King of the Mountain: A Rapid Ethnography of Strava Cycling

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ABSTRACT

Cycling has become a very popular activity, with just under half of UK residents owning or having access to a bicycle. Mayor of London has taken initiative to increase cycling in the city by building cycling lanes and superhighways. With the rise in cycling, more systems have been created to cater to cyclists' needs. One such system is Strava Cycling, a site and mobile application that allows users to GPS record and review their cycle rides while also connecting and competing with other users. The combination of competition and physical activity within a geosocial environment presents a plethora of issues, including safety and privacy concerns. This study, conducted as a rapid ethnography, gathered information from Strava Cycling users about their demographics, attitudes, and uses of the system. Four major topical themes were addressed: risk-taking, behavior change, social interactions, and privacy concerns. This information was gathered using three methods: an exploratory qualitative survey, semi-structured interviews with users, and a quantitative survey. The results of this study suggest Strava Cycling users care most about tracking their cycling data than competing with other users. Specific user groups from this study found that their behavior changed significantly as a result of using Strava Cycling. A very important finding was that specific user groups (age, experience, cyclist type) have different uses, motivators, and concerns regarding the system. These findings can be used to improve physical activity behaviour change schemes, like increasing cycling in London, by understanding what factors influence physical activity.

CONTENTS

CHAPTER 1. INTRODUCTION

Bicycles, invented in the 19th century, provide a low cost means of transportation and exercise used around the world. As of October 2012, it is estimated that just under half of Great Britain's population (43%) owns or has access to a bicycle (CTC Cycling Statistics, 2012). There has been an increase in bicycle use in the UK, with the most growth occurring in urban areas like London. Even with the increase in cycling, most men and women do not meet the recommended daily amount of physical activity. Problems with increased rates of obesity are concerning as they will result in a serious economic burden for government and health services in the UK (Wang, McPherson, Marsh, Gortmaker, & Brown, 2011).

Cycling can provide both physical activity and an affordable and sustainable means of transportation, which is why the Mayor of London has been promoting cycling in London. In his Vision for Cycling in London, Boris Johnson describes the plan for a "tube network for bikes" which would consist of bicycle lanes and superhighways being built that follow tube lines (Greater London Authority, 2013). This vision depends on the eagerness of Londoners to choose cycling to get around the city, especially the commuter population.

It appears the cycling movement has already begun; MAMIL, short for "middle-aged men in lycra," is a term used for men in a mid-life crisis who, instead of purchasing a fancy car, start cycling (Casciani, 2010). This growth in the cycling market poses significant benefits for middle-aged men. This group in particular is at serious risk for health problems related to inactivity, including heart disease (Wang, et al., 2011). How might cycling be promoted within this community and other groups who have not adopted cycling?

There are ways of promoting cycling; new ways which use smartphones and dedicated devices that provide information, track activity with global positioning systems (GPS), and help users connect to other cyclists. These systems can be used to promote cycling in the UK and internationally. One such popular and widely used system is Strava Cycling[1].

1.1 Strava Cycling

Strava Cycling is a cycling activity system which started in 2008 as a way for avid cyclists to record and share their cycle rides (Horvath, 2009). Strava Cycling allows users from around the world to GPS record and share their cycle rides as well as explore the rides of other users. Users can record their rides through the Strava Cycling smartphone application or with a dedicated GPS device, such as a Garmin GPS. Strava Cycling is different to most physical activity trackers by providing social competition against the larger cycling community. This competition

[1] See http://www.strava.com/

can be on sections of road or trail which they call "segments." The cyclist with the fastest time for a segment is given the honour of "King of the Mountain" for that segment. This title shifts as cyclists compete and beat out the top time for a given segment. Users can also compete in challenges each month. Challenges typically consist of distance or elevation goals to be met within a month. Screenshots from the Strava Cycling mobile application can be seen below in Figures 1-3.

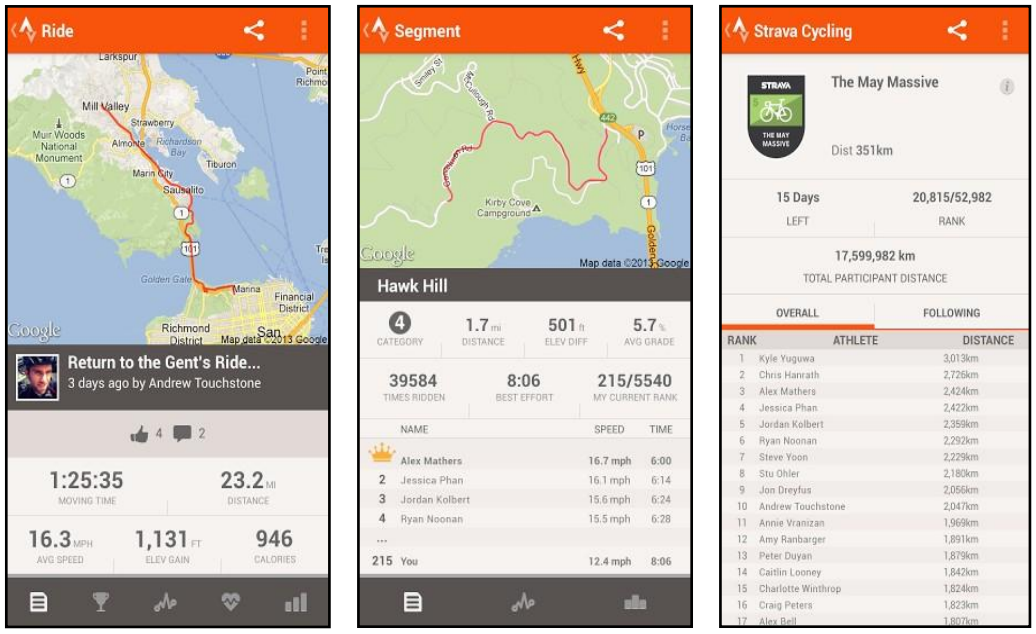

Figure 1-3. Screenshots[2] from Strava Cycling depicting a specific user ride, a segment page, and a challenge leader board

Strava Cycling has a polarising effect in the media, being both praised and criticised by the cycling community. This bipolarity is best exemplified in the following quote from a BBC journalist (Kelion, 2013),

> "The app is either the best thing to happen to training in years, or it transforms users into inconsiderate egotists more concerned about topping online leader boards than road safety."

In following sections of this chapter, we discuss the success and controversy surrounding Strava Cycling.

Success of Strava Cycling

The Strava Cycling mobile application is popular with cyclists; as of August 2013, iTunes[3] has received over 6,000 reviews resulting in an average rating of five

[2] Images retrieved from http://www.appszoom.com/android_applications/health/strava-cycling-gps-riding_bbdjk_screenshots.html

stars. In their technology review this past June, ABC News named Strava Cycling the app of the week, describing Strava Cycling as a means to "enjoy the benefits of competition among riders from all over the world" (Godfrey, 2013). The co-founder of Strava, Michael Horvath, was quoted saying that the "core of Strava" is the "storytelling and social aspect", which connects athletes (Kelion, 2013).

Strava Cycling has been praised for promoting market growth and having a strong, connected user-base. One blogger compared the good and bad effects of Strava Cycling. Strava Cycling was commended for promoting personal GPS devices like Garmin[4], creating a "fun environment for new riders to challenge themselves," and motivating experienced riders to renew their interest (Vargas, 2013). With a user-base in the "millions", according to Mr Horvath (Kelion, 2013), there is clearly strong interest and demand for the system.

Media Coverage of Strava Cycling

Strava Cycling has been criticised in the media and cycling forums. A common criticism of Strava Cycling is that it encourages risky cycling behaviour (Gensheimer, 2013; Vargas, 2013). One blogger claims that Strava Cycling's major pitfall is their users cannot be trusted to use Strava Cycling in a "socially responsible manner" (Gensheimer, 2013). The majority of the complaints about safety refer to those cyclists attempting to obtain King of the Mountain (KOM) status on a segment. Although many of these segments are on flat or inclined roads, some are on steep descents which are potentially dangerous. Strava Cycling segments are user-generated and user-moderated, which may explain why these dangerous segments exist. One blogger said he wished all descent segments would be "removed, flagged, and not allowed" as they encourage risky cycling (Vargas, 2013). An infamous incident of reckless behaviour while using Strava Cycling was the case of "William "Kim" Flint. This Strava cyclist from California died attempting to obtain the KOM on a downhill segment. He was reportedly cycling over the speed limit by 10 miles per hour and in avoiding a car crash, fatally fell off his bicycle. His family filed a lawsuit against Strava, claiming that the company carries responsibility for Flint's death.

However, the judge in that case ruled that Strava was not legally negligent, acknowledging that cycling is an "inherently risky activity" (Welch, 2013). Many cyclists agree, recognising it is the responsibility of the cyclist to exercise caution. One blogger supporting this stance claims that "our competitive urges are not new, and technology didn't create them" (Lindsey, 2013). Rather, Strava Cycling provides the medium in which people can compete virtually.

Other criticisms of Strava Cycling include cheating, encouraging poor training habits, and privacy concerns. A common complaint is that users can fool the system by recording a ride while inside, or holding onto, a vehicle. One blogger

[3] See https://itunes.apple.com/gb/app/strava-cycling-gpsbiking/id426826309?mt=8
[4] See https://buy.garmin.com/en-US/US/into-sports/cycling/cIntoSports-cCycling-p1.html

wished that Strava Cycling would have what they called a "bullshit filter" that could recognise obvious cheating (Vargas, 2013).

This same blogger, a cycling coach, explains how Strava Cycling can encourage poor training. As an example, he refers to a friend who was overtraining in an attempt to perform well in Strava Challenges. In her attempts to achieve this goal, and as a result of the social support from other Strava cyclists, she was "ignoring the basic fundamentals of training." Specifically, she attempted to cycle distances her body was not equipped to handle and without proper rest.

Another issue given media attention is criminal behaviour related to Strava Cycling. Strava Cycling tracks cycling activity using GPS, so the location of users and their routines can be discovered. To make matters worse, some users have publicly listed the bicycles they own. This information can be used by thieves to target specific properties. There have been reports of bikes and GPS units stolen as a result (Wynn, 2013). Protective measures are provided by Strava, like the ability to hide your home and work and the ability to restrict who can follow your activity.

Strava Cycling User Population

Strava Cycling does not publicly disclose information about their user-base. It is speculated that around 90% of their users are male (Usborne, 2013; Lambert, 2013); this proportion is estimated based on segment participation by both gender groups. It is unclear whether this proportion reflects the cycling population or whether it is specific to the Strava Cycling community. Even though there are less of them, there are females using Strava Cycling. One female cyclist reported using the site to compete because she was "too intimidated to join her male-dominated local club" (Usborne, 2013). Another female cyclist wrote an article about the lack of women using Strava Cycling. She encouraged the female community to "embrace the modern technology" and demonstrate that women are "a strong force within the mountain bike community" (Lambert, 2013).

