ENCOURAGING EVERYDAY CYCLING:

A PHENOMENOLOGICAL JOURNEY

An exegesis submitted to

Auckland University of Technology

in partial fulfilment of the requirements for the degree of

Master of Creative Technologies (MCT).

Lisa Clist

MCT

2017

COLAB

Auckland University of Technology

Abstract

This thesis addresses the question: How can a phenomenological design approach help better understand and encourage everyday urban cycling for non-active cyclists?

Cycling is a popular pursuit, yet cycling in an urban environment can be perceived by non-active cyclists as too intimidating to do with any regularity. To them, the perceived barriers and challenges tend to outweigh the motivations despite cycling being an enjoyable experience.

The aim of this project was to understand the motivations and perceptions of non-active cyclists towards urban cycling, and explore how these insights may be leveraged to ideate relevant creative interventions that may influence the riding experience.

Adopting a phenomenological, human-centred design approach, this research explored how people experience cycling, through observations and interviews with non-active cyclists. Insights gained from the phenomenological research showed that the embodied experience of cycling positively influenced non-active cyclists' perceptions and attitudes.

Design principles were developed, and one identified pathway was to address feelings of exposure and vulnerability experienced by the non-active cyclist, particularly in relation to other road users. This was distilled down to an experience that embodied the physical act of cycling – within the urban environment, but with the imminent threat of live traffic eliminated. This led to the ideation of a 360° virtual ride, using real video footage, as a strategy to retain the embodiment without the danger.

Separating out the familiarisation of the route and embodied experience of cycling from any external physical traffic removes one of the main barriers identified through the design process. This shows promising potential for non-active cyclists to experience the urban environment as if they were in the space, without being exposed to the physical dangers and uncertainty of traffic, and can contribute to non-active cyclists becoming more likely to engage in everyday cycling.

Contents

List of Figures

List of Tables

Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly indicated), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Signed by Lisa Clist,   31 July 2017

Acknowledgements

I would like to acknowledge the following people for providing guidance, technical expertise or participating in this project.

Intellectual Property Rights

The researcher asserts the intellectual and moral copyright over the creative work contained in this exegesis. All rights of the owner of the work are reserved. The publication contained in all its formats is protected by copyright and use of the recording is restricted. Any manner of exhibition and any diffusion, copying, resetting, or editing, constitutes an infringement of copyright unless previously written consent of the copyright owner thereto has been obtained.

Ethics Approval

This research received approval from the AUT University Ethics Committee (AUTEC) on 3 November, 2016, for a period of three years until 2 November, 2019.
Ethics Approval Number: 16/408
All research was conducted in keeping with the regulations and guidelines of the approval.

Chapters

1. Introduction and Overview

The purpose of this design-based research enquiry is to better understand the factors, motivations and perceptions that influence everyday cycling. Adopting a phenomenological, human-centred design approach, this research explores existing perceptions on cycling through interviews with non-cyclists who express the desire to cycle. The information gathered was used as a starting point for gaining insights, ideating creative interventions and prototypes related to bicycle interaction, bicycle design and the riding experience.

1.1 Structure of the exegesis

This exegesis presents research about the project context, the design processes, development and evaluation of this practice-based enquiry for a Master of Creative Technologies degree, with the aim of developing innovative ways to encourage everyday cycling. This written component outlines the rationale and context of the enquiry, how it is situated against other studies and innovations, the methodology used and an explanation of the research design. It also documents the different stages of the design process, discusses the insights gleaned and challenges encountered, as well as reflecting on the process and the working prototype produced.

The nature of the human-centred approach adopted meant that the design concept or specific technological approach was not established at the outset; rather it developed as the project progressed. This exegesis outlines a journey through the design process, working through several stages towards a concept prototype that addresses some of the issues identified. The written component establishes the context and outlines the iterations and decisions leading to the development of the selected concept.

The insights gained through the user-centred research phase revealed that the phenomenological experience of cycling between the rider and the bicycle was a key influence in motivating people's attitudes and behaviour towards cycling. The development of a 360° degree embodied experience concept is also a realisation of how the increasing interplay between digital and physical environments can be harnessed to reduce barriers to cycling and encourage behaviour change for a specific subset of people.

1.2 Rationale and positioning

The idea for this research arose from my personal experience of everyday cycling in urban environments around the world, having lived and cycled regularly in Auckland, New Zealand; York, Scarborough and London in the UK; and Paris in France. My personal enjoyment of cycling in a non-sporting, urban context has propelled to me to investigate further into what it is about the embodied experience of cycling that makes it so pleasurable, and whether there could be a way to share those sensations with others who are reluctant to ride a bicycle. Would there be ways to enhance or recreate those sensations in innovative ways? Are there technologies or approaches that could motivate other people to choose this joyful activity? The bicycle is widely considered to be one of mankind's greatest inventions (Penn, 2010), though surpassed and virtually supplanted by the automobile as a means of transport in modern western societies. Yet, in line with increasing discussion of sustainability, scarce energy resources and climate change, we appear to be moving into an era of the renaissance of the bicycle (Agervig Carstensen & Ebert, 2012).

My background in user experience design and software technology marketing led me me to consider the potential for digital design to influence and interface with the tangible world of cycling, to enter into the project with an open mind as to what concepts could arise through following a human-centred design process.

1.3 Practical development

While multiple practical designs were considered, the practical design component of this project represents the development of one of the concepts in the design process to prototype stage. This project used the embodied experience of cycling as its focus, however the phenomenological approach and technologies used can be applied to other fields that face similar complexities. The techniques explored throughout the practical research can provide a framework for future projects where attitudes and perceptions of an activity may be challenging to influence and change.

1.4 Objectives

The objectives of the research are:

To better understand the factors, motivations and perceptions that influence everyday cycling.

To use the design innovation process to drive the iteration of the design, rather than identifying a technology and try to find a problem that it solves.

To design creative interventions and prototypes related to the embodied cycling experience to encourage non-cyclists to cycle.

2. Methodology and Research Design

The design of this study uses a qualitative, phenomenological framework, underpinned by theories of behavioural change (Forward, 2014; Prochaska & DiClemente, 1983). Taking a human-centred design approach, the research explores existing perspectives on cycling through interviews with non-cyclists who express a desire to cycle. From an analysis of these perspectives, issues were identified and insights gained to inform the development of design strategies. These strategies were reflected on, and one was eventually selected and developed into a prototype as part of an iterative research-through-design process.

The use of a phenomenological approach, studying the cycling experience using the experience itself as the starting point, is research-through-design, also called action research: defined as 'systematic enquiry conducted through the medium of practical action; calculated to devise or test new, or newly imported, information, ideas, forms or procedures and generate communicable knowledge' (Archer, 1995). The research takes a human-centred approach, with the cycling experience as the central starting point, within the wider environment (see Figure 1). The impact of technology is another layer that influences both the phenomenological cycling experience and the environment.

2.1 Research design
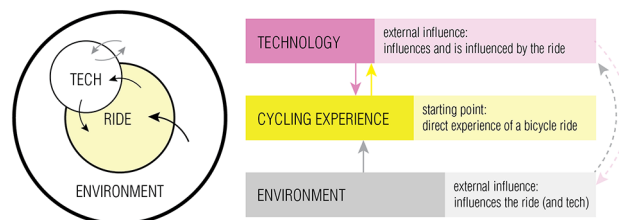
Figure 1. A high-level view of the methodology.

The cycling experience includes direct observations and interviews with participants; the researcher plays a visible role in the research (Figure 2). The influence of technology is explored through the collation of an innovation sourcebook. Both the direct and indirect sources are used to develop insights to inform the design process.
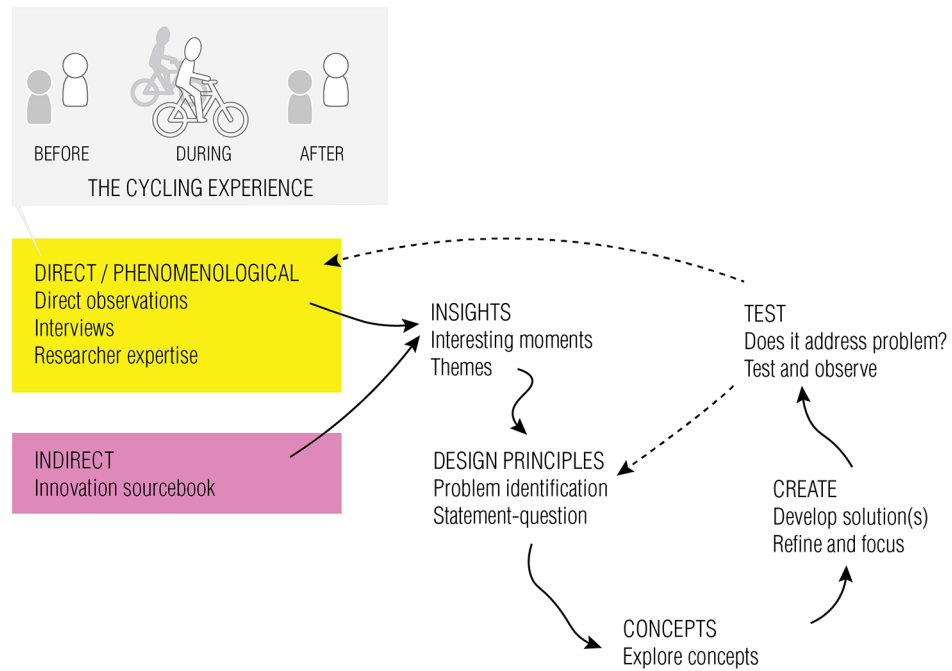
Figure 2. Detailed view of the methodology. The researcher (shown in grey) plays a visible role in the cycling experience research.

2.2 Phenomenological approach

Phenomenological research is based on the way we experience the world around us: the study of conscious experience as encountered from the first person point of view (Smith, 2016). It is the study of our perceptions, thoughts, desires, embodied actions and sensations as we move in the world around us. Cycling is an embodied, social practice: our conscious experience of cycling cannot be separated from the environment it moves in (Merleau-Ponty, 2002).

Participants' reflections should be captured during, as well as after, the experience (von Oldenburg, 2015). Some other cycling studies have taken a phenomenological approach as a means of engaging emotionally with the surrounding environment on a number of levels: "the more intense a sensory encounter, the easier it is for participants to articulate their understandings of it." (Spinney, 2006, 2007).

2.3 Contextual review and sourcebook

A review of relevant literature about cycling, including government reports, research papers, project reports and news articles about cycling, was undertaken to locate and contextualise the project. The findings of the review are detailed in Chapter 3. This process also led to the development of an innovation sourcebook.

2.4 Innovation sourcebook / What else is going on in the context of technological developments in relation to cycling?

An important aspect of the review process was to to establish a context of innovations in bicycle design, and environmental factors relevant to the development of the bicycle. Key innovations and dates were collated and acted as an 'innovation sourcebook', to be used in the design process to gain inspiration for innovation opportunities (Kumar, 2012).

2.5 Human-centred design

A phenomenological approach works hand in hand with a human-centred design approach in this inquiry. Human centred design calls for understanding the user, their needs, motivations, perceptions and the context they operate in. A core premise of this approach is to use contextual inquiry in order to gain a better understanding of the user (Holtzblatt & Beyer, 2015). The context of their situation forms the parameters of the problem definition, and aids in developing a solution based on an actual problem rather than assumptions.

While there are many quantitative studies on the uptake in cycling, there are still gaps in understanding the motivating factors behind these trends, despite there being a relationship between attitudes and actual travel behaviour (Handy, van Wee, & Kroesen, 2014). Qualitative research is aimed at "identifying background information, context and causal factors" (Richter & Flückiger, 2014) and allows for this flexible, exploratory research, open questions and forming hypotheses. The project relies on qualitative findings, gathered through a literature and project review and interviews to provide new understandings and insights to inform the subsequent design process. The model followed in this study supported two areas of research: the observation and understanding of the people being designed for, and establishing the research within a wider context.

2.6 Interviews

The project takes as a starting point in-depth qualitative interviews. This part of the inquiry focussed on the perceptions of non-active riders. The human-centred design approach calls for understanding the user, their needs, motivations, perceptions and the context they operate in. The participants were interviewed on their travel habits and transport options using free-format conversation; they were also asked to ride a bicycle and describe the experience during and after the ride. Observations were made through note-taking, photographs and video recordings.

2.6.1 Selecting participants

This study operates within the framework of the transtheoretical model (TTM), which suggests that different stages of behavioural change require different action (Prochaska, Velicer, Fava, &

DiClemente, 1988; Lipschitz et al., 2015). The five stages of change of the TTM have been identified as: pre-contemplation, contemplation, preparation, action, and maintenance (see Figure 3). The recruitment of participants focused on non-active bicycle riders, those who are at the contemplation stage of the TTM – defined as those who are equally aware of the pros and cons of a specific course of action (in this project, urban cycling) but not ready for immediate change. This model proposes that individuals are at differing levels of readiness to engage in behaviour change. Shifting towards the desired behaviour is described as progress, and shifting further away is described as relapse.
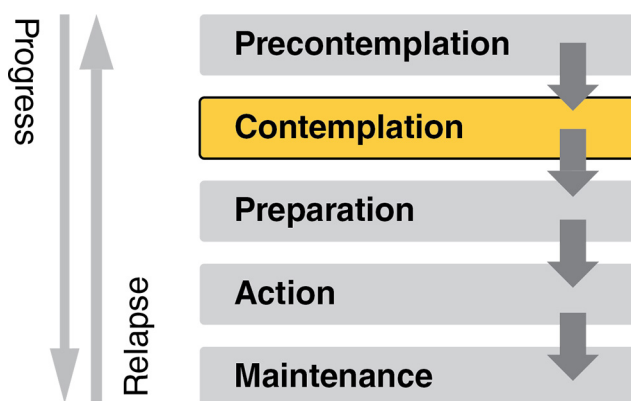
Figure 3. Transtheoretical model of behaviour change. Adapted from text description (Prochaska, Velicer, Fava, & DiClemente, 1988; Lipschitz et al., 2015).

Not all people capable of riding a bicycle are willing, nor at the same stage in readiness or willingness to try; by designing an intervention that meets where they are in the change process, the intervention is more likely to effectively result in long-term behavioural change. "TTM-based interventions meet individuals where they are in the change process rather than push them into action, with the view that this approach increases engagement, efficacy, and long-term maintenance." (Lipschitz et al., 2015). The approach to recruiting participants was through opportunity sampling — posting advertisements on noticeboards in the central city AUT university campus and by posting on social media. Participants self-identified through the recruitment process as people who do not currently regularly cycle but who know how to ride and are interested in cycling. It should be kept in mind that this is a small sample of three interviews and is potentially biased towards those more predisposed to cycling. Samples for qualitative research are generally much smaller than those used in quantitative research. This study involved a complex topic with many people holding many different opinions, and a specific saturation point for the optimal number of participants could be defined in a multitude of ways. The aim in conducting these interviews was not to draw generalities from the participants but to use the insights gained as an inspiration point for the creative process.

2.6.2 Direct observation

Direct observation provides valuable and potentially unexpected insights that change the focus from what people say to what they actually do (Kumar, 2012; Nielsen, 2010), and so provide a richer, more accurate understanding of people's behaviour and perspectives. The research design includes using a field activity – the experience of actually riding a bicycle – in order to observe participants' behaviours. A field activity focuses on the experience, grounds the conversation, and aids in understanding the people involved (Kumar, 2012). Participants' reflections should be captured during, as well as after, the experience (von Oldenburg, 2015). A qualitative approach aims to identify the causes of particular outcomes (Mahoney & Goertz, 2006) and was used to frame insights towards innovative solutions (Kumar, 2012).

The field activity was followed by an interview to engage participants and learn about their responses, opinions, and viewpoints. (Kumar, 2012). Constraints to cycling must be addressed in order to fully understand how to instigate lasting behavioural change; the understanding of why someone behaves in a certain way can also be revealed by studying why they do not (Forward, 2014). Bicycling is an embodied and social practice, and bicycling research should be made in the field, paying attention to the cyclist's body and actions. Key to this is that reflection on the experience should also happen during the experience, rather than relying solely on an interview after the experience (von Oldenburg, 2015).

2.6.3 Ride-along interviews

Semi-structured interviews of approximately 45 minutes to one hour were conducted. The format for the interview was a free-format conversation about the participant's travel habits and transport options, behaviours and choices, as well as a bicycle ride. The direction of questioning followed the concerns and comments raised by each participant.

Each interview had a physical, interactive component: participants rode a bicycle as part of the interview, and provided feedback on their experience during and immediately after the ride. The purpose of the interview is the enquiry into the physical activity of cycling; direct observation provides valuable and potentially unexpected insights that changes the focus from what people say to what they actually do (Kumar, 2012). By using a 'ride-along' format, that is actually riding while being interviewed about the experience of riding, participants were able to directly comment and respond to their physical and emotional experience *as they lived it*. Other studies have used this approach to delve into the insights of the embodied and sensory experience of cycling, conducted while 'riding along' on commuting routes (van Duppen & Spierings, 2013; Spinney, 2006, 2011), and of using video to create a stronger sense of 'feeling there' when you can't be there (Spinney, 2011) for post-interview analysis.

The exact structure of the interviews comprised of three distinct phases:

     Conversation (seated, away from the bicycles)

     Bicycle ride (both interviewer and participant riding bicycles)

     Conversation (standing, with the bicycles)

All phases were recorded with audio and video so that both verbal and non-verbal expressions and behaviour could be noted. For the bicycle segment, a smartphone camera was mounted on the handlebars and the participant wore a microphone. A second GoPro camera was used to provide a backup recording to allow for any technological issues with the primary camera (such as battery or memory space problems). The second camera also allowed for an additional perspective, capturing the surrounding environment rather than solely focusing on the participant.

Notes were taken during and afterward on the participant's physical interactions and reactions, paying particular attention to non-verbal actions during the bicycle ride, and 'interesting moments' that took place over the course of the session. Each participant's data was examined individually and direct quotes that included emotive language were extracted. Concepts were mapped in an open structure to prevent restriction too soon in the analysis – that is, non-hierarchically, to allow for a graphical representation of the complex interrelationships between each theme. Using open mind-mapping early on, prior to any embodiment of ideas, allowed for clearer articulation of design issues (Kokotovich, 2008). Insights were grouped together based on attitudes to transport in general, to bicycles specifically; perceived fears and barriers to cycling; and motivations towards cycling. These gave insights into their perceptions towards cycling and how it relates to their personal situation.

The analysis took place several times. One challenge was that by doing it individually there was a risk of missing key ideas. Other designers were invited to participate and comment during this stage. Originally it was in digital form but this was not as conducive to a shared review as physically talking through, adding, and rearranging concepts. Blu-Tack™ and Post-it™ notes were used so concepts could be easily added and rearranged. Another challenge was in understanding when enough analysis had been made. This was determined by moving on to articulating problem statements that arose from the concept maps. The process is describing linearly here, however there was some overlap between rearranging the concept map and articulating problem statements, as new ways of forming themes became apparent during the design process.

2.7 The design process

This research project includes research through design; the design process forms part of the inquiry. It is a form of action research, that is, a 'systematic enquiry conducted through the

medium of practical action' (Archer, 1995) – where the research activities of the embodied act of cycling and the practical activity of the design process both inform the project and produce communicable knowledge. The objective is to explore and solve practical problems while expanding knowledge (Fendt & Kaminska-Labbé, 2011).

The design innovation process model followed, illustrated in Figure 4, was developed by Kumar (2012), who splits the model into four quadrants: research/observation, analysis, synthesis, realisation. The interviewing and innovation sourcebook represent the observation stages of Kumar's design process. The information gained was used to gain an understanding of the motivations, attitudes and perceptions towards urban cycling, which were then further analysed for deeper meaning and collated into themes. The process allows for several iterations or versions as the information is shuffled and rearranged in meaningful ways. The themes were then rephrased as design principles, written as problem statements with a related question to explore, and these statement-questions were used as the prompt for generating concepts. Potential solutions were selected by reflecting back on the design principles to check that they address the original problems, before being developed to a point ready for testing and further iteration.
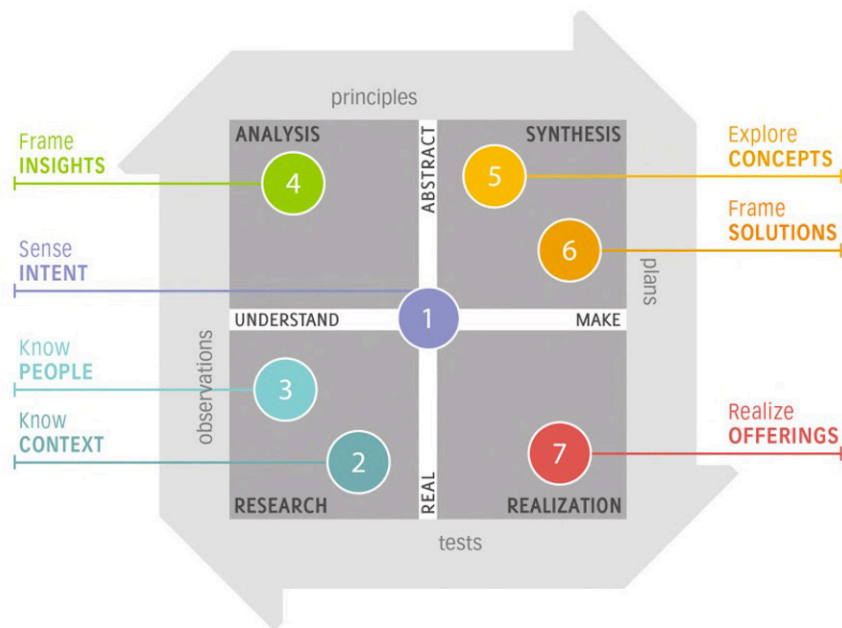
Figure 4. The Design Innovation Process Model. Reprinted from *101 design methods: A structured approach for driving innovation in your organization* (p 8), by V. Kumar, 2012, Hoboken, N.J. Wiley. Copyright (2012) by Vijay Kumar. Reprinted with permission.

The first stage is to understand the direct phenomenological experience of cycling through observation, interviews, direct phenomenological experience and understanding of the environmental and technological context. This is used for analysis to frame insights; these insights are used to then explore concepts and then make and test solutions. The process is iterative rather than linear.

3. Contextual Review: Setting the context

This chapter examines the current context of the project and the field of cycling research in more detail.

This project is situated within the New Zealand context, with some reference to international developments. Following the rise in popularity of the automobile, the bicycle was largely considered surpassed as a means of transport, instead categorised in the realms of leisure and sports. This is largely the case in New Zealand. Policy-makers and planners are increasingly facing challenges in funding cycling projects, often when those limited funds compete for allocation against other transport projects (Handy, van Wee, & Kroesen, 2014). This study plays an important role in understanding attitudes towards cycling and, because bidirectional effects exist between attitude and behaviour, it also has a role in understanding behaviour change. There seems to be a gap in the existing research on examining how we experience the riding of a bicycle, and how the act of interfacing with the bicycle may influence a person's propensity to cycle.

An initial and ongoing focus of the project was to situate any new and developing technologies within the urban cycling context. This was done by collating sources, images, and references within an Innovation Sourcebook (see Figures 5 – 9 as examples, and the full Innovation Sourcebook at Appendix F) – essentially an innovation reference point to use as another source of inspiration (Kumar, 2012). Each cycling innovation or idea was categorised by its function and its purpose – as shown in the examples in Table 1.

Table 1

Innovation sourcebook categorisation

Bicycle accessory	An item that enhances the bicycle, or connects with it, including smartphone applications that connect to the bicycle
Bicycle design	Design pertaining to the actual bicycle
Cycling experience	Any experiential activity
Infrastructure	Relating to changes to the surrounding environment
User accessory	An item worn or used by the rider (as opposed to the bicycle)

Figure 5. Lumos helmet. From *Lumos Helmet*, Retrieved from https://lumoshelmet.co/products/lumos-helmet. Copyright 2017 by Lumos Helmet. Reprinted with permission.

Figure 6. Blaze laserlight in use. From *Blaze*, Retrieved from https://blaze.cc/laserlight. Copyright 2015 by Blaze. Reprinted with permission.

Figure 7. Copenhagen Wheel in use, photo 2. From *Superpedestrian*, Retrieved from https://superpedestrian.com/. Photo by Max Tomasinelli www.maxtomasinelli.com. Copyright 2017, Superpedestrian, Inc. Reprinted with permission.

Figure 8. Flo traffic light optimisation system for cyclists. From *Springlab*, Retrieved from http://springlab.nl/flo-en. Copyright 2015 by Springlab. Adapted and reprinted with permission.
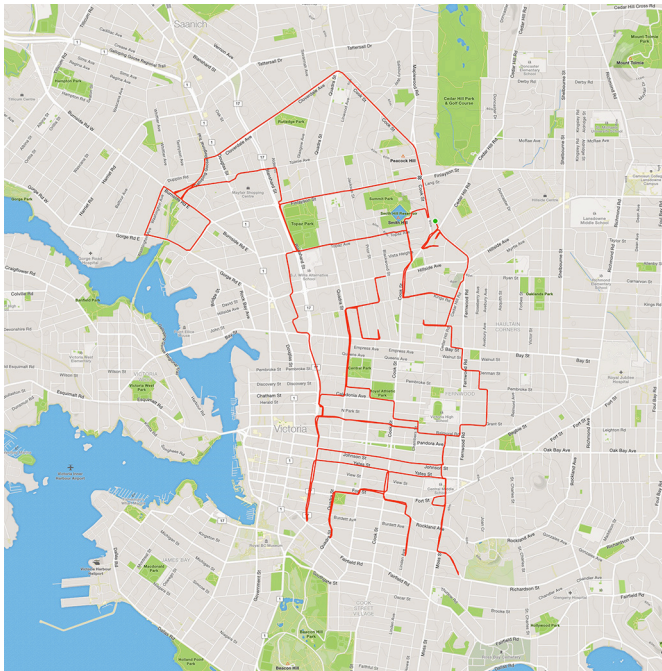
Figure 9. GPS doodle of Santa Claus. From *Sketchbook of a GPS Artist*, Retrieved from https://goo.gl/YP7iH7. Copyright 2015 by Stephen Lund • GPSdoodles.com. Reprinted with permission.

Savan, et al (2017) recognise that "behaviour change programs are most effective when both internal and external barriers can be reduced to the minimum." A key concern in this part of the research was to determine the scope and approaches used in the area of research into motivations for cycling in everyday life, in order to identify potential gaps in existing knowledge.

3.1 Approaches to research: quantitative and qualitative research methods

A large and growing body of literature has investigated the benefits and motivations for cycling, particularly in relation to promoting cycling for transport. There have been many studies of urban cycling and the evaluation of its social, economic, environmental, and health benefits from a quantitative perspective, but less so from a qualitative perspective. There are limitations in existing research methodologies used for cycling studies, as well as areas that have yet to be explored in more depth (Handy, van Wee, & Kroesen, 2014). The majority of studies on cycling motivations have primarily been quantitative, and focus on the health, well-being and safety aspects of cycling, as well as aspects of infrastructure design. According to Handy, van Wee & Kroesen in their 2014 study, *Promoting Cycling for Transport*, there are two elements involved in improving the increase in cycling behaviour in an urban environment: that of improving cycling infrastructure and that of normalising cycling. Therefore, further

investigation into attitudes towards cycling would contribute to the body of knowledge on how to normalise cycling.

3.2 An embodied approach to cycling research

"Research in the past has placed too little emphasis on the meanings of the journey itself, particularly those fleeting and ephemeral meanings that arise through cycling as an embodied and sensory practice." (Spinney, 2008).

There is a growing body of inquiry that acknowledges and examines the phenomenological experience of cycling. Other studies have embraced this approach, such using video as a way of 'feeling there' to extend the sensory experience, or especially when you can't be there (Spinney, 2011), although the researcher acknowledges that video too has limitations in its success as an embodied experience; other researchers have built on this with 'ride-along' rides where the researcher cycles with participants and asks them to describe their experiences aloud (van Duppen & Spierings, 2013).

Spinney discusses the potential for other technologies to make the abstract study of mobility 'less' abstract, including the use of bio-sensor studies and building on the video experience. He argues that technology is not the focus. Rather it provides the potential for bringing to the fore new experiences that will "engage and excite audiences" in relation to studies of movement, where the written or spoken word can be insufficient in articulating the full sensory experience (Spinney, 2007).

3.3 Cycling innovations

Technologies of urban cycling and cycling related innovations have blossomed over the past decade (see Appendix F). Innovation can be described as 'the successful bringing to market of new or improved products, processes or services' (Charpie, 1967, as cited in Archer, 1999); however, I expanded the sourcebook to include any recent concepts, even those which have not been fully launched in the marketplace.

There are innovations that have focused on improving or adding to the bicycle design, for example folding bicycles, using electric-powered wheel hubs, or 3D printed modular bicycle parts. These are in response to specific barriers to cycling such as the ability to easily carry or store the bicycle at either end of a journey or to make it easier to cycle a longer distance or uphill without needing to be in top physical form, or, in the case of the 3D printed parts, to explore the flexible 'manufacturing' possibilities that new technology allows. Other innovations focus on improving perceived or actual safety, many in relation to lighting systems such as

laser-projecting lights, helmets with indicators or LED-decorated wheels, all with the aim of improving the visibility of the cyclist in relation to other road users. Some innovations look beyond the rider and the bicycle to the wider environment, addressing the infrastructure: luminous pathways, bicycle escalators for assistance climbing a steep hill. There are also instances that extended the experience of cycling as a form of artistic expression – using navigation and ride-tracking tools to record cycling journeys that create an artwork, creating clothing that billows out in response to movement and wind while riding.

3.4 Interaction of digital and cycling

In terms of digital innovations, the use of electronics and technology in conjunction with cycling is evident in several areas. In software, this is most prominently through cycle mapping and journey planning, or ride-tracking smartphone applications (Google Maps and Strava are two examples of popular tools). There are navigation and security tools that respond to the bicycle movement through GPS and proximity sensors, or operated in conjunction with smartphone applications. There have also been developments in virtual reality that bring people closer to riding without actually riding, usually for exploration or fitness. Other technology developments have focused on the sports aspects of cycling, for example digital speedometers. Sports-specific developments are outside the scope of this project.

There have been developments in virtual reality that bring people closer to riding without actually riding. These have typically been rejected by cyclists as problematic, even nauseating (Gladstone, 2015) yet the interest in this area is growing as the technology becomes less stilted. One such project relates to a man who rode on his exercise bicycle the length of the UK using Google StreetView (Puzey, 2016). Puzey described the ride as pleasant but nauseating at times when the stretched, static 2D images acted unexpectedly, such as the stitching of a panoramic image. There are two similar types of technology, virtual reality and 360° panoramas. The distinction is that with virtual reality there is more depth and perception interaction, being able to move through the environment, as opposed to 360° video where the viewer remains removed from the scene, unable to fully interact. Users' physical responses to the different technologies diverge slightly: "360° panoramas offer the closest to reality results according to the participants' psychological responses, and virtual reality according to the physiological responses" (Higuera-Trujillo, López-Tarruella Maldonado, & Llinares Millán, 2017). However, there is some convergence and the terms tend to be used interchangeably to describe an immersive visual experience.

3.5 The role of infrastructure as an influencing factor

Studies aimed at transport planners and policy-makers have shown that the type and availability of cycling infrastructure is a major factor on an individual's propensity to cycle (Auckland Transport, 2016 & 2017; Panter, Griffin, & Ogilvie, 2014) – that a perceived or real lack of dedicated cycling infrastructure is a barrier to cycling. I acknowledge that the surrounding environment, including any infrastructure, cannot be separated from the cycling experience without changing the experience: this is part of the phenomenological description that we cannot separate our consciousness, or our bodies, from the surrounding environment. This is a central discussion among phenomenological philosophers, and includes Heidegger's concept of 'being-in-the-world', or Merleau-Ponty's notion that "the body is our anchorage in the world" (Merleau-Ponty, 2002). The world is the site and setting of all activity (Dourish, 2001).

3.6 The rise of the electric bicycle

The increasing interest and uptake in electric bicycles has resulted in greater numbers of people cycling, and recent studies indicate this is most pronounced in older age groups (Astegiano, Tampère, & Beckx, 2015; Johnson & Rose, 2015; Jones, Harms, & Heinen, 2016). Electric bicycles address many barriers to cycling, such as decreasing the physical impact of hills and distance and lowering the level of physical exertion. It has made the bicycle more accessible to older cyclists experiencing a decline in their physical ability, and to sedentary users who otherwise would not have considered cycling when sweating is a deterrent to physical incidental activity (Gojanovic, Welker, Iglesias, Daucourt, & Gremion, 2011; Jones, Harms, & Heinen, 2016). These studies have also noted that other concerns arise related to electric bicycles – the increased speed is problematic for other road users who are not yet used to bicycles moving at high speed; the longevity of batteries and the consequences to running out of power mid-ride, and primarily the prohibitive investment cost. These are all likely to change over time as adoption increases and the technology develops. The greatest development in use of the e-bicycle is that it extends the feasibility of cycling in situations where other modes of travel would be taken, such as car trips over longer distances. What remains to be seen is whether this behaviour change is sustained over longer periods of time.

This research was not specifically geared towards one specific technology, nor towards one type of cycling product or solution. The project focus concentrated on the experience of cycling rather than its infrastructure or one specific technological development; however, I discuss infrastructure and the electric bicycle specifically because they have proved to contribute strongly towards people's attitudes and behaviour towards urban cycling, such as in the city of Auckland where this project is situated.

4. Positioning the Research

The research starts from a human-centred design approach to understanding the current experience of riding a bicycle by non-active cyclists. I set out to observe and experience how non-active cyclists interfaced with a bicycle, and gain an understanding of their attitudes, behaviour, perceptions and motivations towards riding bicycles. To frame it in a wider context I explored their current behaviour and attitudes towards their current mode of transport.

Cycling contributes to improving the vibrancy and quality of urban life (Jacobs, 1961/1993) and yet it still remains a less popular transport mode in many cities around the world. Research on cycling motivation has tended to focus on people already riding regularly in an urban environment, and there is still more to done to understand the effectiveness of strategies for promoting cycling using both quantitative and qualitative approaches (Handy, van Wee, & Kroesen, 2014).

