of the Burrard Bridge, is used in the prototypes but not shown in this thesis.

- **North False Creek Seawall**, by Kyle Pearce (http://www.diygenius.com)
  http://www.flickr.com/photos/keepitsurreal/2383921256/
  This photograph, used by permission, is shown below.

Sewawall path, on the northeast shore of False Creek.
Photo by Kyle Pearce; used by permission.
Windsor St. at E 29th Ave.

Burrard Bridge
Keefer St. at Gore Ave.

Dumfries St., between 33rd and 32nd Ave.
Sewall on the north side of False Creek, between Carrall St. and Quebec St.

Expo Blvd., near the Dunsmuir Viaduct.
W 1st Ave., between Manitoba St. and Columbia St.

Lameys Mill Rd. and Alder Crossing.
Memorial South Park, at 43rd Ave. and Windsor St.

Argyle St., between E 47th Ave. and E 45th Ave.
Glen Park, at the corner of Windsor St. and E 24th Ave.

Corner of Knight St. and Kingsway
Dumfries St., at E 37th Ave.

Cypress St., between Cornwall Ave. and Creelman Ave.
Inverness St. at E 45th Ave.

Union St. at Jackson Ave.
Keefer St., between Princess Ave. and Heatley Ave.

Lameys Mill Rd., just west of Alder Crossing
Union St. between Gore Ave. and Main St.
Appendix E.

Supplemental files:
reproducing figures and obtaining source code

Many of the images in this thesis may be reproduced under Creative Commons licences. Image files are available in the supplemental files (see below). The source code for the prototypes is also available. The supplemental files are located in Simon Fraser University's institutional repository. To retrieve the files, go to http://summit.sfu.ca and search for “Evan Dickinson.”

This appendix summarizes the licences under which the files are released. Each folder has a LICENCE.txt file containing the full licence for the files in that folder.

The supplemental files are contained in the following folders:

Bikeway book

This folder contains the atlas of bike routes presented in Chapter 6. Released under a Creative Commons attribution licence (CC-BY). 10 TIFF files.

Folder name: Bikeway book.

Figures

This folder contains most of the figures in this thesis (the ones I created myself) are reproducible under Creative Commons licences. The majority are released under a Creative Commons attribution licence (CC-BY). However, a few incorporate works released under a Creative Commons attribution share-alike licence (CC-BY-SA) and are, therefore, released under that licence. Figures are sorted into folders, based on their licence. There are 35 TIFF, JPEG, and PSD files. Many of these files are not cropped, as they are in the thesis; they will appear larger than the corresponding figure.

Folder name: Figures.

Map Photos

This folder contains photographs used in Design B of the prototypes. The small thumbnails that appear at certain zoom levels are in the thumbnails folder. These are released under a Creative Commons attribution licence (CC-BY). 50 JPEG files.

Folder name: Map photos.
Source Code

This folder contains the code that runs the prototypes, as well as pre-rendered map tiles to use with the prototypes. To run the code requires a non-trivial setup. I am releasing and archiving the code under the philosophy that it’s better for an academic to release something, even if it’s cumbersome to run, than to release no code at all. Details on running the code are in the file Source code/README.txt.

Folder name: Source code.
Appendix F.

Printed Atlas

This appendix contains the printed atlas described in Chapter 6. Image files for the atlas are available in the thesis supplementary files; see Appendix E. Map data provided by the City of Vancouver; available under these terms of use: http://vancouver.ca/your-government/terms-of-use.aspx#OpenData.
Adanac Bikeway

Hustle, bustle, and traffic. Union has more space for cyclists than Keefer.

Chinatown

Strathcona

The oldest neighbourhood in East Van has numerous heritage houses and corner markets.

Around Clark Dr.

Parks and low-slung apartments characterize this neighbourhood. Commercial Dr. is full of boutiques, cafes, and bars.

Ontario Bikeway

North of Broadway

South of Broadway

The steepest part of the hill ends quickly, and there are many benches where you can rest. After that, enjoy the ride.

Pleasant houses and cafes are nestled between the warehouses.
Central Valley Greenway

First Ave
- Bike traffic
- Auto traffic
- Truck traffic
- Road width
- Road surface
- Roadside debris

Auto repair shops and warehouses dominate this short stretch of road.

Great Northern Way
- Bike traffic
- Auto traffic
- Foot traffic
- Path width
- Road surface

An expressway for bikes: You can go straight through uninterrupted.

Mosaic Bikeway

Around Venables
- Bike traffic
- Auto traffic
- Road width
- Road surface

A large retaining wall gives this area a claustrophobic feel. But some of the houses are nice, and there’s little to slow you down.

North of Grandview
- Bike traffic
- Auto traffic
- Road width
- Road surface

From the crest of the hill, the view of the North Shore opens up. It’s worth taking a detour past the beautiful Mosaic Creek Park (at Charles & McLean).

South of Grandview
- Bike traffic
- Auto traffic
- Road width
- Road surface

If you need a break, Clark Park is spacious, un-crowded, and has views of the city and the North Shore.