There is no information available about the age, nationality, or location of the user-base. Since Strava was developed and first released in the US, this region was the initial source of the Strava Cycling user base. Strava co-founder Mr Hovarth was quoted saying that Strava's current focus for international growth is the "UK, Australia, Italy, and France" (Kelion, 2013).

1.2 Study Purpose and Hypotheses

This study explores Strava Cycling by surveying and interviewing users of the system. The aims of this study are to identify characteristics about the user-base, understand how they use the system, and what motivates their use. This study is important for understanding how the public uses physical activity systems and how they can change behaviour. Future systems can learn from how previous systems have succeeded in changing behaviour, especially behaviour that promotes healthy and sustainable activity.

Based on the media reactions to Strava Cycling, topical themes will be specifically addressed:

1. Risk-Taking,
2. Behaviour Change,
3. Social interactions, and
4. Privacy concerns.

The study was conducted as a rapid ethnography. Although this study was primarily exploratory, the following predictions were made:

$H_{(1)}$: The most important motivators for use will include the following: tracking activity, monitoring performance, and competition.

$H_{(2)}$: There will be differences in motivators for use for men and women of different age groups, for instance men and cyclists under 45 years of age will be more motivated by social competition.

$H_{(3)}$: The younger and less experienced cyclists will report more change in their behaviour as a result of using Strava Cycling.

$H_{(4)}$: Most participants will have moderate privacy concerns, with women having more concerns than men.

CHAPTER 2. BACKGROUND

This section provides an overview of mobile applications and dedicated devices similar to Strava Cycling. First, we discuss physical activity mobile applications and devices. Next, we discuss geosocial mobile networks. The users and motivators for use of these applications will be discussed based on past research. Then, we look at the effects of social competition on users, specifically social competition in the digital world. The mobile application Foursquare is discussed in detail as it is a combined geosocial and competitive mobile application. Strava Cycling will be described regarding its purpose and features provided. There has been no published empirical research examining Strava Cycling and is the subject of the present study.

This study was carried out as a rapid ethnography. A similar study was conducted at Carnegie Mellon University on the mobile application Foursquare (Lindqvist, Cranshaw, Wiese, Hong, & Zimmerman, 2011). Our study approached Strava Cycling by using similar methods for data collection. The qualitative data was examined using thematic analysis.

2.1 Physical Activity Interventions

Some mobile applications and dedicated devices have been developed with the aim of increasing physical activity of their users. The effectiveness of these systems has been examined; specifically, some features which motivate use and provide the behaviour change are studied and identified in past research.

Early research on physical activity and behaviour-change interventions using mobile phones were conducted by Consolvo and colleagues in 2007. Their UbiFit Garden project was one of the first activity interventions using mobile phones (Consolvo et al., 2008). The UbitFit Garden was a visual background display which changes with physical activity. Different flowers represent different types of activity, such as cardiovascular, flexibility, and strength training. The butterflies represented goals being attained through the course of the day. This study was one of the first to demonstrate how effective these systems can be in motivating activity as well as showing their users how active they have been without having to manually record activity. This system was very basic, providing no analytic detail on user activity. More recent systems provide a multitude of information and a social space to see and speak to other users.

Figure 4. UbiFit Garden Display (Consolvo et al., 2008)

More recent studies have attempted to understand what features make physical activity systems successful. One review recommends that in general, physical activity systems should include the following features: social support, tailored programs, self-monitoring and motivation schemes (Fukuoka, Kamitani, Bonnet, & Lindgren, 2011). In another study similar to UbiFit, the researchers developed a physical activity intervention called ActiveU. They found an increase in physical activity when users logged their activity and set goals (Buis et al., 2009).

Studies have found that groups differ in what physical activity. One study specifically examined physical activity interventions for the older population. They found that mobile phones with activity level indicators for each day showed a significant increase in activity for this age group (King et al., 2013). Another study on the older population found that social and analytical features provide good motivators for use of physical activity systems (King et al., 2013). For teenagers, different motivators are more effective. A study using a mobile physical activity intervention found that teenagers respond best to systems which are competitive, social, outdoor, easy to learn, and have variations (Arteaga, Kudeki, Woodworth, & Kurniawan, 2010). Men and women also differ in what motivates them; while women respond well to interventions which provide step counts, men are more influenced by friendly competition and variety in activities (George et al., 2012). These group differences could have major design implications for a system which has a wide user-base.

2.2 Geosocial Networks

Geosocial networks let users share information with others, particularly information about their geographical location. Some well-known examples of

geosocial networks include Skype[5], Facebook[6], Twitter[7], and Foursquare[8]. These networks are very popular, likely due to the social elements. Some geosocial applications, like Foursquare, add a game-like aspect, where users are rewarded for "checking in" at different retail or restaurant venues (Lindqvist, et al, 2011).

Geosocial networks present a multitude of potential issues. Studies have shown that geosocial applications present issues regarding safety, privacy, and reliability (Soute, Markopoulos, & Magielse, 2010; Boulos & Yang, 2013; Cramer, Rost, & Holmquist, 2011). Specifically, these studies demonstrate how users, in pursuit of prizes for instance, may find themselves in dangerous places. Also, privacy may be jeopardised when the geolocation of users is tracked and displayed publicly. There are technical issues with GPS; for instance, if the smartphone or GPS device loses signal, the data record my not accurately represent the activity completed. Users may become frustrated if their performance data is not accurately tracked, a common issue for geosocial networks.

Geosocial elements could be added to physical activity systems to improve the user experience. An editorial on "exergames" describes how adding GPS to physical activity applications could both improve the user experience and increase activity in the users (Boulos & Yang, 2013). Like Foursquare's gamification with mayorships, how might social competition affect the user experience of a physical activity system?

2.3 Social Competition

Competition, either within groups or individually, is one of the key driving forces of organised sports. Competition has been examined as a motivating factor for activity in behavioural psychology. Competitive contingencies, compared to cooperative or individualistic contingencies, have been shown to result in greater productivity and higher levels of arousal in participants (Scott & Cherrington, 1974). However, not everyone obtains the same enjoyment from competition; research with children has shown that those with more positive perceptions of their ability enjoy and feel more successful in competitive sport activity than those with less positive perceptions (Scanlan & Lewthwaite, 1986; Ames, 1978). Therefore, when designing a competitive intervention for physical activity, it is important to know your audience.

Physical activity systems have been studied recently, as mentioned in Chapter 2.1. The ActiveU study found an increase in physical activity with group competition (Buis et al., 2009). Social competition has been shown to increase physical activity for older adults (King et al., 2013). A review of physical activity interventions presented multiple studies which found that males are highly motivated by friendly competition (George et al., 2012).

[5] See http://www.skype.com/
[6] See https://www.facebook.com/
[7] See https://twitter.com/
[8] See https://foursquare.com/

This collection of research suggests that social competition can be highly effective in physical activity interventions, but more so for specific participant groups. Physical activity interventions should include a wider set of motivators to be effective to all groups.

2.4 Strava Cycling as Intervention

Strava Cycling differs from the other physical activity systems by providing a direct competitive aspect with their segments and challenges. Similar to Foursquare's mayorships, Strava Cycling awards King (or Queen) of the Mountain status to its fastest cyclists. Strava Cycling differs from most other cycling systems because it provides this athletic competition within a geosocial environment. This combination may result in specific types of users and unexpected uses, which this study explores. Currently, there is no published research specifically examining Strava Cycling. With this in mind, we chose to conduct this study as a rapid ethnography.

2.5 Rapid Ethnography and Methods Chosen

Ethnography, as a research approach, uses qualitative research methods to understand a culture or social group by discovering patterns of behaviour and their social relevance (Brewer, 2000). Methods commonly used in ethnographic research include, but are not limited to the following: participant observation, interviews, and surveys. Data gathered is almost exclusively qualitative in nature. The researcher should be aware of biases they have while collecting and analysing data (LeCompte & Goetz, 1982).

The methodological approach used in this study is similar to that of Carnegie Mellon University's Foursquare study (Lindqvist et al., 2011). This study follows their approach because both studies shared some similar sensitising questions about the user experience. These topics include privacy management and meeting new people through the system. The methods include the following, carried out in the order stated: a qualitative survey, semi-structured user interviews, and a quantitative survey. First, data was collected from cyclists in the qualitative online survey. From the data, user and use case themes guided questions for the semi-structured interviews with Strava Cycling users. The data from these interviews identified and solidified themes, which would then be tested by the larger Strava Cycling user pool through a quantitative online survey.

Thematic analysis was used to examine the qualitative data. Thematic analysis is an approach used to identify and examine trends in qualitative data (Guest, MacQueen & Namey, 2012). A comprehensive article on this approach describes how thematic analysis is a "poorly demarked" but widely used method in qualitative research (Braun & Clarke, 2006). This study provides a step-by-step process for how to conduct a thematic analysis, shown below:

1. Familiarising yourself with your data
2. Generating initial codes
3. Searching for themes
4. Reviewing themes
5. Defining and naming themes
6. Producing the report

These phases allow for analysts to maintain a relatively uniform approach to analysing qualitative data. There are different approaches to the analysis, like inductive versus theoretical frameworks. In an inductive framework, the resulting themes are entirely data-driven, meaning the experimenter has not imposed hypotheses or expectations. A theoretical framework would consist of identifying themes based on the experimenter's interests in the area. The theoretical approach was taken by the experimenter in the present study.

2.6 Summary

Some mobile applications and dedicated devices have been developed with the aim of increasing users' physical activity. Early research with the UbiFit garden found that ambient physical activity displays on mobile phones can encourage users to be more active. Recent studies have assessed which factors motivate users to be more active, some of which include: social support, self-monitoring, and goal setting. Other studies have found that there are significant group differences for motivating physical activity. These group differences should be considered when designing a system with a wide user base.

Geosocial networks let users share information with others, specifically information about their geographical location. By combining geographical and social information in one system, there are privacy and safety concerns. These systems must take care to reduce the safety and privacy issues for their users. Geosocial elements can be adapted to physical activity systems and may provide increased user activity.

Competition has been examined as a motivating factor for activity in behavioural psychology. Competition has been adapted to physical activity interventions with marked success. These studies have found that competition is an effective motivator for activity, especially among certain user groups.

Strava Cycling is a combination of the previously described systems; it is a geosocial network that encourages physical activity through competition. As there was no published research specifically examining Strava Cycling, this study was conducted as a rapid ethnography. For the qualitative data gathered, thematic analysis approach was used to gain insight and identify patterns. These themes were further explored and validated in the final quantitative survey.

CHAPTER 3. QUALITATIVE SURVEY

A qualitative survey was conducted to gain initial insight on who uses cycling activity systems and how and why they use it. This survey was intentionally designed to be broad in its questions in order to be exploratory. The data helped to narrow the scope of questions for the interviews with Strava Cycling users in the next phase.