The research sets out to find out what influences people's motivations and perceptions towards the experience of riding a bicycle to subsequently inform the development of design strategies to improve cycling uptake. The intention was to examine non-active cyclists in the context of an urban environment, where the bicycle is used as a means of transport for commonplace trips, such as travelling to local destinations. Non-active cyclists offer a potential growth opportunity for increased cycling participation.

4.1 The impact of place

While initially I intended this project to be independent of location, aiming for a global solution to a global challenge, it quickly became apparent that the experience of cycling cannot be divorced from the environment it takes place in. For this reason, it became important to situate the project within the urban environment of central Auckland, and to be aware of the local context before being able to extrapolate to other urban environments.

Locally, Auckland Transport has published The Auckland Cycling Account and the Active Modes research report focussing on statistics on cycling in Auckland. The reports are annual surveys of Aucklanders on their cycling activity. The reports track changes in people's perceptions, and has identified there is still opportunity for increased uptake of cycling (Auckland Transport, 2016; TRA, 2016). The core barriers to growth in cycling for transport in Auckland were identified as low confidence cycling in traffic, and associated safety concerns; a perceived lack of infrastructure, both for the actual travel and for bicycle parking (TRA, 2015); the updated study (2016) described a positive movement in the perception of cycling and

improved infrastructure and cycle ways. The 2015 report notes that there is a "…real requirement for deeper insight into barriers than can be delivered via a survey" (TRA, 2015), and the 2016 report recommended promoting the emotional rewards of cycling to encourage repeat behaviour, and for the local council to focus on facilitating the removal of perceived barriers to cycling.

My research extends beyond these surveys by using qualitative research and direct observation of the actual experience of cycling. These methods provide valuable and potentially unexpected insights that change the focus from what people say to what they actually do (Kumar, 2012; Nielsen, 2010), and explore how the experience impacts their motivations and perceptions towards everyday cycling. For the community, cycling is widely considered an environmentally-friendly, healthy and socially positive means of transport that mixes well with other modes of travel in an urban environment, and contributes to improving the quality and vibrancy of urban life (Jacobs, 1961/1993). The qualitative research was used to develop insights to inform design solutions and strategies to encourage everyday cycling.

Studies in other urban cities, primarily in Europe, North America and Australia, have multiple similarities to those identified in Auckland, with perceived safety concerns, a lack of infrastructure, and both internal and external barriers to behaviour change, and individuals' attitudes and perceptions of cycling act as a common, deep-rooted barrier to cycling (Savan, Cohlmeyer, & Ledsham, 2017), and even those motivated to cycle more need help getting started (Gatersleben & Appleton, 2007). "In short, cities of all sizes with very different land use patterns, histories, and cultures have succeeded in increasing cycling and making it safer" (Pucher & Buehler, 2012). However, there is no one single approach and various efforts should be coordinated to promote cycling, keeping in mind the specific urban situation for where this research is placed.

5. Interview Analysis and Insights

The initial stage in the design process was to design the research project (the research design). This included identifying the overarching research approach and the most appropriate methods. As part of the Ethics Application process, methods for selecting the participants and the design of interview protocols and questions were developed. As described in the methodology, the closest approach to understanding the experience of non-active cyclists was in observing the actual experience of cycling. A field activity focuses on the experience, grounds the conversation, and aids in understanding the people involved (Kumar, 2012).

As the participants were non-active cyclists with no established cycling behaviour to observe, a route was created for the study. This route was designed to go through a park and along a road that has a separated bus lane. All turns were left hand turns, the ride was in daylight hours, and the participant was also able to suggest an alternative route with which they were more familiar. Each decision was made in order to minimise risk to the participant, while still observing the cycling in an urban area. Participants were videoed to capture their verbal and physical behaviour. The researcher accompanied the cyclist in order to observe any behaviour not captured by the video footage. Another aspect of the research design was to observe participants' attitudes and behaviour prior to and after the cycling experience. This was to compare whether the direct experience had any immediate impact on their expressed viewpoints or their physical demeanour. Given the in-depth nature of the interviews, the number of participants was kept small. The interviews were designed to be used to frame insights towards innovative solutions (Kumar, 2012).

The next stage was to carry out the interviews (refer to Appendices C, D & E for the transcripts). This section covers the analysis of the interviews, grouping and coding ideas, words and emotions. The analysis included identifying interesting moments, looking for deeper meanings and arranging key ideas into themes.

For the initial findings, each interview was analysed for its emotive content, in both words and actions. Direct quotes and emotive language were highlighted in the transcribed interviews and matched with any non-verbal observations. These were then grouped into attitudes towards transport, cycling in particular, or classified as a fear, barrier or motivation to cycle. Figure 10 shows the initial research analysis in progress.

Emotive words that were frequently used included discussions of exposure and vulnerability, and the intimidation of other traffic. 'Jess' mentioned that just the thought of being near cars and buses was intimidating. She didn't feel safe on the road, feeling "much more exposed when you cycle".

Figure 10. Grouping emotive language and interesting moments and observations, using Post-it notes for flexibility in sorting.

5.1 Physical sensations

The next step was to identify themes in each interview, considering a participant's speech, and beyond the words spoken: their actions, body language, their wider life situation, and their awareness of the surrounding environment while they rode, to "get at the essential meaning of the experience" (Waters, 2016).

The bicycle was supplied and not familiar to any of the participants, yet all seemed quickly comfortable with the general experience. It was a road-safe commuter bicycle suitable for urban use, with flat pedals that did not require specialist clip-in shoes. Participants were asked to reflect on the physical sensation of riding. This encouraged them to think consciously about a sensation that they may take for granted, and to encourage them to reflect on the physical experience, something they may not describe explicitly without prompting. I also examined the physical observations made through my notes and video footage. Two participants described the sensation as child-like. I observed that it was the moment of sitting on the bike with hands on handlebars that evoked this response. The purpose of asking them to reflect on the physical sensation so as to help generate "new ideas of design, for inspiring new form-giving activities and for the creation of new objects" (Wiberg, 2014).

Figure 11. Interview participant seated on the bicycle. Even after the ride, the participant was comfortable and relaxed, preferring to stay seated on the bicycle to continue the conversation.

Each participant had an issue with the gears on the bicycle. This could be interpreted as a lack of familiarity with that particular bicycle, a 21-gear mountain bike, as it was supplied and they had never ridden it before. The participants mentioned this but commented more that it was poor knowledge on their part rather than anything wrong with the bicycle, and it did not prevent them from enjoying the ride: "I'm neglecting to change gears because I'm not sure which one does what. But I'll leave that alone because maybe that's okay." There were no other aspects of the bicycle that were observed as disconcerting. Each participant commented on the helmet, their lack of enthusiasm for wearing it and its mandatory use in New Zealand. Each had ridden bicycles in countries where it is not mandatory so their comments may have stemmed from recollections of situations where the choice is not made for them.

There was some expectation that the interface of the bicycle – its physical design, the interfacing between the cyclist and the bicycle, including the touch points of the seat, handlebars, pedals – would generate interesting insights through researcher observation and participant comments. However, the verbal commentary on the interaction with the bicycle was limited, and when remarked were expressed in a tone of voice that suggested that it was not an important consideration. The most marked observation was that the use of the gears was not immediately intuitive, but when questioned none found it a particular obstacle to enjoying the ride. It could be that a longer ride would elicit further insights in relation to the interface that would not be apparent in such a short period of time, however the amount of comment in relation to the overall experience indicated that the interface was not a primary consideration for these participants.

Some of the insights generated through the interview and observation sessions included the role of the environment: the participant's sense of entitlement to space as a cyclist compared to a car driver, bus driver or pedestrian. There was a sense of delineated places, such as footpaths for

pedestrians and bus lanes for buses, and confusion and discomfort as to where a cyclist belonged. This unease about space was mentioned along with comments and their personal fear and safety, particularly in relation to riding alongside motorised traffic. The perceived danger of traffic was talked about at length by most participants. This was discussed before, during and after each ride. However, the emphasis on danger changed at different stages of the interview, identified by the type and extent of emotive language used. Prior to riding, participants described this fear in much stronger terms.

The purpose of cycling in participants' daily life was discussed as part of the open-ended questions at the beginning of the interview. The questions were to understand the role of cycling in the person's life as well as their attitudes towards it as a means of urban transport. Prior to the ride, participants spoke more in generalities about cycling. After the ride, and to a limited extent during the ride, they were more able to articulate their attitudes, and referred to the physical sensations of cycling to explain their point of view. They were more specific about the actual experience, and the aspects that concerned or excited them. The physical activity elicited more positive comments about cycling, such as feelings of freedom or flying, and physically going fast.

The emotive aspects of cycling were discussed, such as attitudes towards the speed of cycling as both a fast and a slow activity. Participants related their experiences of cycling as a means of discovering new places, and their consideration of it as a functional means of transport or a leisure activity. The way they framed the activity, and the environment they compared it to, influenced the language and attitudes they had towards cycling.

These insights related to the attitudes, fears, motivations and behaviour from the first grouping (as shown earlier in Figure 5) were then shifted into a non-hierarchical mind map, in order to explore the various concepts and their relation to each other: to uncover themes.

5.2 Theme-finding and coding

The next step involved revisiting the original clusterings, reshuffling the ideas that arose from the interviews, to delve deeper into the complexities and group the ideas into themes. Again this was done with the coded Post-it notes, this time with imagery of other technological developments from the innovation sourcebook (see Appendix F), as well as direct participant quotes and emotive imagery that visually represented key ideas described by the participants. Part of this clustering is shown in Figure 12. Some concepts developed directly out of this process and these were noted down in a separate area. As described by Kuniavsky, Goodman, & Moed, "the process of making abstractions inevitably bleeds into the process of designing and delivering research outcomes" (2012).

Figure 12. Arranging quotes and innovations into identified themes. The blue Post-it notes detailed the key themes that arose from the interview analysis; the white text blocks contained direct quotes from participants; the printed images relate to products and solutions in the innovation sourcebook as well as emotive imagery to provide the researcher with further visual cues relating to cycling.

Figure 13. Interview participant riding through a car park. The participant was relaxed and confident the entire ride, despite having described cycling as 'going to war'. Her physical demeanour was contradictory to what she had described minutes earlier.

5.3 Looking for contradictions and problems

Next I looked for the relationships between the different areas, and for contradictions, counterintuitive events or positions. Examining disconnects or contradictions, such as where people's actual behaviour does not match their reported behaviour, can provide valuable and potentially unexpected insights (Kumar, 2012; Kuniavsky, Goodman, & Moed, 2012).

Contradictions in individual perceptions were apparent. Cycling was simultaneously viewed as physically easy and hard; "as easy as riding a bike" or as challenging as riding up a steep hill. There were perceptions across the full spectrum of speed: as a thrilling activity, a means to race downhill, yet also something to be done at a leisurely, slow pace. Comparisons with other transport modes influenced the perception of the speed of cycling; further evaluation of these apparent discrepancies revealed that it depended whether the interviewee compared cycling to walking, to public transport, to driving, or to driving in congested traffic.

The one area where people were more unanimous was in cycling being less safe, specifically in the context of Auckland. However, this did not seem to match other comments later in the conversation, nor with their actions during the physical bicycle ride. The emphasis here was heavily weighted toward Auckland as a dangerous place to cycle. One of the interviewees considered cycling in Auckland much more dangerous than cycling in Shanghai, and then proceeded to describe the extent of the dangers in China, far beyond what would be normal here (e.g. locals deliberately colliding with the 'wealthier' foreigners so that they can claim compensation). Another used very emotive language, describing cycling in Auckland as like going to war; yet confidently navigated the intersections during the ride immediately after, and described it as a pleasant experience. During the interviews I probed deeper when I noticed any contradictions, asking for further detail so that the analysis was more meaningful. Anomalies and contradictions such as these can provide valuable insights so these sorts of findings were noted for further investigation. Were they more confident cycling during the interview because the planned trip was on a quiet street, or because they were not cycling alone? Are they reflecting a wider societal perception of cycling as a dangerous activity? Is it the uncertainty, the lack of control over traffic, that is creating the feeling of danger?

6. Generation of Design Principles

The next stage in the design process was to reshape the themes into design principles. These were expressed by shaping the one- and two-word themes and associated quotes into problem statements, or sentences, with associated thought-provoking questions in response to the statements. These design principles act as the launch point for creating concepts, to jump from inquiries to possibilities (Kumar, 2012).
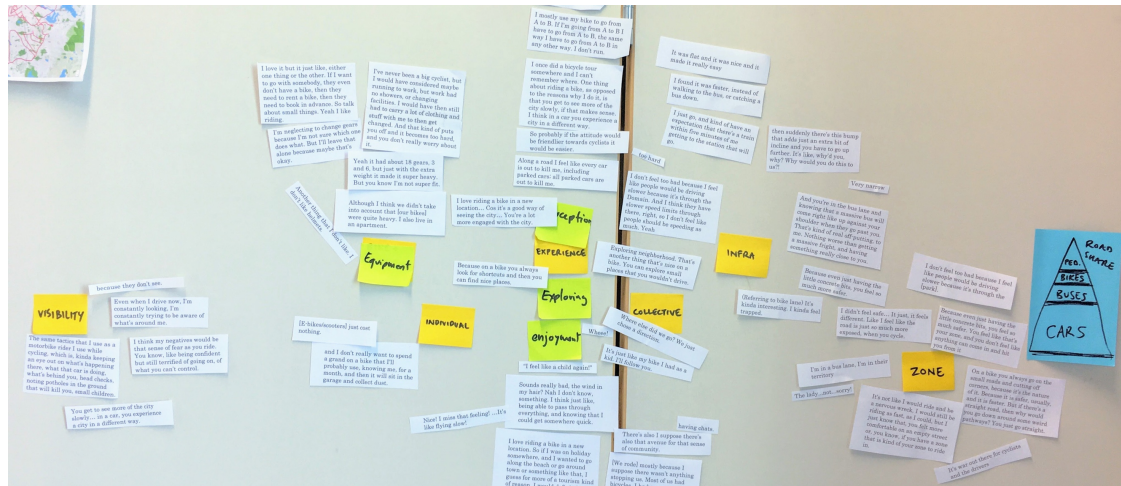
Figure 14. Focussing the insights around key themes.

6.1 Design principle generation

Through a further round of mind-mapping I examined the themes and insights more closely to uncover contradictions, indirect causes or effects, and counterintuitive events, and any relationships between these. I narrowed these down to these key areas:

a) Perceptions of cycling as both a slow and fast activity, both of which are enjoyable at different moments.

b) Perceptions of safety and danger in different urban environments, where more explicitly dangerous cities such as Shanghai feel safer than the comparatively latent danger of cycling in Auckland.

c) Sensations of having a valid, visible space or zone on the road, and the vulnerability and exposure felt when not in a cycling lane or low speed area.

d) Perceptions of cycling as a fun, social activity and a means of transport, but not necessarily at the same time.

From these identified themes I more specifically articulated the problem to be solved. This took several iterations moving between framing insights, exploring concepts and revisiting the context and interviews both alone and in brainstorm sessions with design colleagues. The design innovation process is non-linear: it is possible, and to some extent encouraged, to break out

from the guiding structure and sequence to validate and improve the idea. As described by Kumar (2012), "doing more iterations generally leads to higher-value, more successful innovations".

To stimulate idea generation, I reshaped the design principles as actionable, statement-questions:

a) I can ride a bicycle with no trouble but the **environment** around me is **challenging** so I don't ride even though I physically know how. How do we make the environment less intimidating?

b) I would like to ride a bicycle because I love the **freedom** of a bicycle but I feel too **exposed** and **vulnerable** sharing the same **space** with **cars** and **buses**. How do we change perceptions so that cyclists feel they have the safety, freedom and space they need?

c) I would like to ride a bicycle because it's a fun way to **discover** new places but it's only an option when I'm travelling somewhere new, not in my daily routine. How do we create excitement, **discovery** and adventure in our normal activities?

The use of a problem statement-question provided a better starting point for the iteration process. In each statement, a simple formula was loosely followed: "I would do this___ but for this ___ reason."

The motivation or action "I would do this___" is clearly articulated to ensure that there is an explicit desire for behavioural change and the problem that creates a barrier is also made clear "but for this ___ reason". The statement provides an unambiguous stance on the subject. It is specific and simple, and aims to resolve one problem (or two) rather than attempting to cover every theme. Key terms were placed in bold to further emphasise the area to be considered, and also to check that they match back to the original insights and themes.

Each statement is then made actionable, to help move the design process forwards, to look towards a solution. Each question is formed with an open "how" to allow for a broad interpretation of potential directions the ideation could take, and also to keep the focus on the user experience rather than one type of solution (for example, a "what" question may indicate that a product design is more likely, rather than a service or experience, as it hints more towards a tangible object).

These principles were important in focussing the design process, discussed later in this exegesis in Chapter 9.

6.2 Commentary on the interviews as part of the design process

The danger of using interviews as a design start point is to generalise too much from a small sample size. The barriers to cycling are complex and the individual life situation and experience of each participant greatly influences their attitudes and behaviours. The balancing act is to find relevant themes and design principles, while acknowledging that these may be unique to the sample group. To counter this, I referred to other quantitative and qualitative studies to evaluate how my insights correlated. How much did they differ?

The participants' attitudes and behaviour were mapped out against the transtheoretical model of behaviour change and the AT transport framework for cycling (TRA, 2016). Both frameworks describe the progress stages involved in behaviour change. The AT transport framework refers specifically to the frequency of cycle travel and the level of readiness to cycle more.

Table 1 shows the interview participants' attitudes and behaviour mapped out, both at their current level of cycling activity and in their readiness to change, against these frameworks.

The stages of behavioural change in the transtheoretical model are described in the World Bank as: '*Precontemplation* is the stage in which people are not intending to make a change in the near future (often defined as the next 6 months). *Contemplation* is the stage where people intend to change (within the next 6 months). People in this stage are aware of the pros of changing but also can identify the cons. *Preparation* represents the stage where people have a plan of action and intend to take action in the immediate future (within a month). *Action* is the stage in which people make the behaviour change and maintenance represents the stage where people work to prevent relapse.' (World Bank, n.d.) Not all versions show a sixth stage, *Termination*, that indicates that the behavioural change is permanent. The AT transport framework was based off the transtheoretical model and is used to track people's current attitudes to cycling. The focus for this research project is those at the contemplation and considerer stages: those who can cycle but do not actively do so.

Even those motivated to cycle need help to get started and to move through the stages (Gatersleben & Appleton, 2007, World Bank, n.d.). Without a planned intervention, it is much more unlikely that the behavioural change will occur. Rosa is a Considerer in her day to day activity, but would shift to a regular cyclist routine if conditions allowed. Shane is a Considerer/at Contemplation stage in his day to day activity, but desires to shift to Occasional or sometime bicycle use; Jess is a Rejector in her day to day activity, but Occasional in her

overall outlook – for her, cycling is an occasional sports or tourist activity rather than purely a means of transport. The mapping of the participants against the models is shown in Figure 15.
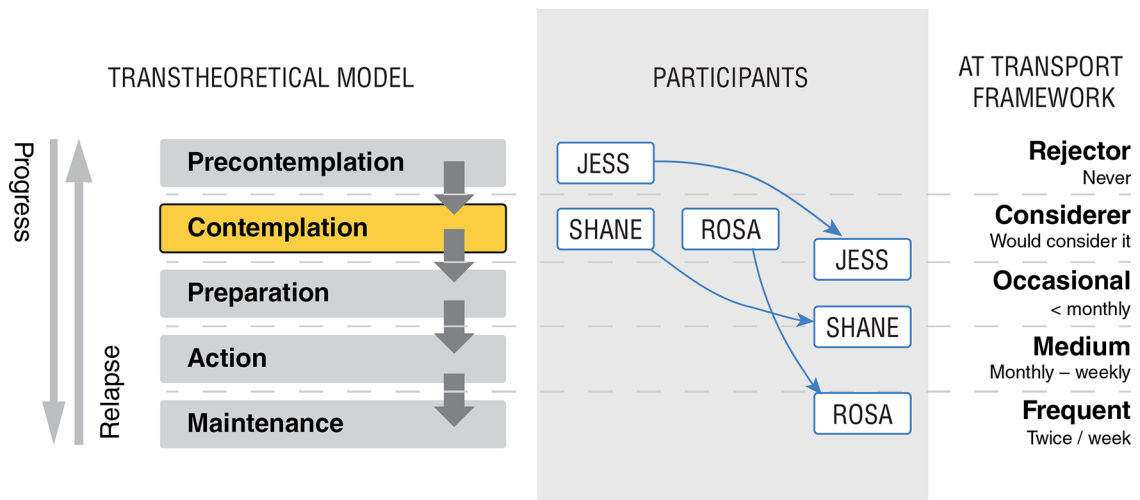
Figure 15. Behavioural situation and attitudes of the participants. Plotting the participants current and desired future behaviour against the Transtheoretical Model of Behaviour Change and the AT Transport Framework.

To map these classifications back to the Transtheoretical Model, a Considerer would be in the contemplation stage (i.e. with a desire to change but strongly and overwhelmingly aware of barriers to change); an Occasional would be at the preparation stage (i.e. Actively looking to change behaviour), while a Rejector would be in the precontemplation stage (i.e. not considering a behaviour change at all).

The strongest insight gained from the interview, observation and analysis process was that the embodied experience of cycling significantly altered the attitudes and emotive language of the participants. They were reminded of the joy of the act of cycling, and it was fresh in their minds. Instead of nostalgia from an activity they no longer participated in (identified in the initial interviews), they could vividly imagine riding in their current life situation – they had just done so in an urban environment.

6.3 The influence of the environment

Part of my discussions with participants centred around their perceptions of cycling in Auckland. I had set out to explore urban cycling in a more general sense but judging by participant responses, some of their attitudes towards cycling were specifically in the context of Auckland: "Well because I live here. Because this is the current situation… You either live [in a place] or you travel. So we're talking about living and we are living in Auckland so that's why I'm talking about Auckland."

For Rosa the environment of the current city cannot be separated from her actions in cycling, as they are inextricably linked. She considered herself a confident cyclist in other contexts and environments, describing her cycle travel from Europe to New Zealand, as well as her cycling experiences in Wellington and on the rural roads. Yet in the context of cycling in Auckland, she called it "like going to war" – that you have to "fight" with cars and buses for space on the road, particularly at intersections where cyclists are most exposed to danger of the unpredictability of drivers. She didn't feel confident that they would allow her space to cycle or to navigate around obstacles.

While generalising would be convenient for the design of a potential global solution, the specifics of the actual environment that the rider must be addressed. Early on in the bicycle ride, we (Rosa and I) were riding downhill and came across some parked cars that occupied most of the lane on a relatively narrow street. At the same time, cars were approaching from behind. Rosa commented in the moment that she never knew what to do in this situation, but took the decision to pull out to pass the parked cars before the other cars reached us. Afterward she reflected that the situation was safe, and that the cars were considerate, before qualifying, "Drivers, they were nice, because they were letting us pass, but it [does not always happen]— sometimes it does, sometimes it doesn't, and you never know." It was the uncertainty, the gamble of having to constantly consider how best to defensively ride that she found difficult, tiring and what she described as a key reason for no longer cycling. Her descriptive language was particularly emotive.

Jess also described a similar contradiction: her perception of cycling in Auckland was particularly negative, again in consideration of her view of drivers' careless attitude towards cyclist safety and their lack of awareness on the road. Yet she went on to describe the incredible dangers of cycling as a foreigner in Shanghai – and, as noted previously, related that local Chinese had been known to deliberately cause accidents with foreigners in the hope of a large cash payout. She had also been involved in a low speed crash while in China. It seemed as if the apparent dangers of cycling in an obviously dangerous city were easier to negotiate than the latent dangers of what appears to be a safer city.

At the outset of the interview Jess would have fitted into the precontemplation stage of the TTM model, as she hadn't really considered that cycling was an option for her. Her consideration set was between driving or public transport to get around town. It wasn't until the interview that she seemed to consider that cycling could be potentially be an option, if she had a bicycle available to her.

6.4 Contrasting with the expert view

At the start of this project, I considered the use of an expert point of view as part of the interview process. It became apparent through the course of the research, riding with the participants as the more experienced rider, that this expert position was already occupied by me as the interviewer and researcher. Throughout the analysis of the interview findings I reflected on how the participants' views differed from my own, and questioned my own background and how I came to ride regularly in an urban environment. The phenomenological approach applied to me as the researcher, riding alongside or behind the interview participant. I also drew on my own experience (see Appendix H) as a contrasting source to help with the creative development of practical responses for the project.

7. Ideation of the Practical Project

The design principles developed through the interview/observation/analysis phase infer that the greater concerns are related to the environment and the cyclist's confidence, rather than with the actual bicycle. There are many factors that contribute to the inexperienced urban cyclist feeling vulnerable, such as the unfamiliarity of riding a bicycle, the environment is challenging, dealing with traffic, negotiating space comparative to other road and path users, as well as navigating the route. Therefore, I focused on mitigating at least one of these factors to reduce the unease. Each question led to more questions in the design process, and the identification of the following nine creative pathways. These are listed below, with more detail provided for Ideas 1 and 7 (shown in bold text in Table 2) as these are the ideas that I chose to develop in more depth.

Table 2

List of concepts

IDEA #	DESIGN PRINCIPLE – QUESTION ADDRESSED	IDEA
1	How do we make the environment less intimidating? How do we change perceptions so that cyclists feel they have the safety, freedom and space they need?	Practice being-in-there without actually being there: 1a) Closing the road/route/intersection to traffic, such as through car-free days. 1b) Plotting the route with mapping software, then travelling along it statically (current solution) 1c) Riding the route virtually, combining a real bicycle combined with a virtual road and virtual traffic.
2	How do we make the environment less intimidating?	Ride with an expert who takes the stress out of it for you

3	How do we make the environment less intimidating? How do we change perceptions so that cyclists feel they have the safety, freedom and space they need?	Go into an environment that matches your ability: A "ski-map" of bicycle routes coded according to your ability
4	How do we create excitement, discovery and adventure in our normal activities?	Make the hard parts more interesting: design interesting motifs/colours (sounds? lights?) to encourage you as you, quite literally, level up and head up a steep slope.
5	How do we make the environment (= bicycle/tool) less intimidating?	Make the bike interface less perplexing
6	How do we create excitement, discovery and adventure in our normal activities?	Involve cycling in a wider activity
7	How do we create excitement, discovery and adventure in our normal activities?	Re-imagine the childish flying excitement: superhero cape /wings
8	How do we create excitement, discovery and adventure in our normal activities?	Geocaching / obstacle course / scavenger hunt concept
9	How do we create excitement, discovery and adventure in our normal activities?	Gamify through the collection and conquering of space or territory based on the distances or areas covered while cycling

The concepts listed in this table are numbered for ease of reference to discussion in the following section of this chapter, this ordering does not signify any priority or ranking. The concepts in bold were those selected to ideate further as they both take a phenomenological approach, rather than one of product design or coaching.

7.1 Idea 1: How do we make the environment less intimidating? Practice being-in-there without actually being there

Touching on my own experience mapping out transport routes, by bicycle or by car, I use mapping tools, first to plot my route, then to check if the route is appropriate. When cycling, I then use Google Street View to check what conditions there are, particularly on busy roads. Is there a cycle lane? How wide is the shoulder? Are there likely to be parked cars? How will I cross the busy intersection? Knowing in advance what to expect makes the environment less overwhelming once I'm in it.

Non-cyclists have the added fear of feeling especially exposed and vulnerable on a bicycle. They may be on a street or at an intersection they are familiar with, but the sensation and experience is entirely different from that of a car. Suddenly there are new scenarios to consider, such as how to overtake a parked car when there is traffic approaching from behind; how is the cyclist meant to act in this situation? The uncertainty is anxiety-inducing.

What if you could practice cycling the route before putting yourself in danger? To physically ride the route, but without the real danger of traffic. We could do this by:

1a) Closing the road/route/intersection to traffic, such as through car-free days.

1b) Plotting the route with mapping software, then travelling along it statically (current solution)

1c) Riding the route virtually, with a real bicycle combined with a virtual road and virtual traffic.

7.1.1 Closing the road

The first option is limited to specific times and would require significant planning and disruption, and therefore more difficult to achieve. There are instances of this, such as the Open Streets project (The Street Plans Collaborative, 2011). Typically, the freedom of the area means that cyclists act much differently to when they share the roads with traffic. My personal observations at Open Streets events were that when the road first closed, cyclists rode slowly, and stuck to the 'invisible bike path' on the roadway next to the footpath. Over the course of the day, as the road filled up with people, cyclists weaved in and out of the crowds, going in whichever direction they pleased, relishing the complete freedom of having nothing faster than a running child to watch out for.

7.1.2 Plot the route

The second option is an existing solution, using Google Street View. It uses static imagery taken from the roof of a car, and lacks the immediacy or any sense of danger. It is informational, focusing on the functional how. There is a sense of perception but there is no specific applicability to a cyclist, being from a slightly different viewpoint.

Figure 16. Google Street View of Grafton Bridge, Google, 2009. Copyright (2017) by Google. Retrieved from https://goo.gl/1etM52

7.1.3 Ride virtually

The third suggested option builds on the Street View option, but creates a more immediate sense of presence, place and space. The cyclist is positioned as they would be on a bicycle, and with the perspective of a cyclist on the roadway; for a non-active cyclist this is not necessarily familiar. The ability to pedal along and have the view change while riding creates a sense of being able to travel through the space – of being-*in*-there while not being exposed to the physical danger of the actual cycling environment. This could be effective for planning routes in advance, particularly intersections and high-risk areas, or discovering new routes and pathways.

7.2 Idea 7: How do we change perceptions so that cyclists feel they have the safety, freedom and space they need? Re-imagine the childish flying excitement

The sensation of moving quickly downhill creates an immediate reaction. The momentum of the bike, the feeling of the air rushing past, the speed while not actually expending much physical effort. This sensation is reminiscent of childhood for those who learned to ride at a young age. It is freedom. What is fun, creates child-like wonder, nostalgia, and evokes the sensation of flying? A cape, or wings evoke this impression.

7.3 Selection for prototyping

The ideas were evaluated against the design principles and assessed for their viability and feasibility. The framing of solutions stage of the design process helps with defining the concepts to refine further (Kumar, 2012). Idea 1c, the virtual ride, addressed all the design principles to some extent, while focussing primarily on the design principle to make the environment less intimidating. There has been some exploration of virtual reality rides (see Appendix H) but these have primarily been made by individuals with personal projects, rather than with the aim

of influencing cycling behaviour. There was room to explore how situating oneself virtually in a 'real' environment could influence perceptions and attitudes towards cycling in that environment. Would a virtual ride would influence the uncertainty of cycling in an unfamiliar urban environment? Would it help increase confidence, and reduce the barriers to cycling in an urban environment? Would the different type of movement – riding a stationary bicycle rather than out in the environment – positively or negatively influence people's perceptions and motivations towards urban cycling?

Idea 7, the wind-filled superhero cape, addressed the design principle to make normal cycling more exciting and adventurous. There has been a similar project, an aeolian ride, an art experience that that explores the joyful act of riding as a shared experience (Findley, 2004). The artist described it as a "joy loop," a seemingly senseless act of joy to counteract or respond to seemingly senseless acts of violence. Would the wearing of a cape that fills with air as you ride amplify the excitement of the ride? Would a playful approach, tapping into emotions, positively influence the cycling experience and perceptions towards urban cycling?

Idea 3, the "ski map" route planning, was initially considered for further development also. I started drafting some ideas further. However, while it matched the goals of some of the design principles, it did not fit with the phenomenological approach taken for this project – there was no clear link to the embodied experience of cycling, which had been identified through the interview process as a key emotional driver for influencing perception, attitudes and behaviour – and so this idea was set aside in order to focus on the prototyping of the other two concepts.

8. Prototyping

The two practical concepts I chose to refine further were the wind-filled superhero-esque cape and a virtual bicycle ride using actual urban footage. Both take a phenomenological approach, rather than one of product design, as is reflected in my initial insights. The two concepts approach the lived, phenomenological experience from opposite directions: one a playful experience out in the actual urban cycling environment, the other is sheltered from the full exposure to both the risks and joys of the lived experience of cycling. What has been clear from the interviews is the physical act of cycling itself creates the sensation of excitement, of joy. This was apparent from the first movement of the bicycle for the participants in the study sample, all of whom had not ridden a bicycle for some time.

8.1 Wind-filled cape

What is the concept? A superhero-shaped cape that fills with air as you ride along, the amplified sensations of wind evoking the unusual sensation of flying.

Design principle applied: How do we change perceptions so that cyclists feel they have the safety, freedom and space they need? Re-imagine the childish flying excitement.

The inspiration for this concept came from the aeolian ride (Findley, 2004), and emphasises the child-like, playful fun of cycling, and the sensation of moving quickly. The prototype was sewn out of lightweight parka material to ensure it was not dragged down by its own weight. The length of the cape was limited by the proximity of the rider to the rear wheel of the bicycle. There were several iterations tested, adjusting the size and placement of the opening in the garment, and modifying the form to test how the cape filled with air. The purpose of the garment is almost the direct opposite of typical sports-cycling clothing, which is designed to be aerodynamic and to minimise drag, whereas this was aiming to gather the wind. The first iteration showed the wind inflating around the shoulders (see Figure 17) and did not flow further down the cape; however, it quickly filled even cycling at low speed. There was no noticeable drag, and it was a playful experiment, although as the rider I had to check if it was inflating because it was behind me. When stationary there was no noticeable difference in my appearance, but as soon as I started riding the cape billowed out gently and I felt more conspicuous and visible despite not being able to see much of it myself. This increased body mass and resulting real or perceived increase in visibility and decrease in vulnerability were further considerations that related back to the barriers to cycling (not feeling safe or visible in the urban space). This could be further extended by adding in LED lights that glow through the opaque material in low light situations, or by experimenting with different fabric colours (the orange-red of the prototypes attracted attention), or testing out more sizes and shapes.

An advantage of this concept is that it requires the cyclist to ride a bicycle, and therefore experience the joy of riding, and share and demonstrate that joy to others. As seen in the participant interviews, the act of cycling is in itself a strong motivator towards cycling, and by wearing the cape and riding along the individual has a heightened awareness and positive reinforcement of the movement, speed, and playful joy of cycling. Conversely, these sensations are only felt by participating, and the idea of wearing a cape may not appeal to people who are already feeling uncertain or less confident about cycling.

Figure 17. Prototyping a wind-filled cape; testing that the air filled the gaps, and also as the researcher, reflecting on the sensation of riding with a filled cape: does it recreate the child-like sensation of riding? Does it instil enjoyment and discovery in everyday riding?