3.1 Method

Design & Materials

This survey divided respondents into four categories based on their responses: non-users, Strava Cycling-only users, other cycling system users, and those who use both Strava Cycling and other cycling systems. The survey contained questions about why participants do or do not use cycling systems and their views on the system they use (if applicable). The set of survey questions for all participants can be found in Appendix A. Strava Cycling users were asked to describe the benefits and pitfalls of the system. The survey was created online using the commercial software "Opinio."

Procedure

To advertise the survey, a hyperlink was displayed on various social media (Twitter and Facebook) and distributed on the university announcement mailing list (UCL-Announce). Participants were provided with study information and instructions at the top of the survey and were asked eligibility questions first. If they met the eligibility requirements (over 18 and current cyclist), they were given access to the remaining survey questions. The survey was estimated to take anywhere from three to ten minutes to complete depending on the length of their responses. Participants were told they could stop participating at any time. After completing the survey, participants were given the opportunity to be entered in the prize draw. The prize draw consisted of one £30 and two £10 Amazon e-vouchers.

Participants

Participants eligible for the qualitative survey were current cyclists who were over the age of 18. Of the 276 responses, 16 were deleted because they were incomplete. The majority of participants were between the ages of 18-25 (47%) and 26-35 (41%) and were male (62%) (see Figure 5-6). The vast majority of participants lived in the UK (93%) with most of those living in London (75%). There were eleven participants from the US, six from various European countries, and one from Australia.

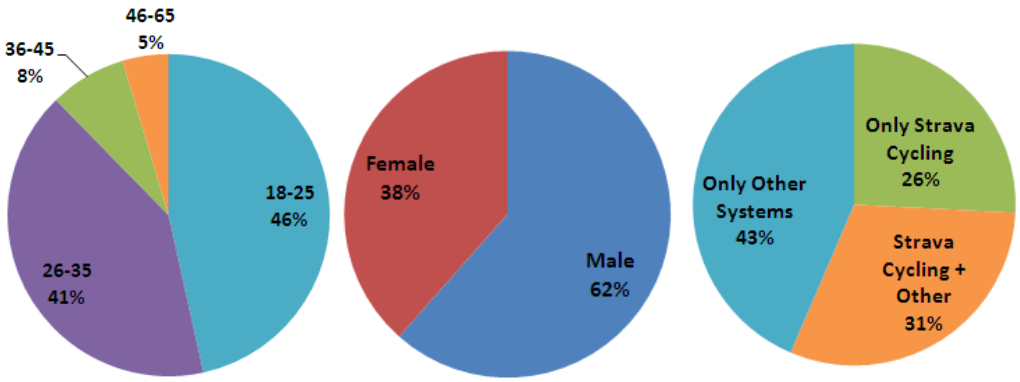

Figure 5-7. Participants by Age, Sex, and Cycling System Used

The majority of cyclists identified as recreational cyclists (81%) and/or utility cyclists (70%). Only a few identified as competitive cyclists (14%). There was an even split between the participants who use mobile applications or dedicated devices to record cycle rides (48%) and those who do not (52%). For those who use an application or device for cycling, the majority claimed to use Strava Cycling (57%) (see Figure 7). About half of the Strava Cycling users also use another device or application. The other popular apps were MapMyRide and Endomondo while the most popular dedicated device was Garmin GPS.

3.2 Results

The data was analysed by identifying common patterns or themes from each open-ended question. The resulting themes are described below, along with their prevalence in the dataset.

The participants (136) who indicated that they did not use any cycling system were asked why they did not use any applications/devices. The most common answers reported were that there was "no need" to use any application/device (26%). A significant number of participants reported that they were unaware of applications/devices or the benefits of using them (21%). Some participants also claimed that lack of a smartphone (18) and costs (9) were the reasons.

The participants (124) who indicated using cycling system were asked whether they used Strava Cycling, other applications/devices, or both. The participants who reported not using Strava Cycling were asked why they did not use it. The most common answer given was not having heard of it before (57%). Eight participants reported that they had been using other systems and did not feel the need to switch; Strava Cycling did not appear to be the superior system or they were too comfortable with their current situation.

Those who claimed to use Strava Cycling (69) were asked why they use Strava Cycling and what the benefits of using it were. The most common reason for using Strava Cycling was to keep a record of their cycle rides and to track

performance (54%). Other reasons included comparing/competing with others (23) and socialising (10). These participants were also asked about the pitfalls of Strava Cycling. The most common answer was that Strava Cycling encourages reckless behaviour, specifically with the segment competition (34%). Another common answer was technical limitations of the phone or application, specifically problems with GPS, battery life and "CPU" storage space (23%). Four participants claimed cheating was the biggest pitfall.

The participants that claimed to use both Strava Cycling and other cycling systems (38) were asked to compare the two. The most common response was that Strava Cycling was the best or better than other similar systems (14). Some participants claimed that Strava Cycling was lacking when compared to other systems (11), examples include "less useful", "(other systems) do a better job with performance", and "(it's) limited by the device through which it is run on [sic]." Seven participants claimed that Strava Cycling was the best for social features, with a large community and better social media features. Three participants simply said Strava Cycling was more fun compared to others.

3.3 Discussion

The themes identified in the qualitative survey were discussed in the following sections. The discussion includes potential implications of the data. The themes identified were then explored further in the next phase of the study.

Major Themes

The purpose for this phase of the study was to gain initial information from users and non-users of Strava Cycling. It seems that, for non-Strava Cycling users, the main theme was a general lack of awareness of the system and its benefits. This suggests that non-Strava Cycling users do not necessarily dislike the system; they simply do not know about it.

For Strava Cycling users, the themes for use included recording activity, competition and socialising. The first of these themes (recording activity) is not unique to Strava Cycling, since most physical activity systems provide this feature. The other two themes (competition and socialising) are not featured in most cycling systems. This result suggests that Strava Cycling may be more effective than its competitors with these two features.

The common negative themes from users included encouragement of risk-taking, device limitations, and the ability to cheat in competition. The risk-taking theme was expected to be present based on media and forum discussion about Strava Cycling. However, these users merely pointed out the encouragement to risk taking; most did not admit to personally taking risk. Because smartphones can be less accurate, a significant number of participants may use other systems, like a stand-alone GPS device, to record their rides and export the data to Strava Cycling.

Additionally, the theme of cheating may lead to users not trusting the recorded data, especially the ride data of those who achieve KOM (or QOM).

These themes were further investigated through the user interviews in the next phase of the study.

Limitations

Although this phase of the study was intentionally exploratory, there were some limitations regarding the data collection and sample population. Due to time-constraints, the survey was only available on the Internet for ten days. Only those who had access to the URL would have been able to take the survey.

The majority of participants were students at UCL, since this population was the easiest and most convenient to recruit. As a result, most participants were between the ages 18-26 and living in London. Also, the majority of data collected was from non-Strava Cycling users. With only 107 responses from Strava Cycling users, the themes derived from their data have limited reliability. As a result, the data gathered may not be representative of the Strava Cycling population.

3.4 Summary

A qualitative survey was chosen to identify themes in the user experience of cycling systems, Strava Cycling included. The survey was designed to be intentionally exploratory to gather initial data. Over two-hundred current cyclists were asked open-ended questions about their experience with cycling systems. Patterns were uncovered within the responses given.

The common themes were identified for each question asked. Those who do not use cycling systems most commonly reported not being aware of such systems. For non-Strava Cycling users, there was a general lack of awareness of the system and its benefits.

For those who do use Strava Cycling, the common benefits reported were the ability to track and monitor cycle rides, followed by competition and socialising. The secondary importance on competition and socialising may place Strava Cycling in front of its competitors.

Common issues reported with Strava Cycling include encouraging reckless behaviour, technical limitations, and cheating. Although many participants mentioned reckless behaviour, very few reported personally behaving recklessly. The issue was generally perceived by participants but not personally admitted.

Limitations for this phase of the study included a lack of time and a narrow participant sample. These issues are mitigated by the fact that the data was intended to guide questions for user interviews, not to be considered as probative evidence in the overall conclusions.

CHAPTER 4. USER INTERVIEWS

User interviews were conducted after collecting initial data on cyclists from the qualitative survey. The interview questions were devised using information from current Strava Cycling users, specifically information regarding their cycling habits and their experience using Strava Cycling. Topical themes, such as risk-taking, behaviour change, social networking, and privacy were further investigated.

4.1 Method

Design & Materials

The interviews were semi-structured. There was a specific set of questions which were for all participants, with additional follow-up questions as needed. The set of questions for all participants can be seen in Appendix B. The data was analysed using thematic analysis approach. This method was chosen to gain insights by identifying themes in the interview data. Interviews were recorded using a voice recorder and manually transcribed by the experimenter.

Procedure

The interviews were advertised online using a hyperlink displayed on various social media (Twitter and Facebook) and an ad distributed on the university announcement mailing list (UCL-Announce). Additionally, flyers were placed at various bicycle stations around central London, most in or around UCL campus in Bloomsbury, London (see Appendix C). The interviews were conducted either in person or through Skype, depending on the location of the interview participants. Participants were given an information sheet and a consent form to sign prior starting the interview (see Appendix D). Interviews lasted approximately 15-20 minutes and were recorded for transcription. Participants were told they could stop participating at any time and were free not to answer any questions they did not feel comfortable with. Once the interview was complete, participants were compensated with a £5 amazon e-voucher.

Participants

The participants interviewed for the study were Strava Cycling users. A list of the participants and their demographics can be found in Appendix E. A total of 17 users were interviewed, eleven male and six female. The age range of participants was 18-55, with the majority of participants between 26-35 years old (35%) and a high percentage of 18-25 year-olds (29%). The majority of participants were residents of the United Kingdom (76%), three lived in the United States, and one participant lived in Australia. All participants were originally from the country they reported living in. Most participants identified as both utility and recreational cyclists (53%) and the second largest group identified as both recreational and competitive cyclists (18%). Seven participants were masters or PhD students; the

rest worked in a range of fields from software companies to magazine publishing. All participants cycled regularly, at least three times a week, and had been cycling for over a year. The majority of participants were road cyclists, with only a couple exclusive trail cyclists. All participants had been using Strava Cycling for at least four weeks, but the majority had used it for over six months (65%).

4.2 Results

The major themes identified through the interviews are described in the thematic analysis results below. These themes include competition and safety, behaviour change, social networking, and privacy concerns. For each theme, sub-themes were identified and discussed using example quotations from interview transcripts.

Competition and Safety

Competition, specifically competing with others on segments and challenges, is a unique aspect of Strava Cycling. Many participants reported being drawn in by the competitive aspects of Strava Cycling which have led to some positive behaviour changes, as previously. The participants also expressed how segment competition in Strava Cycling creates temptation to break traffic laws or to take unnecessary cycling risks.

Competition as Motivation

About half of the interview participants mentioned "competing" or "comparing with others" as one of the major reasons they use Strava Cycling. Most participants referred to competing against others in general, not specifically against other friends. Participant 1 referred to how it was interesting to compare segment times to professional athletes on Strava Cycling.

The majority of participants who did not mention competing against others as a motivator instead stated that competing with themselves was important to them. Participant 11 explicitly pointed out the difference in this quote: "I definitely think comparing to myself is more important than others. [sic]" The data suggests that competition is a motivator for almost all users, but some find competition with themselves more motivating than competing with others.

Pushing Safety Limits

Many participants mentioned that a result of using Strava Cycling and the segment competition is a temptation to break the law or breach safety limits. Participant 12 stated that the emphasis Strava Cycling puts on speed and segment times results in users being "tempted to go through traffic lights when they're red... it's dangerous." However, this participant did not admit to acting upon the temptation.

A few participants suggested this temptation affects users differently as a function of their age or level of experience. Some mentioned that if they were younger, they would find the temptation more difficult to resist. Some said that because they were experienced cyclists they knew their personal limits better. Those cyclists who were not competitive suggested that only those who compete in segments are the ones who take extra risks. Most participants did not report personally taking risks while using Strava Cycling, instead they just pointed out that it is a temptation for other cyclists.

Behaviour Change

As a result of using Strava Cycling, some users may change their behaviour. When asked directly, only four participants claimed their behaviour did not change as a result of using Strava Cycling. The remaining participants believed their behaviour had changed by working harder, pushing safety limits, and/or exploring more routes.

Working Harder

Eight of the participants responded that the segments motivated them to "push harder" or "go faster" when they would not otherwise. Participant 1 described this phenomenon as "a natural way to get intervals in your ride." Most participants reported this behaviour change as a positive, with the exception of participant 9 who claimed that sprinting on segments "encourages poor training practices." By this, the participant means that unregulated sprinting intervals in a cycle ride are unsafe and ineffective.

Those participants disinterested in segment competition reported that the changes in their behaviour were a result of other features like challenges. Participant 11 explained their experienced behaviour change in the following quote:

"When there's challenges on, I've done things like ride an extra 20 kilometres on my way to work just to add kilometres to the challenge.[sic]"

The challenges seem to effectively promote working harder by cycling longer distances, or increased elevation. This non-user specific goal setting can be detrimental to a cyclist's performance and health, as previously discussed in the Introduction (1.1).

Exploratory Cycling

A couple of participants (14, 1) mentioned that they have changed their behaviour by riding new routes discovered through Strava Cycling. Participant 14 claimed that Strava Cycling makes it easy to try new routes or make adjustments to routes taken,

"You definitely try different routes because you can see where you've been. You can actually use it to stitch together the bits of the route you like doing."

Participant 1 mentioned that by being able to see where others have cycled, they were motivated to try new routes. This participant provided an example where they were on holiday, and used Strava Cycling to find an appropriate cycle route near them.

Social Networking

The social networking aspect appeared to engage participants either by enabling them to start conversations with unknown cyclists or by promoting conversation between cycling friends about their rides. Among the social aspects, the following sub-themes were identified: social facilitation or hindrance, communication with others, and stream of information.

Social Facilitation or Hindrance?

Some users described Strava Cycling as a way to bring cyclists together in one medium. Participant 3 explicitly stated "it's a good way to connect with other cyclists." Specific user generated examples of how Strava Cycling brings cyclists together included seeing where friends are cycling and initiating conversation with other cyclists about routes and specific rides both in person and virtually. These results suggest that Strava Cycling users can use Strava Cycling as way to stay connected with friends and to meet new cyclists.

Other users have reported that Strava Cycling can hinder social interaction. In this excerpt, participant 2 explains how the social aspects of group cycling can be diminished as a function of using Strava Cycling:

"You don't want people to be more worried about what time they are doing a particular couple of roads in, they tend to be a little less chatty so it detracts from that somewhat."

This quotation implies that when group cyclists becoming competitive on segments, the casual chat which occurs during group cycle rides can be compromised. Participant 9 pointed out how Strava Cycling can promote "testosterone fuelled group rides" which not only takes away from social cycling, but can also promote poor training.

Communication with Others

Generally, Strava Cycling allows users to discuss cycling with other cyclists, with the ability to view and comment on others rides. Many participants brought up how Strava Cycling helps instigate conversation about cycling with their real-life friends, "you start actually talking about the rides that they've done, and you get little conversations going" (Participant 2). Participant 11 mentioned how his co-workers might "chat about the rides we saw the others did throughout the week." These results suggest that Strava Cycling is an effective instigator of cycling conversation between friends and co-workers alike.

Many users reported using the crowdsourced features of Strava Cycling, specifically the user ride data. Participant 1 mentioned how if they were new to an area, they would go to Strava Cycling and "see where people have ridden" and maybe start a conversation with a user to "get their feedback" on a route they have cycled. Participant 12, a solitary cyclist, suggested that because Strava Cycling shows you other cyclists in your area that they "might possibly reach out to someone who does weekend cycles in the forest." This participant only mentioned doing this hypothetically; they had not actually reached out to another cyclist through the system. This suggests that although the features are available, users may not take the opportunity to meet other cyclists. This drives the question of whether Strava cyclists use the platform mainly with their established friends or if users do attempt to meet new people through Strava Cycling.

Stream of Information

Participants reported mixed feelings about the constant stream of information on Strava Cycling. Participant 8 directly stated their disinterest in following others, that they are "not interested in having a stream of information." Participant 14 reported the exact opposite; they find it interesting following others, they enjoy "being aware of what other people are doing." Participant 7 made an interesting remark about sharing cycling data; this participant was embarrassed by their data, as apparent by the following quote: "I don't really want other people to see my cycles, I'm embarrassed." This presents an interesting issue; although users may want to see others ride data, users who are not confident or comfortable with their cycling ability may feel embarrassed to share.

Privacy Concerns

Privacy was a concern for most participants, while a few were unsure whether to be concerned or not. The privacy zone feature allows for users to hide the location of their home or work address on their recorded GPS data, which minimises some privacy concerns. Other privacy measures were taken by participants to ensure their privacy.

"Should I worry about it?"

The majority of participants said they had thought about privacy concerns when using Strava Cycling. When asked what measures they took to manage their privacy, common responses included setting up a privacy zone to hide their home, not using full name to prevent identification, start recording after leaving the vicinity of their house, not listing which bicycles they own to prevent theft, and/or requiring approval to follow their rides. A select few reported that they hadn't thought about privacy concerns. Participant 12 provided the following statement to that effect: "I'm not that paranoid. I feel sometimes I should be more concerned about it. [sic]" Generally, participants claimed they felt aware of dangers and took appropriate precautions; they were "clued up" on privacy issues.

Privacy Zone Feature

The privacy zone feature, a way of hiding your home or work location on Strava Cycling, was used by over half of participants interviewed. Of the participants who do not use the feature, two (2, 8) indicated they did not think it necessary since they lived in densely populated areas. The other three participants (11, 14, and 15) reported they were not concerned with using a privacy zone, claiming that there are other means of discovering home addresses and places of work. This could be because two of these participants lived in smaller, quieter towns in rural/suburban areas.

Improvements to Privacy

One improvement to the privacy zone feature was pointed out by participant 1, who reported frequently cycling to their friend's house mid-ride; they reported "they don't have anything for that mid-ride." This participant recommended Strava Cycling should allow multiple privacy zones which could be taken into effect at any point in the journey.

Another issue with the privacy zone is the lack of control over the area covered. Participant 6 reported not using the privacy zone feature because "it would cut off half my rides." This participant frequently cycled around a park next to their home, and the privacy zone would essentially ruin their ride tracking data. This suggests that users would like more control over the location of privacy zones.

4.3 Discussion

In this discussion, the results from the user interviews discussed. The themes and their implications are discussed followed by the limitations.

Theme Implications

These results suggest there are four major themes regarding attitudes and use of Strava Cycling. Competition was mentioned by almost all users as a reason for using Strava Cycling, either competing against others on segments and challenges or competing against themselves. The importance the users placed on competition in Strava Cycling suggests this aspect may be an essential user requirement. Although most identified safety as an issue, none admitted personally taking risk. This could suggest that although Strava Cycling has a reputation for promoting dangerous cycling, most users do not believe they are affected. Users' perception of personal risk-taking was assessed in the next phase of the study.

Behaviour change is another major theme from the interviews. Most participants believed their behaviour had changed for the better as a result of using Strava Cycling. Working harder by sprinting more on segments or attempting to complete a challenge are two ways in which the participants identified changes in their cycling. Also, with Strava Cycling's mapping features, the users are given a

means to find new routes to cycle. The participants did not discuss other potential behaviour changes, so these were examined in the next phase.

Social networking is the third major theme identified from the user interviews. Based on the interview data, it seems users take part in the social aspects but have different attitudes towards them. It is unclear how much of the social interaction occurs between real life friends, virtual friends, and strangers. These differences were further investigated in the next phase.

The last theme identified from the data was privacy concerns. Although most users mentioned using one or more measures to ensure their privacy, generally they were not very concerned. The next phase of the study further investigated which privacy measures users took, and how concerned comfortable they were with sharing their data with friends and the global community.

Limitations

As a novice to conducting interviews, the experimenter's questions and follow up could have been more thorough. Because the interviews lasted 20 minutes maximum, it was not possible to follow up every intriguing response. As a result of these two factors, the depth of the data may have been limited.

Due to budget and time constraints, no more than seventeen Strava Cycling users were interviewed. The majority of participants were London based because those participants were easiest to recruit. Even after attempts to recruit cyclists with varying background and demographics, the sample was too small to identify any group differences. Although this sample provided interesting insights, the results are not generalizable for the larger Strava Cycling population. Instead, the data should guide the aim of questions for the next phase of the study, the quantitative survey.

4.4 Summary

To gain a better understanding of Strava Cycling and its users, interviews were conducted with current Strava Cycling users. A wide range of users were recruited for this study, ranging in age (18-53 years old), Strava Cycling experience (4 weeks to three years), and cycling background (commuter/utility, recreational, and competitive). The interview data was analysed using a thematic analysis technique.

The results suggest four major themes in the data: competition and safety, behaviour change, social networking, and privacy concerns. Users suggested that competition, through segments or challenges, is a feature that motivates their use of the Strava Cycling. However, the competition in Strava Cycling can tempt users to take unnecessary risks, according to the participants. Although most identified the risk, they did not admit to personally taking risks.

Most users reported that Strava Cycling changed their behaviour, but in different ways. Many users found that Strava Cycling encouraged them to work

harder. Other users reported that the crowd sourcing element allowed them to explore new routes to cycle.

Strava Cycling may affect socialising depending on the context in which it is used. Most users reported that Strava Cycling provided a means to social network with fellow cyclists, friends and strangers alike. The social aspects of cycling may be affected differently as well, in that solitary cyclists are given a medium to communicate to others while group cyclists can lose the social aspect of cycling together. It is clear the stream of information affects users differently. Some enjoy seeing what others are doing; some are indifferent and others are too embarrassed to share their ride data.

Most participants reported being concerned and taking precautions to ensure their privacy. Curiously, a few participants admitted not thinking about privacy concerns and wondered if they should. Most participants reported using the privacy zone to hide home and/or work addresses from the GPS ride data. The privacy zone feature has complications, however, and has room for improvement.