8.2 Virtual ride

What is the concept? Cycle virtually through the city streets using 360° film footage viewed through a VR headset while remaining safely on a stationary bicycle. 360-degree footage provides an immersive experience, deeper than what is currently provided by 2D video footage. As video rather than static imagery the sense of motion and movement can also be conveyed.

Design principle applied: I can ride a bicycle with no trouble but the environment around me is challenging so I don't ride even though I physically know how. How do we make the environment less intimidating?

The inspiration for this project came from Cycling Britain in VR (Vincent, 2016): A British cyclist created a virtual bicycle route using static imagery from Google Street View, connected his computer to his stationary bicycle and a virtual reality headset and then proceeded to ride the length of the UK, documenting his experience in a series of blog posts. The purpose of that project was to be able to cycle the length of the UK from the comfort of his home – he was able to get exercise while simultaneously exploring the countryside, without having to worry about the weather or complicated logistics. He reported some moments where the static 2D panoramas caused him to feel nauseous, and described the limitations of using 2D static imagery such as stretching and skewing of the imagery as he moved through, and occasional bouts of nausea when the images didn't stitch together correctly. What if this experience was improved upon, using actual 360° video footage while seated on a stationary bicycle to ensure the experience is as real as possible? I set out to explore whether a virtual 360° experience would make urban

cycling less intimidating, given that the cyclist can experience the event but with the danger of a potential incident with traffic removed. My expectation was that with the physical risk removed, this would allow a non-active cyclist to explore and experience an actual urban route in safety, and learn how to navigate the route and roads ahead of time; to practise being-in-the-environment without actually being there. By reducing one, or several, factors of uncertainty, such as navigating intersections and determining on-road positioning ahead of time, the cyclist would have less stress once actually on the road and dealing with traffic. Through the prototyping process I also wanted to explore the impact on the physical sensation of cycling, as the stationary cycling experience would be imitating a properly moving bicycle and whether this would significantly reduce the effectiveness of the virtual phenomenological experience as a motivator towards increasing everyday urban cycling.

Developments in virtual reality (VR) have primarily been in artificial, constructed worlds or gaming environments, such as VirZOOM (VirZOOM, 2015) or in documentary journalism (such as experiencing war zones or earthquakes (Patrick Eha, 2015), in a halfway space between film-making and software development, although the positioning of it is as a medium is yet to be established and new developments are continuously being released as the headsets and software improve. The major virtual reality software platforms Unity and Unreal Engine are typically associated with game development, particularly using artificial worlds; however, the real and imaginary are converging and these software engines now support 360° video footage natively.

The virtual cycling builds on the existing VR cycling solutions because it uses real filmed material to set the scene for the cyclist rather than a virtual world or static imagery. With the increasing availability of 360° cameras it is possible to use filmed rather than static footage. A 360° camera captures photo and video footage with two back-to-back fisheye lens. The recordings are considered immersive because a view is recorded in every direction simultaneously. This opens up possibilities for a smooth immersive experience for this project, translating the first-person phenomenological experience of cycling into an immersive virtual reality setting.

8.3 Focussing on one prototype

At this stage I had two pathways exploring very different responses to the design principles. Both concepts raised valid points for further exploration. The wearable prototype clearly had future potential, and even at the prototype stage was exciting. However, given the time restrictions of this project, and the need for deeper inquiry, the decision was made to focus on developing one concept to a tangible working prototype.

The decision to move forward with the virtual reality concept was two-fold: the platform technology that it would be based on had very recently started supporting 360° footage natively (Unity 5.6 was released in March 2017) and the viability of reaching a workable prototype was more likely; more importantly it raised interesting questions about embodiment in relation to virtual experiences, and whether they can exist in duality. There also appears to be a number of ways this idea could be extended through further research: for example, exploring different types of footage (such as contrasting cycling at night or day, in heavy or light traffic, using different camera viewpoints); testing different quality headgear; exploring different physical stationary setups (does the presence or absence of a stationary bicycle influence people's motivations or perceptions).

8.4 Prototype design: the components

The prototype was made up of the following components: The bicycle was positioned in a stationary bicycle stand with a magnet attached to the rear wheel. A reed switch sensor in the electronic circuit reads when the bicycle wheel rotates. When the cyclist pedals the stationary bicycle, the magnet on the bicycle wheel passes by the Arduino and completes the circuit. Each time this magnet passes the Arduino sends a signal to Unity and the video player. The speed that the cyclist pedals at controls the video's play speed, in that the faster the individual pedals, the faster the video plays on the smartphone / VR headset. For the initial prototyping, the sensor connected to the computer through the USB port, however the code was subsequently adjusted to allow for the freedom of a Bluetooth connection for the second stage. The viewing of the 360° footage was using the ubiquitous Google VR Cardboard and a smartphone. The software programme Unity was used to package the video prototype ready for the smartphone and VR viewer.

8.5 Sensors

Two different types of sensors can be used for sending a signal from a rotating wheel to an Arduino microcontroller. A reed switch is a simple open/close switch that completes the circuit when the magnet approaches, and then executes the code. A hall effect sensor also detects when a magnet approaches, but is more fragile and easily damaged. A reed switch was selected to avoid introducing complications in the testing, and the code could be modified to include a hall effect sensor at a later stage. The most effective sensor setup was developed through a cycle of testing and refinement. The readings from the wheel were best with the magnet positioned close to the centre of the wheel, as this minimised 'bouncing', or false double readings. The code was also modified to include information on the rotation speed, so that the speed of pedalling on the bicycle would control the speed of the video.

Figure 18. Reed switch
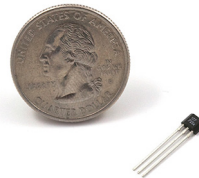

Figure 19. Hall effect sensor
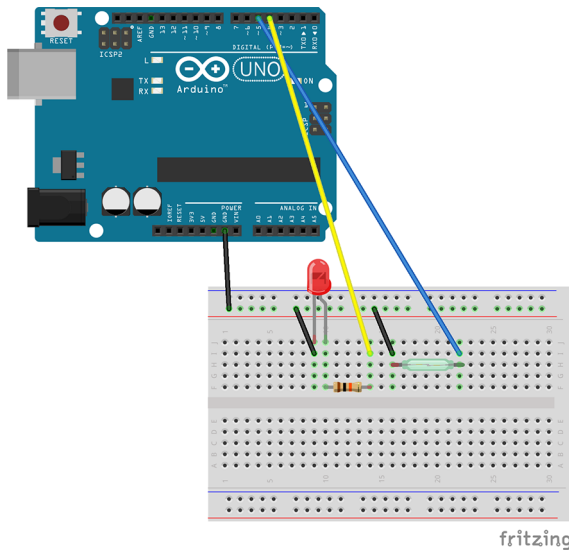
Figure 20. Simple reed switch circuit diagram using the Arduino Uno. The LED lights up when the magnet comes near and closes the circuit.
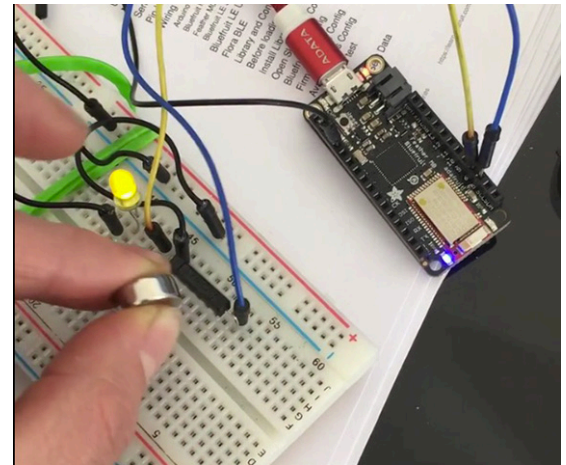
Figure 21. Testing the Bluetooth connection manually – each time the magnet passes the reed switch, data is sent over Bluetooth.


Figure 22. Testing the reed switch and magnet placements on the rear wheel.

8.6 Footage: 360° video

There were both technical and content considerations to take into account for the video filming. From a technical standpoint, the positioning, movement and direction of the lens, the quality of the audio, the lighting, and the overall video quality of the LG360 camera all needed testing, as well as consideration for the actual bicycle route taken.

8.6.1 Camera positioning

The camera was placed in two different positions, on the handlebar and on the cyclist's helmet, as shown in Figures 23 and 24. The positioning of the camera primarily affected the perspectives in terms of height for the end viewer, the stability of the camera, whether the viewer can see the other rider in the frame, and the sense of control of the movement of the video. With the camera on the helmet, the rider is nearly invisible, and only the helmet and hands can be seen. This provides a sense that the viewer *is* the cyclist, seeing the world through the cyclist's eyes, albeit somewhat higher. It places the passive viewer as close as possible into the scene while still allowing for a 360-degree angle of view, including looking behind the cyclist. However, when the cyclist actually filming turns her head, the camera also rotates; when she shifts or stands on the pedals, the movement translates to the camera. This could be distracting or frustrating for the viewer as they do not control this action, and needs further feedback through more user testing.

Testing the different perspectives with viewers when the video was playing automatically provoked mixed responses. With the camera attached to the handlebar it was more stable, although the viewpoint was lower than what is the usual perspective for a cyclist, as if the viewer was perched on the handlebars. This creates a more artificial perspective, as it is more obvious that the viewer is not in control; he is merely a passenger on the bicycle. Testing this on a flat computer screen gathered positive feedback – the viewer is clearly passive and aware that he is not in control. However once in the VR headset this changes the relationship and should be further tested.

Figure 23. 360° footage from the viewpoint of the helmet. The cyclist's hands are at the bottom of the frame, but the rest of the cyclist is hidden by the helmet.

Figure 24. 360° video footage with the camera mounted on the handlebars. The cyclist is clearly observed standing up on the pedals to get more power going up the hill.

Prototyping using the handlebar view provided an unforeseen advantage due to seeing the cyclist in the film: it makes it possible to check how to navigate or negotiate the route. For example, in Figure 25, the cyclist is looking over her right shoulder to check for traffic as she changes lanes and moves towards the centre lane. For a right hand turn. This is a potentially complicated manoeuvre for a new cyclist viewing the footage, who may gain helpful information from looking at the actions of the cyclist and how she positions the bicycle on the road.

Figure 25. 360° video footage with the camera mounted on the handlebars. The rider is clearly in the footage and it is possible to observe how the rider acts. In this frame the rider is looking over her right shoulder to check for traffic as she changes lanes.

Another point identified during prototyping was the zoom adjustment of the footage. It is good practice in virtual reality development to have something still in the frame while everything else is moving, so that the viewer can 'ground' themselves to this concrete object and avoid feeling nauseous. The prototyping used a view that always has the hands and handlebars in the frame; however, this could be adjusted with further testing (see Figure 26 for examples of different zoom levels).

Figure 26. Four stills taken from the same footage, but at different zoom levels. A+B) showing the rider's hands. C) Showing the zoomed out footage with the rider in the shot D) Showing the zoomed in footage, with the rider completely out of shot.

8.7 Creating the video player

The first step working in Unity was to test out the ability to play 360° video. I created a sphere, and projected a short test video onto it. This worked, so the next step was to project the video onto the inside of the sphere, and then view the scene from within the "world" of the sphere. I did this by moving the camera viewpoint to the centre of the sphere (xyz coordinates of 0,0,0) and flipping the normals of the shader that projects onto the sphere, so that instead of projecting onto the outside of the sphere it projects on the inside (because the viewpoint and the camera are situated *inside* the sphere).

8.8 Arduino to Unity

Once the video player environment was set up, the next step was to check that the Arduino data could control an object inside Unity. So, each time the Arduino sent output, that data would shift the sphere along one axis. Then the next stage involved using the received data to activate the play/stop of the video. Arduino and Unity don't easily communicate with each other, so an additional setup was required. Additional plugins to aid with Arduino-Unity connections, as well as Bluetooth communication, were available so I downloaded these to add to the scene.

8.9 Physical setup and testing

The choice of test setup has been designed for easy availability and accessibility. Most bicycles fit into a standard stationary bicycle stand and the Google Cardboard is an affordable and universally available virtual reality headset. The setup was designed with the Cardboard in mind as it is accessible to a larger group of people, and the code can be adjusted to suit other headsets such as the Samsung Gear VR or the Oculus Rift. Testing was carried out on an iPhone smartphone, although the choice of Unity as the video player also allowed for export to Android smartphones.

8.10 Commentary on the prototype

The speed of the rotation of the wheels was problematic to measure, given the sensitivity and 'bounces' in the raw data from the sensor. Most sensor data are messy, and design guidelines for movement-based games recommend that rather than try to improve the accuracy, the actions within the environment should be constructed to account for discrepancies and errors (Isbister & Mueller, 2015). The code was modified to account for and smooth out sharp increases or decreases in speed to provide a gentler, more comfortable experience. Another source of a less than ideal experience was in the selection of the headset. The hard edges of the Google Cardboard combined with the weight of the phone caused the headset to press onto the viewer's face; this is a reflection on the choice of a cheaper yet more accessible headset over other

options with padding and cushioning, and would be easily remedied by upgrading to a different VR headset.

The main limitation identified in the cycling experience was that the handlebars serve no purpose and the user remains a passive rider, unable to change direction or shift off-course. This is a limitation of using real footage; the route is limited to the route chosen at the time of filming and the amount of interaction within the scene is limited. Another limitation was in the speed of playback: by adjusting speed, for example slowing down, the entire frame slowed down which is not representative of the real world. To some extent the user was captive to the camera, unable to stop without pausing time, nor able to move when the cyclist in the footage had stopped moving. While the terms 360° and VR can be used synonymously, 360° and VR offer differing levels of interactivity: in 360°, the user has control over the field of view and can look in any direction, but there's no interactivity to the experience and the scene remains removed from the user. By contrast, VR usually refers to a computer-generated environment in which the user can interact with and control objects within the scene. However, it is possible to map interactive objects within a 360° scene and a future iteration could explore this further, and introduce further sensors on the real-world bicycle.

Evaluation of the content of the video footage raises further questions and possibilities for iteration. The route chosen for the prototype represented a mix of cycling experiences including a shared bus lane, a multi-laned road without any dedicated cycle facilities and an off-road shared path. There were also intersections and uphill and downhill segments to navigate. Other pathways, or changes in the environment, such as increased traffic, would likely influence the enjoyment of the experience. The segment was kept short to allow for easier development suitable for a prototyping phase. The length of the film, variety of the footage and style of footage need further exploration as the iteration of the prototype continues.

The development of a prototype represents a tangible realisation arising from the design process. In the methodology, the prototype is listed as the final stage of the design process (refer to Kumar's design process model, Figure 4 in Chapter 2), but the non-linearity of the process also means that further testing and observation circle the design process around again for further iteration (refer to the research design for this project, Figure 2 in Chapter 2). The success of the prototype is in measuring its effectiveness in influencing non-active cyclists' perceptions towards cycling, and whether it encourages them to take up urban cycling. To continue the iteration process, it would be beneficial to approach the original interview participant, observe their response to this 360° virtual ride, and enquire whether it resulted in any change in perception.

My expectation was that with the physical risk removed, this would allow a non-active cyclist to explore and experience an actual urban route in safety, and learn how to navigate the route and roads ahead of time; to practise being-in-the-environment without actually being there. By reducing one, or several, factors of uncertainty, such as navigating intersections and determining on-road positioning ahead of time, the cyclist would have less stress once actually on the road and dealing with traffic. The impact of the stationary cycling experience needed exploration through iterative prototyping and testing, in relation to its effect on phenomenological experience, and its overall effectiveness as a motivator towards increasing everyday urban cycling.

The transtheoretical model suggests that people at different stages of behaviour change have different needs and requirements. Non-active cyclists have different concerns in comparison to regular cyclists, and the design principles developed during the design process centred around their concerns — in particular, examining how to make the environment less intimidating and to reduce feelings of vulnerability and exposure. In the case of the 360° virtual ride, it is the use of real video footage – and the ability to cycle virtually, and safely, through an urban area – that is presented to alleviate uncertainty and make cycling in the urban environment seem less daunting.

9. Critical Commentary

This section addresses commentary on the overall research project and reflects on the process and findings.

9.1 The impact of the cycling experience as motivation to cycle more

Early on in the design process it was identified that the activity of cycling provided a strong positive influence on the motivation to cycle more. This was interesting because it implied that experiential interventions may be more effective than a product solution. During the analysis it was noted that interaction with the bicycle, or the bicycle as an object, were barely mentioned as an issue, aside from unfamiliarity with the workings of the gear levers and ratios – and even that, when examined further, was considered a minor issue. The positive drivers were all centred on the sensations and movement while cycling, while the majority of negative drivers were in relation to the challenges of the environment and the uncertainty and perceived lack of safety moving through the space.

9.2 The multiple layers of a research-through-design / action research approach

There were several layers of action research at play in this project: the overall research design used a research-through-design process; the interview participants engaged actively in a bicycle ride and the researcher rode with them in a shared phenomenological experience, and finally the prototype involved cycling in an urban environment. The study of the embodied experience of cycling *through* the act of cycling helped make it less abstract. In the interview phase this made it easier for the participants to describe the sensation of cycling, and as researcher it enabled me to more closely observe and understand how and where they were most or least at ease on the road; I was able to delve deeper into interesting moments particularly when their words did not match their actions. The act of cycling provided a strong positive influence on the motivation to cycle more. If I had not included the bicycle ride as part of the interview it is unlikely that I would have picked up on this aspect as quickly.

My role as observer, interviewer and fellow cyclist during the interviews provided another layer to examine. The nature of action research is that sometimes "the investigator is a significant actor in the human situation in which the action intervenes" (Archer, 1995). The participants were all very relaxed about the cycling on the day, and the attitudes was somewhat at odds with their comments at the beginning of the interview. The simple act of joining them on the ride – and dictating the route to follow – influenced their confidence, and may have contributed to the overall positive effect that the cycling experience had on their propensity to cycle more.

This in turn influenced the prototyping phase: the footage had two versions, one version with the original cyclist visible within the frame, the other with the cyclist hidden anonymously below the helmet. As an experienced cyclist I had initially discounted the version with the cyclist in frame as less relevant because it was not showing the scene as the viewer would see it on a bicycle, and therefore provided a less authentic view. It wasn't until a non-active cyclist watched the 360° video from this angle, and referred to the cyclist's body language and movement to help understand how to deal with specific situations, that its potential value as an alternative guided viewpoint became clear.

9.3 Limitations of using a human-centred design approach

There has been some debate over whether the human-centred design process prevents the development of 'great' design. Norman plays devil's advocate to the human-centred design community: "Great design, I contend, comes from breaking the rules, by ignoring the generally accepted practices" (Norman, 2005). During the design process, I was concerned I could be limiting the design potential, however, a framework was necessary in order to guide the process.

By using the human-centred starting point, the concerns and perceptions of the non-active cyclist remained centre-stage, and provided insights so the design process remained open to 'breaking the rules'.

9.4 Embodied cycling and virtual reality

The hypothesis when ideating the 360° virtual ride was that the closer the experience is to a real bicycle ride, without the danger, the more effective it would be in motivating a hesitant cyclist to ride more. The 360° virtual ride could be described as both an embodied and disembodied experience. The individual's mind is mentally immersed in a virtual reality, and their physical body imitates what is happening in the virtually reality by pedalling *as if* the body was there. The virtual cyclist has control over the forward momentum of the bicycle through their pedalling efforts, but is unable to take full control and steer the bicycle. Overall, this project opens up future exploration into areas that enable more complete freedom and control, if a full embodied reality is required.

9.5 Participant and supervisory feedback on prototype

The original participants were approached for feedback on the preliminary prototype. The target group for research was specific to non-active cyclists. However, a broader group was used in testing and evaluation for the initial prototype: supervisor feedback for a research and design perspective, and additional testers for technical checks. The broader group was used to examine and correct any technical problems early on that would detract or otherwise interfere with the evaluation process. Their personal responses to the prototype were also noted.

9.5.1 Evaluation setup and process

The prototype comprised of a bicycle connected to a stationary bicycle trainer, a magnet attached to the rear rotating wheel, the circuit board connected to the trainer, and the wearable Google Cardboard headset with a smartphone inside operating the video application. A single speed bicycle was used as gears were not necessary for testing. Small steps were placed on either side of the bicycle to enable easy mounting and dismounting. Testing was carried out indoors and participants were interviewed individually.

Figure 27. Gradual introduction of components: the participant familiarises herself with pedalling on the stationary bicycle, then tries the headset whilst seated, then the smartphone is added to the headset for the full 360 video experience.

Testing was carried out on people who had not been involved in the initial interview and their feedback was used to inform the evaluation setup and process. The additional testers were three male colleagues, one a non-active cyclist with little interest in cycling, one a non-active cyclist with interest in cycling (similar to the research target group), and the third an active cyclist. One of these participants was noticeably uneasy: the non-active cyclist with little interest in cycling. He had not tried a VR headset before and did not enjoy physically being unable to see the handlebars. More familiarity with riding the stationary bicycle would help mitigate this, as well as allowing time to get used to wearing a headset while seated on a bicycle, and therefore these changes were made to the evaluation process. The two other testers were eager to test the headset and much more likely to look around and explore the virtual view. Their physical demeanour was very relaxed and they did not continuously use the handlebars. All testers asked for a brief explanation of what to expect before putting on the headset. When questioned on the image quality, all found that it was low but that it was not a barrier to using the Google Cardboard headset. However, the use of a video with a sharp turn was a detraction to the experience, as was any unexpected camera movement.

Following the initial testing, careful consideration was made to the design of the feedback session. The researcher allowed time for familiarisation with each part of the setup, and explained each stage of the process. Firstly, the participant mounted the bicycle to check for seat height and posture adjustments, and to practise pedalling to become familiar with the setup. Next, the researcher presented the VR headset (without the smartphone) for the participant to check for headset comfort while already seated on the bicycle. Then the researcher activated the application and inserted the smartphone into the headset for the participant to begin pedalling. The rotating wheel from the participant's cycling powered the playback speed of the application. During the playback participants were observed, and asked to describe their experience. Each participant tried the application twice, the second time after some of the questions, comments and discussion. Each time the researcher observed the participant's demeanour, comments and made notes.

For the purposes of this initial testing the researcher was myself – there is a risk that this may have introduced some feedback bias because all of the participants were aware that I had created the prototype, and therefore they may have reacted or responded more positively than had there been an independent researcher. However, this potential bias was taken into account during testing, and particular note was made of negative responses. It is recognised that this feedback is limited, but has provided insights to assist further refinement for a future stage of prototype. Further user evaluation, iteration and independent testing would be needed before taking the project into a real-world situation or developing a public application (see conclusion).

9.5.2 Evaluation responses

Open-ended questions were asked to allow for in-depth responses. These questions addressed their expectations prior to starting as well as their actual experience during the ride. They were asked whether they had any strong positive or negative opinions towards the activity, and whether it was different from what they expected. Further focussing questions probed deeper into what they particularly liked or disliked, as well as further inquiry on specific moments or comments they had made during the experience.

Changes were made between user feedback sessions to avoid duplication of feedback, if that feedback related to a specific technical aspect of the content or hardware that required minor modification (Nielsen, 2011). In this manner, highlighted problems areas could be resolved so that subsequent users would have an improved experience where these areas did not detract (as opposed to receiving three sets of feedback all focusing on the same insights). For example, the first participant commented that the wheel resistance was uneven; I was able to adjust the hardware to a smoother rotation so that the next participant would focus on another aspect of the experience, rather than provide identical feedback that would not add further insight.

Comments included responses to the physical setup and to the visual imagery as well as the overall experience. All participants were familiar with the concept of using a VR headset and had some small experience trying them out, and all also had experience riding a stationary bicycle for exercise. The physical confinement of not being able to manoeuvre the bicycle reflected in the cyclists' reactions – the participants were less inclined to look around and were more focused on the forward momentum of the video playback.

Participants were not initially told what design problem the prototype was intended to address – however they asked for an explanation of what they would experience. They were then asked how it compared to a normal bicycle ride, and whether they could see the experience as a useful way to experience cycling through a real-world environment without the associated intimidation

or danger. While not knowing the design problem removed any preconceptions, it became apparent that knowledge of the problem led to a more satisfactory experience for the users. This suggests that future iterations should either focus on making the aim more apparent early on, or should integrate the purpose within the experience.

9.5.3 Immersion and control

The extent of participant immersion and control within the experience was a key discussion point. All participants commented on the rigidity of the handlebars, and the lack of turning ability. One commented that the lack of control of the direction was akin to a theme park ride or a train journey, observing but not choosing the path. This indicated that the experience felt passive despite use of the pedals to control the video speed. The desire for more active control over the video and the bicycle was viewed as a major factor in rendering the experience more interesting.

The rigidity of the handlebars was particularly apparent when the bicycle in the video turned a corner, and the participant could not reflect that action by turning the bicycle handlebars or lean with their body. One participant found this unnerving as they did not expect the change in direction, and made him feel suddenly detached from the experience. This comment was valuable as it demonstrated the potential for solid engagement with the footage, yet also that the embodiment connection is fragile. Careful consideration should be given to any sudden actions in the content or alternatively, warning signals should be provided, in order to avoid any perceived loss of control.

Technical issues detracted from the immersion experience. At times the camera alignment did not match the direction the rider was facing. This was a major distraction to the participants who experienced this, as they had to turn their head, it did not feel natural, and there was no apparent way to realign the camera.

Familiarity with the route helped put participants at ease. Each would try to recognise the area. Those who correctly identified the location cycled more briskly and appeared more relaxed and confident, increasing or experimenting with changes in speed. When asked where they could see the prototype being used, two participants mentioned that it could be applied either as a tourism solution for discovering a new, interesting cycle trail or place, or else to experience what it would be like in terms of road safety, such as with a truck going past. One also mentioned that it could be used for professional sports cyclists to train for a specific fixed route.

The use of real video footage simulated the actual external environment, but may have shifted focus to the quality of the surroundings rather than the entire embodied experience and it could

be argued that it rendered the experience less, rather than more, immersive. Further exploration into attitudes in comparison to virtual worlds may be useful, or in testing variations in content.

The initial prototype included speed changes associated with the participants' changes in pedal speed. Not all participants noticed this, and commented that it was very subtle. They experimented with speeding up and slowing down, and when they noticed it they enjoyed having the ability to control it. However, the speeds would require further adjustment and testing to more accurately reflect the bicycle speed and changes in speed of the participant.

9.5.4 Sensory impact

All participants in this initial testing suggested that the use of a headset meant that other senses should be specifically addressed. The use of sound positively impacted the experience. At one moment in the test clip there was music playing in the background (as the virtual cyclist passed some practising musicians). One participant said he found it a pleasant surprise – he wanted to find the source of the unanticipated music – and added depth and interest to the experience.

In contrast, poor sound volume and image quality influenced immersion and engagement. One participant did not appear very engaged with the surroundings, nor aware of traffic and close-passing cars. She also commented that the lack of danger, or lack of control over the direction of the bicycle, removed the element of fear – possibly so much that it made it too unreal. She could cycle onward knowing that nothing could go wrong because the video would continue regardless. After some discussion, a higher quality video was loaded into the application. She was immediately far more engaged in the video, looking around to identify the area, and commented that both louder sound and higher quality video greatly improved the experience and made it more real. However, she still desired greater control to be able to explore her own reactions within the environment.

The test clip had moments with the cyclist riding over a speed bump. The visual judders were described as odd as they didn't match up with the physical experience, and created a disturbing disconnect for the participants: a sensation of their view moving up and down and yet their own head remained level. The footage was filmed on a bicycle rider's helmet and the camera moved as the original cyclist in the film pedalled and travelled over uneven surfaces. There could be several ways to reduce the camera motion: to film on a more stable setup, either on the bicycle or in some sort of vehicle; to reduce camera shake further in post-production, or to carefully select smoother environments to film.

One participant was shown a second iteration that used a different video: it was a ride along a straight, smoother road, had motion reduction applied in post-production, and was produced to a

---

higher quality bitrate to provide a sharper final image. She commented that the higher quality video made a substantial difference to the experience, and that the absence of speed bumps removed the nauseating effect of a sudden motion change. These changes would need to be tested further with more participants.

The prototype used a Google Cardboard as the headset. As an entry level headset, the optics are not very clear and focus issues were identified if the phone was not accurately placed in the headset. All participants commented that higher clarity or directly catering to the other senses to compensate for the low visual quality would add further enjoyment to the ride. The lack of depth also caused discomfort in terms of double vision and one participant commented that it was easier for him to close one eye. These issues were addressed to some extent by more accurately placing the smartphone inside the headset. Further testing on a higher quality headset would be required to explore the extent of these issues and whether they can be overcome. One participant commented that the experience was just as good when holding the smartphone without the headset – he wore glasses and found that the headset image quality was detracting from the experience (for the next participant, I increased the bitrate in the application's video quality and the feedback on image quality was far more positive).

When asked about potential use cases participants suggested ways to make it fun, rather educational, and to provide more control and ability to make more decisions that impact the experience, such as choosing the direction, adjusting resistance for uphill and downhill sections, making quick actions or being able to respond to the situation. In its current form, they see the prototype as a fuller experience than looking at a static map, but limited to a specific route rather than a personal exploration of a space. Further iterations should be explored, either providing more control in the physical setup, such as the ability to move the handlebars, or by removing the handlebars from the setup so that their rigidity is not a consideration.

None of the participants were intimidated by traffic or the environment during the prototype experience. They were able to practise being in the environment without being exposed to the dangers or uncertainty of a real urban ride. The original framing of this study was in focusing on behavioural change for non-active cyclists, to reduce their feelings of vulnerability and exposure in order to encourage them to cycle more. However, there is a risk that the experience in its current form is too removed from the real world – while it provided a first-person perspective of a real-world ride, the feedback sessions suggest that some uncertainty or unexpected events could be introduced, or more control provided to the virtual cyclist, to provide a more effective and engaging experience.

Table 3

Potential changes for future iterations (Hardware/ Content/ Software)

Type of Change	Detail	Importance
Software modifications		
Pedal speed	Adjust playback speed to more accurately represent the user's pedalling speed	High
Correct camera alignment	Correct the camera alignment and/or allow the user to reset the camera alignment	High
Stopping / slowing down video	Decrease the time decay when the user slows down or stops pedalling.	Low
Video sometimes starts with no pedalling	Verify start speed is zero	Low
Content modifications		
Handlebar control	Add in functionality to choose direction and route	High
Correct image quality	Use a high-quality video when exporting	High
Increase sound quality	Modify sound levels to amplify sounds	High
Introduce different video content	Introduce more interesting content or traffic movement e.g. truck passing close to the cyclist	High
Unexpected turns	Eliminate sharp turns, or introduce warning signals of a turn coming up	High
Reduce unnecessary camera movement	Remove unnecessary movement (speed bumps, small turns)	Medium
Hardware modifications		
Focus	Fix 3D blurriness so that both eyes work together. This would require testing with another headset, or re-filming the footage.	High

9.5.5 The value of this feedback

This feedback was used as a means of evaluating the success of the prototype particularly in terms of response to the design principle applied: to make the cycling environment less intimidating for non-active cyclists. It also informed the direction the project could head for future iterations and testing.

The feedback has revealed that the extent of immersion and control of the experience is of high importance to the user. This manifested in the control of the viewpoint and movement of the camera, the pedal speed, and the physical handlebars. As opposed to the passive fly-by of viewing a 360° tourism video while seated (Jung, Dieck, Moorhouse, & Dieck, 2017), the physical setup of the stationary bicycle places the user actively in the environment. The implications for this need to be further explored, such as whether the use of a physical bicycle is necessary, or whether the 360° video alone provides adequate immersion for the non-active cyclist to experience the cycling environment first-hand. Alternatively, further development of the movement of the handlebars, or refinement of the speed control and pedal resistance, may provide enough control to make the experience sufficiently enjoyable and useful.

It should be recognised that the feedback is useful in demonstrating what the participants liked and disliked about the experience, and whether they thought it met the design principle applied, but that they were not expected to come up with the solution to the aspects that did not seem satisfactory. A more explicit purpose for the experience may help manage expectations. For example, as a means to discover a route along a cycle pathway that crosses a busy intersection, or to ride along a specific pathway – the expectation would then be that only that specific route would be shown, and users would not be anticipating steering control. The familiarity, excitement and unexpectedness of the video content all influenced the enjoyment and engagement of the participants and further investigation using various types of video content would reveal further insights.

The impact of other sensory devices was revealed through this feedback. Studies on movement-based 360° and virtual reality games have indicated that audio and haptics can increase enjoyment and decrease cognitive overload from the imagery on the screen (Isbister & Mueller, 2015), and the feedback corroborates with this analysis. The unique scenario of cycling while experiencing a 360 video provides a starting point for an embodied experience.

By tweaking the application software between each participant evaluation, I was able to correct technical issues ready for the next user evaluation, to be able to look beyond the technology to the experience itself.

9.6 The researcher's evaluation of the VR experience

I started this journey with an open mind as to where the project would take me. I cycled through the worlds of electronics, programming, textile design and augmented reality, finally arriving at an intersection of the digital and lived experience. One of the greatest challenges was of the viewpoint that I brought to the project – that the actual experience of cycling cannot be supplanted by a digital experience. Once I realised that my project is positioned before, rather

than instead of, the actual cycling experience, I could reconcile myself to the use of 360° video: it is not replacing the cycling experience, rather it is preparing a person for the riding experience when they could otherwise be reluctant to cycle at all.

The prototype provides the opportunity to experience cycling in an urban environment, and the use of actual footage provides a measure of bridging the gap between the artificial and real experiences. There is a risk that the current iteration does not have enough of the physical sensation that makes cycling so enjoyable – therefore it should be made clear to the user that it is a preparatory step towards the ride. In that regard, further testing of non-active cyclists first trying the prototype followed by going on the actual ride would be useful as it would likely reveal further insights on whether the 360 video experience helps allay their fears.

The stationary bicycle would need to imitate the real-world experience more closely – with increases and decreases in resistance according to the gradient of the path in the video, or with freely moving handlebars so that the user can imitate or initiate the direction of bicycle within the video. This would render the experience more active and realistic.

There are some limitations to the chosen technology. The use of real footage currently restricts the extent of freedom and control the user may have to move only in the direction that has been filmed. There would be a need to either provide additional footage or to be very clear about the route to take. However, the prototype shows potential to achieve its purpose: to encourage non-active cyclists to give urban cycling a go.