These results identified the four major themes: competition/safety, behaviour change, social networking, and privacy concerns should be examined on a more detailed level. This was achieved through the next phase of the study on a large scale, in the quantitative survey.

CHAPTER 5. QUANTITATIVE SURVEY

A quantitative survey was conducted in order to validate hypotheses and discover unpredicted trends of a larger Strava Cycling population. The questions on the survey assessed participants' use of Strava Cycling and their attitudes. The questions covered themes identified in the interviews, which include: safety, privacy, social media, and behaviour change.

5.1 Method

Design & Materials

This survey was designed to gather data on users of Strava Cycling and to probe users on the major themes identified in the user interviews (4.3). The set of survey questions can be found in Appendix F. The survey was created online using the commercial software, "Opinio." The survey contained questions about demographics, cycling habits, and then prompted users to reflect on their experience with Strava Cycling. The questions were all multiple choice or rating scales, with the exception of one open question about risk taking. The quantitative data was analysed using IBM SPSS Statistics (SPSS) and the qualitative data was analysed using a thematic analysis approach.

Procedure

To advertise the survey, a hyperlink was displayed on various social media (Twitter and Facebook) and distributed on the university announcement mailing list (UCL-Announce). The survey was also advertised in a range of cycling forums, including, but not limited to the following: SingleTrack[9], road.cc[10], BikeRadar[11], Road Grime[12], mbtr[13], bikeforums[14], and ctc[15]. The survey was available online for seven days. Participants were provided with study information and instructions, and then were asked eligibility questions before completing the entire survey. If they met the eligibility requirements (over 18, current cyclist, Strava Cycling user), they were given access to the remaining survey questions. The survey was estimated to take anywhere from four to ten minutes to complete. Participants were told they could stop participating at any time. After completing the survey, they were given the opportunity to be entered in the prize draw. The prize draw consisted of one £30 and four £10 Amazon e-vouchers.

[9] See http://singletrackworld.com/
[10] See http://road.cc/
[11] See http://www.bikeradar.com/
[12] See http://www.roadgrime.com.au/
[13] See http://www.mtbr.com/
[14] See http://www.bikeforums.net/forum.php
[15] See http://forum.ctc.org.uk/

Participants

The dataset included 1010 responses, collected from Strava Cycling users around the world. The vast majority of participants lived in the UK (85%) and were UK citizens (85%). The second and third most common place of residence included Australia (7%) and the United States (3%). Almost all participants were male (93%) with only a few female (6%) and "other" (<1%). The age distribution of participants was the following: 18-25 (15%), 26-35 (31%), 36-45 (38%), 46-65 (15%), and 66+ (<1%). The majority of cyclists identified themselves as recreational cyclists (78%) and/or utility cyclists (35%). Only a few participants identified as competitive cyclists (47%) or touring cyclists (11%). About half of the participants had been cycling for over 5 years (50%) and had been using Strava Cycling for over a year (54%).

5.2 Results

The quantitative data was analysed using SPSS to discover the significance of specific themes and significant group differences regarding use and attitudes of Strava Cycling. The findings are listed below, starting with the overall results, followed by group differences, and ending with the thematic analysis of the open-ended question about risk-taking.

Overall

Participants most commonly reported "tracking activity" (88%) followed by "to improve my cycling" (54%) as the main reasons for using Strava Cycling. Participants reported being most interested in "monitoring personal progress" (70% very important; 24% moderately important) and "mapping rides" (45% very important, 29% moderately important).

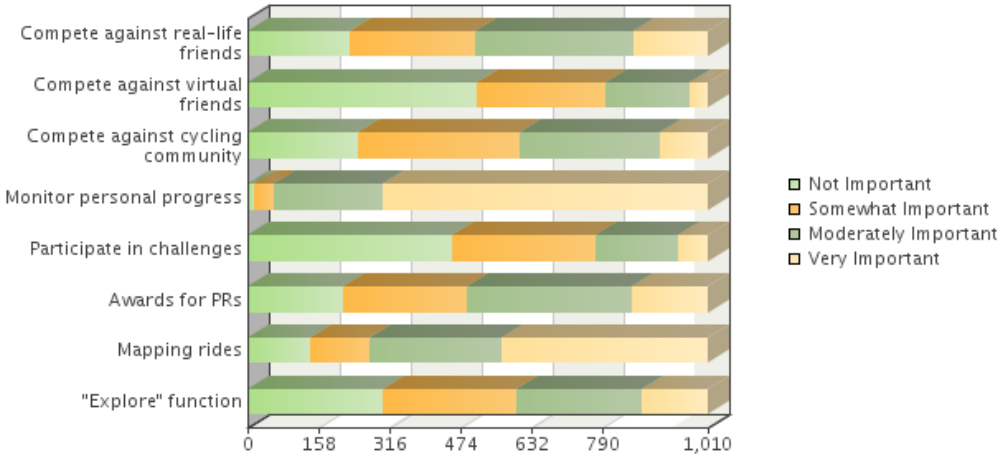

Figure 8. "Important features" rating scale
Note: numbers on x-axis indicate number of participants

When asked how their behaviour changed, most participants reported "more self-reflection on performance" (34% significant change; 43% moderate change) and "sprinting more on segments" (29% significant change; 33% moderate change).

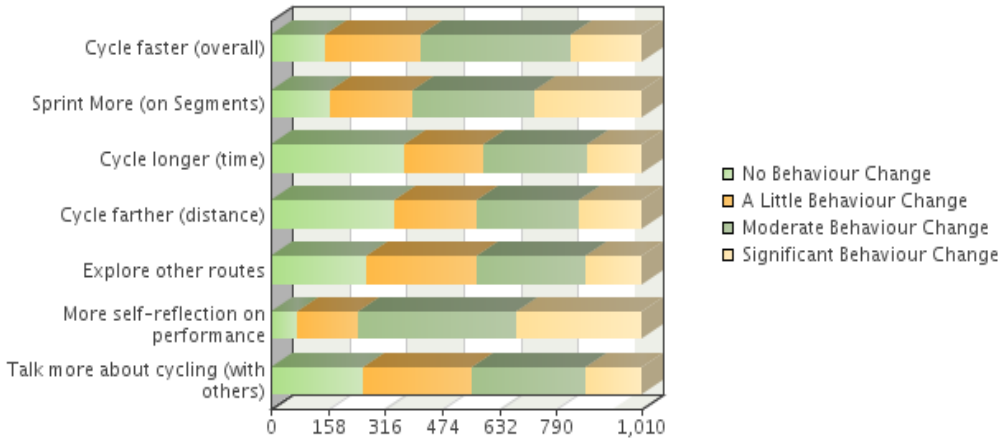

Figure 9. "Behaviour Change" rating scale
Note: numbers on x-axis indicate number of participants

Of the social features/aspects of Strava Cycling, the most widely used by participants were "follow real-life friends" (82%), "view others rides/routes" (75%) and "real-life friends follow you" (74%). Most participants reported being very comfortable sharing their cycling data with real life friends (73% very comfortable; 21% somewhat comfortable), but fewer participants reported being comfortable sharing with virtual reality friends (33% very comfortable; 35% somewhat comfortable). Participants were generally not concerned with personal safety when using Strava Cycling (67% not concerned), and were most concerned with equipment security (40% moderate to very concerned).

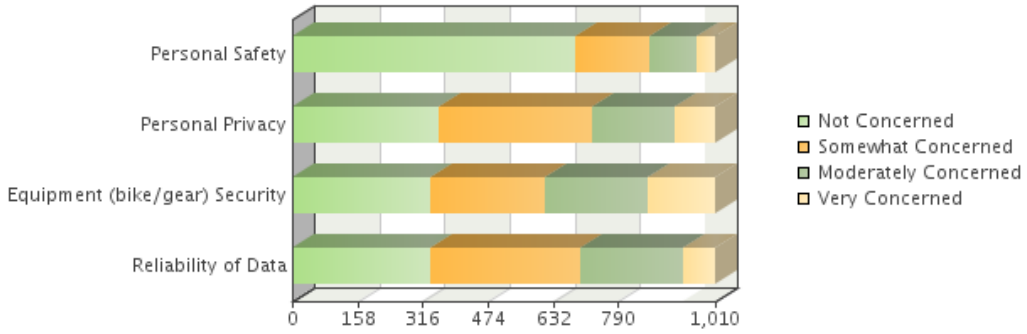

Figure 10. "Concerns" rating scale
Note: numbers on x-axis indicate number of participants

Most participants reported never or rarely taking risks while cycling using Strava Cycling (39% never, 28% rarely) with only a few participants claiming to take risks often or very often (2.5% often; 1.8% very often). The most common privacy measures taken by participants included "privacy zone for home" (74%) and "restricting who follows you" (41%).

Group Differences

Gender

Groups were compared to identify any significant differences in Strava Cycling use or attitudes. Gender differences were found in how long they had been using Strava Cycling; men had been using Strava Cycling for significantly longer than women ($t(1005)=-3.917$, $p=0.001$). Men reported more concern for equipment (bike/gear) security ($t(1005)=-2.001$, $p=0.046$).

Age

There were also age differences in Strava Cycling use and attitudes. Significant differences in the importance of competing were found for participants ($F(3,1006)=3.635$, $p=0.001$). Planned comparisons revealed that the young age bracket reported "competition" as a main reason for using Strava Cycling more than the older age brackets (57% for 18-25yr; 25% for 45+yr). Also, when asked how important certain Strava Cycling features were to their experience, the younger age brackets gave more importance to competing with real-life friends than the older age brackets ($p=0.001$). There were significant age differences for reporting behaviour change. Planned comparisons revealed the oldest age bracket (45+) reported significantly less behaviour change than the youngest age bracket for "cycling faster" ($p=0.006$), "explore other routes" ($p=0.002$), "more self-reflection on performance" ($p=0.029$), and "talking more about cycling with others" ($p=0.022$). Significant age differences were present for risk-taking while using Strava Cycling ($F(3,1006)=3.961$, $p=0.008$). The young age bracket reported significantly more risk-taking while using Strava Cycling than the old age group ($p=0.002$).