9.7 Support for this approach from other fields

The potential of this approach is also supported by a growing body of research into the efficacy of the use of virtual reality in other areas such as graded exposure therapy, where people who have phobias are gradually exposed to various stimuli related to their anxieties within a computer-generated world. The use of VR experiences for treating Post Traumatic Stress Disorder has proven to be effective. More recent approaches to pre-deployment stress inoculation training using VR are showing positive results and are being used by the US military (Lake, 2015). This is not to suggest the non-cyclists who participated in this study were traumatised or stressed, but to cite examples where VR immersion has been used and evaluated to help people overcome fears and anxieties. The use of VR has also been explored as a tourism tool to help people get an understanding of a destination's offerings, such as to visit the Lake District in the UK (Jung, Dieck, Moorhouse, & Dieck, 2017). Results showed VR to be effective in enhancing behavioural intentions to visit the virtual destination.

10. Conclusion

10.1 Meeting the research objectives

This project set out to explore how a phenomenological design approach could help encourage everyday urban cycling for non-active cyclists. Through participant interviews and observation an understanding of some of the factors, motivations and perceptions that influence everyday cycling were identified and analysed. This process addressed the first objective of the research. Actionable, statement-questions were distilled from the interview insights. These centred on three key themes: that the urban environment is challenging for non-active cyclists; that the freedom of riding a bicycle is compromised by feelings of exposure and vulnerability as a result of having to share the same space with traffic; that cycling is an enjoyable way to discover new places but only in a tourist capacity. There is no solution without identification of the problem and these statements provided a reference point for ideating solutions, both within this study and with any future explorations beyond this study.

The second objective of this project was to use the design innovation process to drive the iteration of the design, rather than identifying a technology and try to find a problem that it solves. The project methodology centred on an embodied phenomenological approach, with the experience of the person riding the bicycle central to the research. This continued through the design process, the direction and destination unfolding as the project developed. Research through design is not objective. There are limitations in using a design through research approach and care must be taken when extrapolating the insights to wider populations. The insights and creative interventions outlined in this thesis were developed using an iterative design process, which allowed for a non-linear process of ideating, prototyping, testing and exploring insights. Researcher bias, in the sense of the researcher's subjective experience and position is unavoidable in a phenomenological approach. However, the experiences and reflections of the participants and the iterative process of designing, reviewing and testing helps create greater awareness on the part of the researcher. This project contributes to a deeper understanding of how a research through design process and new technologies can be used to design strategies to influence behaviour change.

From a starting point of examining the cycling experience and perceptions of non-active cyclists, this research used a human-centred design approach to develop insights and ideate relevant creative interventions with the end goal being to encourage everyday urban cycling. The third objective of the research was to design creative interventions and prototypes related to the embodied cycling experience to encourage non-cyclists to cycle.

10.2 How this research has added to the body of knowledge in the field

The project adds to the growing body of qualitative knowledge on people's perceptions and attitudes towards urban cycling, with particular focus on how people experience riding a bicycle. The predominant form of knowledge gathered on the uptake of urban cycling has been quantitative data, and yet the personal choice to take up cycling has many qualitative influences. The thesis presents a realisation of how the increasing interplay between digital and physical environments can be harnessed to create a richer cycling experience for a specific subset of people.

The focus of the project was on changing the attitudes of people currently at the contemplation stage of behaviour change, to break down barriers that they hold toward cycling. Individuals at this stage on the Transtheoretical Model are acutely aware of the pros and cons of the behavioural change, and the cons in particular need to be reduced so that there is less likelihood of a relapse (Lipschitz et al., 2015). The 360° virtual ride was not designed to replace the embodied experience of cycling itself, but was created as a precursor experience – with the intended aim of enabling exploration without feeling exposed to traffic, and to reduce one of the identified barriers to urban cycling.

The initial evaluation of the virtual ride by the participants provided critical insights as to where further research should be directed, particularly in terms of providing more user control and sensory immersion, as well as positive reactions to the embodied virtual experience. The potential of this approach is also supported by a growing body of research into the efficacy of the use of virtual reality in other areas such as treating PTSD and in tourism.

The virtual preparation before undertaking an activity could be transferred to other complex scenarios, to give people the freedom to experience the "lived experience" in 360° degree surroundings without the stress of other potential dangers.

10.3 Future research direction and possibilities

There is potential to explore multiple factors that may influence the virtual riding experience. These could include changing weather conditions, traffic speed in relation to the cyclist, the experience riding at night, exploring different perspectives from a child's bicycle or a recumbent bicycle. This would involve introducing different video content to the experience and studying the influence and potential impact on people's intentions toward cycling.

The introduction of further physical aspects could be developed, such as adjusting the resistance of the pedals as the incline changes, introduction of wind resistance or heightened audio to enhance the interaction and experience of the rider in the virtual scenario. Further development in AR/VR technology should also be considered, to develop for a more realistic 3D perspective as the bicycle progresses, and also allow for freedom to control the route of the virtual bicycle. There is potential to compare the virtual bicycle ride with other VR applications, such as in gaming or therapy, where users may have a similar physical response. There is a need for more extensive user evaluation to assess the viability and use for 360° video within the field of cycling and extending to how it could relate to other embodied experiences.

The early stages of this research also identified a number of possible areas of research and strategic approaches. There are opportunities to develop or explore other early-stage concepts that were raised by this study, such as the wind-filled cape, where the development looked viable but proved to be beyond the required scope of this project. There is also opportunity to replicate this study in different urban areas, or with another group of participants, to continue building up knowledge of latent variables that may arise.

The thinking developed in this thesis may be applied to other complex scenarios, giving people an embodied experience of an unfamiliar environment while not being unduly exposed beyond their comfort zones. This approach could be useful for any other scenario where the attitudes and perceptions of an activity may be challenging to influence, such as within the tourism and health spheres.

Cycling has many benefits for society as well as the individual, as a sustainable means of transport and as an enjoyable everyday activity – yet there are many complex issues that motivate or disincentivise people in relation to cycling in their daily lives. There is a need for different research approaches to address the complexities of people's perceptions and motivations, including addressing perceptions of risk when cycling in an urban environment. A qualitative approach provides a more in-depth understanding of the complexities behind non-active cyclist's behaviour. The phenomenological research of this project provides valuable insights into the embodied experience of cycling and understanding strategies in which to encourage non-active cyclists to engage in everyday cycling.

The design research process led to the ideation of concepts, including the development of the 360° virtual bicycle experience as a prototypical means to address non-active cyclist's concerns. The 360° virtual bicycle ride realises a preparatory experience of cycling that allows a non-active cyclist to cycle in an urban environment while mitigating perceptions of risk. This phenomenological approach builds on existing research enabling greater understanding of the factors, motivations and perceptions that influence everyday cycling.

References

Agervig Carstensen, T., & Ebert, A.-K. (2012). Cycling cultures in Northern Europe: From Golden Age to 'Renaissance'. In J. Parkin (Ed.), *Cycling and sustainability* (pp. 23–58). Bingley: Emerald, 2012.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Archer, B. (1995). The nature of research. *Codesign*, 6–13.

Archer, B. (1999). Design, innovation, agility. *Design Studies*, *20*(6), 565–571. https://doi.org/10.1016/S0142-694X(99)00025-3

Astegiano, P., Tampère, C. M. J., & Beckx, C. (2015). A preliminary analysis over the factors related with the possession of an electric bike. *Transportation Research Procedia*, *10*, 393–402. https://doi.org/10.1016/j.trpro.2015.09.089

Auckland Transport. (2016, July). The Auckland cycling account 2015. Auckland Transport. Retrieved from https://at.govt.nz/media/1873018/akl-cycling-account-book.pdf

Auckland Transport. (2017, June). The Auckland cycling account 2016. Auckland Transport. Retrieved from https://at.govt.nz/media/1873018/akl-cycling-account-book.pdf

Blaze. (2015). Laserlight. Retrieved 27 February 2017, from https://blaze.cc/laserlight/

Dourish, P. (2001). *Where the action is: the foundations of embodied interaction*. Cambridge, Mass.; London: MIT.

Fendt, J., & Kaminska-Labbé, R. (2011). Relevance and creativity through design-driven action research: Introducing pragmatic adequacy. *European Management Journal*, *29*(3), 217–233. https://doi.org/10.1016/j.emj.2010.10.004

Findley, J. (2004). Aeolian ride information. Retrieved 1 May 2017, from http://www.aeolian-ride.info/info.html

Forward, S. E. (2014). Exploring people's willingness to bike using a combination of the theory of planned behavioural and the transtheoretical model. *Revue Européenne de Psychologie Appliquée/European Review of Applied Psychology*, *64*(3), 151–159. https://doi.org/10.1016/j.erap.2014.04.002

Gatersleben, B., & Appleton, K. M. (2007). Contemplating cycling to work: attitudes and perceptions in different stages of change. *Transportation Research Part A*, *41*, 302–312. https://doi.org/10.1016/j.tra.2006.09.002

Gladstone, H. (2015, September 9). Who needs virtual reality biking? (Not me). Retrieved 1 May 2017, from http://www.cyclingweekly.com/videos/cycling-tech/who-needs-virtual-reality-biking-not-me

Gojanovic, B., Welker, J., Iglesias, K., Daucourt, C., & Gremion, G. (2011). Electric bicycles as a new active transportation modality to promote health. *Medicine & Science in Sports & Exercise*, *43*(11), 2204–2210. https://doi.org/10.1249/MSS.0b013e31821cbdc8

Google. (2009). [Google Street View of Grafton Bridge, Auckland, New Zealand]. Google. Retrieved from https://goo.gl/1etM52

Handy, S., van Wee, B., & Kroesen, M. (2014). Promoting cycling for transport: research needs and challenges. *Transport Reviews*, *34*(1), 4–24. https://doi.org/10.1080/01441647.2013.860204

Higuera-Trujillo, J. L., López-Tarruella Maldonado, J., & Llinares Millán, C. (2017). Psychological and physiological human responses to simulated and real environments: A comparison between photographs, 360° panoramas, and Virtual Reality. *Applied Ergonomics*. https://doi.org/10.1016/j.apergo.2017.05.006

Holtzblatt, K., & Beyer, H. (2015). *Contextual design: evolved*. San Rafael, California: Morgan & Claypool Publishers, [2015].

Isbister, K., & Mueller, F. 'Floyd'. (2015). Guidelines for the design of movement-based games and their relevance to HCI. *Human-Computer Interaction*, *30*(3/4), 366–399. https://doi.org/10.1080/07370024.2014.996647

Jacobs, J. (1993). *The death and life of great American cities* (Modern Library edition). New York: The Modern Library.

Johnson, M., & Rose, G. (2015). Extending life on the bike: Electric bike use by older Australians. *Journal of Transport & Health*, *2*(2), 276–283. https://doi.org/10.1016/j.jth.2015.03.001

Jones, T., Harms, L., & Heinen, E. (2016). Motives, perceptions and experiences of electric bicycle owners and implications for health, wellbeing and mobility. *Journal of Transport Geography*, *53*, 41–49. https://doi.org/10.1016/j.jtrangeo.2016.04.006

Jung, T., Dieck, M. C. tom, Moorhouse, N., & Dieck, D. tom. (2017). Tourists' experience of Virtual Reality applications. 2017 IEEE International Conference on Consumer Electronics (ICCE), Consumer Electronics (ICCE), 2017 IEEE International Conference on, 208. https://doi.org/10.1109/ICCE.2017.7889287

Kokotovich, V. (2008). Problem analysis and thinking tools: an empirical study of non-hierarchical mind mapping. *Design Studies*, *29*, 49–69. https://doi.org/10.1016/j.destud.2007.09.001

Kumar, V. (2012). *101 design methods: A structured approach for driving innovation in your organization*. Hoboken, N.J: Wiley.

Kuniavsky, M., Goodman, E., & Moed, A. (2012). *Observing the user experience: a practitioner's guide to user research* (Second edition). Waltham, MA: Morgan Kaufmann.

Lake, J. (2015). The integrative management of PTSD: A review of conventional and CAM approaches used to prevent and treat PTSD with emphasis on military personnel. *Advances in Integrative Medicine*, *2*, 13–23. https://doi.org/10.1016/j.aimed.2014.10.002

Lipschitz, J. M., Yusufov, M., Paiva, A., Redding, C. A., Rossi, J. S., Johnson, S., … Prochaska, J. O. (2015). Transtheoretical principles and processes for adopting physical activity: a longitudinal 24-month comparison of maintainers, relapsers, and nonchangers. *Journal of Sport & Exercise Psychology*, *37*(6), 592–606.

Lumos. (2016). Lumos helmet. Retrieved 27 February 2017, from https://lumoshelmet.co/products/lumos-helmet

Lund, S. (2015). Sketchbook of a GPS artist. Retrieved 28 February 2017, from https://gpsdoodles.com/

Mahoney, J., & Goertz, G. (2006). A tale of two cultures: contrasting quantitative and qualitative research. *Political Analysis*, *14*(3), 227–249. https://doi.org/10.1093/pan/mpj017

McNiff, J. (2013). *Action research*: *principles and practice*. Milton Park, Abingdon, Oxon: Routledge, 2013.

Merleau-Ponty, M. (2002). *Phenomenology of Perception*. (C. Smith, Trans.). London; New York: Routledge.

Nielsen, J. (2010, 26). Interviewing users. Retrieved 2 June 2016, from https://www.nngroup.com/articles/interviewing-users/

Nielsen, J. (2011, January 18). Parallel & iterative design + competitive testing = high usability. Retrieved 2 June 2016, from https://www.nngroup.com/articles/parallel-and-iterative-design/

Norman, D. A. (2005). Human-centered design considered harmful. *Interactions*, *12*(4), 14–19. https://doi.org/10.1145/1070960.1070976

Panter, J., Griffin, S., & Ogilvie, D. (2014). Active commuting and perceptions of the route environment: A longitudinal analysis. *Preventive Medicine*, *67*, 134–140. https://doi.org/10.1016/j.ypmed.2014.06.033

Patrick Eha, B. (2015). Just like being there. *Entrepreneur*, *43*(12), 62–63.

Penn, R. (2010). *It's All About the Bike: The Pursuit of Happiness On Two Wheels*. Penguin UK.

Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, (3), 390.

Prochaska, J. O., Velicer, W. F., Fava, J., & DiClemente, C. C. (1988). Measuring processes of change: Applications to the cessation of smoking. *Journal of Consulting and Clinical Psychology*, *56*(4), 520–528.

Pucher, J. R., & Buehler, R. (2012). *City cycling*. Cambridge, Mass.: MIT Press, 2012.

Puzey, A. (2016, July 1). Cycle VR. Retrieved 1 September 2016, from http://www.cyclevr.com

Richter, M., & Flückiger, M. (2014). *User-centred engineering: Creating products for humans*. Heidelberg: Springer.

Savan, B., Cohlmeyer, E., & Ledsham, T. (2017). Integrated strategies to accelerate the adoption of cycling for transportation. *Transportation Research Part F: Psychology and Behaviour*, *46*(Part A), 236–249. https://doi.org/10.1016/j.trf.2017.03.002

Smith, D. W. (2016). Phenomenology. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Winter 2016). Metaphysics Research Lab, Stanford University. Retrieved from https://plato.stanford.edu/archives/win2016/entries/phenomenology/

Spinney, J. (2006). A place of sense: A kinaesthetic ethnography of cyclists on Mont Ventoux. *Environment and Planning D: Society and Space*, *24*(5), 709–732. https://doi.org/10.1068/d66j

Spinney, J. (2007). Cycling the City: Non-place and the sensory construction of meaning in a mobile practice. In D. D. Horton, D. P. Rosen, & D. P. Cox (Eds.), *Cycling and Society* (pp. 25–45). Aldershot, England: Ashgate Publishing, Ltd.

Spinney, J. (2008). *Cycling the city*: *Movement, meaning & practice* (Ph.D.). Royal Holloway, University of London. Retrieved from http://ethos.bl.uk.ezproxy.aut.ac.nz/OrderDetails.do?uin=uk.bl.ethos.499099

Spinney, J. (2011). A chance to catch a breath: Using mobile video ethnography in cycling research. *Mobilities*, *6*(2), 161–182. https://doi.org/10.1080/17450101.2011.552771

Springlab. (2015, June 30). Flo. Retrieved 28 April 2017, from http://springlab.nl/flo-en/

Superpedestrian. (2017). The Copenhagen Wheel. Retrieved 24 July 2017, from https://content.superpedestrian.com/

The Street Plans Collaborative. (2011). Open Streets Project. Retrieved 27 June 2017, from http://openstreetsproject.org/

TRA. (2015, June). Measuring and growing active transport modes in Auckland June 2015.pdf. Retrieved 1 February 2017, from https://at.govt.nz/media/1346356/auckland-transport-active-modes-report-june-2015.pdf

TRA. (2016, July). Measuring and growing active transport modes in Auckland. Auckland Transport. Retrieved from https://at.govt.nz/media/1957535/at_active-modes-2016.pdf

van Duppen, J., & Spierings, B. (2013). Retracing trajectories: the embodied experience of cycling, urban sensescapes and the commute between 'neighbourhood' and 'city' in Utrecht, NL. *Journal of Transport Geography*, *30*, 234–243. https://doi.org/10.1016/j.jtrangeo.2013.02.006

Vanderbilt, T. (2013, January 8). How Strava is changing the way we ride. Retrieved 13 March 2017, from https://www.outsideonline.com/1912501/how-strava-changing-way-we-ride

Vincent, J. (2016, August 9). This man is cycling around the UK in virtual reality using Google Street View. Retrieved 1 September 2016, from http://www.theverge.com/2016/8/9/12411262/cycle-vr-google-stree-view-uk

VirZOOM. (2015). VirZOOM. Retrieved 1 September 2016, from http://www.virzoom.com/

von Oldenburg, T. (2015). Representing bicycle-based interaction: An interaction design exploration into bicycling research. Retrieved from https://dspace.mah.se/handle/2043/19420

Waters, J. (2000, revised 2016). Phenomenological research guidelines. Retrieved 5 April 2017, from https://www.capilanou.ca/psychology/student-resources/research-guidelines/Phenomenological-Research-Guidelines/

Wiberg, M. (2014). Methodology for materiality: Interaction design research through a material lens. *Personal & Ubiquitous Computing*, *18*(3), 625.

World Bank. (n.d.). Theories of behavior change. World Bank. Retrieved from http://siteresources.worldbank.org/EXTGOVACC/Resources/BehaviorChangeweb.pdf

Appendices

Appendix A: Ethics approval

Ethics approval letter
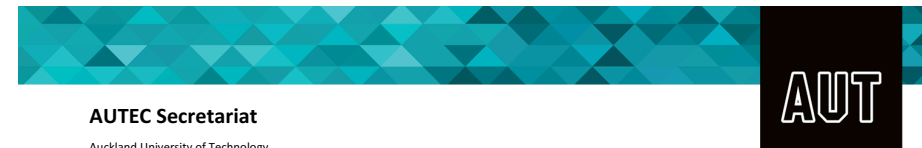
AUTEC Secretariat

Auckland University of Technology
D-88, WU406 Level 4 WU Building City Campus
T: +64 9 921 9999 ext. 8316
E: ethics@aut.ac.nz
www.aut.ac.nz/researchethics

3 November 2016

Frances Joseph
Faculty of Design and Creative Technologies

Dear Frances

Re Ethics Application: **16/408 How does the way people interface with the bicycle influence cycling in everyday life?**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Subcommittee (AUTEC).

Your ethics application has been approved for three years until 2 November 2019.

As part of the ethics approval process, you are required to submit the following to AUTEC:

- A brief annual progress report using form EA2, which is available online through http://www.aut.ac.nz/researchethics. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 2 November 2019;

- A brief report on the status of the project using form EA3, which is available online through http://www.aut.ac.nz/researchethics. This report is to be submitted either when the approval expires on 2 November 2019 or on completion of the project.

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to obtain this.

To enable us to provide you with efficient service, please use the application number and study title in all correspondence with us. If you have any enquiries about this application, or anything else, please do contact us at ethics@aut.ac.nz.

All the very best with your research,

Kate O'Connor
Executive Secretary
Auckland University of Technology Ethics Committee

Cc: lisaclist@gmail.com

Participant Information Sheet

AUT
TE WĀNANGA ARONUI
O TĀMAKI MAKAU RAU

Date Information Sheet Produced:

17 October 2016

Project Title

How does the way people interface with the bicycle influence cycling in everyday life?

An Invitation

Thank you for your interest in taking part in this research. My name is Lisa Clist and I am a postgraduate student at AUT. I am investigating how to encourage people to ride their bicycle more as part of their everyday life, and I am looking for participants who know how to ride a bicycle but don't currently do so.

What is the purpose of this research?

This research forms part of my postgraduate studies and it will contribute towards my Master of Creative Technologies qualification. It will be used to develop design insights to discover new ways to encourage people to start riding a bicycle more regularly. For the community, more people cycling is widely considered to be beneficial: it is an environmentally-friendly, healthy and socially positive means of transport that mixes well with other modes of travel in an urban environment.

How was I identified and why am I being invited to participate in this research?

Recruitment has been through a public Facebook post, as well as a printed poster displayed around the AUT campus. You self-identified as someone who knows how to ride a bicycle but doesn't currently do so, and who lives within 8km of your nearest main daily destination, both of which are reasons for being selected as part of this research. If you already cycle regularly (such as more than once a month) then you may not be able to participate – please ask me if you are unsure! Participants who self-identify as meeting these criteria have then been chosen on a first-come, first-served basis.

How do I agree to participate in this research?

Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time. If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible.

You will need to complete and sign the Consent Form, which you will have received along with this Information Sheet. Please contact me if you have not received it.

What will happen in this research?

This research involves answering a short questionnaire, a one-on-one interview with me, as well as a short bicycle ride. We will do the research in one or two sessions. You do not need to own a bicycle; I can supply one for you.

The questionnaire will ask you basic demographic information, your travel behaviour, and attitudes and perceptions towards travel and cycling.

The interview is conversational. I will ask you some questions on your travel habits and your cycling experience. Further questions may be asked that follow the direction of the answers you give.

Both the interview and bicycle ride will be recorded on video, and take place at the same location as the ride. This will be in the Auckland Domain (specifically at the Domain Grandstand if it is poor weather), or at an another mutually agreed public location if you prefer to ride at another location you are more familiar with.

The bicycle ride will be on a quiet road that is closed to traffic, followed by riding on a public road once you are comfortable with doing so. You will talk during your ride about your experience and this will be recorded as you ride. The ride should take 5 – 10 minutes. I will ride with you for part of the time, and you will ride alone for part of the time.

Following the ride, we will talk about your experience. This may be in the same session or a future session. If it is in a future session, I may also ask you for feedback on the design outcomes arising from the initial session.

What are the discomforts and risks?

You will need to ride a bicycle. I will set up the bicycle so it is safe, comfortable and you are able to ride it correctly. Part of the ride may be shared with road traffic.

How will these discomforts and risks be alleviated?

The route is a mix of a car-free road, a quiet street, a cycle lane and a bus lane. We will choose a time when the traffic is light and you do not have to ride anywhere you are not comfortable with doing so – I am an experienced cyclist and I will show you the route before the ride. There are no right turns so you can keep to the left of the road, and I have alternative routes if you are feeling more adventurous. You can also suggest a route that is more familiar to you if you prefer. As part of this research I have evaluated the risks and created a safety plan. You will be provided with a helmet and time to get used to riding the bicycle.

AUT Health Counselling and Wellbeing is able to offer three free sessions of confidential counselling support for adult participants in an AUT research project. These sessions are only available for issues that have arisen directly as a result of participation in the research, and are not for other general counselling needs. To access these services, you will need to:

- drop into our centres at WB219 or AS104 or phone 921 9992 City Campus or 921 9998 North Shore campus to make an appointment. Appointments for South Campus can be made by calling 921 9992

- let the receptionist know that you are a research participant, and provide the title of my research and my name and contact details as given in this Information Sheet

You can find out more information about AUT counsellors and counselling on http://www.aut.ac.nz/being-a-student/current-postgraduates/your-health-and-wellbeing/counselling.

What are the benefits?

The research will be used to develop insights to uncover new ways to encourage people to start riding a bicycle more regularly. This research forms part of my postgraduate studies and it will contribute towards my Master of Creative Technologies qualification.

What compensation is available for injury or negligence?

In the unlikely event of a physical injury as a result of your participation in this study, rehabilitation and compensation for injury by accident may be available from the Accident Compensation Corporation, providing the incident details satisfy the requirements of the law and the Corporation's regulations.

How will my privacy be protected?

Your details will be kept confidential. The video recordings made as part of this research are for developing design insights and not intended for publication; they will only be accessible to me and my research supervisors. If I end up using any imagery where you may be identifiable, I will ask you for your written consent before any publication in the public domain.

What are the costs of participating in this research?

You can expect to spend up to 90 minutes of your time.

What opportunity do I have to consider this invitation?

Please take the time to consider this invitation. You have one week to consider this research.

Will I receive feedback on the results of this research?

You will not receive direct feedback on the findings of the research, but you will be able to comment on the design outcomes that stem from the research. These can be shared via email (or, if no email is supplied, by text message).

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Dr Frances Joseph fjoseph@aut.ac.nz, +64 9 921 9999 ext. 8750.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

Whom do I contact for further information about this research?

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

Researcher Contact Details:

Lisa Clist lisaclist@gmail.com, 021 083 50793

Project Supervisor Contact Details:

Dr Frances Joseph fjoseph@aut.ac.nz, +64 9 921 9999 ext. 8750

Dr Ricardo Sosa ricardo.sosa@aut.ac.nz +64 9 921 9999 ext. 7947.

Approved by the Auckland University of Technology Ethics Committee on 3 November 2016, AUTEC Reference number 16/408.

7 November 2016   page 1 of 2   This version was edited in July 2016

Consent form

Consent and Release Form

Project title: How does the way people interface with the bicycle influence cycling in everyday life?

Project Supervisor: **Frances Joseph**

Researcher: **Lisa Clist**

○   I have read and understood the information provided about this research project in the Information Sheet dated 17 October 2016.

○   I have had an opportunity to ask questions and to have them answered.

○   I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without being disadvantaged in any way.

○   I understand that if I withdraw from the study then I will be offered the choice between having any data that is identifiable as belonging to me removed or allowing it to continue to be used. However, once the findings have been produced, removal of my data may not be possible.

○   I am not suffering from any illness, injury or any health condition that impairs my physical ability to ride a bicycle.

○   I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.

○   I permit the researcher to use the video recordings and photographs that are part of this project and/or any drawings from them and any other reproductions or adaptations from them, either complete or in part, alone or in conjunction with any wording and/or drawings solely and exclusively for (a) the researcher's portfolio; and (b) educational exhibition and examination purposes and related design works.

○   I understand that the video recordings and photographs will be used for academic purposes only and will not be published in any form outside of this project without my written permission.

○   I understand that any copyright material created by the photographic sessions is deemed to be owned by the researcher and that I do not own copyright of any of the photographs.

○   I understand that if I withdraw from the study then, while it may not be possible to destroy all records of the focus group discussion of which I was part, I will be offered the choice between having any data that is identifiable as belonging to me removed or allowing it to continue to be used. However, once the findings have been produced, removal of my data may not be possible.

○   I agree to take part in this research.

Participant's signature: ....

Participant's name: ....

Participant's Contact Details (if appropriate):

....

....

....

....

Date:

Approved by the Auckland University of Technology Ethics Committee on 3 November 2016 AUTEC Reference number 16/408

Note: The Participant should retain a copy of this form.

2 July 2015   page 1 of 1   This version was last edited in June 2016

Appendix B: Ethics approval appendices

Recruitment protocol and recruitment advertising

Recruitment Protocol

People will be recruited via:
- Public posts on the Facebook groups Auckland and CRAKL (Creative Auckland)
- Posters around the AUT city campus (WG, WA, WB buildings)

The recruitment message includes information to help self-identify the participants who fit the research criteria. Participants will be informed of the details of the study in the Information form and the Consent form. By signing these forms, they consent to proceeding – however participants are also informed that they can pull out at any time.

- Potential participants can register their interest via email, Facebook message or text message. They will be emailed the information form and consent form, and given up to one week to respond.
- Potential participants who have not responded after one week will be sent one reminder using the communication medium they initially used (email, Facebook message or text message).

Figure 1.1 – Diagram of the research process:
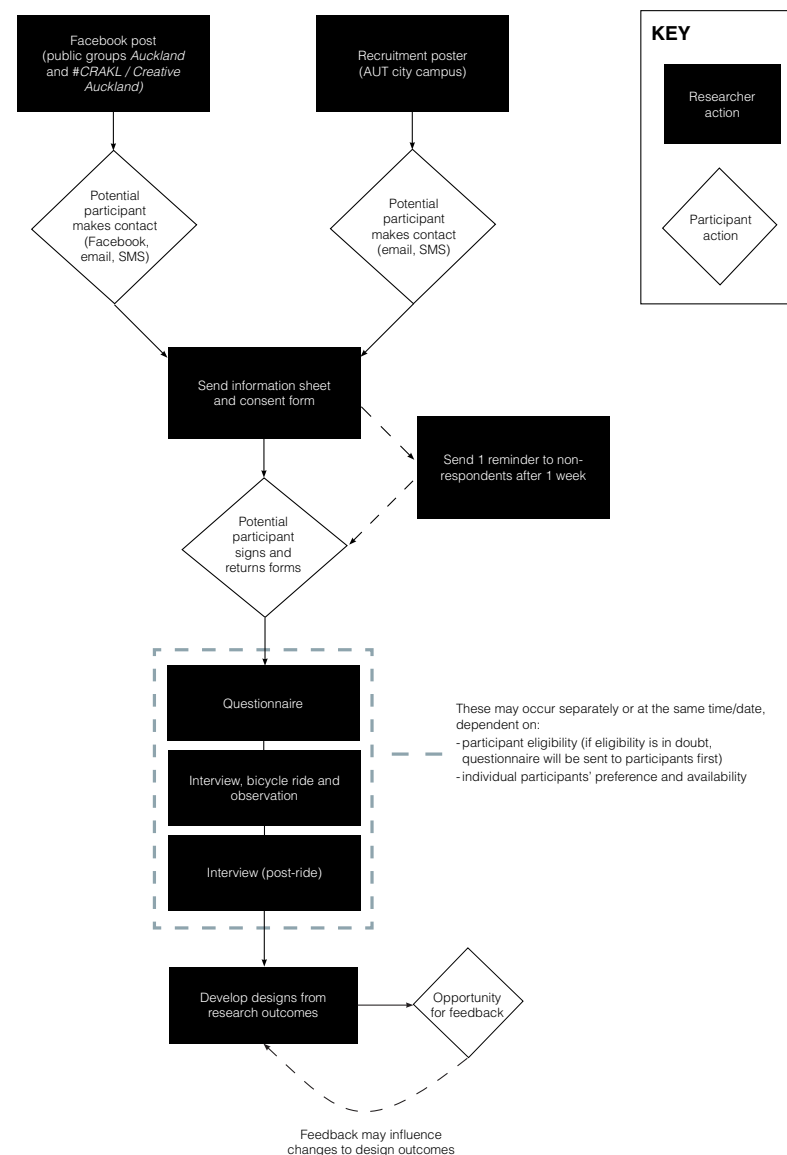
Recruitment Advertising

Facebook post

Know how… But just don't ride? Want to participate in a bike-related study? You're the sort of person we're looking for if you don't consider yourself to be an active bike rider, even though you have learned to ride a bicycle. We're looking for 2 or 3 men or women who agree with these statements:

- You live in Auckland, within 8km or so of your main daily destination (such as your place of work or study)
- You don't normally ride a bike but know how (no you don't need to own one, or have ridden one in the last 5 years)
- You're over 18 years old and you're in good enough health to go for a short, safe, guided bike ride (not sure? If you can walk 200m you should be able to participate)

What can you expect? You'll participate in a short 1-on-1 interview and go for a brief bike ride in a quiet area – all up it should take no more than 90 minutes.

Interested? Contact Lisa Clist: walk.bike.ride.drive@gmail.com or text 021 083 50793
Please provide your preferred email address so we can send you more information.

The research is via CoLab – the Department of Creative Technologies at AUT University.

Poster

Initial questionnaire, indicative interview questions and observation protocol

Initial Questions (after signing consent form and information sheet)

Hello! Thanks for your interest in taking part in this university study. Here are a few questions to understand more about your current situation.

First of all, I'd like to understand your everyday travel.

1. What modes of transport do you currently use? Check all that apply.
- Car (driver)
- Car (passenger)
- Public transport (bus/train/ferry)
- Bicycle
- Walking

2. What is your home suburb?

3. What is your work/study location, or the location of the main place you travel to most days? (If it is your home, please select your home suburb)

Comments _____

Next, some questions on physical activity related to everyday travel.

4. Which of these statements best describes your physical fitness? Check all that apply.
- I am active
- I am not very active

5. Which of these statements best describes your bicycle riding **skill**)?
- I am not at all skilled at riding a bicycle (never ridden a bike/cannot ride)
- I am able to ride a bike
- I am able to ride a bike off-road only
- I am able to ride on or off the road, with little/no traffic
- I am able to ride on the road, with traffic
- I am able to ride on the road in busy traffic, with or without a bike/bus lane
- I am extremely skilled (regularly ride/competent in all situations on and off road)

6. Which of these statements best describes your **confidence** in riding a bicycle?
- Terrified 😱
- Uncomfortable/not confident in most situations 😨
- Nervous 😦
- Okay 🙂
- Confident in some situations but not all 🙂
- Confident in most situations 😀
- Extremely confident 😎

Comments _____

7. Do you have regular access to a bicycle?
Y/N

8. Which of these statements best describes your bicycle riding intentions?
- 'I currently do not bike and I do not intend to start biking in the next 6 months'
- 'I currently do not bike, but I am thinking about starting to bike regularly in the next 6 months'
- 'I currently do not bike but I am planning to start'
- 'I currently bike regularly but I have only begun doing so within the last 6 months'
- 'I currently bike regularly and have done so for longer than 6 months'

9. Do you have any existing health problems that would prevent you from riding a bicycle?
Y/N/Unsure

Finally, some background information.

10. How old are you?
- 18-29
- 30-39
- 40-49
- 50-59
- 60-69
- 70+

12. What is your occupation? _____

13. Do you have a driving licence? Y/N
If yes, what licence do you have?
- NZ Full Licence
- NZ Restricted Licence
- NZ Learners Licence
- International Licence
- Other _____

14. Do you live with any children aged 14 or under?
- Yes
- No

Thank you!

Interview

Part A: Indicative questions

The questions that follow are indicative, and the interview will be more of a conversation than a Q&A.
Objectives:
- Understand current attitude and perception to current travel options.
- Understand current attitude and perception to cycling.
- Understand the journey types made e.g. length, variety, whether they are usually A-to-B or often include incidental side-trips/additional stops.

"This is an open-ended interview on how you get around Auckland. I'm interested in understanding your opinions on the options you have and how you currently travel from place to place."

Questions on current travel habits/routines/journeys
How do you tend to get around Auckland? (May have follow-up questions)
Thinking of the past week, do you have a regular journey you make?
Create a visual journey of a local trip you made this past week.
There are a lot of different ways people use to get to local destinations. Which of the following do you use? (car driver/car passenger/bus/train/walk/cycle/ferry/other)
Can you think of a time you could or would use each mode?
Why would you/wouldn't you choose each mode?

Questions specific to cycling
Do you have regular access to a bicycle?
What's your ideal environment for using a/your bike? (people, place, style etc)
What sort of cycling have you done in the past week starting from last Sunday? Why did/didn't you cycle?
What sort of rides have you done? (mountain-biking, road cycling, tourism, leisure)

Questions specific to cycling motivation
What prevents you from using a bike to:
- Ride to work?
- Ride to shops?
- Run errands?

How do you get satisfaction from cycling?
What motivates you to use a bike to:
- Ride to work?
- Ride to shops?
- Run errands?

Why do you think people use bicycles more?
What activities do you enjoy?

Part B: Bicycle ride and observation
Meet at Auckland Domain for a bicycle ride, or at an agreed location with a route that is familiar to the participant.

Figure 2.1 – Competency check route
First is a competency/safety check 500m ride along a quiet lane (Grandstand Rd North, now closed off to cars):
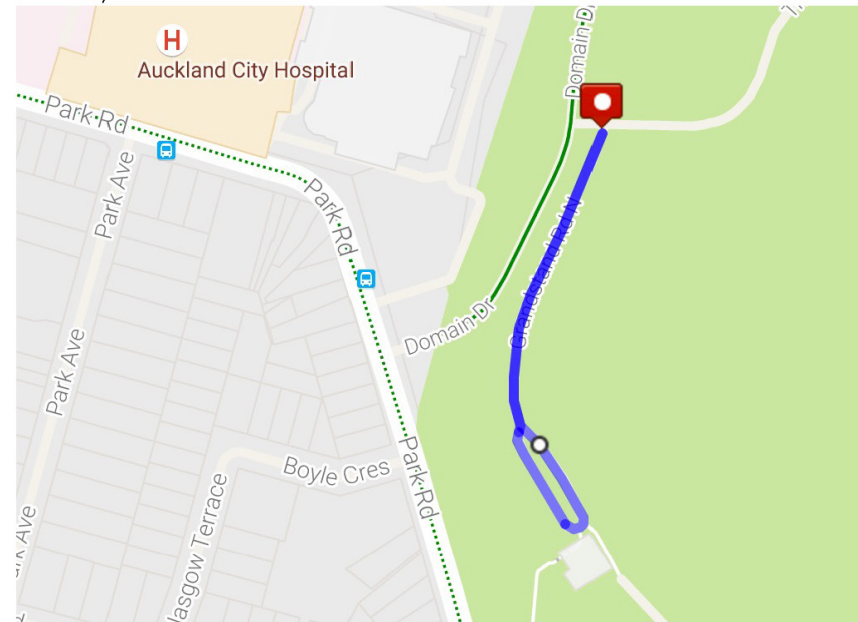
Next is a ride that includes riding on the road. There are three suggested routes. All involve mostly left hand turns, a use a combination of bike lane, bus lane, normal road. The rider will be observed by the researcher, and instructed to talk about their experience as they ride (recorded).

Figure 2.2 – Short route option (1.2km):

Figure 4 – Medium distance route (2km):

Figure 2.3 – Longer distance route (2.7km):

Observation Protocol

People will be recruited via:
- Public posts on the Facebook groups Auckland and CRAKL (Creative Auckland)
- Posters around the AUT city campus (WG, WA, WB buildings)

Participants will be informed of the observation on the Information form and the Consent form. By signing these forms, they will consent to the observation.

Their actions as they mount, ride and dismount the bicycle will be observed. The researcher will instruct the participant to describe their experience as they ride. The researcher will ride with the participant for part of the ride, and may also talk with the participant during the ride in order to encourage a verbal response. This will be recorded on a GoPro video camera and a smartphone device for the researcher to refer to after the event.

Data that will be collected includes participant demographics (as detailed in the questionnaire), riding speed, time taken to complete the circuit, qualitative data relating to their confidence, skill and attitude towards the bicycle and the surrounding environment.

There is no deception involved in the observation.

Appendix C Transcript 1

'Shane'

The name is a pseudonym and identifying information has been redacted.

Location: Grafton

Recording device: GoPro helmet camera, iPhone smartphone on handlebars with earphones/microphone.

Pre-ride

There's nothing like watching cyclists on the road to terrify you.

I used to live on [redacted] Road and I remember watching the slowest crash I have ever seen where this massive Jeep was driving along. You know how on [redacted] Road, just opposite where all those shops are, between [redacted] and [redacted], near the bus stop there was a cyclist in the morning cycling away and then this Jeep just started nudging, drifting left, like really slowly, just drifting left. So he was like 'oh I'm going get crushed between this and the car'. He was just like, banging on the Jeep, banging on the Jeep, then slowly basically just going to get crushed so the Jeep just basically crushed his bike against this other car and he flew forward and landed on the pedestrian crossing bit and it was just like 'what the hell?!' He was trying to desperately trying to squeeze through the gap so he could get into the pedestrian bit so he could be "free", while this car slowly squeezed him…

I was walking, watching. We were all like going "Hey! Hey!" (waving hands), watching this guy frantically slam… and obviously the guy in the Jeep was like… (mimics steering) you know it's [redacted] Road and then yeah.

<What happened next?>

The light went green and the guy drove off.

<Did he ever see the cyclist?>

We're not sure. The cyclist chased after him and tried to yell and stuff, but you know, then went back to his bike and someone was holding it, and 'what the hell was that?' and swore a little bit, and you know. Yeah man that's totally his fault, and he's gone. This was… maybe about six years ago now. It was still like the cycle {mumble}, you know when it was mostly guys in um, jocks, the, what's the thing, I keep thinking activewear but it's not when a guy wears it, what's it called when a guy wears it, oh I dunno – Lycra. There we go. Mamils. Its going backwards. It just was the whole men in Lycra, slash you know, maybe one or two people who sort of cycled bicycles that can cost 3 grand.

I lived in the city for about 8 years, no, 9 years now. I mostly moved every couple of years since – I was originally born in Japan but I've been here for 23 years now. I work at [redacted], which I don't know what that means yet – nah I do know, it's been 9 months since I've ... The role was kind of created for me and one other person so we've been defining what the role means. So a lot

of it is to do with tactical urbanism, so interventions within public spaces, but specifically related to [redacted]. So I could include everything from the [redacted: he describes a bicycle project specific to his work, where he would ride a bicycle in the local community].

I'm also part of a couple of creative organisations and I've done all sorts of weird stuff like build a kayak out of plastic bottles and kayak it through the Abel Tasman with a group called, funnily enough, Plastic Bottle Kayak. What else?

I did own a bike. I still do actually, it's slightly rusted. It's a Japanese one that I brought it over from Japan because it was cheap. I used to ride it a lot until for some weird reason the design meant, I think it's really heavy and so the tyres kept popping and so there was this one moment where I got two punctures and I was just like, argh, and then, didn't ride it again.

I used to go out with a bunch of mates, we called it a cycle "gnag" – because of Facebook misspellings all the time (yeah, a gang) and yeah we use to try and, yeah I'd lend my buddy a bike, and we'd have lots of fun times like, having a puncture together (laughs), down on the waterfront, and realizing that gas stations don't have wrenches anymore, which is funny, because the Japanese bikes don't have quick releases they're the old wrench-the-wheel off, yeah.

Mostly after the two punctures I think, partly, because I used to go to the Tumeke Cycle Space in Newton to get my, you know, maintain my bike, look after it, somewhat, like every six months or something. Whenever there was an issue I could go there, but I lived in [redacted] Street and of course when your bike is broken, it's really hard to get it from the broken place to the place that fixes the broken thing. I went to Tumeke mostly because it was flat – whereas to get to T Whites, which is probably you know like, "here, money, fix it", it was up a hill – so it was easier going along the flat than it was to get to T Whites.

Then of course with two punctures, a heavy bike it was just like "I'll do it… next week." And that was about probably three years ago.

<What's the situation right now?>

It lives in our garage.

<Broken?>

Yeah it's still got two flat tyres. It also hung out outside for a while, you know I pretended that I'd get it fixed next week so it got all sorts of moisture damage, so all the handles are rusty. It probably still works. Just a little bit… unloved.

What else? And my wife used to cycle occasionally as well.

<So how big was this gang? Tell me more about this gang.>

There were 4 to 5 depending on. Funnily enough old youth group slash student group kind of. I used to be a youth group leader and also a student group leader for a local church. So they're just old friends from there. I can't remember what it was. It was probably because one of them was joking about how he needed to cycle more to stay healthy so I was like "all right, let's do it".

One of them had just bought a bike. So three of us got together and were like, cycle somewhere, then one other person also said he had a mountain bike so he'll join us. So we were kind of 4-ish, plus one …who was like a friend of a friend. But my buddy, who kinda had a bike but all his bikes were also like broken from his parent's place, so he would borrow my wife's bike. So we'd ride that way.

We went to Onehunga, Royal Oak, One Tree Hill once, we went along the Western cycle route before it was super awesome – it was still awesome but yeah not as connected. But we went to St Lukes yeah. Where else did we go? We just chose a direction. We once tried to go to Mission Bay, got as far as the waterfront, did like a loop up to Ponsonby, and the loop was quite hilarious because yeah we had a punctured front tyre (laughs) so we had to figure out how can we get this bike back to a place which has a wrench, and so the fastest route we found was to take it round, um, up the steps, those steps that basically go up near the St Marys Bay side of Ponsonby. Carry it up there and then went to his parents' place. We couldn't actually fix it. We couldn't actually find, there were multiple punctures. Well I think what had happened – this is my theory – it was my friend on my wife's bike, is that he did a jump, and it's a really heavy bike to do a jump on and he landed on the kerb, and by landing on the kerb it was too much pressure and it was jump like 'pck', and he put this little hole in it. So we got, you know we had the little repair-y stuff and we got it out and we got the tube and we put it in water and found the bubble you know, put the thing over the bubble bit, pumped it back up and we were like 'yeah we're awesome' and it kept deflating and we were like …. So yeah it was just cheaper to buy another inner tube, basically. But yeah, you don't cycle with a spare inner tube on you, so, that was that. Yeah.

<What made you go, let's do it, to this guy?>

Mostly because I suppose there wasn't anything stopping us. Most of us had bicycles, I had a spare one. It was summer, sunny. When we had spare time. So yeah, why not. Let's go cycle.

<So how long did this last, this gnag?>

Probably about 3 or 4 months maybe. Obviously in saying 3 or 4 months it didn't mean like every weekend. It was just we'd try, every couple of weeks we'd be like all right let's go somewhere! And be like, oh I can't, my bike exploded, I have an exam, I have work, I'm doing this that day, oh yep, try next week. And then we'd try and start it up again. [That was] about three or four years ago.

One thing that was unfortunate was my wife could never go, because we did it on days when she was working, at the time, or she was studying, it was one or the other – cos she used to work weekends, and now I work weekends.

It was always just us 4 to 5 guys. There wasn't ever any girls, because it was five that were single, maybe? Dunno. That's not necessarily a...

I used to go on a cycle date with my wife every now and then, when we first got our bikes, but it got less and less. Mostly because she was really busy with studying and work.

[She got her bike} the same time as me. We both bought them in Japan. I think at the time it was because we wanted an interesting… we wanted a commuter bike but not one that was too expensive which was really hard to find. If you wanted something that was slightly stylish you had to pay a lot. We didn't want to do that, we just wanted to pay a little bit, we just wanted to try it out, and we happened to be in Japan at the time and so we were like let's buy a bike. So we went into some shop and got one for like 150 bucks. It was way cheaper. And Air New Zealand were happy to let us bring it back as just luggage so there was no extra luggage costs or anything like that. I mean apart from the really awkward thing of getting it to the airport and back from the airport. Although I think we didn't take into account that they were quite heavy. I also live in an apartment.

We used to live in five years ago which had a garage, which we still rent out, but that's still up on Liverpool St, so we rent it as like storage for our car and our bikes and other stuff that doesn't fit in our new apartment. And our new apartment doesn't have a garage, or it does have a garage but we're not allowed to use it for garage purposes, and so we still rent it out for garage purposes. So it makes it hard to store our bikes and so it means we still have our bikes stay

up at the other place, which makes a 15-minute walk to get to the bike or car. So we're actually realizing that we're going to get rid of the car cos we don't use it that often. Since I live in [redacted], and my work is in the central city so it's a 10-minute walk and my wife works in Newmarket and it's a 30-minute walk or 15-, 20-minute bus. Most of our friends want to come into the city to do something or if they're not, we tend to grab a lift with them because we can carpool, or we can Uber somewhere if it's super special so we don't have a need of, yeah, a car. And then we don't have a space to store a bike. So the bike's kind of gone the same way that the car does.

<When you bought the bike, so you said you chose a commuter bike, and you were looking at style?>

So yeah it's a mamachadi – it's Japanese, and it has a basket on the front, it's flat and it's very Dutch-like and you sit upright, you don't sit forward. It's not mountain-bikey.

When I was younger Dad would always buy mountain bikes – Dad was always a second-hand buyer, so he'd always buy bikes that were second hand, but were not quite perfect, as a bargain, in classic Kiwi style. He would tell stories about how he made slash fixed his own bike, you know in the 1960s.

And so I have distinct memories of cycling with all my friends and we'd go down the hill and stuff but my bike never had brakes (laughs) so I learnt to slow down by turning. Or – it used to have a front brake or some kind of half brake that would engage but then after a while would be like pffff (makes wobbling motion with hand) and I never really learned the skills to fix it. Dad was like "you can fix it" and I was like "how?" and he was like "oh, you know, just figure out how." So I didn't.

So I just had these bikes (mumbles) which made me quite a reckless rider I suppose. Because you know, when you've got no brakes (laughs) you have to be a reckless rider. I have memories of going down Queenstown Rd which is a fairly steep hill, it's the end of Manukau Rd, going down that hill, and then realising that I was going slightly faster than all my friends in front but I had no brakes, so yeah then realising oh crap I have no brakes and I think I crashed into the wall and that helped (laughs).

And then, what else? But anyway yeah but with the Japanese bikes I kind of didn't want to do the whole mountain bikes thing, although in hindsight I probably should have. You know, New Zealand hills, I couldn't make it up Queen St. There's no way I'd make it up Queen St. No that's not true I made it up to, the furthest I got was just past Myers Park. Yeah it had about 18 gears, 3 and 6, but just

with the extra weight it made it super heavy. But you know I'm not super fit.

And the reason I probably thought I'd buy a bike: I was helping out at the Sustainable Business Showcase, and we were doing a project, we were making a cardboard city for them. So it was lots of work, I was studying at the time, and then we had, yeah I was still living up the top of the hill and then working inside Shed 10 and I needed to get back at like 2am and of course all the buses are done and they had those, it was post Rugby World Cup and there were still those bicycle things that were around the waterfront. They disappeared for a while and now they're back again, you know, where you swipe your credit card and you cycle away and you can lock it to another spot and get whatever it was back or something. So they had those at Shed 10, they were left over, and we were like "oh can we borrow these for a night? Because we're back in the morning" and they were like "Sure" and so then this dude who was then at the time also living in Occupy Aotea, we took the bikes and we cycled up Queen Street and when we got halfway I was like yeah this is kinda fun so I had a drive and then I died and then I walked it up and then I zoomed down in the morning.

Yeah and for a while I had a job straight after that and I used to be working on the North Shore. So I'd catch the bus in the mornings and I found it was faster, instead of walking to the bus, or catching a bus down, from home, cycle down Queen Street and I found that if you maintain a certain speed then you basically maintain a certain speed all the way down. So that meant it was just really fast, I think top to bottom in four minutes or something like that. And then yeah I'd just jump off, tie it to one of the poles, go off catch my bus, come back off my bus, cycle back up slash walk it. Yeah. And so at the time I was like yes! Justifiable financial expense slash hardship so I get this done but then yeah but then small chance of that, because job changed and moved to Orewa and that meant that it was just too hard to have to deal with anything else.

<So what did you switch to to get to Orewa?>

Just bus. Cos I take, I don't… I have a learner licence, but I didn't for a while. I used to ride a motorbike until I had a motorbike accident. So interestingly, with motorbike mostly, I got my motorbike licence when I was 18 and I was going to get a car licence because it's the same exam, except for the last four questions or something, but I was a poor high school student and I was like $150 to take the same test twice, no way! So I didn't. But then I never had a reason to afterwards because I could still get from A to B on my motorbike.

And I was going to work at a high school once, and I was on a straight and a car pulled out in front of me, so I came off my bike, basically by braking too hard, trying to not T-bone the car because I knew that I would be worse off out of that experience. But when I came off the bike I landed on my shoulder and rolled so I shattered my shoulder socket and cracked some vertebrae and stuff. Which meant that I had to be in hospital for three weeks. The car that came out was charged with something but I got a $150 fine for my trouble, oh not me, they had to pay a fine and that $150 came to me. So that was like, yay.

<And what happened after that with the motorbiking?>

The motorbike was, my bike was fine, I took all the damage, but I just couldn't psychologically ride it anymore. It just made it, I think just the fact that… yeah, on a bicycle I can go on a footpath although that's illegal, you know, I'd hug the sides and I'd feel safer, whereas on a motorbike I'm on the road, and cars (shakes head), Auckland drivers are terrible. They're atrocious. Even as a pedestrian they're so, yeah, that's probably why I ticked terrified (points to questionnaire) because they don't see. There's no concept of "there is a cyclist" or "you should look for a cyclist" and that you should watch out what's going on. So it makes it really hard. And yeah I think as well, it's funny as well as a cyclist, I'm definitely like a, kind of the whole wheeled pedestrian idea, I don't really go fast anymore, because it makes me hot and sweaty and gross. So I'll probably just leisurely cycle somewhere and if I'm not like that I probably just don't need to be on the road. I feel like on the road is if you're trying to hit top speed on your whatever bike, or if, I don't know, if you're super late for something you're not going to do it like, oh crap I'm going to jump on my bike and get there really fast?! You only do that if you're recreationally cycling so I mostly use my bike to go from A to B. If I'm going from A to B I have to go from A to B, the same way I have to go from A to B in any other way. I don't run. Well actually I do run to the bus stop but I don't run to go to the dairy, I'm not like "oh I need to get to that candy bar!" (acts out running with arms), you just go for a walk (laughs). Yeah so that's kinda how, I suppose…

That was interesting because I felt like I was like oh, can't ride a motorbike but I can still cycle, that's probably why it's because I'm not going fast. Most of the time I'm not really in a situation where a car would hit me because I'm in the inner city. It's when I go places like trying to go up Symonds Street that it becomes a bit crazier, or you know, when we, the cycle gang went to Cornwall Park. Obviously most of the time we cycled through the Domain, and we cycled through – because we started in the city, then we went

through the Domain and then we went through Newmarket and it was all fine, and then suddenly we hit Manukau Road, and then it got slightly, like then we weren't talking as much, we were definitely single file, you know trying to get on the footpath as much as possible, getting off when there were poles, bus stops, driveways… really hoping like hell that a car wouldn't just decide to open their door while driving or something. Rational fears like that (smiles).

<Why don't you have that fear in the CBD?>

I think it's, one is that cars have to go slower, slightly slower in the CBD. Obviously there will be different - Hobson Street, Albert St, I can't remember those arterial routes, it's different, but generally when you're looking at areas like K Rd, ah…

I hesitate by saying Ponsonby Road but some sort of Ponsonby Road, cars are slowing down. So, even if, apart from the slow cycle accident that I described earlier that's kinda you know you're not going to have that sort of "prrr!" (makes exploding action with hands) crazy action, although you might get that from cars coming out of driveways. So I have the fear in residential areas but in a shopping area, not so much. You know a car's not going to come out of a dairy, intersection, most garages have the blinky-light thing so you can keep an eye out for that so if a car is coming out you can just slow down. Yeah. That's kind of how I feel. Probably statistically it's just exactly the same and you die both ways (laughs). But yeah. Yeah. And generally I don't wear a helmet. That's probably the other thing. Although the helmet laws are complicated. So yeah. I understand why you should have a helmet law but I understand why you shouldn't as well. But I just choose not to (shrugs). For example, with my wife sometimes. But then sometimes she doesn't as well. So yeah.

<So why's that? Could you explain.>

I remember reading a whole bunch of stuff from the UK about how cars will often drive closer to you when you're wearing a helmet, and then kind of realising yeah, a lot of the reasons why – it's like a chicken and egg argument, if you don't wear a helmet in Auckland, when you get hit by a car you will die, because you'll get issues with, basically, brain injuries. Whereas the other point is of course the more people wearing a helmet you're like, yeah, cycling, death sport – commuter cycling is a death sport so you should wear a helmet. Well actually maybe I should just ride wearing what I used to wear as a motorcyclist which is full-on body gear. Is that what we're expecting? Is that the safest way to ride? And that's just as

ridiculous as well so it's kind of like, yeah, which one is it supposed to be?

I think realistically it comes back to what a commuter cyclist – and I'm not actually trying to go really fast and I'm not trying to do silly things then, you know, are we kidding ourselves by saying … But then at the same time the reality is that only, you would be best not wearing a helmet when only a large proportion of the population cycling and a large proportion of the driving population aware that there are cyclists so it doesn't … The only time that you don't need helmet laws is once there are so many cyclists because you don't have everyone's aware of it which is what has happened in countries such as Denmark and Amsterdam. Interestingly in Amsterdam I found cyclists super rude and they were just like cars. Don't cross a – don't even step onto a cycleway if there's a cyclist 100 metres away because they will yell abuse at you as you cycle past, because that's their lane (laughs). I mean they are going down that lane…

<Have you had a personal experience, after reading that sort of stuff, a personal experience of, considering that sort of safety. Do you own a helmet?>

I used to own a helmet when I was a kid. I think, yeah, I've seen issues, I haven't had any issues, nah. And I think the other thing is, the issues that I've read about – to be fair they're issues that I've read about that have been posted by friends who are cyclist friends so they're different, often you know, it happens in St Heliers, or you know, a car or a truck hits them you know, run over a cyclist, and when you read about stuff like that you're like I don't know if a helmet would have saved that person. Then you also read about the speed that they're going and you know I'm not saying that the speed that they were going is like 50km/hr and they were going top speed, I suppose I'm saying that they were trying to go from A to B quickly. Yeah so I'm like well, you know, it doesn't… it sounds pretty bad because I'm trying to say I'm not blaming the cyclist for going fast but it's like well, there's obviously an added risk because even if you're wearing a helmet, if you go faster, it's harder to react. Reaction speeds, you have to react faster to a problem that's comes up (shrugs). Yeah.

<So do you have a sort of ideal environment for when you do jump on a bike?>

Like, weather-wise? Or like…

<In general>

When I used to live on top of redacted Road, and I used to ride my bike, one of the shortest trips I'd do would be down to the dairy down the road to get these, were they $2? No they were $1.50 pita things. And that was because we were like we should have Mexican tonight or something and I'd be like, cool, I'd just rrr, grab, come back (indicates). I think that was my ideal that I could easily just do that, and it was really quick, and it was also really fun because I mean my friend in Ponsonby was like along the ridge, you know? It was flat and it was nice and it made it really easy. What else? Totally contrary to everything I just said before but, I did like going down Queen Street really fast. I'd go down the top part really slowly and squeaking my brakes all the way down and then along the flat. Yeah. That bit I would go faster.

<And why did you like that?>

Sounds really bad, the wind in my hair? Nah I don't know, something. I think just like, being able to pass through everything, and knowing that I could get somewhere quick. It's so contrary. (shakes head, laughs). But yeah that would probably be my one route that I do enjoy. Whereas if I went along a flat bit I'd be like, it's funny, down a hill I would freak out. But on the flat I'd be like, I'd still slow down…obviously I'd go through some of the pedestrian green lights as well. So you just slow down.

The other one is for work, redacted it's been fun redacted. But it's good fun doing a circular flat route, just visiting people, stopping and starting and having chats. So that's kind of exciting.

[Redacted part of the conversation where we talked about his work project, and how it came about]

<And why is that cool?>

Huh, why is that cool? It kind of creates this culture of bicycles on streets and that's part of having bicycles in the streets and that's cool.

<Why is it cool?>

Why is it cool? (Thinks). Being on a bicycle is cool? Why is being on a bicycle cool? Being on a bicycle is cool because… I don't know why being on a bicycle is cool. Meeting people is cool. Okay I suppose being on a bicycle is cool because the more people thinks it's cool the more people on bicycles, and therefore then everyone's on a bicycle. I don't know. I suppose it's sustainable but then I don't necessarily – it's not a driver for me either. Why do I think riding a bike is cool? I expect it's because I look good on a bicycle? Um… Why else would I think that riding a bicycle is cool? Yeah

I'm going to stick with I look good on a bicycle. Yeah, there we go. I'm going to stick with that.

<What if we turn it around and say, imagine Auckland with no bicycles? What is it losing from that, or, what are you losing from that personally? What does it not add to your life?>

Currently not really since I don't ride (laughs). I suppose it's interesting as well like if I'm a, where did I once do a bicycle tour? I once did a bicycle tour somewhere and I can't remember where. One thing about riding a bike, as opposed to the reasons why I do it, is that you get to see more of the city slowly, if that makes sense. I think in a car, you experience a city in a different way. You're in a bubble, you're less exposed, you have your own stereo you have your own climate, you're going from A to B a lot faster, so you don't explore as much - you still can, jump in a car with some buddies and go explore places but if you're on a bike you explore it differently to when you're on foot. If you're on foot you kinda have a limit, well I mean you don't really, you could just keep walking but you do get tired whereas on a bike you can do twice that distance in the same amount of time and still be able to see that slowly, and still be able to see more. I think there's a loss in that.

There's also I suppose there's also that avenue for that sense of community. I don't know that if we did the opposite and we removed all the cars and said there were only bicycles in Auckland I don't know if necessarily that would create the same community that it currently does because it's still quite niche. I did one little cycle-along thing where people meet up in a cycle group and then cycle somewhere, but that sense of community there, that sense of community exists like, Tumeke Cycle Space or you know when you go down to the repair things they've set up at ? or Shed 10 which are probably run by the same guys, or the parking bays set up by Auckland Transport, there's this community of cyclists, wannabe cyclists, people who like bicycles and then really, people who like cycling really quickly from A to B or whatever. Whereas you don't really get that with cars, unless you have a really, then it's slightly different, it's like a Mini Cooper gang or something but there's not a lot of places that they can hang out, whereas there are lot more spaces that cyclists can hang out. And although that it kind of exists, walkers you don't really classify them as walkers. There's not like a walking gang, if that makes sense. Although obviously there's like jogging gangs and you know, there's a reason why, the walking thing in Olympic sports isn't as super popular as everywhere else because it just looks weird, but also you give different titles, like the photography society and they walk somewhere and take photos. It's not because they like walking. Or they probably do like…

During the ride

Spoken

Physical

Helmet camera is on his helmet, a GoPro. A second camera is on his handlebars, a smartphone, with the screen facing up towards him. He wears the earphones/microphone that is connected to the second camera.

It's kinda heavy. Well you know it probably isn't heavy but it feels heavy.

Camera on helmet. Moves head. Looks around.

So where are we going again?

Just round, that way.

Don't wobble my head? Laughs.

Helmet camera on his head drops forwards

I fix camera.

Alrighty then.

Breathes.

Starts cycling.

I really should have changed gears before I started. Figured out which gear did what. That's all right.

Ooh yeah this is gonna be fun.

Starts pedalling. First few pedal rotations and he turns the front wheel side to side.

The first section is a slight incline, with a left hand turn. Cars and pedestrians to go around, checks right for traffic

(ooh yeah sounds like he is putting in more effort)

And, pedestrian.

Cycles past pedestrian confidently, giving her enough space.

Bumpy hill thing.

Goes over speed table

car behind me

my foot slipped again

Car passes – sound of car passing

and that slight fast thing that cars do when they go past you which is kinda scary

And then kinda hugging the line

Slightly heaving breathing, but mostly talking steadily while cycling steadily. Stays on seat.

Ah... I think gutters always scare me because I always feel like if you hug the line too much to the gutter your bike will slip and fall in and then it's hard to get out, and then it wobbles, and then you fall and go flat in front of a car and then another car runs you over

then you die.

Following/cycling over the yellow dashed lines on the road.

Or, like as you come up to whatever this thing is, and there's a bump, and there's also one of those ledgey things so you have to go where cars go.

Looks over to the right. Car passes. There short are walls on either side. Coming up to an intersection that also has a speed table. He is looking ahead - he mentions the speed table/bump about 5m /several seconds before physically riding on it – unless he is mentioning another smaller bump just before that.

I'll guessing we have to stay on the road.

Looks right and left, at intersection now. (Unclear whether he is saying yay about the pothole or the bus lane. Suspect the former)

Look, pothole, yay, bus lane

Pothole on road, just to the right of cyclist.

Ah!

Something happens on bike that makes him do that (gears? Pedal?)

<slight pause>

and then… I'm neglecting to change gears because I'm not sure which one does what. But I'll leave that alone because maybe that's okay.

Looks down at gears.

My legs aren't hurting as much, oooh so many muscles

Pedestrians on footpath, no cars going same direction, only cars going opposite direction across the other side of the road.

And then we go.

Glances to lane alongside

It's nice and flat.

Kinda wobbling.

Wind noise. Speed picks up. Looks right.

I can hear a car

Car then goes past in other lane.

Pauses talking

Glances behind at me (following on second bike).

Glances up at lights

And I'm probably just going to go onto the footpath instead of going through the traffic lights

looks behind left to check for pedestrians

Whispers: cos it's easier

goes up ramp to footpath. Concrete is lighter and easy to spot ramp.

Glances right.

And then we can go behind these people who are talking about stuff

Rides past people at lights. Plenty of space on footpath.

And watch as this car goes…

Looks right to see what traffic is there.

Oh look! There's like a bike lane!

Very excited tone of voice

Ooohahh I won't go across the kerb cos I have electronic things attached to me.

Looks down at phone, looks at bike lane.

Bike lane!

Spots and goes down the bike ramp onto the bike lane.

I haven't recognised this bike lane. It's kinda interesting.

Rides on downhill slope of bike lane.

I kinda feel trapped. Giant poley things.

It's like going up the hill in a bike lane when someone's coming down it.

More wind noise obscures speech. Going faster than before. Going downhill.

I'm turning left and hand signalling is hard.

Looks right, checks for traffic. Speech slightly disjointed while checking for traffic/indicating. Indicates.

Whee!

Turns corner.

And I think we're going forward.

Turns head a bit (checking different options?)

Smiles as he goes past a pedestrian

The lady...not…sorry!

Rides slowly past person walking. We are going through a shared roadway with parked cars on one side.

Oh. The percent of people who'll get videoed while I ride, that will be quite scary.

Passes about 4 or 5 people walking on a quiet street of the Domain.

Now we're back in a car park, where I kinda want to be in the middle of the lane,

Looks to the right (possibly back towards me)

otherwise a car will come out and run me over, open a door and, you know, side-swipe me. What else?

pause

Road is flat. Bike rattles.

Probably not as wary as I would be in a car park like as this mostly because most of the cars seem kinda empty

He has slowed down, looking around a bit from left to right.

And further away from the road, whereas, yeah, along a road I feel like every car is out to kill me, including parked cars, all parked

cars are out to kill me.

I have come up alongside and can hear him talking now.

Oh look

? Possibly on seeing the grandstand building where we started.

Alright. Ahh, back at the start, again?

Slows down, stops.

Sorry boss.

Apologises to a pedestrian walking past.

There you go. I only stopped talking at one point, and then I figured out I wasn't talking

Stays on bike, relaxed, one foot on ground, seated on bike.

Immediately after ride

I only stopped talking at one point, and then I figured out I wasn't talking.

<Where was that?>

Probably about there (points to the bus lane, heading towards lights).

<Oh okay. You did well. Up the hill and everything?>

Yeah, it wasn't too bad. I didn't know what gear I'm in. (Looks at gears). 2, 5.

<Did you change gears?>

No.

<Oh okay. How did you find the different points in the journey?>

It kind of felt like my old bike, cos that was what I usually did anyway. I think, I didn't, I suppose I couldn't really comment on the gear changes but like, I think, well yeah – history of bikes, the second-hand bike riding where changing gears was dangerous at best (laughs) but with the Japanese bike I think what I found was that you know, that was the stage where it's a little bit hard, but if I go down a gear I'm going to be spinning like a hamster on a wheel so I'm just going to stay at the hard bit and keep going and so I just got used to that. That was that bit (points to hill).

Um, yeah. I don't think I've even noticed that that was a bike lane and I've even walked up that hill, before. <obscured by wind noise> The little bike lane thing with the whatsits. But I think the thing with bike lanes that is really fascinating is that um… yeah, it's

always mono-directional as if bikes always operate the same as cars which legally we are, bicycles are like vehicles but cyclists don't operate like cars, you know they go on footpaths sometimes, they decide to stop whenever they like, they have their own little traffic symbols and stuff but you know sometimes it's more convenient to be on the wrong side of the road. So I was just thinking if you're cycling up the hill that really sucks because you'd have these guys cycling down and you'd be like argh and then be like ahhh (imitates handlebar avoidance manoeuvre) and then you know, I don't know, you don't have a way to get out because, it's all you know happily blockaded in, in this narrow little footpath. Yeah. That's just my thoughts.

<Do you drive much around Auckland at all?>

Not at all. I've got no driver's license, remember.

<You've got the car, so it's your wife that?>

Yeah it's my wife that drives when we use it, every three months, which is often to Rotorua when we visit her grandparents. We don't use it in Auckland.