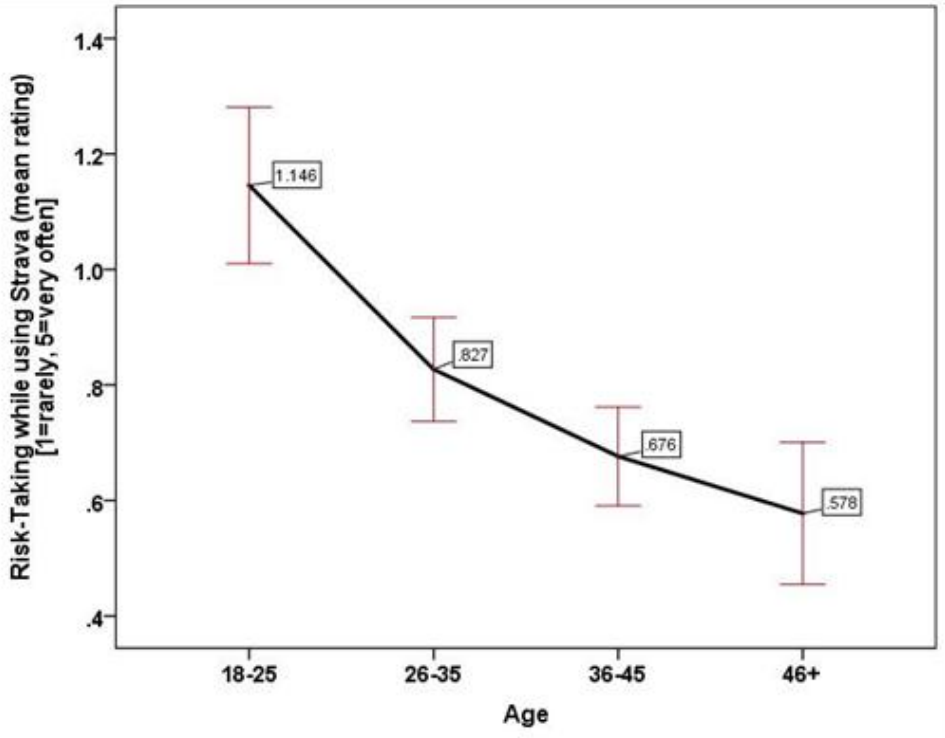

Figure 11. Mean risk-taking as a function of Age group

Note: Graph numbers indicate mean risk-taking, red lines indicate std. error, risk-taking scale [1= rarely to 5=very often, with 0=never]

Cycling Experience

Groups were also compared based on cycling experience. There were significant differences for behaviour change as a function of cycling experience. The most behaviour change was reported by the least experienced participants (under two years cycling) while the least behaviour change was reported by the most experienced participants (over five years cycling). Planned comparisons revealed that the least (under one year) experienced participants reported significantly more behaviour change than and most (over ten years) experienced participants in the following categories: "cycle faster" (p=0.001), "cycle longer (time)" (p=0.001), "cycle farther (distance)" (p=0.001), and "more self-reflection on performance" (p=0.001). With regards to equipment security concerns, there were significant differences between experience cycling groups (F(4,1005)=4.067, p=0.003); the most experienced cyclists (over ten years) reported significantly more concern for the security of their equipment than the least experienced group (under one year) (p=0.021).

Strava Cycling Experience

Differences were found as a function of experience with Strava Cycling, specifically how long the participants had been using Strava Cycling. There were differences in the rating of importance of "competing against virtual friends" ($F(2,1007)=6.365$, $p=0.002$) and "mapping rides" ($F(2,1007)=4.199$, $p=0.015$) based on Strava Cycling experience. Participants with more experience using Strava Cycling (over one year) rated "competing against virtual friends" significantly more important ($p=0.010$). The least experienced participants (under one) rated "mapping rides" significantly more important ($p=0.004$). The most experienced Strava Cycling users reported "commenting on others rides/routes" significantly more than the least experienced Strava Cycling users ($p=0.001$).

Types of Cyclists

There were significant differences in use and attitudes for different types of cyclists. Those who identified as utility/commuter cyclists reported taking significantly less risk while using Strava Cycling ($t(1008)=3.597$, $p=0.001$). Commuter/utility cyclists reported significantly less behaviour change with in "cycling faster" than non-commuters ($t(1008)=2.167$, $p=0.030$).

Recreational cyclists reported "improving your cycling" as a main reason of using Strava Cycling significantly more than non-recreational cyclists ($t(1008)=-3.569$, $p=0.001$). Recreational cyclists found "participating in challenges" ($t(1008)=2.508$, $p=0.012$) and "Awards for PRs" ($t(1008)=-2.186$, $p=0.029$) significantly more important than non-recreational cyclists. Recreational cyclists reported significantly more behaviour change than non-recreational cyclists for "cycling longer (time)" ($t(1008)=-2.118$, $p=0.034$) and "cycling farther (distance)" ($t(1008)=-2.405$, $p=0.016$).

Competitive/racing cyclists found the following significantly more important than non-competitive/racing cyclists: competing against real-life friends ($t(1008)=-6.347$, $p=0.001$), competing against virtual friends ($t(1008)=-3.982$, $p=0.001$), and participating in challenges ($t(1008)=-4.130$, $p=0.001$). Competitive/racing cyclists reported significantly less behaviour change for "cycle longer (time)" ($t(1008)=2.545$, $p=0.011$) and "cycle farther (distance)" ($t(1008)=2.130$, $p=0.033$).

Cycling Venue

Where people reported cycling also showed major differences. Participants who cycled off-road (482) reported significantly less participation in challenges ($t(1008)=4.964$, $p=0.001$) and talking about cycling with others ($t(1008)=3.941$, $p=0.001$). These participants also reported significantly more risk-taking ($t(1008)=-2.543$, $p=0.011$), use of the "Explore" function ($t(1008)=-2.051$, $p=0.040$), and more personal privacy concerns ($t(1008)=-3.409$, $p=0.001$).

Those who indicated cycling on country lanes (823) reported significantly more interest in competing against the cycling community ($t(1008)=-2.412$,

p=0.012), participating in challenges (*t*(1008)=-2.814, *p*=0.005), talking with others about cycling (*t*(1008)=-3.159, *p*=0.002), and more concern about equipment security (*t*(1008)=-3.070, *p*=0.002). These cyclists also reported taking significantly less risk (*t*(1008)=2.105, *p*=0.036).

Those who indicated cycling on low density traffic roads (574) reported significantly less concern with equipment security (*t*(1008)=2.108, *p*=0.035). These participants also reported less behaviour change regarding sprinting (*t*(1008)=2.515, *p*=0.012) and self-reflection (*t*(1008)=2.102, *p*=0.036). They also reported much less risk-taking behaviour as a result of using Strava Cycling (*t*(1008)=2.635, *p*=0.009).

The cyclists who indicated cycling on high density traffic roads (307) reported significantly more participation in challenges (*t*(1008)=-3.380, *p*=0.001) and more interest in mapping rides (*t*(1008)=-2.039, *p*=0.042). These cyclists reported less behaviour change regarding sprinting (*t*(1008)=2.130, *p=0.033*), cycling faster (*t*(1008)=3.109, *p*=0.002), and exploring new routes (*t*(1008)=2.178, *p*=0.030). These cyclists also reported less concern with the security of their equipment while using Strava Cycling (*t*(1008)=2.520, *p*=0.012).

Thematic Analysis of Risk-Taking

Thematic analysis of the one open question about risk-taking behaviours revealed some common risks taken while using Strava Cycling. The most common risk reported was cycling dangerously on descents (77). The reasons for cycling dangerously downhill included: "to try and get a personal record," "if I know I'm on a segment," and for the "overall average for the whole ride." Other popular examples of risk taking include: cycling too fast (25), cycling through red traffic lights (22), and over- or under-taking vehicles on the road (14). Some reported injuries (11) as a result of their risk-taking while actively competing for KOM on a segment, examples include: "broken ribs," "broke my humerus in five places," and "swollen hand." One respondent was humoured by their collision, as evident from this excerpt:

> "Hurt myself quite a bit recently by going too fast to make it round a tree, it was exciting to use Strava to see I hit the tree at 31mph."

5.3 Discussion

In this discussion, the results from the quantitative survey are synthesised and discussed. First, general patterns of use are discussed. Next, the results relating to the main topical themes are discussed followed by a section on the survey limitations.

General Use Patterns

In general, respondents placed higher priority on tracking activity than socialising and discovering new routes. This finding suggests that Strava Cycling

users are more concerned with being able to reflect on their own cycling data than they are about using the system as a social media and discovery tool. This finding is supported by respondents placing very high importance on monitoring personal progress and mapping rides through Strava Cycling.

The participants reported using most of the social features except for those which involve new or virtual friends. This suggests that the social features play some important role in Strava Cycling with regards to connecting and interacting with real-life friends.

The majority of participants were at least somewhat concerned with privacy, equipment security, and data reliability but most were not at all concerned with personal safety while using Strava Cycling. Most participants do not take extra privacy measures other than using a privacy zone to hide their home address. This suggests that users do not want unknown Strava Cycling users to be able to view the location of their home, but are generally not worried about the public display of their other data.

Competition and Social Aspects

Despite the amount of discussion around the competitive aspects of Strava Cycling, most users questioned in this survey did not rate competition as important as tracking activity and seeing improvement. This suggests the focus Strava Cycling places on competition in segments and challenges is not a general motivator for use for all Strava Cycling users. However, it is apparent that competition is a vital reason for specific user groups. The results indicate that young adult cyclists, long-term Strava Cycling users, and competitive/racing cyclists place a higher importance on competition in Strava Cycling. Recreational cyclists placed higher importance on participating in challenges and getting personal records, suggesting they are also interested in competition, including competing against themselves.

The majority of participants reported connecting with real-life friends through Strava Cycling, but less interested in meeting or connecting with new or current virtual friends. This suggests most cyclists using Strava Cycling do not use it as a means to meet new people, but as a way of becoming better connected to the real-life friends they already have. Additionally, this is supported by how users were generally very comfortable sharing their data with real-life friends, but less so with virtual friends. The cyclists who seemed most interested in competing with the virtual world were competitive/racing cyclists. This trend suggests that competitive cyclists do indeed care more about competing.

Viewing and commenting on rides and routes were two other significant social features identified in this survey. Generally, the users placed significant importance on being able to view others rides and routes. Also, those with more cycling experience were more interested in commenting on others rides. This demonstrates the relative importance of viewing and interacting with the user GPS data on Strava Cycling.

Behaviour Change and Risk-Taking

Most users reported that Strava Cycling made them reflect more on their cycling performance. Over half the participants reported cycling faster on known segments as a changed behaviour. It is interesting that sprinting more on segments was reported by over half the participants when under half reported competition as a main reason for using Strava Cycling. It appears that even though Strava Cycling users do not find competition very important, their behaviour has become more competitive, regardless.

With regards to behaviour change overall, it appears that both young cyclists and those who are relatively new at cycling change their behaviour more as a result of Strava Cycling. Among the most popular behavioural changes reported by these groups are changes in performance and self-reflection. This suggests these user groups might use Strava Cycling to improve their cycling, while the older, more experienced cyclists use Strava Cycling for other reasons.

The vast majority of participants did not report taking any more risks while using Strava Cycling. Those who did report taking risks were the younger cyclists. Also, commuter/utility cyclists reported much less risk taking than other cyclists. This could suggest that the commuters perceive cycling as more dangerous, or perhaps this is simply the result of less behaviour change. This group reported significantly less change regarding cycling speed, which supports the latter conclusion.

The common risks identified (too fast downhill, running red lights, overtaking vehicles) suggest that those tempted to take risks are in considerable danger. This danger becomes more salient from the injuries reported while trying to obtain a KOM or personal record on Strava Cycling. Since cycling dangerously downhill was so commonly reported, Strava Cycling might consider removing downhill segments to prevent their users from taking unnecessary risk.