<So what made you, answer my shout out?>

Um, I always like volunteering …. (Obscured by wind noise. Moves bike to sheltered area.)

<You can take the helmet off if you want.>

I think mostly because yeah I literally ticked all the boxes. I'm someone who used to cycle but no longer does cycle. I also… I like cycling. I think it's… cool? Maybe. Just got to figure out what that means. But I don't cycle. Whereas I've got a lot of opportunities in the sense that I'm an inner city commuter and I work in the you know. I don't even know how many k's I live from my work. I used to live 3 minutes away on Victoria St and that was the best. I probably wouldn't have cycled then. I wouldn't have been…I would have been like why would I cycle probably just like, I'd fall over and I'm at work. I suppose I always try and volunteer for stuff cos you never know what comes out of it. I've yet to have a volunteer experience that even when it's for research or for (muffled) labour, hasn't been kind of fun.

<Last time you cycled? How long ago? This year?>

Nah, oh actually yeah. It would be if I include the [work project]. But before that it would be like a year and half, two years.

<What did it feel like being back on a bike?

Well, that's the saying, right? Like riding a bike (laughs). So it's kinda the same. I don't think, Yeah... I suppose the same kind of tactics. That sounds so heavy – but yeah the same tactics that I use as a motorbike rider I use while cycling, which is, kinda keeping an eye out on what's happening there, what that car is doing, what's behind you, head checks, noting potholes in the ground that will kill you, small children. I still remember, cos I recently sat like a year and half ago, that learner thing, and it had that bit that was like spot the hazards and I'm just like "They're all hazards! (imitates circling everything in the picture) Everything's a hazard which is what you have to do on a motorbike. And it's kind of the same on a bicycle. Spot all the hazards that will annoy you, like potholes, changes in kerbs, changes in the road in which cars are just like 'whee' (hand motion for flowing over) but bikes are like 'ooh' (hand motion for bigger bump). I once remember going over a bump with our cycle gnag. The bumps were just really steep. So you're going up a hill and there'd be a bump, cos obviously for cars going downhill but there was this bump enough that you're like ugh! And you know it's hard, like you're already going and you're already on a low gear and you're already standing up to try and push yourself forward and then suddenly there's this bump that adds just an extra bit of incline and you have to go up further. It's like, why'd you, why? Why would you do this to us?!

And things like when you were going up a hill and you'd assess whether it's easier on the footpath, because the footpath might be, no the road is steep, but the road is at least possibly uniform, without said bumps, but then you look at the footpath and but actually footpaths are never uniform but then maybe it was just be really harder, but maybe it be like less incline, maybe it goes flat every now and then, and so you hope that maybe the footpath will be easier and then you just try and go for one of them and you should have chosen the other option before and then next week you do the other thing and you should have done the first option. But you forget. Yeah you always make the same mistakes all the time. Yeah.

<Is there anything particular about that bike that was different?>

I think. Yeah I suppose the bike that I have the handlebars are higher and so I sit sort of lower kind of… So I sit higher So I sit kind of higher, whereas this kind of mountain bike, and other sports bikes they kind of value you leaning forward and then your butt's kinda higher, it's kinda how it's styled. That kind of always freaks me out especially going down hill, cos it feels like I'm trying to pitch myself forward.

Also I've yet to fit a comfortable bike seat. It always just feels like it just pushing my butt. Yeah, even on my own bike. I've sat on some that were just like giant cushion things. But even then maybe bikes were never designed to be super comfortable. I don't know. I don't really know. Maybe there is a really comfortable bike seat out there and I just never forked out the money for it.

Otherwise yes, the suspension's weird. I've not ever really had a bike with suspension that works. I did have one that did have suspension that didn't work. Which is like having 2 inches of something that would occasionally give and then just jar really hard. That bike didn't last. I think the wheel fell off actually. Yeah literally. It was good fun. I once bent a wheel too. Literally.

<Have you ever had negative experiences?>

I think my negatives would be that sense of fear as you ride. You know, like being confident but still terrified of going on, of what you can't control. A similar fear to what I have when I'm on a motorcycle. I was saying like riding along here, with parked cars, suddenly a car will just drive straight back out and you're moving slightly faster than a pedestrian and so they didn't judge it, or whatever.

I think also, the bits that I do when I was part of "gnag", we'd cycle along in a group of 4 and we'd go places and we'd have chats and stuff, but as soon as you're on a busy road it suddenly became very utilitarian, you're in single file, you're trying to hug the kerb as much as possible, trying not to run over a pedestrian or whatever it is that you're trying not to do, that sense of car, you hear it way before and then rrr you hear it roar past. I always find that kind of sucky I suppose. As soon as you're passed that like in the Domain, or you're in a suburban street then you'd spread out a bit more, and have a chat…yeah, muck around.

<You mentioned before that you wouldn't do a walking gang. Have you gone for walks with your, say, those same guys?>

Yeah. We'll wander. Not in the same sense. So we wouldn't have a destination, that's the thing. I wouldn't do a walking gang where we'd be like "Let's walk to Cornwall Park" I'd be like "Hell no".

<How about let's do the coast to coast?>

Yeah. Still no. (Laughs). I have friends who've done it. And funnily enough I have kind of done it.

<But cycling is in a different space, or something?>

Yeah. It's interesting. For some reason I don't mind cycling to St Lukes to buy something, but walking to St Lukes? Not so much. In saying that, my wife likes hikes, so she does lots of walking, occasionally I do, but not so much.

<What's your take on public transport?>

Yes. (Laughs)

<Do you use it?>

Yeah. I use it a lot. Mostly because obviously I can't drive so it means that if I want to go a long distance, public transport would probably be the way. I still find it annoying that it's never on time. I was thinking just as I was catching the bus here, I was staring at the bus timetable and wondering why we even bother to print those. It's really expensive to print that much data and information but it's never accurate like why do we even bother? Why do we even say that this bus will be here at 5:55 and the next one will be at 6:10 and the next one after that will be at like 6:18 it never is, it's never on time, it never actually leaves that and it's not even the spot where you're at it's like it will leave Britomart at 5:55 and you know it hasn't left Britomart at 5:55 because you were there and you walked up and you know it's just why do we even bother to print them? It's not even… I've been really early in the morning for a bus and there's pretty much zero chance of it being delayed by anything apart from maybe the bus driver broke their leg or something out of this world and it's still late and I'm like How? Some engineer sat there and worked really hard to make that maps on this worked, and yet it's still not on time. None of that makes sense.

I recently saw a Japanese comedy skit by some Japanese comedian living in England and she was commenting on some poster she saw on the Tube which was about during this certain period of time London public train transport things were within five minutes of their scheduled time and so in her mind she was like "is this confession?" And in the next sentence it was "we are striving to do better" and she was like "is that like an apology?" cos like in Japan, sort of in Japan, trains leave on time. When they say on time it's like 5:55 it's gone. The door is shutting on you. It's not like… I think that world is really interesting.

I've got a friend who works as a lecturer ▓redacted▓, with the design students, and he does a lot for Auckland Transport ▓redacted▓. I

bumped into him actually, just last week. He was talking with one of his design students who was visually impaired and he was discussing signage, way-finding for buses. And I always think about the way people seek and find information. The point that he was bringing up was that all the trains from out west and north go from Wellesley St up. So it's like this bus stop is for west and north for the most part. And over there is for all the southern and western buses arriving. And over that side is going another different western route and … This is a hub for west and northish. Then I pointed out that if you wanted to go from crosstown from North Shore to south you just can't anymore, and you wouldn't know where you're going, or how you'd get there. And all our buses have weird branding exercises where there's Wake Pacific but also some of the western routes because they ran out of buses somewhere. Just stuff like that. Constantly thinking about what is the way we find our way around A to B, how to get there.

Oh we did do a cycling route through the Grey Lynn kinda… Auckland Transport used to publish those cycling map things, little day trip cycling ones, so we did that once. We chose a route and we were like yeah this is cool. What it was is really a lot of connected routes that all grouped together, not actually a single route. But we did that and it was quite nice, and it was pleasant and stuff. Except that we realised we ended up at some beach, Westmere maybe, and in order to get back it was all uphill. And you're like…. ohhhhh they didn't tell us this! This wasn't on the map! So we all walked up the hill and then tried and yeah we died, we all needed showers. I don't know, it's just, even if you do that cycle route, the only reason we knew is because we had a map. Yeah. I find that really. And even currently what Auckland Transport is currently is effectively a cycle loop, which is great, but it kind of feels like the equivalent of going for a ride in a stadium, and riding in a circle, you're not really going anywhere. Which is fine in some sense but. Obviously it ticks all these boxes. What is does is that it encourages cyclists, most people just do want to go in a circle and they just want, it's creates a safe environment, it's great, all those things tick some great boxes, but from a network perspective, does that really develop that? Probably not. Maybe it does develop the whole, in the same way that the City Rail Link creates a network? I don't really know because we don't have capacity. I suppose there is a limited capacity on the cycle route but yeah. And so public transport and how cities and how cities work is also kind of interesting.

Appendix D Transcript 2 'Rosa'

The name is a pseudonym and identifying information has been redacted.

Location: Glenfield (participant's preferred location)

Recording device: GoPro camera, iPhone smartphone with earphones/microphone.

Pre-ride

<General intro about yourself>

One of the things why the study was interesting to me was basically I came to New Zealand on a bike. So basically it was a one year trip and we cycled from Europe to here, and then I arrived to New Zealand and I basically stopped cycling. Because commuting here, it's not made for cycling. Even like you know, I could basically go, I'm physically fit – to go from where I am to the centre or anywhere else but it's just because of the traffic, it's impossible, the drivers are… yeah you go to the war, and I don't want to go to the war.

I'm originally from [a country in Europe], so this is where I cycled from.

It's been a few years ago. It's been 7 years ago.

<What do you do instead for getting around town?>

So when you're in the city you walk, because it's too small, but to get from one suburb to another I usually drive the car. I was very desperate to use the transport, public transport, but then it takes like one and a half hours to get for example from North Shore to Dominion Road and it was like 20 minutes by car. So what do you do, you just give up. Because life gets in the way you know, and you get busy and you just can't afford yourself to spend all that time just commuting from one place to another because Auckland is so spread out. I'm all for public transport, I'm all for cycling, it just basically, I just gave up because it was impossible. And I know many people who did that, here in New Zealand.

<What are the places you go? What is Auckland for you?>

Starting from Manukau, Auckland CBD, West Auckland, Orewa, you know major parts of Auckland, great Auckland, super city.

<What about in your typical week?>

Well it varies you know but in the mornings I'm coming here, three or four times a week, coming from Mairangi Bay, coming here to Glenfield. It would be a nice bike ride actually, but because either there is no bike lane, coming from Sunset Road, there is no bike lane. On Glenfield Road there is a bike lane but it is either shared with buses, or it's cars parked over the road, so basically you're always exposed to the traffic, and the drivers like you know, driving, it's sort of like, yeah you're thinking, do I really want to do that you know. And I'm not scared of it, it's just like after a while you just give up. Yeah.

<So did you try at any point?>

Yeah. When I first arrived we lived in Wellington, and we lived in a small village so I would cycle 7, 8 kilometres one way and another to get to work. But when I came here to Auckland I just like… too much.

<I didn't really tell you what I'm doing did I?>

You're trying to make us like cycling and I'm really excited by that.

So you're looking at the dynamics of how a body is moving on a bicycle, or you're just looking at how a person feels from a psychological perspective?

<Both. I'm being very open and I'll see what path I go down.>

<Because I'm not familiar with the North Shore I'll start with a map. Tell me a bit about the places you go.>

Our neighbourhood is … We go for beach walks to Orewa, because it has a long beach there, so usually in the mornings when I'm not at the gym I'm up there. Then what do we do else? We go here to Northcote to have lunch or to have dinner. I go to Birkenhead Library to write my thesis. We often go to the city. We have friends in Devonport. Sometimes we go here. We come to Albany to do shopping and there are some nice places to eat out, sometimes we go here. And then West Auckland, and South Auckland.

<Who is we?>

Me and my partner. Or friends.

So I go to, because we get called out to [redacted]. I'm not used to looking at a map (laughs).

<How do you normally get around?>

Oh with Google Maps, or because you learn the road you know, so…

Like CBD-CBD, we usually park at Cook St, and we usually go for a walk around the waterfront, and around the marina. …

Usually we drive to town, because we work hours when other people don't work, and we live against the traffic so it is easy for us to drive because we –like, today I will start work at 1:30 and I will work til 9. So basically it is that time, then if I need to drive somewhere I'm not crossing the traffic, I will be against the stream.

We work – [redacted] in Mairangi Bay so we get called out to the

[redacted] sometimes, and we need to drive to the city.

<And do you use your own car?>

Yes.

<Can you tell me about a recent time that you've gone for a bike ride? Is there one?>

No (laughs). My bike tyres are… because it's that bike I came here to, so it's dear to my heart, so I just keep it, but my tyres are flat now. It's just stored there. Because if you want to go somewhere for a bike ride you need to put it into your car, drive somewhere, take out the bike, and I'm sort of like, I can't, I'm not used to that. I'm used to just getting on a bike and just ride, and just go somewhere. Because here it's just too, it's just too complicated to do that and so basically it just sits there. So I'm just waiting until yeah I move out from New Zealand and I start riding again, or move somewhere where it will be… Like now CBD is getting better, like you know they have those proper bike lanes where you have, like you know, where you have like barricades where you can get safely around. I mean it is okay, you know. Or drivers need education. But I think that is hard to do because if you don't have cycling experience, you know, that passing – the scariest it is on the crossings, when you need to go through a crossing through the traffic. And if you need for example to turn right or to turn left through the cars, and I got cut off a few times, you know, where they actually cut you off.

<That happened to you?>

Yeah. And it's one of the reasons why I stopped. Because you need to really fight for yourself you know. And I don't like to do that. How can you fight, you know, every time, you can make it a principle, like yes I will ride now, and you will not stop me, or, just yeah, how long can you go on a principle? So I used to do that, you know, I used to ride out of the principle, but after a few times of being cut off, I'm thinking like you know do I want to live. We have patients coming in to our clinic with broken shoulders, broken collarbones, broken legs just because of riding bicycle. So.. (laughs) it's like a war out there.

<Having seen the changes in the CBD, has that changed anything for you personally?>

Not really. What it means that if you live on the North Shore you would need to go to the CBD to have a bike ride, it's sort of like really?! (laughs) It's like going to an adventure park, to ride around the CBD with a bike, you can get other kinds of exercises. It's sort

of like going to exercise on a bike, it's not like commuting, it wouldn't be like commuting for me, I like use bike for commuting actually.

<What is the best way you can think of for you to use a bike? What's your ideal in your current life?>

In my current life, I don't so I just don't use it. Like, really I tried, honestly I tried, but basically because as I say it's war out there for cyclists and the drivers, you know, or for example, yeah those lycra cyclists yeah who are going to, like when you're driving to the west coast from the North Shore, you know, sometimes they are on those narrow roads, you know, and he is going you know, 10 kilometres (motions uphill slowly) per hour up the hill, and all the traffic is behind him like dingdingdingding (indicates beeping horn) so how …? How does that work, you know? It doesn't work! (laughs)

If it would make like you know that you could cross the bridge, that would be easier for North Shore but then again how do you get to the bridge, they need to share the bus lane, maybe they would, you know. If they would make that easier so people would commute I'm pretty sure that people would commute from North Shore to Auckland. Even now people going from, going to Devonport they can get the ferry and go in to CBD by bike, which is like 20kms, so you need to be really dedicated.

<Imagine that every road is a bike lane, or there were no cars, where would you cycle?>

First it is time, like if you need to go to South Auckland, you will not cycle… Unless it is a day just for that you know. But to go to Northcote from Mairangi Bay, or to come here from Mairangi Bay or even to go to the west coast you could do that. It would be okay. Or to go to CBD, yeah.

<In Wellington you cycled 7 or 8km>

Up the hill, yeah!

<So it's really Auckland, you're telling me?>

Yeah, it's just because it's such a big spread out, and second because, okay, highways, and small streets are very narrow, and you need to manoeuvre, and it is narrow streets but then there's the cars parked so then it's just hard, so to go on the sidewalk, it's hard as well because it's like, you know (gestures up and down for uneven surface/driveways).

<And would you call yourself a cyclist?>

Not any more. I used to be. But not like not cyclist as per – it's a different understanding what is a cyclist, you know, if those guys who going there at 5 in the morning dressed in lycra, for their bike ride with other cyclists, you know, what would you call it, if I'm commuting am I a cyclist, so what it is, a cyclist? Somebody who is doing competitive mountain bike cycling, are we a cyclist? So many groups, so many perspectives.

<And where would you put yourself? Do you put yourself in a group?>

At the moment? No. No, just, yeah I got out of the cycling world and yeah I would like to, because I enjoy it, but…

<When you cycle, do you normally cycle alone, or in a group, or what do you prefer to do?>

Well in just commuting, usually I used to use bike as getting places, for commuting, so like if you're going alone you're going alone, if you're going with somebody you're going with somebody. But because now I don't do that, so…

<Okay. Jumping around a little bit, you said you were from [Europe], were you from a big city or…?>

I grew up in a small city, but then I moved to study, to big city and then I moved to capital, and then I moved out. And I lived in Holland for a while. There you can cycle.

<At what point was that?>

It's been a while ago. After my studies I lived there for a few years. And in UK we lived in a small town and I cycled because we didn't have a car. In Europe – oh, when I came to New Zealand, I didn't know how to drive. Yeah?

<Okay>

So basically I was that dependent on public transport and getting around on a bicycle, so I was absolutely – I didn't need that, there was no need, but then I came to New Zealand and you have to learn to drive.

<Okay. And was that when you were in Wellington?>

No. Here, in Auckland.

<How about because you came from overseas, and there being any difference in the road rules and the change in direction?>

No, it doesn't matter, because when we were travelling in other

country it was either right or left, with a bicycle you just get on the other side of the road and that's it (laughs).

<If we talk about all these barriers to your current situation, would you have a priority list of what's the worst, or what would be the one thing that might make a difference more than the others? Do you have an opinion on that?>

Well, probably the drivers' attitude. Even there are no bike lanes, but drivers' attitude is not they… paying attention to you as part of the traffic, if they would acknowledge you as part of the traffic then it is easier to get around. If they don't acknowledge you as part of the traffic, then you, you know, they don't notice you on purpose or by accident, because they're not used to paying attention to the cyclists.

So probably if the attitude would be friendlier towards cyclists it would be easier.

<And how could you tell that it's friendlier?>

They don't cut you off. They don't come really, really close to you, you know. Or if you need to… if you're cycling and there is a car parked, you need to go around you know, they don't cut you off, or they give you space, so that's the attitude, you know. So they see, it would be like they see you as another car, you know, so then they see another car and, like, overtaking, they will give them space, for bicycles they don't give space. So it's just that.

<What about taking the opposite view, is there anything that you make you, not make you, motivate you to cycle more in your current situation?>

I don't know. I stopped looking for the solutions because, you know, at the moment this is how it is, and let's just get on with it. Auckland is busy and basically traffic, everybody is moaning about horrible traffic, but, yeah, nothing is really done about it. It's like, okay so what do we do? We make our highways wider. People are moving less. There are research in other countries where people are actually commuting by public transport or by getting around by bicycles, obesity rate is lower. New Zealand doesn't care about that at all, we just make the highways wider. And yeah, and as well, transport prices. If you are looking at going, for example if you would live in Albany and you would go to the city okay it's a good ride and it's easy to get, but this costs I don't know now, about six

bucks, so just imagine going there and back, when it is easier for you to take a car and drive, you know, so the four of you if it's a family of four, what will you take? You will take a car, you will take a bus.

<So for you a lot of it is about Auckland.>

Well because I live here. Because this is the current situation. If you're looking in all New Zealand, the distances are so, so big. Will you really go from Auckland to, I don't know, to Whangarei by bike? I don't know. It's possible. I've done that, but, it is already travelling by bike and it's different. When you live, you… You either live or you travel. So we're talking about living and we are living in Auckland so that's why I'm talking about Auckland. Yeah. Just ask me if you want me to go in other directions. I'm just not sure what you're wanting to get out of me (laughs).

<I'm letting you guide the… How often do you use your car in a typical day? Say today or yesterday? Or move places.>

So it would be two or three times a day. Yeah. And I don't like it. Because it's ah.. In the beginning it was shop, but now I need to come to the gym. Previously I didn't need to go because… but commuting actually gives you the natural movement that you need. So when I came here and I stopped cycling and I stopped walking, yeah there is nowhere to walk, you need to drive everywhere, I don't like not being physically active. And so then you have to create that on top. So that's why here we go to the old leisure centre you know. So on the weekends we have to go on hikes. All day hikes just to get that physical activity you would normally, if you would be commuting, by bike, by walking, you would normally get in your daily routine and basically, yeah, you go when you want, but here you need, it's an extra…

<So that is new, the going for hikes?>

No I enjoy it of course, but on top, how to say that, that extra hit of physical activity that you need.

<Okay. And for cycling say you could catch a bus, and it goes exactly straight to the leisure centre, and there was a cycle route that goes straight to the leisure centre, what would you choose?>

I would cycle. Because it's fun, because you don't need to wait for a bus, you've just got a bike and you're more dependent on

yourself. And yeah you can if you can get somewhere by yourself why wouldn't you do that you know?

<Actually I've got an interesting question. So you moved to Auckland and you chose to live on the North Shore. How did you make that choice?>

Because my partner lives there, and our [workplace] is there. So, that's why, this is how it happened.

<So it started… But you moved to New Zealand with your partner?>

Oh it's complicated, sorry. (laughs, embarrassed).

<or with another partner>

It's complicated, sorry!

<Okay. So your partner already had the place. I thought you meant that you'd chosen to move to Auckland together.>

No, it's complicated life situation and yeah.

<Well that makes more sense. So [your workplace] was already there. It wasn't like you'd moved to Auckland and said alright >

I'm not sure I'd really do that you know, choose Auckland as a priority. It's a nice city but, it's not like, not a dream place.

<Because I was going to ask you why not live in the city rather than the Shore for example, because of the different facilities, or the distance between places.>

Yeah like it is different. But because our workplace is there… We were thinking of doing that, living in the city and commuting to the North Shore, because you go against the traffic again, but it's still commuting and it's still the same either way you go. And because in the city there is a parking problem, and if you need to park your car (laughs), Yeah. If you would have your bike, then it's no problem you know. Because it's easier to live in a different suburb and you can move around. And here, actually the first decision that you make, is that, is there parking? For example, we have a [workplace] in the North Shore and if we want to move it to central Auckland. But to rent the facilities it needs to have parking because otherwise it's takes half an hour driving around to find parking. It's everything about parking.

During the ride

Spoken

Physical

Another thing that I don't like. I don't like helmets.

Handling helmet, putting it on

Which side do you put it on?

(Asked her if she wears a helmet in NZ)

Well I tried not to.

Rolled up right leg of her jeans before getting on the bike. Adjusted the seat height.

I haven't been on a bike for so long (laughs). It's strange.

Did a short circle in the car park, as she turned she put her foot down.

<Is it similar to your bike?>

No. Mine is more like yours. It just has gears.

She puts the headphone in her ears. Asked if she was fine with talking while riding.

It's like a driving test.

<Is the bike okay?>

The bike is okay, yeah.

Oh, I remembered when I rode the last time. I went to Christchurch to do a course and instead of renting a car I rented a bike. I think it was really nice because I could get everywhere by bike. It costs the same.

Going through carpark. Very confident riding, but at slow speed. Went over speed bump, talking to me.

No speech. Negotiating carpark exit, was in front, turned out without indicating, following a car, around a bus.

Went fast down hill.

I never know what to do here.

Negotiating a parked car.

Cars went past.

Moved to centre to queue up with the right turning

traffic. Stopped at intersection.

Standing start up a hill. Confident. Going slow but confident on the main road. On left turn, checked for cars behind before turning.

Oh I'm in the wrong gear.

Changed up gears.

Nice! I miss that feeling!

<What's that?>

It's like flying slow!

There is a longer period where she does not speak. We reach a T- intersection, and wait behind a car for our turn. She is positioned confidently in the right side of the lane, waiting in the right turn queue.

On path, uphill.

Wo! I'm not sure how you are using these gears.

Stopped on steep hill.

Now I'm in a very high gear.

Struggling to get into the correct gear.

<Oh well, we can walk.>

No, we can go.

On hill. Tries to start again, but unable to get going without turning the pedal. Eventually starts smoothly.

That's a hill!

Still on the steep slope, stationary.

<You would have been fine if you had been in gear, I think.>

Yeah. It's just about getting used to it. Because if you, you have a momentum.

Oh we are back.

Pleasantly surprised tone of voice. We have circled back around to near the starting point, back to the road near community centre.

Exploring neighbourhood. That's another thing that's nice on a bike. You can explore small places that you wouldn't drive. Because on a bike you always look for shortcuts and then you can find nice places.

Immediately after the ride

<So do you apart from commuting, have you taken your bike out just for the fun of it?>

I planned, I planned and planned and I failed. (laughs)

<Do you like biking, actually?>

Yeah I love it! I love it but it just like, either one thing or the other. If I want to go with somebody, they even don't have a bike, then they need to rent a bike, then they need to book in advance. So talk about small things. Yeah I like riding.

<How did you find the cars in the roads, then?>

It's a short distance. Drivers, they were nice, because they were letting us pass, but it is not always happens, sometimes it does, sometimes it doesn't and you never know.

Well you know we drove from Kerikeri (?) to Wellington basically all of New Zealand…what happened basically is like, trucks are the worst. Especially the milk trucks. Even if you go on a quiet road. They will do it that way, but they will leave you in the dust, they will cut you off, and you need to get off a bike. And just every time if you see a big truck coming, it just, yeah. But it is riding outside of the city. When you see one, you think, yeah maybe you will get off.

… Because we were going slowly, I don't remember actually because it was a while ago. In New Zealand I find that you can go, if you go for longer periods of time you can go about 70km a day, confidently. Because there are countries where you can go 100, 110 km a day. But in NZ if you go continuously, I'm not talking you know - you can go 100ks in one day - but if you go every day it will be too much. Because it's very windy and hilly. Wind is your enemy. Because here there are hills because when you get on a very steep hill and then you want to go down the wind is blowing so hard that you're like pedaling. (laughs)…

In Auckland it's different but once you get into the country it's different… Maybe we were just unlucky going in the wrong direction!

<How do you feel now?>

Good! Yeah.

<Even though it wasn't your bike?>

This is an okay bike I just didn't know how to – I didn't see this

(indicates the other gear lever). Usually with this clip you go up and down on the bikes that I rode so that's why I didn't drop a gear (laughs) – in front of a hill! It was an epic failure.

<But you didn't change before then. You didn't change gear>

I was putting it up because we were going down a hill and I couldn't pedal, so I figured out how to do it up, and I knew how to put this one down, but then I was expecting that you can just drop it, and I was dropping it and I was going up, and up and up and up (laughs). I was going the wrong way! And when I got to that hill I was like, (looks at chain/derailleur) oh my God (laughs). Well you are used to that (*indicates my bike with no gears*).

Talking about Glenfield Rd:

It's like the usual North Shore situation, it's like cars parked. And there are two lanes. Yeah there is a bus stop as well. There are a few bus stops because it's like a town centre.

With a bike it's easier to direct it because you can stop quickly… you can stop and basically just get off the road faster. And you can start off faster, like from the crossing [intersection]. The cars will overtake you but you will can get off from their path faster.

I just don't like it because there is no…like Sunset Rd? So basically this is like this road yeah (*indicates Bentley Rd)* this is like Sunset Rd, this is where it gets to work. Basically the cars are parked and sometimes when you are overtaking the cars parked, in a car, so

basically you need to cross the mid lane. So if a bicycle is in between there and a car is coming in front [in the opposite direction], the car will cross to be very close to you in that moment … So when I'm driving every day I'm looking, you know, how will it be here to ride the bike, after seeing so much space, when the cars are like (indicates tiny gap).

…But it's not like the place to go for cycling.

It's not like where people commute. It will be more like people who cycle for exercise.

On a bike you always go on the small roads and cutting off corners, because it's the nature of it. Because it is safer, usually, and it is faster. But if there's a straight road, then why would you go down around some weird pathways? You just go straight.

<Do buses scare you or are you okay with them?>

Yeah, buses are scary. Because they… Even with a car when you drive, when they come off from their bus stop they don't look and they will cut off you, so imagine if you are on a bike, yeah, in the middle of a bus while it is taking off. It happened to me. Well what do you do, you get off! You don't speed up because it goes. My friend she was stuck between two buses in the CBD. It was Britomart, that place where it used to be many buses. And one bus was parked and it started moving and another bus was going and she was in between them. And they were coming closer and closer, closer to each other. After that she stopped biking.

Appendix E Transcript 3 'Jess'

The name is a pseudonym and identifying information has been redacted.

Location: Grafton

Recording device: GoPro camera, iPhone smartphone with earphones/microphone.

Pre-ride

Because I'm self-employed most of my daily life doesn't involve going to and from work. It's kind of normally out and about quite a lot more, which could be going to meetings which could be all over Auckland. So a lot of my transport I rely on is obviously cars, and the biggest problem I have is public parking. Because obviously a lot of meetings I have are in Auckland central, and a lot of the parking is quite cost-prohibitive if you're doing it on a daily basis.

<When you organize your day do you think a little bit about your transport?>

I do because where I'm living in Remuera is so close to the Remuera train station which is obviously one stop to Britomart. So if I know I can make a day out of going to the city and making meetings, or maybe working remotely from the city, I'll get the train in, which will mean I don't have to park, I don't have to worry about traffic and it's super close, for me it's like a ten-minute walk down to the train station to then get on there and go to Britomart. So I do think about it a little bit, and more so from the fact of drive time, so how long do I have to leave to get to a meeting on time. That's probably the biggest consideration.

<So have you caught the train in the last month?>

Yeah. Yeah. Oh the last time was to go down to catch the ferry, so to go down to the viaduct. So yeah obviously the trains often are quite inconsistent. I don't check what times the trains are. I just go, and kind of have an expectation that there's a train within five minutes of me getting to the station that will go. And then obviously because it's only the single stop, hoping there's not too many delays, which actually every time I catch it, there's always delays.

<What do you mean by that?>

I think there's too many trains for what Britomart can handle. So quite often when you come past Parnell you sit there, until I'm guessing another train leaves the station so that our train can go in. So I've never been – I don't think I've ever caught the train where it's just been a straight ride there, without having to stop and wait. Yeah.

<How does that compare to say, driving in?>

I mean the train's easier, it's just means that when you're there you can't quickly go and do something else. So if I needed to then, you know, want to leave early or something, then I'd have to rely on the train to get me home again. Or the other thing I'd quite often do is take the train into the city and then use the bus to get home, because the bus actually is, if I have, obviously if I go home I don't have to rush home for some specific time, I can just get the bus home and it drops me off even closer to where I live. So it's probably more convenient (smiles) but the train somehow seems a bit easier than a bus.

<So you haven't done it the other way around?>

Not since I was at university. When I was at university I'd be taking the bus every day to get to uni.

<What changed?>

Moved to China. Nah having a car. Once I left university I had a car so I drove to work. Really when I graduated I worked close to uni. I probably could have cycled but because in Remuera there's a lot of steep hills, and I've kind of always felt that if I cycled to work I'd need a shower by the time I got to work. And that was kind of always the put off for either walking, or cycling, or running to get to work. So I drove. And there was no real bus or public transport routes to where I worked. From home.

<Where were you working?>

Down in [redacted] Road. So there was nothing that was going to take me from Remuera to kind of St Georges Bay without having to drop me off in say Parnell, and still having to walking down the hill. Which was a laziness factor maybe (laughs) but parking was free, you know driving to work wouldn't cost you that much in petrol. I find bus transport to be kind of expensive, paying four bucks a trip. You know how much petrol's going to cost for a trip, you know less than five-minute drive. So. Laziness (laughs).

<So was that actually in your consideration set?>

No. No definitely not to get public transport. I would have considered it, because obviously being quite active I obviously considered it. I've never been a big cyclist, but I would have considered maybe running to work, but work had no showers, or changing facilities. I would have then still had to carry a lot of clothing and stuff with me to then get changed. And that kind of puts you off and it becomes too hard, and you don't really worry about it.

<So that was before you went away?>

Yes.

<And now you're back, your situation is similar, or different?>

I guess obviously living in China, I guess when I first I was pretty dependent on public transport, which was obviously metros, you take a lot of taxis. The more confident I got on the streets there I then moved to push bike, so I would cycle quite a lot. And then, after that I got a scooter. Because obviously I was working further away from where I was living. So it kind of would have taken me too long to cycle every day. It would have been an hour there, an hour home. And in the middle of summer you're not going to do that. And same thing, there's no changing facilities, no showers, so it's easier to go onto an electric scooter to get to work.

I think I would probably consider using say e-bikes or push bikes here if, one if it was flatter, and if there were more facilities to make that easier. Like obviously the landscape sometimes makes it difficult, in Auckland with the hills and stuff, so you'd have to have a reasonable level of fitness. For me I know I'd be someone who'd want to shower after I did it so it would need to be somewhere - if I could shower the other end it would probably make it a lot more desirable. And then just things like parking, like, where do you park the bike, is it going to be safe, I have to wear a helmet, so that's going to ki- you know, for girls, considerations of what you're going to wear, what your hair's going to do, and then if the bike breaks and things like that, you know if the wheel, tyre bursts, how am I going to get it fixed, where do I have to go, I might have to carry my bike somewhere to sort that out, you know. It's just I feel like things like that aren't that easy here. And then there's the cost as well. The cost of bikes is so much higher. The cost of probably getting them fixed is so much higher. The maintenance of it would be, also, a little bit more expensive.

<What made you choose to get a bike in China?>

Mmm. It was definitely cheap. Price is one of them. It's so flat there that it's just so much easier to… I mean there's bike lanes so rather than sitting in traffic I could just cycle down the bike lane. There wasn't, there's not so much restrictions. Everyone cycles, so it's really accessible, you know you're not kind of fighting traffic that's not used to cyclists. It's part of the culture and the psyche that cycles came first, you know, cars very much come second. So you're seen on the road a lot more. You don't wear any safety protective gear in China as well so everyone's kind of a lot more aware of what their surroundings are, and it kind of works a lot better traffic-wise. That's the other thing about Auckland. I don't think Auckland drivers are particularly that good. I find them quite aggressive. It would be a big… I would be more worried getting

knocked off my bike here than I would in China. So you know that's kind of saying something. Next question (laughs).

<Did you have those kind of thoughts before you got the bike in China? Did you buy a bike in China?>

Yeah. It cost me about, less than $40 NZ to buy a bike. They don't come with gears. You don't need gears. They're kind of quite often the old-school bikes with a basket to go – and you don't have a car – so to go and do grocery shopping having a basket on the front is a massive help because obviously you can put shopping, food and things to take in it. I think yeah. And my friends all bought bikes. And it was something we'd do in the weekend, we'd all go off to a pub, or a park, or something like that, and we'd all ride our bikes kind of together. So again it was like part of a friend's circle…

<So your friends all bought their bikes first?>

Um, we kind of all lived in the same area. One of our friends bought one first, and we all thought they were pretty cool and so we all bought them. The quality of them wasn't great. They're certainly not, like you certainly noticed they rust quite a lot. A friend's pedals fell off and stuff but you know it's so cheap you'd kind of just buy another one. You'd spend maybe twenty bucks more and then buy a better one next time. And then it kind of shifted from there, obviously, with weather conditions and the heat and stuff, um, and the shift in the expat culture. It went from being used to ride bikes to now a lot of expats will have scooters, because people were feeling more confident, expats wouldn't be pulled up riding them. You wouldn't be targeted as much as maybe you might have used to have been.

<What do you mean by that?>

It used to be that expats were seen as a dollar sign and if you know if you hit an expat then maybe they'd pay you, so they'd hit you, so they'd kind of do it for monetary payout. So… used to be kind of targeted in some ways.

<Say that again?>

So because you were an expat you'd be perceived to have more money and so what would happen is that sometimes people would hit you, or walk in front of you, or something like that, because then they're like if they hit me, then they'll pay me money. So they saw it as a kind of payout kind of thing.

<Because you're at fault?>

Well, it wouldn't matter if you're at fault or not, you had the right-coloured skin and the perception is white people, or expats, were rich. And so expat would pay. Because it was going to be less hassle for them to argue in Chinese with the policemen and the community gathering around them, to just pay some money and go.

<Did you ever have a direct experience of that?>

No, but I had it in taxis. I mean one time it was definitely like, my friend was getting out of the car and he basically didn't look and he opened his door and the girl basically cycled straight into the door. So that was definitely his fault, he should have looked. But you know, she just wanted more and more money you know, it wasn't that she was hurt or anything, it was just she wanted the money. She was like more, more, more. And I've had friends that have been in cars, that the taxi has got into an accident, obviously nothing to do with them and they've been the one having to pay, so just having to get out and walk off before a crowd can gather because you're never going to win in that sort of situation. And then the other consideration for bikes and scooters is that they get stolen, a lot, so you didn't want to spend a lot of money on them because if you had a good looking bike it would quite often get stolen. And the same for scooters as well. So people would not spend as much. Or they'd do things to make them not look as nice, like wrap tape around the brand or something like that, that might make them look a little bit less desirable for people to steal them.

<What made you move from bikes to scooters?>

It was the ease. The bikes there was two of us often going places, so it got to the point that we were like doubling up on a push bike, and I think from that it was like well rather than having two bikes constantly to park and everything, we'll just get a scooter and then we'll share the shooter. So it was kind of an ease thing. And I started working further away from where I was living. So it saved so much money. Apart from maybe pumping up the tyres which maybe cost twenty cents, or maybe fixing a lamp when it off at the front, like it cost nothing apart from what you paid for it. Like you don't pay, like you might pay to charge the bike it you get stuck somewhere when you need to use it, like a little meter on the wall. But it just cost nothing. Like taxis, you'd be paying ten bucks a day, say, to get to and from work, so you work that out you'd be paying five days a week for a couple of years, that scooter's paid for itself.

<And then coming back to New Zealand, did you make any conscious decisions about transport?>

Well, at the moment I'm car sharing with the family. And part of

that decision was because one, I wasn't sure if I was going to stay in Auckland, I didn't want to commit to buying a car and then having all the costs associated with it, and then having to park it, if I was going to stay in Auckland. Two, if I was going to look quite seriously at getting a scooter or a bike here, but as I said, the drivers here in Auckland would seriously put me off that. So it was really a matter of, waiting to see what I would do next, and I was like functionally do I need a car that's big and can take a surfboard or do I just need something that can get me around the city. Or if I was living more central like do I need a car? It's a big thing. If I was working in the city and actually living in the city, do I actually need a vehicle or could I just rely on public transport, Ubers, you know things like that.

<And how are you finding it so far?>

It's all right. It's up and down. I'm find the traffic here is worse than I remembered. I always kind of think that if I could get somewhere before 3 or 4 in the afternoon then I'd be fine, but now it's probably like after 2 o'clock that traffic gets bad. And you know it's just, that totally puts you off driving in Auckland, it's just like how bad the traffic is. Even if, just living centrally you can't go anywhere without it taking at least half an hour, you know. So it's just constantly having to factor in that traffic, time cost.

<How long have you been back?>

Two and a half months.

<Oh okay, quite recent then.>

Yeah.

<What about, you've mentioned quite a lot about travelling for work, what about other travelling that you do around the city?>

So I travel quite a bit for sport. I go to a gym in Newmarket so I quite often walk to and from the gym. It's maybe a twenty-minute walk from home to the gym. But obviously if I drive there they've got quite a lot of free car parking at the gym so that makes it quite easy. My other travel is all kind of sport related. So where I play Gaelic football is West Auckland. So our training is all the right out at Oratia, so it could be forty minutes plus to get out there for a 7 o'clock training. And then we play by the zoo at Western Springs there, so both of them I would have no idea how to get there other than by driving there (laughs). And they're both far enough away that getting there by other means would be quite tough. Like even if I had a scooter or something, driving out to Oratia would take a

long time. And I probably wouldn't do it. So where I can I do like to try to walk or run there if it's for exercise. Otherwise I would probably just drive.

<And for those two places that you just mentioned there, is that just you driving, by yourself?>

Yeah. Yeah, not many of my teammates - most of them live in West Auckland. So they're all a lot more accessible to then train and play. There's only like a couple others who live like in Onehunga or something, but none of us live close enough to car pool. Yeah.

<So what would you say is – It's quite difficult not to have an agenda, but I'm trying not to have an agenda when I'm doing this – why would you not just keep using the car? What would push you to not use the car?>

One if I lived somewhere that didn't have parking. So if I lived in the city, and if I moved into an apartment, then quite often car parks are additional, and that would be, you know if I didn't need the car, if I could get to sports trainings via friends or Uber or something, then I wouldn't need one. But to be honest I think it's about freedom. if you don't have the car I feel like you kind of feel trapped and like in China, you know, not having a car, you couldn't just pack up and go somewhere. I think in New Zealand especially for summer in our culture, on the weekends we do weekend trips. And I would, I don't think I would personally like the feeling of having to really on other people, or have to depend on their timelines. I would quite like the freedom to just be able to pack my own car, and go when I am ready, and go where I want to go, with whoever wants to come, and just be able to make that sort of decision. And that's what I've really felt not having my own car, even coming back, is still feeling that sense of not having my own freedom, and just depending on other people. I don't like to depend on other people. I like to do things on my own steam. So there would have to be a big reason not to have a car. It would have to be work, living related, or too much additional cost that I wouldn't be able to justify it.

<And do you have a bike?>

Um, my parents have just given it away to the Salvation Army! (laughs) It was collecting dust in the garage, basically.

<Was it rideable?>

It would have needed its tyres changed. The tyres were basically all shot, the rubber was all gone. It was good enough, it was a

mountain bike.

<It was the right size?>

Yeah. Oh it might have been a little bit small now. But It would have been okay to ride. And I rode bikes a lot as a kid. We had a beach house up north and that was how you'd go to see your friends; it was on a bike. It was just not really something that's kind of stuck with me since spending more time in Auckland.

<Thinking in general, when would you love riding a bike?>

I love riding a bike in a new location. So if I was on holiday somewhere, and I wanted to go along the beach or go around town or something like that, I guess for more of a tourism kind of reason, I would definitely hire a bike. It's something I've done quite a lot when I travel. Cos it's a good way of seeing the city. I feel like you're a lot more engaged with the city. Often places where you can hire bikes have quite good bike routes, and give you quite detailed maps and guides as to how to get around. That would be probably now, when I would enjoy riding bikes. Definitely. I don't think I would use it for a day to day functionality kind of thing. And I think part of that is laziness, you know it's not part of my psyche, it's not something that would come to the front of mind you know "I should cycle there". (laughs)

Yeah. Probably looking for the difference between "I should" and "I want" to cycle.

Yeah I should. But then I'm like, the cost. My friends who have road bikes, I know how much they paid for their bikes, and I don't really want to spend a grand on a bike that I'll probably use, knowing me, for a month, and then it will sit in the garage and collect dust. You know. That's what I think. It's like joining a new gym that you know is expensive and super cool, and then not going after three months, and you're still paying for it. I'm now trying to be wiser with my decisions and purchases, that I know I'm not going to use for a long period of time.

<Okay. Do you have quite a lot of friends that use their bikes?>

I'm not sure I know anyone that cycles.

<So those ones that have a bike?>

I have some friends that would do... I have friends that are getting into road biking and stuff. But I don't think they'd use it on a daily-they use it to go on rides on the weekends or they use it to go to Woodhill and do mountain biking. I don't know anyone that rides a

bike to work on a daily basis.

<Where else, you mentioned the gym. Where else do you go locally?>

I come here [to the Domain] for the soccer. I have quite a lot of meetings in Greenlane, Remuera, Newmarket. Then you get further into Ponsonby, Grey Lynn, the city centre. So everything I do is fairly central. There's not a lot of time that I'm travelling. There's not a lot of times I'm using the motorway or something other than just to get on, and get off again in the city.

<I think that's good enough now, we could probably go for a ride.>

During the ride

Spoken

> *Physical*
>
> *Slight drizzle.*

She said, in a mock dramatic voice, "I feel like a child again!"

> *Said this while I was explaining about the ride, and she was sitting on the bike. I said I wanted her to talk while walking, talk about what you're thinking as you're riding, how you're feeling.*
>
> *Looks down at camera*

Ok now what have you done! *Adjusts camera.* Oh now it's all right now.

> *She's smiling.*

Oh!

> *Gear makes cracking sound*
>
> *I ask if she is fine with changing the gears.*

Yeah.

> *Smiling*

Oh. There we go.

> *Looks down at gears, changes gear, twice in very quick succession. Gear cracks noisily into place.*

It's just like my bike I had as a kid. I'll follow you.

> *Cycling at a slow pace.*

Wheee! It's a pity about the rain.

> *We go down a slight downhill slope.*

She is squinting slightly.

Huh? Are we going up here?

<No, no, straight. Past the portaloos, then turn left up the hill, then at the top turn left.>

> *The chain on her bike creaks as we go along, on a slight incline. I can hear it, and she is pedalling slowly. I ask about the gear, and if she wants to be in a different gear.*

Ok.

<How's that? How's the bike?>

It's good. I love riding bikes, I do.

Still smiling. She is still squinting against rain.

But for fun, I think.

<For fun. When was the last time you rode a bike?>

Um.. probably before I left in China.

> *Looking around as she talks, going at a slow pace up the hill.*

<Before you left China?>

Yeah. Well, while I was still in China. I hadn't ridden one since I've come back. I did contemplate when my parents were giving my bike away, at home, keeping it and getting it redone. It was literally the bike I'd had as a child.

> *Alternating between slow pedalling and coasting, continuing to glance around to continue the conversation.*
>
> *There are no cars around (still in the no cars area).*

<What made you not keep it?>

Well because I saw the tyres and, to replace the tyres it's probably a bit small for me now like as an adult. Kind of didn't really be bothered.

<Left and left.>

Ooh. Struggles up hill. Look forward. Car.

> *Joining section of road with cars.*

Am I too slow? Heeh.

> *Stops talking, negotiates intersection, puts in effort to start hill climb.*

How's that?

Yeah.

> *Looking around more.*
>
> *A car passes, but she keeps looking forward and doesn't give any outward sign of having noticed it. The car is moving at the correct speed for the area (around 30km/hr).*

I always think cycling's the best, as well, for like sports rehabilitation.

<Oh yeah?>

> *Using leg muscles to gain momentum up the hill.*

Like I've always had quite bad knees, from just playing so much sport. So I just think like it's the best thing to like strengthen your leg muscles and stuff.

> *Approaching intersection, looks left and right, pauses talking.*

<Go left here into the bus lane.>

> *Car noise. Joining the bus lane now. Still not talking.*

Rar! Those gears are like, I can't get them to change.

> *Changes gear.*
>
> *Changes gear again.*
>
> *Stands up on pedals, looks around to me as she comments. Sits down again, looks down and changes gear.*
>
> *Looking around a lot, scanning ahead. Serious face.*

Huh?

<Go left here.>

Ok.

> *Approaching intersection, cars idling at the lights. Seems physically tense, concentrating, and doesn't hear me so well over the noise of the cars idling.*

Woo! There, it changed.

> *Gear changes noisily. She looks down at the gears.*
>
> *Turns the corner and enters the bike lane, which is the beginning of a downhill section.*

And our first bike lane.

> *(Said in a slightly "finally/at last" cynical tone)*

If I could do this the whole ride, sit here and not have to cycle, I'd do this every day.

> *Going downhill, inside the bike lane, separated from traffic.*
>
> *Seems to relax physically and goes faster, in front of me.*
>
> *Glances left at points to see what's ahead. Sniffs (it's lightly raining).*
>
> *Brakes, and turns left. I catch up to her around the corner.*

Woo! I was talking to the camera. I was like, if I could do this, just cycle, and not have to pedal, I'd do it every day.

> *Smiles, slightly puffed. Completely relaxed now.*

Even still doing that, I felt like, I didn't feel safe.

> *Still cycling, now back in the park, going along a shared space with a lot of parked cars.*

<Yeah what was it?>

I don't know. It just, it feels different. Like I feel like the road is just so much more exposed, when you cycle.

<At what moment was that?>

Like along the top bit there.

> *She indicates with her arm. Comfortable with one hand guiding handlebars.*

And you're in the bus lane and knowing that a massive bus will come right like up against your shoulder when they go past you. That's kind of real off-putting, to me. Nothing worse than getting a massive fright, and having something really close to you. (Coughs) Huh?

<Did you have a look around a bit?>

> *Uses hand to make small gestures while talking.*

I think, from after riding in China, my awareness is a lot more on. Even when I drive now, I'm constantly looking, I'm constantly trying to be aware of what's around me. Because basically in China people only look at what's in front of them.

> *Seems unconcerned by the parked cars.*

They don't look in their rear-view mirror, they don't turn their head when they turn a corner. It's just like I'm coming, you watch out for me.

> *Continues talking as she stands on the pedals to go up the incline.*

So it makes you so much more aware, because obviously you don't want to be hit and have to go into hospital in China or whatever, and kind of have to worry about that. So. And I feel like you're kind of forced to become a much more aware driver.

<What about as a pedestrian?>

Same again, like, even if your green's on the road, like on the crossing, you don't have the right of way. So you're having to look when you're crossing at a pedestrian, or at an intersection. Even if you think you have right of way you don't so you're always looking.

> *Dismounts. (Conversation continues)*

Immediately after the ride

<So does that mean because it's more dangerous you feel safer?>

I think you just look more, you're more aware. You make more of an effort to stop, and be like, cars coming, bikes coming, no. Whereas like here, people think oh the green light's on, I'm going to cross the road, and then a car comes around a car and hits them, or, you know, almost hits them. Then it's just like well who's fault is it? (takes off helmet)

<So in that ride there, you mentioned that the bus lane was a bit gnarly, and that you liked the downhill bit better.>

Because even just having the little concrete bits, you feel so much more safer. You feel like that's your zone, and you don't feel like anything can come in and hit you from it, you know. Like even about the other day you hear about the two people who were walking along at Remuera and Shore Rd and got hit by a car and one of them died, you know it's like, you should feel safe, being a pedestrian or being on a bike or something. And I don't think if you do, then why would you want to do it? So putting up those little barrier things, that's a pretty low cost, minimal barrier kind of solution that would give people.

<What about this hill?> (I ask her about the first part of the trip, up the hill in the Domain).

I don't feel too bad because I feel like people would be driving slower because it's through the Domain. And I think they have slower speed limits through there, right, so I don't feel like people

should be speeding as much. Yeah.

<Because if we think about that specific trip that you just did, that was the only moment cars came near you. Did you notice that?>

Yeah I did. That's why I thought if the bus came, I was like, I'm in a bus lane, I'm in their territory. But along here like traffic I don't think is pretty stationary. I mean it doesn't bother me, it's not like I would ride and be a nervous wreck, I would still be riding as fast, as I could, but I just know that, you felt more comfortable on an empty street or, you know, if you have a zone that is kind of your zone to ride in. It's like being a pedestrian, you don't want to be walking on the street. You have a designated area that you should be safe on. Yeah.

<And would you consider yourself a risk taker or anything like that?>

When I drive?

<Just in general actually.>

I think I'm quite an aggressive driver. I think I drive too fast. And I like to drive fast. I don't think I'm a dangerous driver. I certainly don't tailgate people or anything like that. In terms of being a risk taker? I wouldn't say I am, probably. I'd say I'm a bit more conservative, like I wouldn't go bungy-jumping or sky-diving, but I do like to do things that I feel like I can go fast in. I don't like the feeling of falling. So I love like the Shotover jet. Like I love that, it's so much fun. Whereas bungy-jumping, no I don't like falling.

<That's very specific.>

Very deep isn't it. I only really realised this recently because I could never place my finger on why I didn't like flying. And like I've had a few bad flights where I really thought it wasn't going to end well for us and I was like what was the sensation I don't like, because it's not the turbulence. It's the sensation of that weightlessness and the kind of sensation of falling I don't like.

<Okay. So what about a bike?>

No but you're kind of going forwards, like you're moving in a horizontal direction, and I love it. Like I would always drive my scooter as fast as I could safely. You know. I think that when it's just you, you can feel more reckless, whereas when you've got passengers and stuff you kind of have that sense of responsibility and I have to slow it down if it's not me, not just me in the car that I'm responsible for.

<We may as well start walking.> (On the way to the car)

Or we could start cycling.

I'm not going to get pinged if I just cycle slowly without the helmet. Oh well, I may as well put it on. It's Auckland.

<You're very good.>

I've been seeing all this stuff on Facebook and everything about people not cycling with helmets anymore. Is there a new movement?

<Oh it's very small... I'm one of them.>

Oh was it you maybe that posted it? Probably!

Do people get pulled over often for not wearing helmets? I think if…

<I got pulled over the other day>

Once by someone in a car?

<No by a police officer.>

What's your excuse? What's your reasoning?

<Oh I didn't say it. He asked where's your helmet? I said I don't have it. And he goes 'well where is it then?' I actually don't – these [helmets] are borrowed.>

I mean I never wore a helmet in China, but every time I rode my bike, or my scooter, my biggest thought was, if I crash, one, my family never knew I had the scooter, so I thought one, it would be a

bit of a shock for them to get a call that I'd been hit on a scooter that they didn't know I'd had, and two if I wasn't wearing a helmet your chances of survival are a lot lower. But did it make me wear one, no. So yeah. And the chances of me getting hit are still very high, especially in China, or anywhere I guess. I had a helmet. I bought a helmet. Just never wore it.

<Oh okay. Did you have any near misses or anything like that?>

Yeah. The scooter. I was a passenger one time on a bike, and a car pulled out of a driveway and we basically went straight into the side of it. And I wasn't really paying much attention, being the passenger, and cut my hand open on the rear view mirror. So that was probably the worst. But like I had times where I was just going down the road, not even fast, and I had cars come and hit the back of the bike, just come around the corner and just didn't want to stop, didn't want to slow down, didn't knock me off the bike, but they broke the taillight. So just a couple of things like that, that I was like, okay. And it's kind of the attitude there is that the biggest vehicle wins. So buses drive very fast. Cars always think they have the right of way. Pedestrians and cyclists are pretty much the lowest in the food chain.

<Is there something wrong with your bike?>

Oh yeah sorry. If this clicks in, it just like, starts rubbing. It was just this jamming in a couple of times.

<Oh it's the front brake.>

Yeah, this button, like if I push it, and it just clicks.

Appendix F: Innovation Sourcebook

Key	Manual Tags	Date	What	Note	Source (type)	Author/Company	URL
Bicycle Accessory	bicycle lighting; safety	2008	Monkey light bike lights	LED designs and patterns for wheels. Be seen with our amazing bicycle wheel lights. Make your bike rides safer and more fun. Made in California.	blogPost	Monkey Light Bike Lights	http://www.monkeylectric.com/
Bicycle Accessory	bicycle lighting; safety	2011	Revolights bicycle lighting system. The future of bicycle safety.	Revolights are the FIRST and ONLY bicycle lighting system that provides complete 360° visibility (legal headlight, functional brake light & side visibility).	webpage	Revolights	https://revolights.com/
Bicycle Accessory	bicycle lock	2011	Lightweight bike lock	titanium bike lock	TiGr lock	Our lightweight bike lock is made from titanium, both elegant in style & secure. Hand crafted in the USA. All TiGr® Locks are ART® certified.	webpage	TiGr	https://tigrlock.com/
Bicycle Accessory	lighting; safety; textile technology	2013	Accessories: baskets, LED lights, bells	A considerable number of designers today are working to transform the bicycle into a fashion statement. A bicyclist's new look is not only about clothing, it's also about the type of bike you choose to ride and how it is accessorized. Recognizing that you want to tailor your bike to match your personal look and styling, many companies are selling accessories that will upgrade your bicycle: from special bells, baskets in a panoply of shapes and colors, seat covers and even a box of LED lights that attaches to the wheels and creates a colorful display of graphic designs.	magazineArticle	Gvily, Elinor	http://www.dmh.org.il/magazine/magazine.aspx?IssuesId=12&id=205
Bicycle Accessory	storage	2014	Clug: simple bike storage		blogPost	Clug	http://getclug.com/
Bicycle Accessory	bicycle lighting; safety	2014	Bicycle HD camera and bicycle light combos	Cycliq has produced the world's first combined bicycle light and camera! The HD bike camera and bike light have up to 10 hours of battery life. Buy online!	webpage	Cycliq	https://cycliq.com/
Bicycle Accessory	apps; cycling; UI; navigation; IoT	2015	UX/UI design for paired bicycle app & wearable device	HUB is mobile application that connects cyclists and small business owners with local government to move bicycle infrastructure forward.	webpage	Bartley-Matthews, Jessamine	http://www.jessaminebartleymatthews.com/hubapp/
Bicycle Accessory	bicycle lighting; safety	2015	Laserlight	The Laserlight forward projection technology combines a white light and laser image to beam out of blind spots, junctions and situations where you're unseen	webpage	Blaze	https://blaze.cc/laserlight/
Bicycle Accessory	IoT; signalling	2015	smrtGRiPS - world's first connected bike grips	Put the future of cycling in your hands. Uses haptic vibration notifications in handlebars for eyes-free navigation. Bike tracking/locator., connected app.	webpage	Boréal Bikes	http://smrtgrips.com/
Bicycle Accessory	bicycle accessories;	2015	This smart bike navigation gadget relies on a slick ambient UI	The SmartHalo looks dead simple on its surface, which is precisely how a navigation tool should be.	webpage	Budds, Diana	http://www.fastcodesign.com/3050637/this-smart-bike-navigation-gadget-relies-on-a-slick-ambient-ui
Bicycle Accessory	IoT; navigation; locking; data tracking	2015	COBI sets	World's Smartest Connected Biking System.	webpage	COBI	https://get.cobi.bike/us_en/
Bicycle Accessory	bicycle lighting; safety	2015	Review: Blaze bike light uses a laser to keep cyclists safer	The Blaze Laserlight is designed to let motorists know that a bike is approaching, by laser-projecting an image of a bicycle onto the road in front of the rider. We recently had a chance to try it out for ourselves.	webpage	Coxworth, Ben	http://www.gizmag.com/blaze-bicycle-headlight-review/40555/
Bicycle Accessory	IoT; navigation; data tracking; app	2015	Brompton – an IoT sensor platform for smarter city cycling apps	Discover how EVRYTHNG's IoT Smart Products Platform transforms a Brompton bicycle into an IoT sensor platform for smarter city cycling, with the help of a ThingSee sensor pack.	videoRecording	EVRYTHNG	https://www.youtube.com/watch?time_continue=269&v=tifEeG1oW70
Bicycle Accessory	haptic; interface design; UI	2015	Zero UI — the future of interfaces	Zero UI is the concept of having a more seamless interaction with technology.	webpage	Palermo, Jenna	http://sixrevisions.com/user-interface/zero-ui/
Bicycle Accessory	IoT; navigation; locking; data tracking;	2016	COBI connected bike system overview (smartphone integration, GPS navigation, advanced lighting)	Electric bike with the integrated COBI system (the integrated phone bracket, front and rear lights and control pad). COBI is a modular system that is built around a smartphone mount, biking app, navigation and weather, ambisense lighting system for safety and security with audible alerts. What does COBI stand for? It stands for Connected Biking. The system can be navigated with touch screen but includes an independent button pad so you can use it without taking your hands off the bar. The goal is to make your ride as intuitive as possible and de-clutter your handlebars.	videoRecording	ElectricBikeReview.com	https://www.youtube.com/watch?v=osjM0ALHa2w
Bicycle Accessory	bicycle bell	2016	Bicycle bell brings innovation to one of the oldest designs	Bike accessory brand Knog takes the challenge head on and has successfully created a much sexier bike bell called the Oi	blogPost	Pena, Azalea	http://www.psfk.com/2016/03/bicycle-bell-innovation-knog.html
Bicycle Accessory	IoT; data tracking	2017	ByCycling - automatic cycling tracker	Cash by cycling. ByCycling is an automatic Day-to-Day cycling tracker that helps you to be active every day, rewarding your effort and encourages you to compete with your colleagues and friends. Hit a daily 5 km goal to stay fit and healthy and earn cash or extra days off paid by your organization's incentives program. The app automatically tracks rides using built-in GPS and recognizes trips as bike commutes if they begin or end at the workplace. That way, employers won't be on the hook for employees' grocery shopping, socializing and wild weekend rides. To be eligible for the rewards, the rider must also travel between 10 and 30 kilometres per hour.	webpage	ByCycling	http://cashbycycling.com/
Bicycle Design	ebike	2009	Copenhagen wheel project	Smart, responsive and elegant, the Copenhagen Wheel is a new emblem for urban mobility. It transforms ordinary bicycles quickly into hybrid e-bikes that also function as mobile sensing units. The Copenhagen Wheel allows you to capture the energy dissipated while cycling and braking and save it for when you need a bit of a boost. It also maps pollution levels, traffic congestion, and road conditions in real-time.	webpage	Senseable City Lab	http://senseable.mit.edu/copenhagenwheel/
Bicycle Design	ebike	2010	FlyKly - your next smart move	Smart Wheel that adds an electric hub to your bicycle.	webpage	FlyKly	http://flykly.com/en/
Bicycle Design	3D printing	2012	ETT industries	3d printable parts for e-bike and motorbike frames.	blogPost	ETT Industries	http://ettindustries.com/
Bicycle Design	ebike	2012	Top 10	electricbike.com	The best of everything related to electric bikes and ebikes.	webpage	Hicks, Eric; Roberts, Ronald	https://www.electricbike.com/category/top10/

Category	Keywords	Year	Title	Description	Type	Author	URL
Bicycle Design	IoT; connected bicycle; navigation; cor	2012	BikeBorg	Most futuristic bicycle concepts concentrate on the bike itself but not the interaction between the bike & it's rider. This BikeBorg concept is a result of an investigation into the possibilities and challenges of a bicycle-human hybrid. Copenhagen Institute of Interaction Design »	webpage	Matsui, Hideaki; Nip, Andrew; Schmeiduch, Markus	http://ciid.dk/education/portfolio/idp12/courses/performative-design/projects/bikeborg/
Bicycle Design	folding bicycle	2013	Andrew Ritchie at iFest'08	The Brompton bicycle which folds easily and quickly into a highly-compact and portable package.	videoRecording	Infonomia	https://www.youtube.com/watch?v=-fhcR4pOx4
Bicycle Design	IoT; navigation; locking; data tracking	2014	This is why you should be excited for the 'Internet of bikes'	You can't really get lost on this super connected GPS-enabled bike, which also tallies calories burned and other stats.	webpage	Shandrow, Kim Lachance	https://www.entrepreneur.com/article/233931
Bicycle Design	ebike; IoT	2014	Vanhawks	The Vanhawks Valour is the safer, smarter solution for the urban commute. A sleek carbon fibre bicycle with built-in GPS and blindspot detection. Get on and get riding.	webpage	Vanhawks	http://www.vanhawks.com
Bicycle Design	ebike	2014	Race bike vivax forza CF with electric motor vivax assist	The world's leightweight E-Bike kit. Weight 1.8 kg. Hidden in the bike's seat tube. For race, MTB, Trekking.	videoRecording	vivax drive	https://www.youtube.com/watch?v=EgOWHMRt9Qw
Bicycle Design	ebike	2015	Electric bike motor comparison: hub, mid drive, & friction drive	Here is a comparison of the different electric bike motor systems to help you determine which configuration is best for your riding needs. In this article there are the pros and cons of each system...	webpage	Prebus, Pete	http://electricbikereport.com/electric-bike-motor-comparison/
Bicycle Design	3D printing	2016	On the road to 3D-printed bikes and bridges	In the Arc's case, the bike handled well, offering a smooth ride even on bumpy surfaces, and weighs in at 20 kilos, about the same as your non-3D-printed bicycle	blogPost	Alonso, Bogar	http://www.psfk.com/2016/03/3d-printed-bikes-and-bridges-delft-university-mx3d.html
Bicycle Design	3D printing	2016	The GO wheelchair: a bespoke solution for wheelchair users	Custom 3D printing for wheelchair users.	blogPost	Benoit, Stephanie	http://www.materialise.com/blog/the-go-wheelchair-a-bespoke-solution-for-wheelchair-users/
Bicycle Design	ebike; IoT	2016	IoT enabled e-bike delivers a smooth ride	Following the trend of 'smartifying' products for device-to-device communication, the Electrified S Vanmoof ebike pairs with your phone (bike lock control, distance tracking)	blogPost	Lechner, Ido	http://www.psfk.com/2016/04/iot-enabled-e-bike-delivers-a-smooth-ride.html
Bicycle Design	3D printing	2016	Inject personality into your e-bike (now and forever) with 3D-printed add-ons	A 3d printing bike platform fostering creativity amongst bike owners is also in future plans, allowing sharing of customer-designed parts and other modes.	blogPost	Lutero, Leo	http://www.psfk.com/2016/04/e-bike-3d-print-spare-parts-at-home-ett-industries.html
Bicycle Design	bicycle design; distribution	2016	On the road: Ikea Sladda bicycle review – 'Build your own Ikea bike? It's either a masterstroke or a recipe for disaster'	I worried I'd not screwed everything in tightly enough.	newspaperArticle	Pidd, Helen	https://www.theguardian.com/technology/2016/jul/02/ikea-sladda-bicycle-review-helen-pidd
Bicycle Design	3D printing	2016	3D-printed wheelchair tailor-made for the perfect fit	London-based design company debuts a 3D-printed consumer wheelchair that uses a person's biometric information for a made-to-measure fit. Matthew Stock reports.	videoRecording	Reuters	http://www.reuters.com/video/2016/05/25/3d-printed-wheelchair-tailor-made-for-th?videoId=368643407&videoChannel=118065
Bicycle Design	ebike	2016	VanMoof		webpage	VanMoof	https://www.vanmoof.com/en_us/bikes/electrified-s
Bicycle Design	ergonomics	2016	Lovely bicycle!: On female anatomy and saddle discomfort (5 year anniversary re-issue)		blogPost	Winters, C	http://lovelybike.blogspot.com/2011/04/on-female-anatomy-and-bicycle-saddles.html
Cycling Experience	VR	2009	Biking in place through Google StreetView		webpage	Mimoto, Aki	http://bako.ca/streetview-riding/
Cycling Experience	event	2004	Aeolian ride information	An international art event where the public becomes inflated sculpture on bicycles, transforming the landscape of each city. The effect is a sort of joy loop:	webpage	Findley, Jessica	http://www.aeolian-ride.info/info.html
Cycling Experience	VR	2011	Google bike: 7 steps (with pictures)	Has the winter weather got you down? Is the snow preventing you from training for the next Tour De France? Or are you afraid to ride outside with all those cellphone weilding drivers? Google bike is the answer for you! Now you can ride anywhere in the world in the climate controlled safety of your home. Google bike is a virtual bike riding program. Using a few simple electronic components and some software hackery you too can ride in virtual style! Here is the bike in action!	webpage	Graham, Brett	http://www.instructables.com/id/Google-Bike/
Cycling Experience	VR	2011	StreetView explorer	A new perspective on Google Streetview. Download at http://code.google.com/p/streetview-e...	videoRecording	Wagener Paul	https://www.youtube.com/watch?v=EEN4DxrkXrM
Cycling Experience	navigation	2013	Dynamic connections map	The Dynamic Connections Map is an interactive biking map for the city of Berlin. While traditional mapping efforts show the here and now, the Dynamic Connections Map shows both the current Berlin biking network and its potential future. The Dynamic Connections Map rates different Berlin streets on their amenability for cycling, based on a variety of criteria, including traffic volume, topography, and safety considerations. Users are able to identify which streets should have future biking infrastructure, creating a crowdsourced map of the potential future biking network in Berlin.	webpage	Smith, Rachel; Schimmel, John; Dawson, Dave	http://www.bmwguggenheimlab.org/where-is-the-lab/berlin-lab/berlin-lab-city-projects/dynamic-connections-map
Cycling Experience	VR	2014	Manufacture cardboard – Google VR		webpage	Google	https://vr.google.com/cardboard/manufacturers/
Cycling Experience	VR	2014	Widerun the first full immersive virtual reality fitness experience	Meet the first bike trainer you connect to VR headsets. Ride in VR environments.	webpage	Scipioni, Alessandro; Piccardi, Tiziano; Avanzi, Riccardo	http://www.widerun.com/
Cycling Experience	art; navigation; GPS	2015	Sketchbook of a GPS artist	GPS doodles/Strava art.	webpage	Lund, Stephen	https://gpsdoodles.com/
Cycling Experience	VR	2015	VirZOOM	VirZOOM creates thrilling VR experiences powered by you. Pedal your VirZOOM Controller to propel yourself through endlessly exciting VR games.	webpage	VirZoom	http://www.virzoom.com/
Cycling Experience	event	2016	Auckland Open Streets 2016	Closing the street to cars for one day.	webpage	Auckland Transport	https://at.govt.nz/about-us/news-events/auckland-open-streets-2016/