Privacy, Safety, and Security Concerns

Most participants did not report major concerns regarding privacy or safety. The most concerns presented were to do with the security of their cycling equipment. The equipment security concern was most prominent for men and those with more cycling experience. This suggests that perhaps these groups are more aware of thefts, or that these groups own the most expensive equipment.

Although most users did not report being concerned with privacy, users did report taking measures to ensure their privacy on Strava Cycling. Specifically, the majority of all participants reported using the privacy zone feature on Strava Cycling to hide their home on their GPS maps. Just under half reported restricting their followers. This cross-section of data could suggest that users are not concerned with their privacy on Strava Cycling because they are already taking adequate measures to secure their privacy.

Limitations

Although this quantitative survey received a large number of responses, there were some issues with sampling. The sample was overwhelmingly male-dominated, with only six per cent female respondents. The estimated proportion of female Strava Cycling users is about ten per cent, which is more than the proportion of survey respondents. This imbalance could account for the lack of statistically significant group differences between men and women users.

Most of the respondents for this survey were obtained through forum thread postings and through the UCL student population. Therefore, the participant pool may not be an accurate representation of the general Strava Cycling population.

5.4 Summary

A quantitative survey about Strava Cycling was conducted to validate the themes identified in the user interviews. A wide range of users were recruited for this study, ranging in age, experience, and location. The quantitative survey data was analysed using in SPSS and the open question about risk-taking was analysed using thematic analysis.

The results suggest that the most important features of Strava Cycling for users were the ability to track cycle rides and monitor personal progress. Unexpectedly, less than half of the survey participants rated "Competition" as a main reason for using Strava Cycling. This finding suggests that although competing may be attractive to users, quantifying their cycling data is paramount.

Interestingly, although users placed less importance on competition, they reported competitive behaviour changes. Specific user groups reported more behaviour change; these groups included younger users and less experienced cyclists. Most users did not report any risk-taking behaviour. Most participants who did report taking risks as a result of Strava Cycling were young cyclists and non-utility cyclists. The most common risk-taking behaviour reported from the open question was cycling dangerously downhill. This suggests that to minimise safety concerns, Strava Cycling could eliminate segment competition on descents.

When asked about the social features, participants reported more interaction with real-life friends than virtual friends or strangers. Additionally, participants reported being much less comfortable sharing their ride data with virtual friends. This suggests that most people use Strava Cycling to stay connected with established real-life friends as opposed to virtual friends.

Most participants did not report serious concern with their privacy or safety while using Strava Cycling. However, most did report using the "privacy zone" feature to hide their home address. Certain user groups reported more concern with equipment security; these groups included men and those with more cycling experience.

CHAPTER 6. CONCLUSION

This study was run in three parts, each narrowing the focus on aspects of Strava Cycling that are unique or essential to the user experience. There were a few topical themes the experimenters wanted to explore, which included: behaviour change, safety, social networking and privacy/security. However unexpected trends in Strava Cycling use were discovered through these methods. This chapter will provide a comprehensive discussion, a list of general limitations, and proposed ideas for future work.

6.1 General Discussion

In the general discussion, the data collected from all methods were used to draw general conclusions about Strava Cycling users and their experience with the system. First, the topical themes were discussed. Then, the hypotheses were discussed regarding whether the data supported or contradicted them.

Topical Themes

Risk-Taking

As explained in the introduction, Strava Cycling has been mentioned in the media and cycling forums as a controversial physical activity system. Cyclists have been injured or killed while using Strava Cycling and some people would like to blame the system. The results suggest that although users believe there is a temptation to take risks, most users claim to never compromise safety because of Strava Cycling. This study identified specific user groups who are most susceptible to conscious risk-taking. This suggests that risk-taking is a specific, not global, issue for Strava Cycling users.

Behaviour Change

With regards to behaviour change, most users who identified behaviour change as a positive change. As opposed to taking more risks, most users identified working harder and trying new routes. As with risk-taking, the results of this study suggest specific user groups are more likely to be aware of more behaviour change than others, which again suggests Strava Cycling affects users differently.

Social Interactions

The results of the study suggest that the social features of Strava Cycling are used differently by users. The different uses of social features do not appear to be a factor of different user groups. Results from the interviews and quantitative survey confirm that although many social features are available and interesting to users, users do not necessarily take advantage (i.e. the ability to meet new people virtually through the system). Although the ability to connect with new people on Strava Cycling seems appealing, many users are either fearful or simply hesitant to make

the initiative. Assuming this is not a generational effect, Strava Cycling may be more successful by putting efforts into improving the social features relevant to those connecting with real-life cycling friends.

Privacy Concerns

Most users were not very concerned with their privacy while using Strava Cycling, as evident in both the user interviews and quantitative survey. One unexpected result was that those who cycle on busy roads were less concerned with the security of their equipment. If we assume that most roads with dense traffic occur in cities, this result is surprising. Since most bicycle theft in the UK[16] occurs in cities, like London and Cambridge, this result appears counter-intuitive. Perhaps Strava Cycling users who cycle in cities felt that they take effective measures to secure their bicycles, or they may take part in a bicycle hiring scheme instead of using their own bicycle.

Hypotheses Discussed

$H_{(1)}$: Important Motivators for Use

> Hypothesis: The most important motivators for use will include the following: tracking activity, monitoring performance, and competition.

As predicted, tracking activity and monitoring performance were the most important features identified by both interview and quantitative survey participants. An interesting and unexpected finding was that the importance of competition was lower than expected. Many users in the interviews mentioned competing as a motivator for use, but less than half the population sampled in the quantitative survey agreed. When compared to recording rides and being able to reflect on performance, competition is less important. This may suggest that Strava Cycling should be more concerned with the effectiveness of its data tracking features than its competition features.

$H_{(2)}$: Social Competition More Motivating for Young Men

> Hypothesis: There will be differences in motivators for use for men and women of different age groups, for instance men and cyclists under 45 years of age will be more motivated by social competition.

The results from both the user interviews and the qualitative survey do not suggest that men are more interested in social competition than women. In fact,

[16] See statistics http://www.bikeoff.org/design_resource/ABT_problem_who_are_victims.shtml

men and women did not significantly differ regarding the main reasons for using Strava Cycling. However, the results from the quantitative survey suggest that younger cyclists are more interested in competing than older cyclists. These results suggest that there are few differences between male and female Strava Cyclists and there are significant differences between different age groups.

$H_{(3)}$: More Behaviour Change for Young and Less Experienced

> Hypothesis: The younger and less experienced cyclists will report more change in their behaviour as a result of using Strava Cycling.

Results from the quantitative survey suggest this hypothesis was supported by the data; younger and less experienced cyclists in general did report significantly more behaviour change than the older and more experienced cyclists. This supported hypothesis could suggest that those who are most susceptible to behaviour change through cycling systems are the young and inexperienced. These cyclists may not have fully developed cycling routines. Cycling interventions should target these user groups as they are most likely to change.

$H_{(4)}$: More Privacy Concerns for Women

> Hypothesis: Most participants will have moderate privacy concerns, with women having more concerns than men.

The data did not support this hypothesis. Most participants in both the user interviews and quantitative survey did not report having moderate privacy concerns. In fact, a few participants in the user interviews were completely indifferent about their privacy or were unsure whether they should have privacy concerns when using Strava Cycling. Despite the general lack of concern, almost all participants in both the interviews and quantitative survey reported using the privacy zone feature to hide their home address. This suggests that the users did take some measures to ensure their privacy was maintained. As stated previously, there were very few differences between men and women using Strava Cycling. Privacy was not a more serious concern for women.

6.2 Limitations

In general, time was the largest constraint for this study. With eight to ten weeks to release all three parts of the survey, there was little time to reflect on the results before moving to the next phase. As a result, certain patterns and nuances in the data may have been overlooked and not included in later stages of data gathering.

The primary experimenter for this study was not an active cyclist. Therefore, time and effort was expended in order for the experimenter to become informed about cycling. Especially during the interview phase, the experimenter's elementary knowledge of cycling may have limited the scope of follow up questions.

The user base of Strava Cycling has not been publicly shared by the founders of the system. This means it is not possible to know whether the samples obtained were representative of the Strava Cycling population. Instead, the samples were based on educated guesses and media speculation about the Strava Cycling user population.

As this study did not contain intervention scheme, the data collected was strictly based on the conscious thoughts and reflections of the participants. When a participant was asked about perceived behaviour change, the answer cannot be taken as fact. Instead, the data gathered reflects the perceptions of the participants rather than their actual behaviours.

6.3 Conclusions & Future Work

This study has examined Strava Cycling and gathered information on the system's users, motivators for use, and perceived effects of its use. This information can be used to further physical activity behaviour change schemes, like increasing cycling in London, by understanding which factors are essential for an effective physical activity system.

Future research on this subject could benefit by following up with more in depth qualitative research based on the patterns and themes identified. For instance, longer user interviews could be conducted to dig deeper.

Additionally, the group differences identified in the quantitative survey could benefit from further exploration. These differences, though statistically powerful, may simply be a result of the sample obtained or the phrasing of the questions asked. With more investigation, these differences could be supported and explained.

Another approach to further research on this subject would be to provide an intervention scheme. Instead of an observational study, participants could be recruited to use the system and keep a diary of their experience. Their cycling data could be examined by the experimenter and more in depth information could be drawn.

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APPENDIX A. QUALITATIVE SURVEY QUESTIONS

Qualitative Survey Questions

Eligibility Questions

1. How often do you cycle in a given week?
a. Never
b. Less than once a week
c. 1-2x
d. 2-5x
e. 5x+

2. Your Age
a. Under 18
b. 18-25
c. 26-35
d. 36-45
e. 45-65
f. 65+

General Background

3. Your gender
a. Male
b. Female
c. Other

4. Your location (city/town, country)

5. What type of cyclist are you? You can select more than 1 option.
a. Utility (commuter, travel in city)
b. Recreational (for exercise, for fun)
c. Competitive (participate in races)
d. Other (specify)

Use of Technology for Cycling

6. Do you use mobile applications or dedicated devices to record your cycle rides?
a. Yes
b. No

If Q6a:

7. Why do you not use a mobile app or dedicated device for cycling?

If Q6b:

8. Are you aware of the mobile application "Strava"? Do you use it for cycling?
a. Yes, for cycling I only use "Strava"
b. No, I only use something else
c. Yes, I use "Strava" and also other technology for cycling

If Q8a:

9. Why do you use "Strava" for cycling?

10. What do you think are the benefits of using "Strava"?

11. What do you think are the pitfalls of "Strava"?

If Q8b:

12. Why do you use the other mobile app/dedicated device you indicated during your cycles? What benefit do you find by using it?

If Q8c:

Q9-12 and
13. How would you compare "Strava" to the other mobile applications or dedicated devices that you use for cycling?