Category	Tags	Year	Title	Description	Type	Author	URL
Cycling Experience	VR	2016	Cycle VR	I want to become the first person to cycle the length of Britain in virtual reality. I really really do. In fact I might be the first person to cycle any great distance in VR. Using a Gear VR, a ca...	blogPost	Puzey, Aaron	https://cyclevr.com/home/
Cycling Experience	VR	2016	This man is cycling around the UK in virtual reality using Google Street View	Aaron Puzey says it started out of boredom. He'd been toiling away on his exercise bike for half an hour a day for years, and things were beginning to get tedious. "I'd been day dreaming for a...	webpage	Vincent, James	http://www.theverge.com/2016/8/9/12411262/cycle-vr-google-street-view-uk
Cycling Experience	VR	2016	A VR cycling experience for $40	I've made an Arduino thing that can wirelessly talk to a mobile device over BLE and can now meter the revolutions of a wheel with an optical tachometer.	blogPost	Yan, Paul	https://pauldyan.wordpress.com/2016/01/24/my-vr-bike/
Infrastructure	infrastructure; cycle lanes	2009	Bike escalator / conveyor belt activation	Bike escalators at metro stations in Tokyo and Kyoto	videoRecording	Gzdll	https://www.youtube.com/watch?v=mlWuqqQqDaQA
Infrastructure	infrastructure; cycle lanes	2012	Bike lanes' economic benefits go beyond jobs	You might have heard that bike lanes are a waste of money. The Australian National Audit Office recently investigated the $40 million bike path scheme, announced in 2009 as part of the Federal Government's...	webpage	Pettitt, Brad	http://theconversation.com/bike-lanes-economic-benefits-go-beyond-jobs-6081
Infrastructure	infrastructure; cycle lanes	2013	Trampe/CycloCable®		webpage	Wanvik, Jarle	http://trampe.no/en/home
Infrastructure	infrastructure; traffic control	2015	Flo	The light companion is a innovation for cyclists to catch the green traffic light	webpage	Springlab	http://springlab.nl/flo-en/
Infrastructure	infrastructure	2016	Te Ara Mua Future Streets		webpage	Auckland Transport	https://at.govt.nz/projects-roadworks/te-ara-mua-future-streets/
Infrastructure	infrastructure; lighting; safety	2016	Poland's new solar-powered bike path glows bright blue at night	Poland's New Solar-Powered Bike Path Glows Bright Blue at Night	webpage	Chow, Lorraine	http://www.ecowatch.com/solar-powered-bike-path-poland-2031343702.html
Infrastructure	bike parking; infrastructure	2016	Bikes welcome	Great bike parking. Everywhere. Everyone.	webpage	Clendon, Jo	https://bikeswelcome.wordpress.com/
Infrastructure	infrastructure; lighting; safety	2016	Luminous bike lane opened in Poland	The first self-sufficient luminous bike lane opened last week in Poland.	webpage	Next Nature Network	http://www.nextnature.net/2016/10/luminous-bike-lane-opened-poland/
Infrastructure	infrastructure; bike sharing	2016	The global bike sharing boom – why cities love a cycling scheme	Bike sharing has huge potential benefits - even for people who don't use them.	webpage	Nikitas, Alexandros	http://theconversation.com/the-global-bike-sharing-boom-why-cities-love-a-cycling-scheme-53895
Infrastructure	infrastructure; lighting; safety	2016	Glowing lines		webpage	Studio Roosegaarde	https://www.studioroosegaarde.net/project/glowing-lines/
Infrastructure	infrastructure; cycle trails	2016	Nga haerenga NZ cycle trail evaluation report 2016		report	Tayawa Figuracion, Matilde	http://www.mbie.govt.nz/info-services/sectors-industries/tourism/nga-haerenga-new-zealand-cycle-trail/evaluation
Infrastructure	infrastructure	2016	The Auckland cycling account	A snapshot of cycling in Auckland in 2015	document	TRA	https://at.govt.nz/media/1873018/akl-cycling-account-book.pdf
Infrastructure	navigation	2017	Spring into cycling with Mapzen's new bike map		webpage	Mapzen	https://mapzen.com/blog/bike-map/
Infrastructure	infrastructure; cycle lanes	2017	How to foster cycling in Miami? Copenhagenize it, Danish expert says.	As cycling as transportation takes off across the world and the U.S., but stalls in Miami, a famed Danish cycling planner and proselytizer visits to show us how it's done. He says it's not rocket science.	webpage	Viglucci, Andres	http://www.miamiherald.com/news/local/community/miami-dade/article136115883.html
User Accessory	body scanning; ergonomics	2009	Ergonomic adjustment for bikes, clothing and shoes		webpage	Body Scanning CRM	http://www.bodyscanningcrm.de/en
User Accessory	cycling clothing; textile technology; si	2009	City centered cycling	Sports performance clothing specifically aimed at city cycling commuters. A wearable electronic jacket containing a lighting system aimed at improving safety and comfort aspects affecting cycle commuters.	thesis	Reilly, Lyle	http://aut.researchgateway.ac.nz/handle/10292/895
User Accessory	eyewear	2010	Recon Jet. Smart eyewear for sports.	Smart eyewear. Find out all you need to know about Recon Jet, the World's first Heads-up Display (HUD) technology for sports and outdoor environments.	webpage	Recon	http://www.reconinstruments.com/products/jet/
User Accessory	3D printing; lighting; safety; textile te	2014	Heisel accessories	3d printed wearable. LED accessories by Heisel. belts bags bracelets laptop cases iPhone cases keychains. 3D printed tyvek reflective anti-microbial eco-felt	webpage	Heigel, Sylvia	https://heisel.co/collections/accessories
User Accessory	IoT shoes	2014	Luck potentiometer - Luck cycling shoes	Smart shoes - Bluetooth connectivty, lightweight, aimed at road racers.	webpage	Luck	http://luck-bike.es/en/content/25-luck-potentiometer
User Accessory	bicycle lighting; signalling	2015	Zackees turn signal gloves for cycling	The most technologically advanced glove ever made for cycling. Period.	webpage	Zackees	https://zackees.com/
User Accessory	smart bicycle lighting/helmet	2016	Lumos helmet	The World's First Smart Bicycle Helmet with integrated lights, brake, and turn signals. Named to Cycling Weekly's Best Cycling Innovations of 2015.	webpage	Lumos	https://lumoshelmet.co/products/lumos-helmet
User Accessory	body scanning; ergonomics	2016	Body scan: precision bicycle fit In the digital age!		webpage	McLain Cycle & Fitness	http://mclaincycle.com/articles/body-scan-precision-bicycle-fit-in-the-digital-age-pg211.htm

Innovation Sourcebook References

Alonso, B. (2016, March 29). On the road to 3D-printed bikes and bridges. Retrieved 30 May 2016, from http://www.psfk.com/2016/03/3d-printed-bikes-and-bridges-delft-university-mx3d.html

Auckland Transport. (2016). Auckland Open Streets 2016. Retrieved 3 July 2016, from https://at.govt.nz/about-us/news-events/auckland-open-streets-2016/

Auckland Transport. (2016a, July). The Auckland cycling account. Auckland Transport. Retrieved from https://at.govt.nz/media/1873018/akl-cycling-account-book.pdf

Auckland Transport. (2016b, August 17). Te Ara Mua Future Streets. Retrieved 17 August 2016, from https://at.govt.nz/projects-roadworks/te-ara-mua-future-streets/

Auckland Transport. (2017). It's all go. Retrieved 15 May 2017, from https://at.govt.nz/cycling/

Bartley-Matthews, J. (2015). UX/UI design for paired bicycle app & wearable device. Retrieved 20 April 2016, from http://www.jessaminebartleymatthews.com/hubapp/

Benoit, S. (2016, May 26). The GO wheelchair: a bespoke solution for wheelchair users. Retrieved 26 February 2017, from http://www.materialise.com/blog/the-go-wheelchair-a-bespoke-solution-for-wheelchair-users/

Blaze. (2015). Laserlight. Retrieved 27 February 2017, from https://blaze.cc/laserlight/

Body Scanning CRM. (2009). Ergonomic adjustment for bikes, clothing and shoes. Retrieved 31 August 2016, from http://www.bodyscanningcrm.de/en

Boréal Bikes. (2015). smrtGRiPS - world's first connected bike grips. Retrieved 28 February 2017, from http://smrtgrips.com/

Budds, D. (2015, September 2). This smart bike navigation gadget relies on a slick ambient UI. Retrieved 20 April 2016, from http://www.fastcodesign.com/3050637/this-smart-bike-navigation-gadget-relies-on-a-slick-ambient-ui

ByCycling. (2017, March). ByCycling - automatic cycling tracker. Retrieved 28 April 2017, from http://cashbycycling.com/

Chow, L. (2016, October 5). Poland's new solar-powered bike path glows bright blue at night. Retrieved 27 October 2016, from http://www.ecowatch.com/solar-powered-bike-path-poland-2031343702.html

Clendon, J. (n.d.). Bikes welcome. Retrieved 17 August 2016, from https://bikeswelcome.wordpress.com/

Clug. (2014). Clug: simple bike storage. Retrieved 28 February 2017, from http://getclug.com/

COBI. (2015). COBI sets. Retrieved 4 October 2016, from https://get.cobi.bike/us_en/

Coxworth, B. (2015, November 23). Review: Blaze bike light uses a laser to keep cyclists safer. Retrieved 30 May 2016, from http://www.gizmag.com/blaze-bicycle-headlight-review/40555/

Cycliq. (n.d.). Bicycle HD camera and bicycle light combos. Retrieved 20 March 2017, from https://cycliq.com/

ElectricBikeReview.com. (2016). *COBI connected bike system overview (smartphone integration, GPS navigation, advanced lighting)*. Retrieved from https://www.youtube.com/watch?v=osjM0ALHa2w

ETT Industries. (2012). ETT industries. Retrieved 30 May 2016, from http://ettindustries.com/

EVRYTHNG. (2015). *Brompton – an IoT sensor platform for smarter city cycling apps*. Retrieved from https://www.youtube.com/watch?time_continue=269&v=tifFeG1oW70

FlyKly. (2010). FlyKly - your next smart move. Retrieved 28 February 2017, from http://flykly.com/en/

Google. (2014). Manufacture cardboard – Google VR. Retrieved 1 September 2016, from https://vr.google.com/cardboard/manufacturers/

Graham, B. (2011). Google bike: 7 steps (with pictures). Retrieved 9 May 2017, from http://www.instructables.com/id/Google-Bike/

Gvily, E. (2013, November 13). Accessories to accessory. *Design Museum Holon*, *November-June 2014*(9). Retrieved from http://www.dmh.org.il/magazine/magazine.aspx?IssuesId=12&id=205

Gzdll. (2009). *Bike escalator / conveyor belt activation*. Retrieved from https://www.youtube.com/watch?v=mWuqqQqDaQA

Heigel, S. (2014). Heisel accessories. Retrieved 28 February 2017, from https://heisel.co/collections/accessories

Hicks, E., & Roberts, R. (2012). Top 10 | electricbike.com. Retrieved 27 October 2016, from https://www.electricbike.com/category/top10/

Infonomia. (2013). *Andrew Ritchie at iFest'08*. Retrieved from https://www.youtube.com/watch?v=--fhcR4pOx4

Lechner, I. (2016, April 13). IoT enabled e-bike delivers a smooth ride. Retrieved 30 May 2016, from http://www.psfk.com/2016/04/iot-enabled-e-bike-delivers-a-smooth-ride.html

Luck. (2014). Luck potentiometer - Luck cycling shoes. Retrieved 27 February 2017, from http://luck-bike.es/en/content/25-luck-potentiometer

Lumos. (2016). Lumos helmet. Retrieved 27 February 2017, from https://lumoshelmet.co/products/lumos-helmet

Lund, S. (2015). Sketchbook of a GPS artist. Retrieved 28 February 2017, from https://gpsdoodles.com/

Lutero, L. (2016, April 6). Inject personality into your e-bike (now and forever) with 3D-printed add-ons. Retrieved 30 May 2016, from http://www.psfk.com/2016/04/e-bike-3d-print-spare-parts-at-home-ett-industries.html

Matsui, H., Nip, A., & Schmeiduch, M. (2012). BikeBorg. Retrieved 2 May 2016, from http://ciid.dk/education/portfolio/idp12/courses/performative-design/projects/bikeborg/

McLain Cycle & Fitness. (2016). Body scan: precision bicycle fit In the digital age! Retrieved 31 August 2016, from http://mclaincycle.com/articles/body-scan-precision-bicycle-fit-in-the-digital-age-pg211.htm

Mimoto, A. (2009). Biking in place through Google StreetView. Retrieved 1 September 2016, from http://bako.ca/streetview-riding/

Monkey Light Bike Lights. (2008). Monkey light bike lights. Retrieved 28 February 2017, from http://www.monkeylectric.com/

Next Nature Network. (2016, October 4). Luminous bike lane opened in Poland. Retrieved 27 October 2016, from http://www.nextnature.net/2016/10/luminous-bike-lane-opened-poland/

Nikitas, A. (2016, February 12). The global bike sharing boom – why cities love a cycling scheme [Media]. Retrieved 27 October 2016, from http://theconversation.com/the-global-bike-sharing-boom-why-cities-love-a-cycling-scheme-53895

Palermo, J. (2015, August 28). Zero UI — the future of interfaces. Retrieved 20 April 2016, from http://sixrevisions.com/user-interface/zero-ui/

Pena, A. (2016, March 28). Bicycle bell brings innovation to one of the oldest designs. Retrieved 30 May 2016, from http://www.psfk.com/2016/03/bicycle-bell-innovation-knog.html

Pettitt, B. (2012, April 10). Bike lanes' economic benefits go beyond jobs [Media]. Retrieved 27 October 2016, from http://theconversation.com/bike-lanes-economic-benefits-go-beyond-jobs-6081

Pidd, H. (2016, July 2). On the road: Ikea Sladda bicycle review – 'Build your own Ikea bike? It's either a masterstroke or a recipe for disaster'. *The Guardian*. Retrieved from https://www.theguardian.com/technology/2016/jul/02/ikea-sladda-bicycle-review-helen-pidd

Prebus, P. (2015, February 17). Electric bike motor comparison: hub, mid drive, & friction drive. Retrieved 27 October 2016, from http://electricbikereport.com/electric-bike-motor-comparison/

Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. Journal of Consulting and Clinical Psychology, (3), 390.

Prochaska, J. O. (1), Velicer, W. F. (1), Fava, J. (1), & DiClemente, C. c. (2). (1988). Measuring processes of change: Applications to the cessation of smoking. Journal of Consulting and Clinical Psychology, 56(4), 520–528.

Puzey, A. (2016, July 1). Cycle VR. Retrieved 1 September 2016, from https://cyclevr.com/home/

Recon. (2010). Recon Jet. Smart eyewear for sports. Retrieved 28 February 2017, from http://www.reconinstruments.com/products/jet/

Reilly, L. (2009). *City centered cycling* (Thesis). Auckland University of Technology. Retrieved from http://aut.researchgateway.ac.nz/handle/10292/895

Reuters. (2016). *3D-printed wheelchair tailor-made for the perfect fit*. Retrieved from http://www.reuters.com/video/2016/05/25/3d-printed-wheelchair-tailor-made-for-th?videoId=368643407&videoChannel=118065

Revolights. (2011). Revolights bicycle lighting system. The future of bicycle safety. Retrieved 28 February 2017, from https://revolights.com/

Sarmiento, G., & Kelso, N. V. (2017, March 9). Spring into cycling with Mapzen's new bike map. Retrieved 27 March 2017, from https://mapzen.com/blog/bike-map/

Scipioni, A., Piccardi, T., & Avanzi, R. (2014). Widerun the first full immersive virtual reality fitness experience. Retrieved 1 September 2016, from http://www.widerun.com/

Senseable City Lab. (2009, December). Copenhagen wheel project. Retrieved 25 July 2016, from http://senseable.mit.edu/copenhagenwheel/

Shandrow, K. L. (2014, May 15). This is why you should be excited for the 'Internet of bikes'. Retrieved 30 May 2016, from https://www.entrepreneur.com/article/233931

Smith, R., Schimmel, J., & Dawson, D. (2013). Dynamic connections map. Retrieved 9 May 2017, from http://www.bmwguggenheimlab.org/where-is-the-lab/berlin-lab/berlin-lab-city-projects/dynamic-connections-map

Springlab. (2015, June 30). Flo. Retrieved 28 April 2017, from http://springlab.nl/flo-en/

Superpedestrian. (2017). The Copenhagen Wheel. Retrieved 24 July 2017, from https://content.superpedestrian.com/

Studio Roosegaarde. (2016). Glowing lines. Retrieved 27 October 2016, from https://www.studioroosegaarde.net/project/glowing-lines/

Tayawa Figuracion, M. (2016). *Nga haerenga NZ cycle trail evaluation report 2016*. Wellington: Ministry of Business, Innovation and Employment. Retrieved from http://www.mbie.govt.nz/info-services/sectors-industries/tourism/nga-haerenga-new-zealand-cycle-trail/evaluation

TiGr. (2011). Lightweight bike lock | titanium bike lock | TiGr lock. Retrieved 22 August 2016, from https://tigrlock.com/

TRA. (2016, July). Measuring and growing active transport modes in Auckland. Auckland Transport. Retrieved from https://at.govt.nz/media/1957535/at_active-modes-2016.pdf

Vanhawks. (2014). Vanhawks. Retrieved 30 May 2016, from http://www.vanhawks.com

VanMoof. (2016). VanMoof. Retrieved 30 May 2016, from https://www.vanmoof.com/en_us/bikes/electrified-s

Vigalucci, Andres. (2017, March 2). How to foster cycling in Miami? Copenhagenize it, Danish expert says. [News]. Retrieved 5 March 2017, from http://www.miamiherald.com/news/local/community/miami-dade/article136115883.html

Vincent, J. (2016, August 9). This man is cycling around the UK in virtual reality using Google Street View. Retrieved 1 September 2016, from http://www.theverge.com/2016/8/9/12411262/cycle-vr-google-stree-view-uk

VirZOOM. (2015). VirZOOM. Retrieved 1 September 2016, from http://www.virzoom.com/

vivax drive. (2014). *Race bike vivax forza CF with electric motor vivax assist*. Retrieved from https://www.youtube.com/watch?v=EgOWHMRt9Qw

Wagener, P. (2011). *StreetView explorer*. Retrieved from https://www.youtube.com/watch?v=EEN4DxrkXrM

Wanvik, J. (2013). Trampe/CycloCable®. Retrieved 10 January 2017, from http://trampe.no/en/home

Winters, C. (2016, June 2). Lovely bicycle!: On female anatomy and saddle discomfort (5 year anniversary re-issue). Retrieved 15 August 2016, from http://lovelybike.blogspot.com/2011/04/on-female-anatomy-and-bicycle-saddles.html

Yan, P. (2016, January 24). A VR cycling experience for $40. Retrieved 27 February 2017, from https://pauldyan.wordpress.com/2016/01/24/my-vr-bike/

Zackees. (2015). Zackees turn signal gloves for cycling. Retrieved 28 February 2017, from https://zackees.com/

Appendix G: Sample of thematic analysis

Extract from the thematic analysis of a participant interview.

Table

Behaviour and Attitudes

Toward transport in general	Toward bikes	Obstacles (fears/barriers)	Motivations
Bus vs. Walk vs. Bike	Knowing that I could get somewhere quick	Hills/landscape	There wasn't anything stopping us.
Don't need a car in the city	Freedom	Bike maintenance	The wind in my hair.
Distance - too far	Shortcuts	Speed (slow/fast)	Having chats
Distance - too long	Culture of bikes on streets	As soon as you're on a busy road it became utilitarian	Fun / sensation
Get from A to B easiest	Faster than traffic/alternative modes	We'd have lots of fun times like, having a puncture together.	Sense of community
Car = friends/uber/wife	There's something about cycling.	I don't really go fast any more, because it makes me hot and sweaty and gross	I zoomed down
Being on time	Explore differently.	Too hard	Whee!
Safer in the CBD - cars have to go slower	It was flat. It was nice. It made it really easy.	Really hoping like hell that a car wouldn't just decide to open their door while driving.	I could easily just [go cycling], and it was really quick, and really fun.
		Rational things like that.	Like riding a bike
		Every car is out to kill me.	
		Auckland drivers are atrocious, they're terrible… cos they don't see.	
		Fear of unexpected potentially dangerous manoeuvres by cars, even if unlikely.	
		Everything's a hazard.	
		Storage/convenience.	

"I found it was faster, instead of walking to the bus, or catching a bus down," [Faster than other options available to him.]

I'd catch the bus in the mornings and I found it was faster, instead of walking to the bus, or catching a bus down, from home, cycle down Queen Street and I found that if you maintain a certain speed then you basically maintain a certain speed all the way down. So that meant it was just really fast, I think top to bottom in four minutes or something like that. And then yeah I'd just jump off, tie it to one of the poles, go off catch my bus, come back off my bus, cycle back up slash walk it. Yeah. And so at the time I was like yes!

"As a cyclist, I'm definitely like a, kind of the whole wheeled pedestrian idea, I don't really go fast anymore, because it makes me hot and sweaty and gross. So I'll probably just leisurely cycle somewhere and if I'm not like that I probably just don't need to be on the road. I feel like on the road is if you're trying to hit top speed on your whatever bike, or if, I don't know, if you're super late for something you're not going to do it like, oh crap I'm going to jump on my bike and get there really fast?! You only do that if you're recreationally cycling so I mostly use my bike to go from A to B. If I'm going from A to B I have to go from A to B, the same way I have to go from A to B in any other way. I don't run." [Bike is a means. Not in it for the sport.]

"Totally contrary to everything I just said before but, I did like going down Queen Street really fast. I'd go down the top part really slowly and squeaking my brakes all the way down and then along the flat. Yeah. That bit I would go faster."

"One thing about riding a bike, as opposed to the reasons why I do it, is that you get to see more of the city slowly, if that makes sense. I think in a car, you experience a city in a different way. You're in a bubble, you're less exposed, you have your own stereo you have your own climate, you're going from A to B a lot faster, so you don't explore as much - you still can, jump in a car with some buddies and go explore places but if you're on a bike you explore it differently to when you're on foot. If you're on foot you kinda have a limit, well I mean you don't really, you could just keep walking but you do get tired whereas on a bike you can do twice that distance in the same amount of time and still be able to see that slowly, and still be able to see more. I think there's a loss in that."

"Obviously most of the time we cycled through the Domain, and we cycled through – because we started in the city, then we went through the Domain and then we went through Newmarket and it was all fine, and then suddenly we hit Manukau Road, and then it got slightly, like then we weren't talking as much, we were definitely single file, you know trying to get on the footpath as

much as possible, getting off when there were poles, bus stops, driveways… really hoping like hell that a car wouldn't just decide to open their door while driving or something. Rational fears like that (smiles)."
"So I have the fear in residential areas but in a shopping area, not so much. You know a car's not going to come out of a dairy, intersection, most garages have the blinky-light thing so you can keep an eye out for that so if a car is coming out you can just slow down. Yeah. That's kind of how I feel."

"Now we're back in a carpark, where I kinda want to be in the middle of the lane, otherwise a car will come out and run me over, open a door and, you know, side-swipe me. What else?

"I think my negatives would be that sense of fear as you ride. You know, like being confident but still terrified of going on, of what you can't control. A similar fear to what I have when I'm on a motorcycle. I was saying like riding along here, with parked cars, suddenly a car will just drive straight back out and you're moving slightly faster than a pedestrian and so they didn't judge it, or whatever."

Appendix H: Researcher as cyclist

This section covers the researcher's own experience as a cyclist, written in a conversational, story-telling style.

"The accidental cyclist"

This is my story. I consider myself an accidental cyclist. I never set out to be a cyclist, or as far as I remember, to consciously become a cyclist. My childhood memories of riding are to ride a BMX down to the local school, of hot summer days, and having fun spending time outside with my sisters and neighbourhood friends. We'd go there to ride our bikes on either the netball courts or the grass fields, or to play on the playground, or to swim in the pool. The school was far enough away to make walking feel long, maybe ten minutes, but by bike it was a breeze. There were a couple of short downhill sections to add to the fun but even the uphill parts were rewarding, providing a sense of achievement of having made some effort to actually travel somewhere by cycling up (or part-way up) the hill.

Then a bit older. My brother had a mountain bike, a bike with gears. We'd take turns riding it, using a step to climb up on to the adult-sized frame. My other brother got a racing bike, a 'ten-speed,' we'd call it. It was pink, it was 'flash', and it had a speedometer. That provided a new challenge, and we raced that down the hill, seeing who could record the highest speed. This proved problematic because we lived in a cul-de-sac so you couldn't go too far before reaching the corner. I remember going as fast as 28 km / h before panicking and crashing, gouging a hole in my knee. I still have the scar, more than 20 years later.

Finally, a couple of years after that, I got my own bike. It was a shared present with my sister, but brand new, and exciting. We would take turns riding that or the mountain bike, and both were good: one was brand new, and "our" bike, and the other older and bigger but I think we either thought it was a higher spec or rode better/faster. So it worked well for us.

I don't really know how much I rode during later high school and university years. Not too much I guess. The commuting distances were too far in my mind, but I think I used my bike every so often.

When I moved out of home I got a job ten minutes' drive, or motorbike, or cycle, from my house. Driving wasn't so attractive. In the mornings, traffic was heavy, but not every day, so some days it could take five minutes, some days fifteen or twenty minutes. I didn't like the uncertainty. On top of that, if I drove I'd have to double-park my colleagues' cars in the staff car park and we'd have to do a car shuffle when someone else wanted to leave. Those were two reasons why I tried to limit my driving. One of my other colleagues caught the bus everywhere, and was happy to do so, but the bus route was not at all convenient for me and I didn't enjoy using them. I had a motorbike from driving to university (traffic/free parking reasons) and would take that, but then some days I didn't want to bother with all the extra gear. So I'd bike.

I discovered how much I enjoyed my commute. It was short, but challenging. The motorbike had given me confidence weaving through traffic, of being aware of other cars and driving defensively, and also asserting my place on the road. That made switching to a bike easy because I had that road confidence already. Riding the bike also added different layers to my journey, and I experienced every contour more fully. I had to work to get up the steep hills, but I would fly downhill too. I had to cross Bond St bridge, a road that dipped down then climbed steeply in both directions. Travelling in either direction I'd have to pedal as fast as I could, then freewheel, coast along and slog up the other side. It was a challenge to see how far up I could go before I'd have to walk, and then after a week or two, I could make it the whole way up in both directions. At the same time the bridge roadway is narrow with high kerbs so I was continually aware of the speed, proximity and impatience of cars. Maybe that also pushed me to ride faster, to prove or "own" my right to the road.

Every day leaving work, I'd immediately have to cycle up a steep hill. When I first started, I never thought I'd ever make it to the top. I'd cycle the first ten metres or so and then walk. But again, I made creeping progress each day, until finally I could make it to the top. It was a shifting target though, and I could tell if I was tired or if I hadn't cycled for a while, because I'd no longer make it the whole way up. It became a good test for my fitness. I wasn't concerned about getting sweaty on this hill because it was on the ride home. It also meant that the final part of my journey in to work was a blissful ride down that same slope!

I'd wake up each morning, lie in bed deciding how to get to work, running through an imaginary checklist. Could I hear rain? How hot or cold is it? How much energy do I have? Is it school holidays?

What time is it? And then decide what mode to take, bike, motorbike or car.

A couple of years later I moved overseas to the UK. Suddenly I had no car, and I had to rely on the bus. The bus was infinitely slow, only came every half hour, and wasn't immediately near my house so I'd have to walk at both ends, adding extra minutes to my commute. Compared to driving I had to get up super early, rush to the bus, then be at work with plenty of time to spare. It wasn't long until I found a bicycle so that I could regain my freedom. I would have bought a car too but the compulsory insurance and high pound–dollar ratio meant that it seemed insurmountably expensive. The bike was my ticket to freedom. This was the same scenario at the next town I moved to: inconvenient, slow public transport + no car = bike.

Once again I discovered how wonderful it is to start the day with fresh air and movement. As with central Auckland and its challenging hills, I had my highlights along my routes in the towns where I lived. In Scarborough it was being able to ride along the seafront (the bus took a boring route through town instead), and then in York I would ride along the river and through fields. I'm pretty sure that had I owned a car in Scarborough I probably wouldn't have cycled though. It was a half-hour ride and by the end I needed a shower. In York the ride was fun, and if I had a car I would have had to queue in traffic to get over the river so it would have taken far longer by car. The bus was three times longer again, so even in snow or heavy rain I'd cycle!

By the time I moved to London, cycling was one of my default methods of getting around, and I also was using it as a means of exercise seeing as I was no longer playing so much sport. It kind of continued from there really. I kept on cycling despite having bikes stolen and longer commutes.

Basically that's my story. I'm not a cyclist because I set out to be one. I was motivated by a strong dislike of buses, limited train schedules and comparatively expensive transport. I loved the freedom and physical sensations of cycling, as well how it gave me a sense of adventure. I explored London on my terms, at my speed and really got to know its streets by cycling many places. I was in control of my journey.

When I think of cycling, I think of freedom, of control, of being able to do what I want, when I want, with confidence.

Appendix I: Early-stage concepts

This section refers to the early-stage concepts from the ideation stage of the design process that were not selected for further development.

Idea 2: How do we make the environment less intimidating? Ride with an expert who takes the stress out of it for you

Every rider in the interview process was nervous but relaxed, and had me riding behind them for them to voice their concerns aloud if they needed. There was no need for them to navigate the route themselves because we followed a predetermined route, and I was available to provide directions. Having a riding partner can alleviate some of the stress: Ride with a buddy who shows the route, talks you through the situation, and provides a shared experience.

Idea 3: How do we make the environment less intimidating? Go into an environment that matches your ability

Not all roads are equally intimidating. A non-active cyclist tends to be more comfortable riding down a separated cycle path than a shared traffic lane, or feel safer on a quieter street than a multi-laned road. Mapping tends to deal with this by coding routes. For example, coding quiet, cycling-recommended routes a different colour according to the type of cycling environment. Mapping software solutions use different algorithms to account for cycling preferences and may suggest different routes than those suggested for a car or a pedestrian. However these are functional options, and are based road-by-road, rather than considering the whole route, or the individual cyclist's ability.

Is there a way to help a non-active cyclist to map a route that takes into account their ability on a bicycle?

Consider the maps used for ski resorts. They show a general indication of the mountain, then map routes according to general ability. A blue route is for a beginner, and there are no steep slopes or tricky terrain to negotiate. A red route indicates more slope,

slightly more advanced skills required to negotiate the terrain, and simultaneously an increase in the challenge, thrill and excitement for the skier or snowboarder. Finally, a black route indicates a technically difficult route that may have narrow or steep sections. It is easy to glance at the map and have faith that the route taken has the level of challenge and excitement (or anxiety) that matches your ability.

What if we coded bicycle routes the same way? There is some level of this on mountain-biking and tourism-oriented routes, such as New Zealand's Great Rides. These are graded 1–5, with 1 being flat and family-friendly, through to 5 being extremely technical. These seem to exist outside of the urban environment, but not so much in it.

Idea 4: How do we create excitement, discovery and adventure in our normal activities? Make the hard parts more interesting

When you're riding uphill, suddenly the environment around is less easy to take in. Looking up and taking in the landscape is secondary to actually physically powering/pushing/straining up the slope. The visual world is reduced to those few metres in front, rather than the horizon. One way to make this more interesting and encouraging is to put visual interest on the ground itself. So rather than boring concrete, the slope has interesting motifs/colours (sounds? Lights?) to encourage you as you, quite literally, level up. (Spinney, 2011 also ref. Motifs on the motorway to make the path more interesting, Lightpath lights as you pass).

Another way to do this is to use the bicycle accelerometer to measure the gradient/angle of the bike, along with cadence to confirm the pedals/wheels are turning, and use them to trigger the activity e.g. rhythm sounds. Then downhill there could be a reward too e.g. Wheee! Sound or aircraft taking off or some stat recorded.

Idea 5: Make the bike interface less perplexing

Each participant had an issue with the gears on the bicycle. This could be interpreted as a lack of familiarity with that particular bicycle, a 21-gear mountain bike, as it was supplied and they had never ridden it before. However there were no other aspects of the bicycle that were observed as disconcerting in any way: "it was as easy as riding a bike", as one participant said when I asked whether he had any issues.

Shane: in too high a gear on the hill
Rosa: knew how to change up but not how to change down as she was familiar with a different system
Jess: the gears slipped a couple of times and it took a couple of tries for her to switch gears by applying more pressure to the gear lever.

Idea 6: How do we create excitement, discovery and adventure in our normal activities? Involve cycling in a wider activity

People have varied interests, and cycling is but one aspect of their lives. It is a social activity, yet also transport. Cycling for transport requires that there be a point A and point B; that is the main difference between cycling for leisure and cycling for transport. My research has shown that the act of riding evokes far more positive feelings towards riding a bicycle, and thus makes the individual more likely to consider riding in other areas of their lives. So what if the bicycle trip became one part of the activity? This has been successful in the New Zealand Cycle Trail: the act of cycling is an active means for people to experience the outdoor beauty of the New Zealand's landscapes.

Proposal: bike+: Choose bike + distance/time + type of activity to come up with ideas. Present in app/website/book form.

Idea 8: Geocaching / obstacle course / scavenger hunt concept

Create a route with specific obstacles to achieve, for example riding up the three highest points in the city, or providing hidden destinations around the city for you to uncover and you ride into new territories.

Idea 9: How do we create excitement, discovery and adventure in our normal activities? Gamify through space/territory capture

Encourage more cycling by gamifying the collection and conquering of space or territory based on the distances and areas covered while cycling. This idea takes inspiration from the prevalence and popularity of games, the ability to use GPS tracking on smartphones, and the popularity of competitive aspects of ride-tracking apps such as Strava's King of the Mountain (KOM), an award given to a Strava user who has achieved the fastest time on a steep segment (Vanderbilt, 2013).