APPENDIX B. USER INTERVIEW QUESTIONS

Part 0. Demographics

1. Age?
2. Occupation?
3. Location?

Part A: Background + Cycling Habits

1. How long have you been cycling for?
2. How often do you cycle per week? How long are your cycle rides (in mi/km)?
3. How would you characterise yourself as a cyclist? Utility? Sport? Recreational?
4. Where do you tend to cycle? Describe the area in terms of traffic/scenery?
5. What motivates you to cycle?
6. What hinders you from cycling?

Part B: Experience with Strava Cycling

1. How long have you been using Strava Cycling?
2. How did you hear about Strava Cycling?
3. Describe what you first expected of the application before using it, if you can remember.
4. Once you started using Strava, did it appear to meet your needs immediately? Describe.
5. After using Strava for a longer period of time, did you discover new features which you did not expect? Did they add to your experience with Strava?
6. Describe what you like about Strava.
7. Describe what you don't like about Strava.
8. How would you improve Strava, if you could?
9. As a result of using Strava, have you noticed your cycling habits or behaviours change? ie. do you cycle more/less often, for longer/shorter, try different routes, push harder?

Part C: Social, Privacy and Safety Aspects

1. When using Strava, do you think you take any more cycling risks than usual? Or about the same, or less?
2. If so, what types of behaviours?
3. Let's talk about the social aspects of Strava-- what are your thoughts on them?
4. Do you have any privacy concerns with Strava? If so, how do you manage them?

Part D: Final Thoughts

1. Do you have any final thoughts or comments regarding cycling apps/devices or Strava?

APPENDIX C. INTERVIEW ADVERTISEMENT

Cyclists Wanted!

UCL Academic Study on Cycling + Technology

Do you cycle regularly? Want to make a quick £5?
Get paid for an interview about your experience using the cycling app "STRAVA"!
.... (or other cycling apps/devices)

Eligibility
18+ years old
Cycle at least 1x a week
Have used cycling apps/devices before

Contact: Alison Williams
Email: a.williams.12@ucl.ac.uk
Compensation: £5 for 15-20 min interview

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APPENDIX D. INFORMATION SHEET & CONSENT FORM

Information Sheet Interview Participants:

Title of Project: Ethnographic evaluations of ubiquitous computing devices and applications for physical activity

This study has been approved by the UCL Research Ethics Committee as Project ID Number:

UCLIC/1213/011

Name, Address and Contact Details of Investigators:

Alison Williams	Daniel Harrison	Paul Marshall
UCL Interaction Centre	UCL Interaction Centre	UCL Interaction Centre
MPEB 8th Floor	MPEB 8th Floor	MPEB 8th Floor
University College London	University College London	University College London
WC1E 6BT	WC1E 6BT	WC1E 6BT
a.williams.12@ucl.ac.uk	daniel.harrison@ucl.ac.uk	paul.marshall@ucl.ac.uk

We would like to invite you to participate in this research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, please read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or you would like more information.

Details of Study

The research aims to explore how and why cyclists use the mobile application Strava.
The main purpose of this research is to investigate ways of designing and improving mobile applications for people who are physically active or wish to be physically active.
You will be asked a few questions regarding your experience, if any, with the mobile application Strava. Notes will be made and the interview will be audio recorded.
The expected duration of participation will be 20 to 30 minutes.
You will be provided with a £5 Amazon voucher for your participation.

It is up to you to decide whether or not to take part. If you choose not to participate, you won't incur any penalties or lose any benefits to which you might have been entitled. However, if you do decide to take part, you will be given this information sheet to keep and asked to sign a consent form. Even after agreeing to take part, you can still withdraw at any time and without giving a reason.

All data will be collected and stored in accordance with the Data Protection Act 1998.

Consent Form Interview Participants:

Title of Project: Ethnographic evaluations of ubiquitous computing devices and applications for physical activity

This study has been approved by the UCL Research Ethics Committee as Project ID Number:

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We would like to invite you to participate in this research project. You should only participate if you wantto; choosing not to take part will not disadvantage you in any way. Before you decide whether you want totake part, please read the following information carefully and discuss it with others if you wish. Ask us ifthere is anything that is not clear or you would like more information.

Details of Study

The research aims to explore how and why cyclists use the mobile application Strava.
The main purpose of this research is to investigate ways of designing and improving mobile applications for people who are physically active or wish to be physically active.
Through an online questionnaire, you will be asked a few questions regarding your experience, if any, with the mobile application Strava. Responses will be recorded digitally.
The expected duration of participation will be 10 to 15 minutes.
You will be entered in a prize draw to win a £25 Amazon voucher for your participation.

It is up to you to decide whether or not to take part. If you choose not to participate, you won't incur any penalties or lose any benefits to which you might have been entitled. However, if you do decide to take part, you will be given this information sheet to keep and asked to sign a consent form. Even after agreeing to take part, you can still withdraw at any time and without giving a reason.

All data will be collected and stored in accordance with the Data Protection Act 1998.

APPENDIX E. INTERVIEW PARTICIPANT DEMOGRAPHICS

Table 1. Interview Participant Demographics

#	Sex	Age Range	Location	Occupation	Type of Cyclist
1	Male	36-45	UK	Engineer	Utility; Recreational
2	Male	18-25	USA	Manager	Recreational; Competitive
3	Female	18-25	UK	Student	Recreational; Competitive
4	Female	26-35	UK	Designer	Utility; Recreational
5	Male	18-25	UK	Student	Competitive
6	Female	26-35	UK	Student	Utility; Recreational
7	Female	18-25	UK	Student	Utility; Recreational
8	Male	36-45	UK	Assistant	Utility; Recreational; Competitive
9	Male	26-35	UK	Student	Utility; Competitive
10	Male	36-45	UK	Engineer	Utility; Recreational
11	Male	46-65	Australia	Engineer	Utility; Recreational
12	Male	36-45	UK	Manager	Utility; Recreational
13	Female	26-35	UK	Student	Recreational
14	Male	26-35	UK	Manager	Utility; Recreational
15	Female	26-35	USA	Self-employed	Competitive
16	Male	36-45	USA	Lawyer	Recreational; Competitive
17	Male	18-25	UK	Student	Utility; Recreational

APPENDIX F. QUANTITATIVE SURVEY QUESTIONS

Quantitative Survey Questions

Eligibility Questions

1. Your age
    a. Under 18
    b. 18-25
    c. 26-35
    d. 36-45
    e. 46-65
    f. 66+

2. How often do you cycle per week?
    a. Never
    b. Less than once a week
    c. 1-2x a week
    d. 3-5x a week
    e. 5x+ a week

3. Do you use Strava Cycling?
    a. Yes
    b. No

Main Survey Questions

4. Your Sex
    a. Male
    b. Female
    c. Other

5. Your Current Location

6. Your Nationality

7. How do you identify as a cyclist? You can select multiple options.
    a. Utility (commuter/A to B)
    b. Recreational (for fun/exercise)
    c. Competitive (racing/sportives)
    d. Touring (multi-day cycling trips)

8. Do you typically ride alone or with a group?
    a. Only solitary
    b. Mostly solitary
    c. Even mix
    d. Mostly group
    e. Only group

9. Where do you tend to cycle? You can select multiple options.
    a. City Roads (dense traffic)
    b. City Roads (light traffic)
    c. Country Lanes
    d. Off Road
    e. Velodrome/track
    f. Other

10. How long have you been cycling for (regularly)?
    a. Less than 4 weeks
    b. 1-6 months
    c. 6 months-1 year
    d. 1-2 years
    e. 2-5 years
    f. 5-10 years
    g. 10+ years

11. How long have you been using Strava Cycling?
    a. Less than 4 weeks
    b. 1-2 months
    c. 2-6 months
    d. 6 months-year
    e. More than one year

12. On which platform(s) do you use Strava Cycling?
    a. Strava Website
    b. Strava Mobile Application
    c. Both

13. What are your main reason(s) for using Strava? You can select multiple options.
    a. Socialising
    b. Competing
    c. Tracking activity
    d. Discovering new routes
    e. To improve your cycling
    f. Other

14. Rate the following Strava features by <u>importance</u> to you.

	Not Important	Somewhat Importatn	Moderately Important	Very Im.
Compete against real-life friends	❍	❍	❍	❍
Compete against virtual friends	❍	❍	❍	❍
Compete against cycling community	❍	❍	❍	❍
Monitor personal progress	❍	❍	❍	❍
Participate in challenges	❍	❍	❍	❍
Awards for PRs	❍	❍	❍	❍
Mapping rides	❍	❍	❍	❍
"Explore" function	❍	❍	❍	❍

15. In what ways would you say Strava has <u>changed your behaviour</u>?

	No Behaviour Change	A Little Beh. Change	Moderate Beh. Change	Significant B. Change
Cycle faster (overall)	❍	❍	❍	❍
Sprint More (on Segments)	❍	❍	❍	❍
Cycle longer (time)	❍	❍	❍	❍
Cycle farther (distance)	❍	❍	❍	❍
Explore other routes	❍	❍	❍	❍
More self-reflection on performance	❍	❍	❍	❍
Talk more about cycling (with others)	❍	❍	❍	❍

16. Which of the following social features have you used on Strava? You can select multiple options.
    a. Meet new people (in person)
    b. Meet new people (virtually)
    c. Follow virtual friends
    d. Follow real-life friends
    e. Follow new people
    f. Virtual friends follow you
    g. Real-life friends follow you
    h. New people follow you
    i. View others rides/routes
    j. Comment on others rides/routes
    k. Give "kudos"
    l. Receive "kudos"
    m. None of the above
    n. Other

17. How comfortable are you with publicly sharing your cycling data with real-life friends?
    a. Very uncomfortable
    b. Somewhat uncomfortable
    c. Somewhat comfortable
    d. Very comfortable
    e. N/A

18. How comfortable are you with publicly sharing your cycling data with virtual friends?
    a. Very uncomfortable
    b. Somewhat uncomfortable
    c. Somewhat comfortable
    d. Very comfortable
    e. N/A

19. Rate the following concerns by severity when using Strava.

	Not Concerned	A Little Concerned	Somewhat Concerned	Very Concerned
Personal Safety	❍	❍	❍	❍
Personal Privacy	❍	❍	❍	❍
Equipment Security	❍	❍	❍	❍
Reliability of Data	❍	❍	❍	❍

20. How often do you take risks while cycling using Strava, especially when competing in segments or challenges? (e.g.: too fast downhill, reckless weaving in traffic, cycle through red lights, take excessive sharp turns at T-junctions)
    a. Never
    b. Rarely
    c. Infrequently
    d. Occasionally
    e. Often
    f. Very Often

21. If you have taken risks as a result of using Strava, provide some examples

22. Which features/methods do you use to manage your privacy in Strava?
    a. Do not have profile photo
    b. Do not use full name
    c. Privacy zone for home

d. Privacy zone for work
e. Start tracking after leaving vicinity of home/work
f. Do not post bikes owned
g. Restrict who follows you
h. None of the above
i. Other